

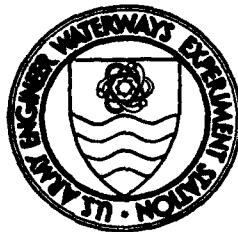
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~~REPORT OF FIFTEENTH INTERAGENCY~~  
~~RESEARCH COORDINATION CONFERENCE~~ (15th)  
Held in Vicksburg, Mississippi on 3-5 November 1987

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CORPS OF ENGINEERS  
BUREAU OF RECLAMATION  
TENNESSEE VALLEY AUTHORITY  
BONNEVILLE POWER ADMINISTRATION

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3-5 November 1987

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PREFACE

This publication summarizes the proceedings of the Fifteenth Interagency Research Coordination Conference held at the US Army Engineer Waterways Experiment Station (WES) in Vicksburg, Mississippi, 3-5 November 1987. It also includes minutes for meetings of work groups which met in 1986 and early 1987. The participating agencies were the Bonneville Power Administration (BPA), US Bureau of Reclamation (USBR), US Army Corps of Engineers (COE), and the Tennessee Valley Authority (TVA). The US Bureau of Mines participated in the Rock Mechanics Session and the US Department of Agriculture-Agriculture Research Service participated in the Hydraulics Session. Representatives of several other agencies were present as observers in many of the sessions.

Planning for the conference was accomplished by the following Steering Committee:

Dr. William E. Roper, Chairman	COE
Mr. Stig A. Annestrand	BPA
Mr. Philip H. Burgi	USBR
Dr. Philip M. Kazemsky	TVA

and Mr. Ellis B. Pickett, P.E., under contract as Conference Coordinator. A great many WES personnel assisted in arrangements for the conference.

This publication was compiled from materials provided by the Steering Committee and from reports prepared by the session chairmen. Valuable assistance was provided by all contributing agencies, particularly in regard to the timeliness and completeness of submitted materials.



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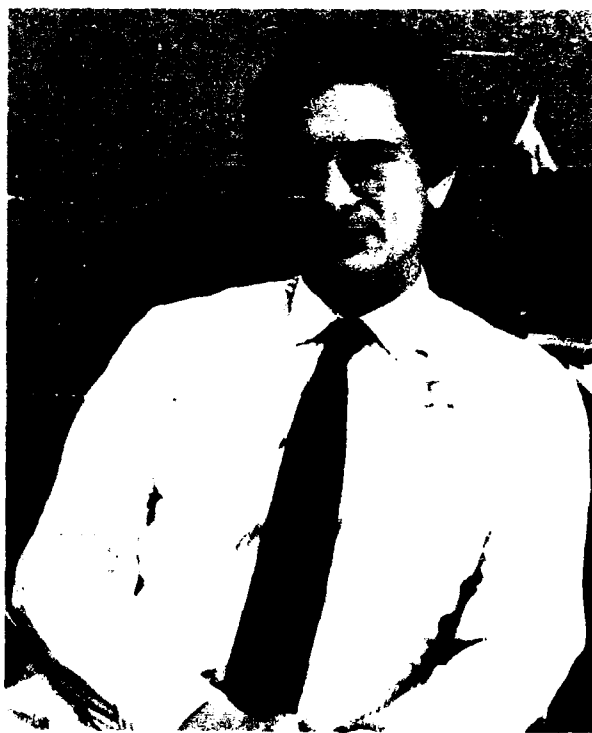
Dr. William E. Roper, COE  
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Steering Committee, Fifteenth Interagency Research  
Coordination Conference

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REPORT OF FIFTEENTH INTERAGENCY RESEARCH  
COORDINATION CONFERENCE

BUREAU OF RECLAMATION  
CORPS OF ENGINEERS

TENNESSEE VALLEY AUTHORITY  
BONNEVILLE POWER ADMINISTRATION

US Army Engineer Waterways Experiment Station  
Vicksburg, Mississippi  
3-5 November 1987

EXECUTIVE SUMMARY

The Fifteenth Interagency Research Coordination Conference was held at the US Army Engineer Waterways Experiment Station (WES) in Vicksburg, Mississippi, 3-5 November 1987. The primary purpose of this conference and its predecessors is the exchange of information between member agencies on current and proposed research in water resources and hydropower development and flood control to (a) eliminate undesirable duplication; (b) identify areas of mutual interest; (c) encourage cooperative efforts; and (d) promote conversation between researchers. Research program information also is exchanged with technical specialists and managers from other Federal agencies who attend the conferences as observers. The member agencies of the conference are the US Army Corps of Engineers (COE), US Bureau of Reclamation (USBR), Tennessee Valley Authority (TVA), and Bonneville Power Administration (BPA). There was limited participation in this conference by the US Bureau of Mines (USBM) and the US Department of Agriculture-Agriculture Research Service (USDA-ARS). Observers were present from the Department of Energy (DOE), Western Area Power Authority (WAPA), Electric Power Research Institute (EPRI), Federal Energy Regulatory Commission (FERC), National Science Foundation (NSF), US Geological Survey (USGS), Environmental Protection Agency (EPA), and a private consulting firm. Total attendance included 63 from WES and 55 from other offices and agencies.

Over 430 topic statements on research projects in the participating agencies were reviewed in seven concurrent technical sessions. The individual

topic statements are grouped in Appendices D-K according to their particular technical areas. These sessions were in the disciplinary fields of Concrete and Structures, Electric Power, Energy, Hydraulics, Rock Mechanics, Soil Mechanics, and Water Quality and Ecology. Three particular overall areas were addressed in all the sessions: safety of dams; project maintenance, rehabilitation, and life extension; and technology transfer. The discussions were directed toward research coordination, general approach and progress, and idea exchange, rather than technical data and findings.

There are many areas in which no duplication occurs, primarily because of unique agency missions; but even these may benefit serendipitously from the exchange of ideas in other areas of more common interest among the agencies. Where certain subject areas are being investigated by more than one agency, adequate coordination between principal investigators has prevented duplication, or ensures that each agency is pursuing different aspects of the same problem. A substantial number of research areas involve active cooperation between agencies in the forms of joint sponsorship; coordination of individual efforts; sharing techniques; and exchange or loan of personnel, facilities, equipment, data, etc. The Department of Defense (DOD) and TVA have recently entered into a Memorandum of Understanding (MOU) to coordinate research and development activities in areas of mutual interest. BPA and TVA have had a similar MOU in force since 1982. Coordination conference participants also meet and exchange research and development information in various other forums. For example, BPA, TVA, and WAPA are all active members of EPRI.

Several work groups meet at times and locations other than the main coordination conferences to compare programs, plans, and research findings more frequently and in much more detail than is possible in the biennial conferences. A relatively low level of work group activity during the last 2 years may be due partly to lack of funding for travel to work group meetings. The paradox was noted that when funds are tight, the need for coordination to maximize return on the research dollar is perhaps the greatest, but funds for coordination activities are at a minimum.

Applications of current and planned research to the safety of dams were included in many subject areas. Some of the specific items are instrumentation, analytical techniques, field observations, model studies, material properties, and environmental conditions. Project maintenance, rehabilitation, and life extension are affected by essentially all these safety

considerations. The COE's Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Program has substantial interagency value as a source for and in the transfer of experience and new technology. Many varied technology transfer methods are being used by all agencies within their own organizations and to benefit the public sector.

A great number of specific areas of needed research, new or expanded and widely varied, were identified in the technical sessions. The area of artificial intelligence is of growing interest to aid younger, less experienced personnel in handling complex job requirements with less formal training. All member agencies are rapidly adapting computer-assisted design and manufacturing (CAD-CAM) techniques and equipment.

### CONCLUSIONS

No areas of unnecessary duplication were identified in any of the sessions. A small amount of duplication is needed for validation and increased reliability of research.

Interagency familiarity with research work among the participating agencies, as gained in these conferences and resulting contacts, has generally precluded duplication of effort and has often enhanced cooperative and complementary research efforts.

A few specific needs for better coordination of research activity were noted, and a number of informal arrangements were made immediately.

Fewer agencies actively participated in some of the sessions than in past conferences, presumably reflecting lack of activity in some of the technical areas or restriction of travel.

Coordination is optimized by personal relationships among project engineers and principal investigators. It is never too early for technical-level interaction beginning with exchange and review of work statements, project outlines, and project study plans.

The existing organization of the Interagency Research Coordination Conference remains appropriate for the mission as defined in the Charter and should be continued in its present format. Although the general disciplinary areas of the technical sessions for the most part remain the same, the specific content of the topics and discussions changes as needed to reflect current priorities in Federal research.

## RECOMMENDATIONS

Project personnel should contact peers in other agencies as early as possible in a new investigation to determine if similar work is underway or planned. Greater, more direct liaison with nonmember agencies may be needed.

Telephone communication by project leaders and research managers would allow more participation in conferences and work groups from agencies with restricted travel budgets. This communication would follow circulation of basic information on topics to be discussed.

The awareness of those in industry and private practice who benefit from Federal research in water resources should be raised by the agencies to gain support in the funding of such work.

Other agencies active in the conference areas of concern should be identified and invited as observers to the next conference and to the work group meetings. The potential for benefits to all participants is high.

The Rock Mechanics and Soil Mechanics Sessions should be combined into a Geotechnical Session, relevant to the common, interdisciplinary interests in soil and rock mechanics and earthquakes.

Work groups should be assigned specific tasks, if necessary, to help assure that the intended purpose is accomplished.

All types of technology transfer should be pursued, with documentation and reporting of unsuccessful as well as successful efforts and techniques, within the agencies and to the public sector. Efforts toward uniformity in guidelines and practice and greater interaction with universities and private practice should be continued. Timely action on exchange of data and results and publication of reports is of special importance.

An interagency meeting during fiscal year 1988 should be considered to discuss implications of the Technology Transfer Act.

## GENERAL REPORT OF CONFERENCE

### Background

Research and investigation studies of many types involving many disciplines have been and are being conducted throughout the agencies and departments of the Federal Government. The US Army Corps of Engineers (COE), US Bureau of Reclamation (USBR), Tennessee Valley Authority (TVA), and Bonneville Power Administration (BPA) have many areas of mutual interest which require research and engineering investigations. The planning, design, construction, and operation of dams, hydraulic structures, and power generation and transmission facilities require extensive and complete studies to aid in making engineering and economic decisions. The agencies have long exchanged project and technical information on informal office-to-office and person-to-person bases and through professional societies and the exchange of research reports.

During Congressional Budget Hearings in 1959, COE was asked if they had regularly coordinated their proposed research programs with other Federal agencies involved in water resource and flood control and power development. The answer was "...very little." So in 1960 COE met with representatives of USBR and TVA in the first of what have turned out to be biennial Research Coordination Conferences. The primary purpose of these conferences was, and continues to be, the exchange of information between member agencies on current and proposed research to (a) eliminate undesirable duplication; (b) identify areas of mutual interest; (c) encourage cooperative efforts; and (d) promote conversation between researchers. A secondary purpose is the exchange of research information with technical specialists and managers from other Federal agencies who attend the conferences as observers. In 1965, BPA joined COE, USBR, and TVA as a member agency in these conferences. The Conference Charter is given in Appendix A.

Discussions are essentially restricted to research activities of the agencies. It is recognized that some agencies identify a type of study as "research," whereas another agency might regard it as a "project study," "prototype testing," etc. To help clarify what is meant by research for these coordination conferences, the following definition is used:

Research, regardless of the source of funding, covers the entire spectrum of scientific and engineering investigations ranging

from basic to applied. It covers all types of technical investigations regardless of whether they are directed simply toward an increase in scientific knowledge without necessarily a specific objective, or whether they are the application or extension of known facts, principles, and techniques in solving specified problems. It excludes those investigations and other activities occurring routinely in the course of business that consist of collecting data and/or testing of materials, instruments, and designs aimed only at numerical determination of their properties, without accompanying efforts toward technological progress.

Engineering research rather than the natural sciences is emphasized at these conferences. The basic subjects discussed in concurrent sessions at the 2-1/2-day conferences include Concrete and Structures, Electric Power, Energy, Hydraulics, Soil Mechanics, Rock Mechanics, and Water Quality and Ecology. Written summaries of the research topics are distributed to all participants about a month in advance of the conference. This permits familiarity with the topics and generally results in the technical sessions being conducted as seminars rather than lectures. At the 1987 Conference, over 430 research topics were discussed and coordinated.

Although these conferences are extremely well planned and well organized, they are conducted in an atmosphere of informality. Most of the attendees are researchers involved directly in conducting or supervising research; and, since the number of attendees in each session is small (usually from 10 to 20), participants are quickly on a first-name basis.

#### 1987 Conference Objectives

The primary objectives of this conference were to make individual agency research programs and results available to the other participating agencies, to exchange ideas and plans on research subjects of mutual interest, to encourage cooperative efforts, and to avoid unnecessary duplication of effort. Three additional particular overall areas were addressed as follows:

- a. Safety of dams.
- b. Project maintenance, rehabilitation, and life extension.
- c. Technology transfer. This area pertains to the processes of how technology is being transferred, by reporting unsuccessful as well as successful efforts, within the agencies and to the public sector.

## Attendance

In addition to the four member agencies, the US Bureau of Mines (USBM) participated in the Rock Mechanics Session and the US Department of Agriculture-Agriculture Research Service (USDA-ARS) participated in the Hydraulics Session. Representatives from seven other agencies were present as observers scattered among six of the sessions. A listing of all attendees is given in Appendix B.

## Agenda

The schedule of sessions is provided in Appendix C. A general opening session was held on Tuesday morning, followed by an executive session and seven concurrent technical sessions. Joint sessions on topics of mutual interest were held between the Hydraulics and Water Quality and Ecology Groups, and the Energy and Electric Power Groups. Over 430 topic statements were discussed in the technical sessions. Details of each session, including attendees and the chairman's report, are given in the following pages. The detailed agendas for the technical sessions are given in Appendices D-K.

The following formal conferences have been held to provide overall information and coordination of the agencies' research programs:

- |                         |   |
|-------------------------|---|
| 1. May 9-12, 1960       | Waterways Experiment Station, Vicksburg, Miss.                        |
| 2. August 1-3, 1961     | Bureau of Reclamation Laboratory, Denver, Colo.                       |
| 3. October 29-31, 1963  | Tennessee Valley Authority, Knoxville, Tenn.                          |
| 4. October 12-14, 1965  | Waterways Experiment Station, Vicksburg, Miss.                        |
| 5. October 24-26, 1967  | Bureau of Reclamation, Engineering and Research Center, Denver, Colo. |
| 6. October 28-30, 1969  | Tennessee Valley Authority, Chattanooga, Tenn.                        |
| 7. October 19-21, 1971  | Bonneville Power Administration, Portland, Ore.                       |
| 8. November 13-14, 1973 | Waterways Experiment Station, Vicksburg, Miss.                        |
| 9. November 11-13, 1975 | Bureau of Reclamation, Engineering and Research Center, Denver, Colo. |
| 10. November 8-10, 1977 | Tennessee Valley Authority, Knoxville, Tenn.                          |
| 11. November 6-8, 1979  | Bonneville Power Administration, Portland, Ore.                       |
| 12. November 3-5, 1981  | Waterways Experiment Station, Vicksburg, Miss.                        |
| 13. November 1-3, 1983  | Bureau of Reclamation, Engineering and Research Center, Denver, Colo. |
| 14. November 5-7, 1985  | Tennessee Valley Authority, Chattanooga, Tenn.                        |
| 15. November 3-5, 1987  | Waterways Experiment Station, Vicksburg, Miss.                        |

These biennial conferences have been highly successful over the years in preventing research duplication and in strengthening communications among

agencies and between individuals carrying out the research activities. Instances of research overlap have been identified and agreements reached to eliminate undesirable and/or to facilitate complementary efforts. The conferences have repeatedly served as a Federal model and example of coordination efforts among these agencies.

This report covers the Fifteenth Conference hosted by COE and held at the US Army Engineer Waterways Experiment Station (WES) in Vicksburg, Mississippi, on 3-5 November 1987.

Tours of the WES Laboratories, the Vicksburg Military Park, and the Vicksburg Harbor were provided Wednesday afternoon. Reports from the executive session and all technical sessions were presented at the closing session Thursday morning.

Some of the conference attendees toured Lower Mississippi River projects Thursday afternoon and Friday morning. This tour included Mississippi River bank revetment mattress placement operation; the Old River Control Structures (Low Sill, Overbank, and Auxiliary--up to 620,000 cfs total); the Old River Lock; the foundation for a 192-Mw, 150,000-cfs, low-head, prefabricated, hydropower plant at Old River; and the new Mississippi River Bridge under construction at Natchez.

### Summary of Session Reports

#### General

Topic statements on the identification, scope, and status of current and planned research activities were prepared by the participating agencies several weeks prior to the conference for advance briefing of attending personnel and preparation of the agenda. The contents were directed toward discussions of coordination, general approach and progress, and idea exchange rather than specific data. Over 430 topic statements on a very wide range of subjects were received by the host office, grouped according to seven general technical areas, arranged according to agenda prepared by the session chairmen, and sent with a set of discussion guidelines and suggestions to the participating agencies and invited observers. As mentioned previously, the detailed agenda and topic statements are given in Appendices D-K.

A summary of the recorded attendance at the individual sessions and the numbers of research activity topic statements are given in the following



tabulation. (The attendance includes part-time participants and also those who may have attended more than one session.)

There was a noticeable increase in attendance and participation by "observer" agencies in several sessions at this conference, which was beneficial to all concerned. The Energy and Electric Power Sessions were joined in a special session for presentations and discussions on health effects of electric and magnetic fields and on superconductivity by representatives of the Department of Energy (DOE) and the Electric Power Research Institute (EPRI).

#### Areas of Duplication

No areas of unnecessary duplication were identified in any of the sessions. Where certain subject areas are being investigated by more than one agency, adequate coordination between principal investigators has prevented duplication or has ensured that each agency is pursuing different aspects of

Agency	Session Attendance								
	Executive	Concrete and Structures	Electric Power	Energy	Hydraulics	Rock Mechanics	Soil Mechanics	Water Quality and Ecology	Joint Hydraulics & Water Quality
Bonneville Power Administration	1	1	4	1	-	-	1	-	-
Tennessee Valley Authority	2	1	2	2	4	-	2	6	9
Bureau of Reclamation	1	2	1	1	1	1	3	2	3
Corps of Engineers	2	26	1	3	22	11	17	12	10
Department of Agriculture	-	-	-	-	1	-	-	1	-
Bureau of Mines	-	-	-	-	-	1	1	-	-
Department of Energy	-	-	1	-	-	-	-	-	-
Western Area Power Authority	-	-	1	-	-	-	-	-	-
Electric Power Research Institute	-	-	2	1	-	-	-	-	-
Federal Energy Regulatory Commission	-	-	-	-	1	-	-	-	-
National Science Foundation	-	-	-	-	-	-	1	-	-
US Geological Survey	-	-	-	-	-	-	-	1	-
Environmental Protection Agency	-	-	-	-	-	-	-	1	-
Other (Private Consultant)	-	1	-	1	1	-	-	-	1
<b>TOTAL</b>	<b>6</b>	<b>31</b>	<b>12</b>	<b>9</b>	<b>30</b>	<b>13</b>	<b>25</b>	<b>23</b>	<b>23</b>
Topic Statements (436)	-	51	71	59	47	46	34	120	8

the same problem. Some duplication is thought to be desirable for validation and increased reliability of research data. Discussions identified desirable changes in some proposed projects to prevent duplication, which also has occurred in previous conferences. Because of the success of coordination efforts, many examples of cooperative or complementary research and development were highlighted during the conference. It was observed that while broad technical areas may be of common interest, applications of technology may differ significantly, according to geographical locale and other factors.

#### Areas of Cooperation

Substantial numbers of general areas of active research and development cooperation between the various agencies were identified in the conference sessions:

Concrete and Structures	10	Rock Mechanics	9
Electric Power	6	Soil Mechanics	10
Energy	3	Water Quality and Ecology	8
Hydraulics	10	Hydraulics/Water Quality	3

The many ways by which this cooperation is accomplished are detailed in the individual session reports, including joint sponsorship; coordination of individual efforts; exchange or loan of personnel, facilities, equipment, data, etc.; sharing techniques; etc.

Some areas of less technical nature that are of interest and for which experience will be shared are the cost sharing of research by private industry, contracting procedures involved in Broad Agency Announcements and Requirements Orders, and the closer cooperation of physical and numerical modelers.

Last year the Department of Defense (DOD) and TVA entered into a Memorandum of Understanding (MOU) to coordinate research and development activities in areas of mutual interest. The coordination activities between COE and TVA are closely related under the Interagency Research Coordination Conference and under the new MOU between TVA and DOD.

#### Areas of No Duplication

There are many areas in which no duplication occurs, primarily because of unique agency missions. Familiarity with other agency research areas as gained in the interagency conferences and other contacts has generally precluded topic statement submissions on those areas obviously of interest to only one agency. However, the preconference distribution of topic statements often elicits useful comments from other agencies concerned with some

seemingly unique problems, even if research is not contemplated by them.

#### Areas of Needed Research

Nearly 40 specific areas of needed research, new or expanded and widely varied, were identified in the technical sessions. These are involved in the more general areas of construction techniques and materials, equipment, measurements and instrumentation, project operation, applications of new technology (such as robotics and superconductivity), health and environment, foundation condition evaluation, water quality control and improvement, and more effective technology transfer within the agencies and to the public sector.

#### Recommendations on Research Coordination

Specific needs for better coordination were noted by the agencies in discussions of some of the topic statements, and in many instances informal arrangements were made immediately. Some of the special work groups within the various technical disciplines will be reactivated or new ones established in areas where special emphasis is needed. Greater, more direct liaison with agencies outside the conference is needed in some instances. The exchange of data bases among interested agencies can result in considerable technical and economic benefits.

### General Problem Area Findings

#### General

Topic statements pertaining to the following general research or problem areas of current special interest, as noted under the 1987 Conference objectives, were identified and addressed where appropriate in the technical sessions.

- a. Safety of dams.
- b. Project maintenance, rehabilitation, and life extension.
- c. Technology transfer. This area was intended to pertain to the processes of how technology is being transferred, with reporting of unsuccessful as well as successful efforts, within the agencies and to the public sector.

Listings of and/or summary comments on the pertinent topic statements are given in the individual Session Reports.

#### Safety of Dams

New instrumentation techniques and analytical tools permit improved assessment of the structural safety of dams. They should be fully utilized in

conjunction with the time-honored methods of longtime studies of existing structures. Model and field studies are being made of flow control gates and valves relative to operations under unbalanced head and to the prediction of cavitation damage. The protection of low embankments from overflow and conditions downstream from a breached dam are being investigated. The dissipation of high-energy flow and the protection of channel material from such flows also are being studied at small and full scales. Essentially, all the soil mechanics topics have a bearing on the safety of dams: properties of materials, in-place conditions, methods of investigation, and assessment of performance (past and future). Applicable environmental topics concerned effects of global climate changes on water resources and allowable vegetation on flood-control levees.

#### Project Maintenance, Rehabilitation, and Life Extension

These primary areas of concern relative to concrete structures are being actively pursued, and much information is being developed in the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Program. Environmental factors of temperature and moisture have a significant effect on most repair situations. Life extension also involves a considerable number of hydraulic-type phenomena which affect the operation of and applied forces on water resource projects. Essentially all the soil mechanics topics also have a bearing on the extension of a structure's life as well as on its safety. A need for better understanding of foundations under existing structures was expressed. A number of environmental aspects affect project maintenance.

#### Technology Transfer

The passage of the Technology Transfer Act of 1986 put into motion a number of major changes for Federal research and development programs. These changes include the establishment of a national consortium managed by the National Bureau of Standards (NBS) to coordinate and facilitate transfer of Federal technology to the private sector. A percentage of Federal agency research and development budgets is to be allocated to this consortium. The act also provides for laboratories and researchers to receive royalty payments from inventions successfully marketed in the private sector. There is an interagency working group addressing implementation strategies and procedures.

An outstanding technology transfer system has been established for the REMR Program involving reports, bulletins, letters, and electronic methods.

Other transfer methods include demonstrations, evaluations, conference and symposium papers, the use of new technology in everyday design, operation, and maintenance practice, design guides, manuals, informal contacts within and among various agencies and with private firms, production of innovative equipment and/or software, direct coordination with foreign agencies, publication of educational materials (including video), and the use of expert systems. All agencies have a very serious commitment to technology transfer, and there are increasing efforts toward uniformity in guidelines and practice and greater interaction with universities and private practice.

#### Other

A general concern of the conference was for the lack of support for water resources research and development. Because research and development is not project specific but broad based, it has virtually no political support and is easily subject to congressional reductions. This problem is particularly important to COE and USBR. Raising the awareness of those who benefit from water resources Federal research is an issue that needs to be addressed by the agencies involved in water resource research.

The area of artificial intelligence was identified as one of growing interest in all of the member agencies. With the decrease in the number of experienced personnel in the inspection training and quality control functions in Federal agencies, the use of artificial intelligence is seen as an important tool to aid younger, less experienced individuals in carrying out job requirements in these areas. Also, all member agencies are moving rapidly into the computerized computer-aided design and manufacturing (CAD-CAM) workstation environment.

It was observed that the construction industry has conducted only limited research and development to advance the state of the art. They have traditionally relied on the Federal sector to provide the technology improvements needed to increase productivity, reduce safety risks, and improve cost effectiveness. In the changing Federal environment with incentives to gain economic return for technology development, the construction industry and architect/engineer firms may have to pay the bill for future benefits they receive from Federal research programs.

Participants expressed the conviction that coordination is optimized by personal relationships among project engineers and principal investigators

where interagency visits at this level are appropriate and desirable and when travel constraints allow.

It was recognized and stressed that it is never too early for technical-level interaction beginning with exchange and review of work statements, project outlines, and project study plans. Such review could lead to a project being expanded or modified to accommodate another agency's interest or objective and lead to a better project with the possibility of cooperative participation and funding. Participants were encouraged to have investigators contact peers in other agencies for those topic statements of mutual interest.

Active participation in some of the sessions involved fewer agencies than in prior conferences. The reason for this is presumably lack of activity in some of the technical areas or restriction of travel. Due to this low level of participation, a change in format may be in order. Perhaps a conference telephone hookup of project leaders and laboratory chiefs would allow more participation from agencies with restricted travel budgets. They could then discuss topics of mutual interest from previously submitted project sheets. One agency could again be assigned to coordinate the conference.

In a joint session between Soil Mechanics and Rock Mechanics it was resolved that the independent technical sessions in each discipline be disbanded in favor of a single Geotechnical Session which is more relevant to professional practice and would provide a better forum for common interests in soil and rock mechanics and earthquakes. The number of topics addressed in research and development programs in these areas has diminished and the number of participants has decreased reflecting manpower constraints and budget limitations.

The work, criteria, and decisions of many other agencies impact the work, procedures, and test methods of the agencies that presently attend these conferences. During the next 2 years, efforts to identify other agency representatives for invitation to participate as observers in the Sixteenth Conference should be completed and the individuals invited. The potential for benefits to all participants is high. The Interagency Research Coordination Conference provides an excellent opportunity for the hosting agency to train their personnel; all of the WES principal investigators (PI's) in the Soil Mechanics area were involved. USBR thought that the conference was an effective "management" forum that was well balanced in technical content (enough to make rational decisions, but not so much as to be overburdened with details).

Invitations to appropriate elements of the US Geological Survey (USGS), NBS, Federal Highways Administration (FHWA), Mineral Management Service (MMS), Department of Transportation (DOT), Soil Conservation Service (SCS), Environmental Protection Agency (EPA), Los Alamos National Laboratory, Lawrence Livermore Laboratory, Sandia National Laboratory, National Science Foundation (NSF), and US Navy are encouraged, at least as observers. The session chairmen should take responsibility as appropriate for extending these invitations.

Much of the applied research project specifics requires greater visibility/dissemination. There also is a need for closeness of research and development and project application, better visibility, and information exchange on capabilities with interdisciplinary interaction.

### Executive Session

The Executive Session of the Interagency Research Coordination Conference met following the opening session on 3 November 1987. Attendees were Dr. Bill Roper, Chairman, COE; Mr. Marv Klinger, BPA; Mr. Bevan Brown, TVA; Mr. George Buchanan, TVA; Dr. Frank McLean, USBR; and Mr. Phil Stewart, Recorder, WES.

The session first reviewed the status of working groups under the seven technical sessions of the conference. The Session Chairman for Water Quality and Ecology had provided a written report to the committee regarding its three working groups. Two of the three working groups had been inactive during the past 2 years. The session chairman indicated that a careful review would be done to determine the need to continue the two inactive working groups. The other session chairmen will also be reviewing their work group activity and making recommendations whether to continue working group activities in their areas. Part of the reason for inactivity appears to be lack of funding to support travel to working group meetings. The Executive Session, in discussing this subject, noted the paradox that when funds are tight the need for coordination to maximize return on the research dollar is perhaps the greatest, but funds for coordination activities are at a minimum. Other ways of conducting working group business such as teleconferencing, computer bulletin boards, or piggybacking working group meetings with other conferences were suggested as alternatives. At a minimum there should continue to be an exchange of reports between the agency members of the working groups to assure that research is coordinated. The session chairmen may also need to assign specific tasks to the working groups for accomplishment during the 2-year period between conference meetings. If no tasks are given, the need for working group activity is diminished. Dr. Roper proposed that the Steering Committee review the recommendations of the technical session chairmen regarding the status of their working groups and decide which ones will remain active.

A general concern of the session was for the lack of support for water resources research and development. Because research and development is not project specific but broad based, it has virtually no political support and is easily subject to congressional reductions. This problem is particularly important to COE and USBR. Raising the awareness of those who benefit from water resources Federal research is an issue that needs to be addressed by the



agencies involved in water resource research.

Another area the session discussed was technology transfer. The passage of the Technology Transfer Act of 1986 put into motion a number of major changes for Federal research and development programs. These changes include the establishment of a national consortium managed by the NBS to coordinate and facilitate transfer of Federal technology to the private sector. A percentage of Federal agency research and development budgets is to be allocated to this consortium. The act also provides for laboratories and researchers to receive royalty payments from inventions successfully marketed in the private sector. Federal agencies are currently in the process of interpreting and preparing for implementation of this new act. There is an interagency working group addressing implementation strategies and procedures. However, it may be worthwhile to consider an interagency meeting during fiscal year 1988 to further discuss the implications of the Technology Transfer Act with regard to water resource research and development programs. This is an area the Steering Committee will be looking into during the next 6 months.

Last year DOD and TVA entered into an MOU to coordinate research and development activities in areas of mutual interest. COE has provided to DOD a list of potential areas of common interest with TVA and specific contact individuals for each area. There is a close relationship between the activities between COE and TVA under the Interagency Research Coordination Conference and the new MOU between TVA and DOD. Dr. Roper will provide to TVA a copy of the input on the MOU that was provided to DOD so that the activities between TVA and COE are fully coordinated for these two joint activities.

The area of artificial intelligence was identified by the committee as one of growing interest in all of the member agencies. Session members gave a brief overview of the artificial intelligence activities that are underway in their respective agencies. With the decrease in the number of experienced personnel in the inspection training and quality control functions in Federal agencies, the use of artificial intelligence is seen as an important tool to aid younger, less experienced individuals in carrying out job requirements in these areas.

The session agreed that all member agencies are moving rapidly into the computerized CAD-CAM workstation environment. BPA has had CAD-CAM workstations for the past 7 years. USBR recently initiated the first phase of a 50-workstation CAD-CAM workstation purchase. COE has also begun a major

procurement of over 200 CAD-CAM workstations nationwide. Also, a computer-aided design and drafting center has been established at WES in the Information Technology Laboratory to assist COE Districts and Divisions in moving into this new technology field. TVA is also using and increasing their capability in the CAD-CAM workstation area.

It was observed by all members of the session that the construction industry has conducted only limited research and development to advance the state of the art. They have traditionally relied on the Federal sector to provide the technology improvements needed to increase productivity, reduce safety risks, and improve cost effectiveness. In the changing Federal environment with incentives to gain economic return for technology development, the construction industry and architect/engineer firms may have to pay the bill for future benefits they receive from Federal research programs. Federal laboratories may choose to release new software programs under exclusive licensing agreements or other methods, rather than into the public domain, in which case the construction industry would have to purchase these tools at commercial prices, rather than getting them free.

The Executive Session reviewed the need for changing the way in which the Interagency Research Coordination Conference is structured and operates given the changes in the Federal resource environment. The particular focus was whether the current technical session areas should be changed. In reviewing this issue, it was found that although the general disciplinary areas of the technical sessions have remained unchanged, the specific content of the research reported in the sessions has changed and is reflective of the current priorities in Federal research. The Executive Session concluded that the organization of the conference remains appropriate for the mission that is defined in the bylaws for the conference and that it should be continued in its current format. This allows the session chairmen to select the technical areas for presentation, and discussions that address the current priority areas of Federal research.

The session accepted the BPA proposal to host the next meeting of the Interagency Research Coordination Conference. It will be held in Portland, Oregon, on 17-19 October 1989.

## Concrete and Structures Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Drange Marshall	CERL	Bill McCleese**	WES
Jim Pierce**	USBR	Mike Hammons	WES
Tony C. Liu**	OCE	Dick Stowe	WES
Lucian Guthrie	OCE	Steve Ragan	WES
George Buchanan	TVA	Tony Husbands	WES
Fred Anderson	OCE	Sam Wong	WES
Don Plotkin	CERL	Bob Denson	WES
Frank McLean	USBR	Lillian Wakeley	WES
Leon Kempner	BPA	Bill Neeley**	WES
Al Costanzo	Consultant	Robert L. Hall	WES
Reed Mosher	WES	Toy Poole	WES
Wayne Jones	WES	Henry Thornton	WES
Tony Bombich	WES	Clophus Semien	WES
Willie E. McDonald	WES	Carl Pace	WES
Bryant Mather	WES	Roy Campbell	WES
Ken Saucier** (Chairman)	WES		

\* Addresses and phone numbers are given in Appendix B.

\*\* Full time, all others part-time.

### General

Fifty-one research topic statements covering three different subject areas were submitted for discussion at the conference. The number of statements submitted in each of the subject areas was as follows:

- a. Repair, Rehabilitation, and Maintenance: 18
- b. Structures: 16
- c. Testing and Materials: 17

The detailed Agenda and the Topic Statements are given in Appendix D.

### Areas of Duplication

No areas of unnecessary duplication were identified. Where certain subject areas are being investigated by more than one agency, adequate coordination between principal investigators has prevented any duplication of work.

### Areas of Cooperation

- a. Other cementitious materials: telephone communications between project personnel
- b. Roller-compacted concrete: mutual site visits (WES, USBR)
- c. Grouting studies: COE and USBR collaborated on training tape

- d. Nondestructive testing: exchange of personnel and equipment between NBS, WES, and Canadians
- e. Dam instrumentation: sharing of techniques between USBR and COE
- f. Data base for repair materials: USBR to add to COE list, TVA and CERL to be asked to join
- g. Alkali-aggregate reactions in concrete: sharing of information between USBR, COE, and TVA project leaders; visits to sites
- h. Field exposure durability studies: many agencies use Treat Island Facility
- i. Erosion-cavitation research: USBR-COE shared design of facilities
- j. Testing of concrete anchor systems and materials for spall repair: COE and TVA

#### Areas of No Duplication

- a. Materials testing
- b. High-strength concrete
- c. Dynamic properties
- d. Multiaxial testing
- e. Concrete conduit research
- f. Instrumentation
- g. Cracking research
- h. Underwater repair
- i. Floodproofing buildings
- j. Concrete removal

#### Areas of Needed Research

- a. New admixtures for concrete
- b. Improved and standardized tests for strength of concrete in tension and shear
- c. Methods to detect size, shape, and depth of voids in concrete and degree of corrosion of reinforcing steel
- d. Method to determine early age (4-24 hr) properties of freshly placed concrete
- e. Method to assess the effectiveness of concrete repair materials in the field using available history of the installation

#### Recommendations on Research Coordination

The following efforts of coordination were discussed and should be continued:

- a. Roller-compacted concrete: between USBR and PCA on tests of joints and COE and private sector on construction of test strip

- b. Methods for disposing of low-level nuclear waste: between WES and NRC
- c. Nondestructive testing: between WES and Texas A&M and between Navy Civil Engineering Lab and NBS
- d. Floodproofing of buildings: between WES and National Flood Proofing Committee
- e. Data base for repair and new construction materials: between WES and USBR

#### Topics Involving Safety of Dams

- a. Longtime Concrete Studies
- b. Dynamic Properties of Concrete
- c. Response of Concrete to Multiaxial Stress States
- d. Incremental Construction Procedures for Mass Concrete
- e. Dam Safety Instrumentation
- f. Improved Instrumentation for Older Structures
- g. Seismic Response of Concrete Dams
- h. Repair of Concrete Affected by Alkali-Aggregate Reaction

Summary: New instrumentation techniques and analytical tools permit improved assessment of safety of dams. They should be fully utilized in conjunction with the time-honored methods of longtime studies of existing structures.

#### Topics Involving Technology Transfer

- a. Use of Cementitious Materials Other than Portland Cement
- b. Fly Ash Cements: Alternative to Portland Cement
- c. Development of Bond Strength between Lifts of Roller-Compacted Concrete
- d. Concrete Materials Systems Research
- e. Longtime Concrete Studies
- f. Superplasticizers and Flowable Concrete
- g. Verification of Deleterious Levels of Calcium Sulfate Concentration
- h. Portland Cement Grouting Studies
- i. Stability of Components of Grout and Concrete in a Salt Environment
- j. Recommendations for Grouting in Basalt
- k. Curing Compounds for Concrete
- l. Technical Assistance in Development of Engineering Criteria and Requirements for Alternative Near-Surface Methods for Disposing LLW
- m. MOBA/MOUT Live-Fire Training Villages: Targets and Ranges
- n. Computer Applications in Geotechnical Engineering: Task Group on Laboratory Automation

- o. Dynamic Properties of Concrete
- p. Structural Analysis of Lock and Dam No. 1
- q. Strength Design of Concrete Circular Conduits
- r. Concrete Pipe Research
- s. Development and Evaluation of Continuous Monitoring System for Structural Safety
- t. Dam Safety Instrumentation
- u. Evaluation of Existing Maintenance Materials and Methods
- v. Repair of Erosion-Damaged Structures
- w. In Situ Repair of Deteriorated Concrete
- x. Techniques for Joint Repair and Rehabilitation
- y. Rehabilitation of Navigation Locks
- z. Application of New Technology to Maintenance and Minor Repair
- aa. Unsolved Problems Relating to Alkali-Silica Reaction in Concrete
- bb. Surface Treatments to Minimize Concrete Deterioration
- cc. Floodproofing Buildings
- dd. Application of X-Ray Diffraction to Determine Residual Stress
- ee. Techniques for Removal of Deteriorated Concrete

In summary, an outstanding technology transfer system has been established for the COE's REMR Program. Reports, bulletins, and letters are distributed to approximately 3,000 interested parties, including many in the private sector. The REMR net is also available to all offices having the ONTYME system and provides information on materials, products, events, training, etc. The conference explored ways the REMR system could be expanded to include many other types of information about concrete.

Topics Involving Project Maintenance, Rehabilitation, and Life Extension

- a. Use of Cementitious Materials Other than Portland Cement
- b. Roller-Compacted Concrete
- c. Concrete Materials Systems Research
- d. Longtime Concrete Studies
- e. Verification of Deleterious Levels of Calcium Sulfate Concentration
- f. MOBA/MOUT Live-Fire Training Villages: Targets and Ranges
- g. Structural Behavior of Sheet-Pile Cellular Cofferdams
- h. Soil-Structure Interaction Studies: Walls and U-Frame Structures
- i. Incremental Construction Analysis Procedures for Mass Concrete

- j. Evaluation of Existing Maintenance Materials and Methods
- k. Techniques for Underwater Concrete Repairs
- l. Repair of Erosion-Damaged Structures
- m. In Situ Repair of Deteriorated Concrete
- n. Techniques for Joint Repair and Rehabilitation
- o. Rehabilitation of Navigation Locks
- p. Application of New Technology to Maintenance and Minor Repair
- q. Concrete Cracking Research
- r. Unsolved Problems Relating to Alkali-Silica Reaction in Concrete
- s. Repair of Concrete Affected by Alkali-Aggregate Reaction
- t. Stability of Existing Concrete Structures on Rock
- u. Predicting Concrete Service Life
- v. Maintenance and Repair Management System for Civil Works Structures
- w. Application of X-Ray Diffraction to Determine Residual Stress
- x. Techniques for Removal of Deteriorated Concrete

Maintenance, rehabilitation, and life extension are the primary areas of concrete activity presently underway in the public sector. Much information is being developed in the REMR Program. Even so, it is impossible to effectively evaluate the many repair materials on the market to date. Information must be shared, and potential users should search for information prior to specifying an unknown material or technique. Environmental considerations, primarily temperature and moisture, continue to have a significant effect on most repair situations.

#### Other

Active participation in the Concrete and Structures Session was limited to only two of the four agencies. The reason for this is presumably lack of activity in the concrete area or restriction of travel. This low level of participation may indicate the need for a change in format. Perhaps a conference telephone hookup of project leaders and laboratory chiefs would allow more participation from agencies with restricted travel budgets. They could then discuss topics of mutual interest from previously submitted project sheets. One agency could again be assigned to coordinate the conference.

## Electric Power Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Jim Ray (Chairman)	BPA	Frank Young	EPRI
Paul Schaad	BPA	Rick Shumar	EPRI
Leon Kempner	BPA	Bert Milano	USBR
Marvin Klinger	BPA	Greg Vaselaar	WAPA
Charles Carter	TVA	Kenneth Klein	DOE
John Kirkland	TVA	Ray Franco (Recorder)	WES-COE

\* Addresses and phone numbers are given in Appendix B.

### General

The Electric Power Session was attended by 12 participants representing 6 agencies. Representatives of EPRI also attended. It should be noted that the Western Area Power Authority (WAPA), TVA, BPA, USBR, and COE are all members of EPRI (USBR and COE as a result of BPA and WAPA membership in EPRI). The 42 topics that were presented address research efforts with starting dates subsequent to the last conference. Topic statements were provided for an additional 29 ongoing projects as updates from the last conference. The detailed Agenda and the Topic Statement are given in Appendix E.

### Areas of Duplication

No indication of unnecessary duplication of research efforts was noted as the topics were presented and discussed. Benefits of the session included identification of one proposed USBR project (EP-6aa) that will not be conducted due to a change in BPA criteria for switching surge control for 500-kV lines.

### Areas of Cooperation

There were approximately six areas of research in which complementary or cooperative efforts were noted. The cooperation or complementary efforts involved joint sponsorship of projects and coordination of independent efforts to exchange complementary information. The effort involved in a project that TVA was about to initiate will be considerably reduced because of the presentation of a BPA project involving much of the same work (EP-4f).



Areas of Needed  
Research and Coordination

Further complementary or cooperative research is needed in the following areas:

- a. Application of artificial intelligence to operations and maintenance
- b. Efficiency, improvement, and reduction of operation and maintenance costs in hydropower plants
- c. Technology transfer of selected results of EPRI research and development including results in hydroelectric and distribution areas
- d. Development of three-phase amplifiers (120 amps) for metering and relays with optical devices
- e. Robotics for transmission line inspection
- f. Grounding practices for maintenance
- g. Application of optical devices to transmission system measurements (including current, voltage, and temperature)
- h. Magnetic field characterization/exposure
- i. High-impedance fault detection
- j. Relay evaluation system (see EP-4f)
- k. Digital fault recorder requirements/fault data file compatibility for exchange of information between utilities
- l. Power system stability control and stabilizers

Some of these areas are likely candidates for joint sponsorship of projects, or work that should be accomplished by EPRI because of potential benefits to all of its members. There were only four new projects in the hydropower plant area since the last conference. No new projects were presented in this area by COE and TVA. It is not clear if this indicates a reduction of effort in this area or if there are actually new projects that were overlooked for presentation. As indicated above, this is an area of needed research, especially efficiency improvement and reduction of operation and maintenance costs. The USBR has an interest in all BPA topics on stability control. Better coordination needs to be established for research and development in this area. More resources are needed to ensure timely solution of problems in this area.

Topics Involving Technology Transfer

- a. Topic EP-1b (BPA): Evaluation of an Automatic Index Test Box to Optimize the Efficiency of Kaplan Turbines
- b. Topic EP-1c (EPA): Study to Improve the Efficiency of the Cross-Flow Turbine

- c. Topic EP-2a (TVA): Lighting Location
- d. Topic EP-2b (BPA): Lighting Monitor System
- e. Topic EP-2c (BFA): Wind Loading on a Lattice Transmission Tower
- f. Topic EP-2e (EPA): Longitudinal Impact Loading on Transmission Structures
- g. Topic EP-2f (BPA): Transmission Engineering Workstation
- h. Topic EP-2h (USBR): Personal Protective Ground Jumpers
- i. Topic EP-3a (BPA): Advanced Technology Breaker Demonstration
- j. Topic EP-3c (BPA): 230-kV Advanced Load Interrupter
- k. Topic EP-3d (TVA): Power Quality Issues for Sensitive Loads
- l. Topic EP-4c (TVA): Digital Protective Relaying
- m. Topic EP-4h (BPA): Digital Fault Recorder Evaluation
- n. Topic EP-4i (BPA): Communications Alarm Processor
- o. Topic EP-5c (BPA): Intertie Performance Monitor
- p. Topic EP-5d (BPA): Dynamic Interact. Monitor Network for Western Power System
- q. Topic EP-5f (USBR): Evaluate Digital Power System Stabilizer
- r. Topic EP-5g (BPA): Evaluation of Programmable Controllers as Remedial Action Controls
- s. Topic EP-5h (BPA): Static VAR Control for Power System Damping
- t. Topic EP-5i (BPA): Stabilize Through Reactive Power Modulation
- u. Topic EP-5j (BPA): System Stability Prediction and Control Based on On-Line Phasor Measurement
- v. Topic EP-5k (BPA): Application of Precise Time Synchronization
- w. Topic EP-5l (BPA): Integrated CAD Software for Stability Control Application

Several of these projects involved demonstration or evaluation of a new device or technique. The results of a few projects were reported in papers presented at conferences. Plans are being made to discuss implementation of results of several projects (EP-1b, 1c, 2h) with other agencies. Other cases of technology transfer for these projects involved use of the information in everyday design, operation, or maintenance practice.

Topics Involving Project Maintenance, Rehabilitation, or Life Extension

- a. Topic EP-1a (USBR): Efficiency Algorithm for Loading Hydroelectric Generators

- b. Topic EP-1b (BPA): Evaluation of an Automatic Index Test Box to Optimize the Efficiency of Kaplan Turbines
- c. Topic EP-1c (BPA): Study to Improve the efficiency of the Cross-Flow Turbine
- d. Topic EP-1d (USBR): Generator Stator End Turn Insulation Evaluation Techniques
- e. Topic EP-2f (BPA): Transmission Engineering Workstation
- f. Topic EP-2g (TVA): Line Rover Transmission Line Inspection Robot
- g. Topic EP-2i (TVA): Long Distance Free-Air Optical Temperature Sensor
- h. Topic EP-2j (USBR): High-Voltage Direct-Current Cable Test Technique Development
- i. Topic EP-3a (BPA): Advanced Technology Breaker Demonstration
- j. Topic EP-3b (BPA): 500-kV Breaker Reliability Improvement
- k. Topic EP-4a (BPA): Series Capacitor Control Improvement
- l. Topic EP-4c (TVA): Digital Protective Relaying
- m. Topic EP-4e (BPA): High Impedance Fault Detection System
- n. Topic EP-4f (BPA): Relay Evaluation System
- o. Topic EP-4i (BPA): Communications Alarm Processor

Other Comments

Many items for follow-up were identified and noted by the participants. Further exchange of information is expected with the principal investigators and with EPRI.

## Energy Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Walter Myers (Chairman)	BPA	Stan Hightower	USBR
Gerlad Cler	CERL	Albert Costanzo	EMSI, LTD.
Allan Lessem (Recorder)	WES	Gordon Yeo	EPRI
Mohan Singh	COE		
Greg Askew	TVA		
Graham Siegel	TVA		

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\* Addresses and phone numbers are given in Appendix B.

### General

Fifty-nine research topic statements covering the following areas of interest were submitted for discussion at the conference:

- a. Solar Technology: 4 topic statements
- b. Biomass Utilization: 3 topic statements
- c. Efficiency: 19 topic statements
- d. Conservation: 26 topic statements
- e. Other: 7 topic statements
- f. Informal discussions without topic statements:
  - (1) Wind energy technology status update
  - (2) Superconducting Magnetic Energy Storage (SMES) interests

Topic submissions by agency were as follows: BPA, 45; TVA, 12; and USBR, 2. The detailed Agenda and the Topic Statements are given in Appendix F.

### Remarks

The stated purpose of the conference to promote coordination between agencies was well served in this session. Several significant areas of common interest and opportunities to exchange data were recognized.

Ongoing information exchange between TVA and USBR was continued in the area of salt-gradient solar ponds. Other agencies (for example, US Fish and Wildlife) are beginning to express interest in the area and will find many problems identified and solved by prior TVA and USBR cooperation. The US Fish and Wildlife is interested in using solar pond energy for conditioning water for use in hatcheries.

COE (CERL) found that an interest in desiccant cooling systems combined with solar heating will be substantively supported by prior and ongoing work in this area by TVA. In addition, in the area of energy storage technology, an interest by CERL in ice storage can be merged with ongoing TVA research in methods for long-term storage of thermal energy. TVA requested input from all session participants in this area of research.

TVA and BPA identified a common interest in development of an index of available software for use in analyzing and controlling industrial facilities and processes. The current BPA effort will be readily adaptable to the TVA industrial sector programs. In addition, common interests were recognized in studies of reflective foil insulation, "high-R-low-E" window development, adjustable speed drives, and power factor controllers. These topic areas are especially of mutual concern for utilities with active conservation/efficiency programs in the end use of electrical energy.

Participants expressed the conviction that coordination is optimized by personal relationships among project engineers and principal investigators where interagency visits at this level are appropriate and desirable and when travel constraints allow. Participants also observed that while broad technical areas were of common interest, applications of technology differ, sometimes quite significantly, according to geographical locale. Climate and energy user life-styles are factors that can make regional solutions to common problems appear different. This is a situation that should not be mistaken for unconcern about duplication of effort. The participants recognized and stressed that it is never too early for technical-level interaction beginning with exchange and review of work statements, project outlines, and project study plans. Such review could lead to a project being expanded or modified to accommodate another agency's interest or objective and could lead to a better project with the possibility of cooperative participation and funding. Participants were encouraged to have investigators contact peers in other agencies for those topic statements of mutual interest.

#### Joint Session

The Power and Energy Sessions were joined in a special session for presentations and discussions of health effects of electric and magnetic fields and of superconductivity. Mr. Kenneth Klein of DOE and Mr. Frank Young of EPRI presented their respective organizations' programs in these areas.

Health effects of electric and magnetic fields. The incentives to study this area are the high level of confusion and uncertainty as to the health effects from fields and the emerging problems in obtaining right-of-way. These incentives are underscored by the adverse court decisions regarding injunctions, punitive awards, and ordered line relocations because of the public concern over field effects from transmission facilities. The problem is further compounded by a variety of differing field strength standards being set or considered by various political subdivisions. DOE is adding the study of magnetic field effects to the previous work in electric field effects. EPRI's research is focusing on the three areas of epidemiology, exposure assessment, and basic science. Specifically EPRI is (a) studying the relationship between electric and magnetic fields from power lines and human health; (b) doing exposure assessment studies to characterize human exposure to electric and magnetic fields from various sources including power lines; (c) doing laboratory studies on the electric and magnetic field effects on laboratory animals and on cellular systems; and (d) modeling magnetic fields created by power lines using actual field measurements.

High-temperature superconductivity. The potential of superconductivity for electrical utility uses is great, but much unglamorous engineering must precede everyday usage. The current status of superconductivity technology is fraught with fragile materials, inability to repeat results, low current densities, and current density reduction in fairly low magnetic fields. The materials science problems are in learning what is actually going on in superconductors. Of interest are the mechanisms and impediments to reaching superconductivity such as cell crystal boundary phenomenon, crystal alignment effects, etc. Solving these problems is essential to actually developing formable materials and devices. Also, a better understanding of the potential uses (market) is needed to help define and direct research and development towards the most promising applications and device parameters. Useful, reliable, and cost-effective products could be many years away.

DOE passed out the results of Argonne Laboratory's superconductivity application review and a three-page summary of the superconductivity performance parameter requirements necessary for utility application. Both of these documents are available from Mr. Klein on request. The Argonne report is based on considering superconductivity application to current utility devices or a retrofit of current designs with superconducting materials. Yet to be

considered are new applications that may take advantage of superconductor characteristics in ways not yet thought of. Mr. Klein stressed that large generators, high-capacity storage, and bulk transmission may not be the ratings of the future. What is needed is a better understanding of how systems will grow and what devices at what ratings they will employ in the future. The nature of a DOE program is still pending identification of program budgets.

EPRI distributed a copy of their September 1987 Journal which contains their observations on the status, promise, and application of the high-temperature superconductivity technology to utilities. The EPRI focus is on motors, generators, and transmission cables with base investigation in the accurate measurement and understanding of alternating current applications and losses. Mr. Young is the coordination point for the three EPRI Divisions that are active in the consideration of this technology. BPA has initiated an in-house study to consider the Northwest Power System 15-25 years from now assuming commercial availability of certain high-temperature superconducting devices. The study is focused on transmission and power system operation with the objective of defining the power system requirements for superconducting technology application. Battelle Pacific Northwest Laboratories is participating in this study by providing baseline superconductivity capability assessment and will take the BPA results as input to a broader economic and societal benefit projection of applying superconductivity to the Nation's utility needs. The BPA study will also provide the input to DOE to help define the utility application areas that are most promising so that basic research can be directed and prioritized.

TVA is participating as a potential host utility for the DOD 10-Mw SMES system that would pulse-power a Strategic Defense Initiative laser weapon. The DOD project is being pursued by two competing design teams led respectively by Bechtel and EBASCO. EPRI has been invited to participate with the predominance of funding to come from the DOD for this \$80 million project. The design technology is conventional low-temperature superconducting materials with a built-in design checkpoint in 1989 to consider the advancements and applicability of the new higher temperature technology.

From the superconducting discussions it appeared that utilities are interested in getting experience with superconductivity even with the lower temperature current technology so as to build a base of cost, operation, and

maintenance understanding that would facilitate adoption of the new technology when it finally emerges from the development phase.



## Hydraulics Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
George D. Ashton	CRREL	Larry Holman	COE
Marden B. Boyd	WES	John J. Ingram	WES
Phil Burgi	USBR	Myron L. Iwansky	TVA
Neil Coleman	USDA-ARS	John E. Kirkland, Jr.	TVA
Deborah Cooper	WES	Drange Marshall	CERL
Albert Costanzo	EMSI, LTD.	Sandra Martin	WES
Robert A. Crowley	FERC	Steve T. Maynord	WES
Ely Driver	TVA	Richard G. McGee	WES
Bob Fletcher	WES	Clark McNair	WES
John F. George	WES	Randy Oswalt	WES
Dean Harshbarger	TVA	Dick Sager (Chairman)	WES
Dale Hart (Recorder)	WES	Mohan Singh	COE
Frank Herrmann	WES	Tony Thomas	WES
John Hite	WES	Ronald Wooley	WES
Jeffery P. Holland	WES	Jim Wuebben	COE

\* Addresses and phone numbers are given in Appendix B.

### General

The Hydraulics Session was attended by 30 participants representing 6 agencies: 22 from COE, 4 from TVA, 1 from USBR, 1 from USDA, 1 from FERC, and 1 from EMSI, Ltd. A total of 47 topics were discussed in subject areas as follows:

- a. Topic H-1, Debris/Ice Control, 4 topics
- b. Topic H-2, Gates/Valves, 5 topics
- c. Topic H-3, Navigation, 5 topics
- d. Topic H-4, Riprap, 3 topics
- e. Topic H-5, Predictive Techniques, 8 topics
- f. Topic H-6, Sedimentation, 10 topics
- g. Topic H-7, Spillways/Stilling Basins, 7 topics
- h. Topic H-8, Turbines, 5 topics

The detailed Agenda and the Topic Statements are given in Appendix G.

### Areas of Duplication

No duplication was defined.

### Areas of Cooperation

The discussion identified several areas of common interest. Specific

areas where interchange will or will continue to benefit research efforts are as follows:

- a. Floating debris control work of TVA and Cold Regions Research and Engineering Laboratory (CRREL)
- b. Gate closure work of TVA and USBR
- c. Sedimentation activities of WES and USDA
- d. Precise mapping of surfaces needs of WES and USDA
- e. Numerical modeling of all agencies
- f. Optimizing application of physical and numerical models of all agencies
- g. Stability of riprap needs of WES, USBR, and CRREL
- h. Tow-induced physical effects on the environment interests of WES and TVA
- i. Instrumentation for cavitation studies by USBR and TVA
- j. Water measurement manual work of USBR of interest to all

The following three areas of less technical nature are of interest to all:

- a. USBR approach of involving private industry in research and development efforts. They are attempting to interest private industry in cost sharing on research. An example is the hydraulics of stepped spillways.
- b. Recent contracting procedure employed by WES Broad Agency Announcement and Requirements Orders.
- c. Emphasis on developing the proper environment to enable physical and numerical modelers to work together to create the best possible product.

#### Areas of Needed Research

The following are specific areas where additional research is needed:

- a. Debris control systems
- b. Impacts of large ice on submerged gates
- c. Design of riprap
- d. Precise mapping procedures for nonwater surfaces
- e. Improved numerical models
- f. Measurement of dynamic pressures

#### Recommendations on Research Coordination

Development over the past 4-5 years has resulted in many changes in laboratory techniques and instrumentation. It was agreed the Work Group on Hydraulic Laboratory Techniques and Instrumentation would be reactivated with

a meeting scheduled for the early fall of 1988 at WES. WES will take the lead in organizing the meeting.

Possibly a water quality modeling working group exists in both the Hydraulics and Water Quality and Ecology technical areas. Working with the Water Quality and Ecology Groups will eliminate this apparent duplication.

The Reaeration Working Group is active and productive.

#### Topics Involving Safety of Dams

The following specific topics involve safety of dams:

<u>Topic No.</u>	<u>Project Title</u>	<u>Agency</u>
H-2a	Emergency Closure of Turbine Intake Gates	TVA
H-2b	Emergency Gate Closures	USBR
H-2e	Cavitation Research	USBR
H-4c	Flow Over Low Embankments	USBR
H-5d	Dam Failure Hydrographs and Downstream Flood Routing	USBR
H-7a	Stepped Spillway	USBR
H-7b	Labyrinth Spillways	USBR
H-7d	Scour Downstream from Stilling Basins	WES
H-7f	Damage to Spillway Plunge Pools	USBR

Nine studies listed under the area of "Safety of Dams" were discussed by participants. Two were of model and field studies to develop design and operational criteria for closure of vertical lift gates under unbalanced head conditions. Another, the study of different types of gates, valves, and surfaces, was for predicting cavitation damage. USBR is looking at the hydraulics of flow over low embankments and ways of protecting them.

Conditions downstream of a breached dam are being studied using available literature and analytical models. A technical memorandum has been published. Model and field studies are underway to determine criteria for design of stepped and labyrinth spillways. Physical models are being used to develop criteria for sizing protective material downstream from stilling basins. High-velocity jets are being studied to predict effects of free-falling water jets in plunge pools.

#### Topics Involving Technology Transfer

The following specific topics addressed technology transfer:

<u>Topic No.</u>	<u>Project Title</u>	<u>Agency</u>
H-1b	Floating Debris Control Systems	CRREL
H-1c	Ice Passage at Submergible Tainter Gates	CRREL
H-3e	Precise Photogrammetric Mapping of Undulating Water Surfaces	WES
H-4b	Effect of Water Flow on Riprap Flood Channels	WES
H-5c	Hydraulic Analytical Techniques	USBR

<u>Topic No.</u>	<u>Project Title</u>	<u>Agency</u>
H-5e	Water Measurement Methods	USBR
H-5f	Pump Station Inflow-Discharge Hydraulics	WES
H-6a	Geomorphic Factors Affecting Sediment Transport and Deposition in Northern Rivers	CRREL
H-6c	Stable Flood-Control Channels	WES
H-6d	Mechanisms and Prediction Methods for Concentrated Flow Erosion	USDA
H-6e	Prediction Models and Control Practices for Upland Erosion and Runoff	USDA
H-6f	Develop and Evaluate Upland Erosion Control Practices	USDA
H-6g	Yazoo Basin Erosion Control Research Project (Hydraulics)	USDA
H-6h	Develop and Evaluate Erosion Control Conservation Tillage Systems	USDA
H-6i	Principles of Sediment Transport in Upland Sand Bed Channels	USDA
H-6j	Water Measurement	USBR
H-7a	Stepped Spillway	USBR
H-7b	Labyrinth Spillways	USBR
H-7d	Scour Downstream from Stilling Basins	WES
H-8a	Analyses of Hydroturbine Vibrations	TVA
H-8e	Hydroturbine Flow Measurement Using the Pressure- Time Method	TVA

The following technology transfer methods were given by the participants:

- a. Technical Reports
- b. Coordination with other agencies and private firms
- c. Symposia
- d. Short Courses
- e. Letter Reports
- f. Summary Reports
- g. Design Guides
- h. Interagency Conferences
- i. Manuals
- j. Technical Notes for REMR Notebook

Topics Involving Project Maintenance,  
Rehabilitation, and Life Extension

<u>Topic No.</u>	<u>Project Title</u>	<u>Agency</u>
H-1b	Floating Debris Control Systems	CRREL
H-1c	Ice Passage at Submergible Tainter Gates	CRREL

<u>Topic No.</u>	<u>Project Title</u>	<u>Agency</u>
H-1d	Hydraulic and/or River Modifications to Control Ice and Floating Debris	CRREL
H-2b	Emergency Gate Closures	USBR
H-2c	Throttling Valve for High Head Applications	USBR
H-2d	Cavitation-Free Slide Gate Design	USBR
H-2e	Cavitation Research	USBR
H-3b	Evaluation of Channel Reaches with High Accident Rates	WES
H-3d	Lock Gate Impact Barriers	WES
H-3e	Precise Photogrammetric Mapping of Undulating Water Surfaces	WES
H-4a	Ice Effects on Riprap Structures	CRREL
H-5b	Predictive Techniques for Approach Flow Conditions to Spillways and Other Structures	WES
H-6a	Geomorphic Factors Affecting Sediment Transport and Deposition in Northern Rivers	CRREL
H-6c	Stable Flood-Control Channels	WES
H-6d	Mechanisms and Prediction Methods for Concentrated Flow Erosion	USDA
H-6e	Prediction Models and Control Practices for Upland Erosion and Runoff	USDA
H-6f	Develop and Evaluate Upland Erosion Control Practices	USDA
H-6h	Develop and Evaluate Erosion Control Conservation Tillage Systems	USDA
H-6i	Principles of Sediment Transport in Upland Sand Bed Channels	USDA
H-7c	Stilling Basin Damage Due to Erosion	USBR
H-7d	Scour Downstream from Stilling Basins	WES
H-8a	Analyses of Hydroturbine Vibrations	TVA
H-8b	Cavitation Studies	TVA
H-8c	Evaluation of Turbine Operation	USBR
H-8d	Online Hydroturbine Efficiency Monitoring and Optimization	TVA
H-8e	Hydroturbine Flow Measurement Using the Pressure-Time Method	TVA

The presentations discussed many research areas which would improve the methods of extending the life of projects. The areas of concern are evident in the subject titles. Examples are debris control, ice passage, emergency gate closure, cavitation control, hydropower and navigation effects, barriers to impact damage, sediment deposition effects and control, erosion control, and vibration prevention.

#### Other

The need to organize a working group on numerical hydrodynamic modeling

was discussed. This group should not be combined with the water quality working group. Organization of the working group should be accomplished at the Sixteenth Conference.

During the next 2 years, efforts should be made to identify other agencies that would benefit from participation in these sessions, and their representatives should be invited to attend the Sixteenth Conference. The potential benefits for all participants are great.

## Rock Mechanics Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
James Warriner	WES	Doug Bolstad	USBM
Wendell Miller	WES	Jack Touseull	USBR
William Strohm**	WES	Fred Anderson**	COE
Sam Boakye	WES	Jerry Huie (Chairman)	WES
Andy Schaffer**	WES	David Bennett**	WES
Jose Llopis**	WES	James May**	WES
		Hardy Smith**	WES

- \* Addresses and phone numbers are given in Appendix B.  
\*\* Indicates part-time attendance.

### General

Forty-four topic statements were submitted for the Rock Mechanics Session. Two additional topic statements were presented during the session for a total of forty-six. These topic statements covered six different subject areas as follows:

- a. Computer Applications: 8
- b. Drilling and Blasting: 3
- c. Rock Property Determination: 3
- d. In Situ Testing and Exploration: 9
- e. Ground Stabilization: 10
- f. Mining and Tunneling: 13

The detailed Agenda and the Topic Statements are given in Appendix H.

### Areas of Duplication

No areas of duplicated research efforts were found among the subjects discussed by COE, USBM, and USBR representatives.

### Areas of Cooperation

- a. COE-USBR: Coordination of selection of remedial seepage control measures, Topic RM-1h
- b. COE-USBR: Data exchange, liaison concerning rock erosion in spillway channels, Topic RM-3a
- c. COE-USBR-USBM: Discussions of concepts of rehabilitating clogged rock drains used as uplift control, Topic RM-3c

- d. COE-USBR: Exchange of software, field sites, and concepts of grouting practices for repair and rehabilitation of rock foundations, Topic RM-4c
- e. COE-USBR-TVA: Mutual workshop on geophysical assessment of existing structural foundations, Topic RM-4e
- f. COE-USBM: Exchange of concepts and techniques for geotechnical acoustic emissions monitoring, Topic RM-4f
- g. COE-USBM-TVA: Exchange of concepts concerning theory, design, and performance of rockbolt tunnel support systems, Topics RM-5b, c, d, and e
- h. COE-USBM: Exchange of data and technology concerning flexible distributed load tunnel liners, Topic RM-6c
- i. COE-USBM: Assistance in refining drilling methods for instrumentation of coal mines, Topic RM-6i

#### Areas of Future Cooperation

Mutual interest was discovered among COE, USBM, and USBR in using geometric fractal analysis to characterize rock surface roughness and correlate with shear resistance. Reports were exchanged and future discussions were planned. The use of abrasive additives to "low-pressure" water jets may be applicable to rock drain rehabilitation. Coordination between COE and USBM is highly desirable.

The subject of computer-based expert systems was found to be of common interest, and data and technology will be exchanged.

COE found great interest in the instrumented drill of USBM because of recent acquisition of a similar drilling parameter recorder for use in geologic interpretation of the core boring process. Data and concept exchange will be initiated.

USBM found the results of rockbolt length versus performance tests at COE to be intriguing. Future coordination will probably be in greater detail concerning bolt performance phenomena.

#### Areas of No Duplication

All areas in which similar subjects are being examined by COE, USBM, and USBR are already areas of direct cooperation or deal with generally available equipment and techniques. The subject of drilling parameter recording is one in which future duplication of effort has been avoided. There are no current areas of duplicated research effort.

#### Areas of Needed Research

The area of high-frequency acoustic emission phenomena is a subject area



initiated by USBM and of interest to COE but one in which work was prematurely halted. Applications of fractal analysis, regionalized variables, and geostatistics to the interpolation and interpretation of rock mass characteristics need to be pursued with greater emphasis. After decades of use and study, the behavior of rockbolts and related support systems is still not adequately understood. Similarly, after many applications, the behavior of grout injected or infused into rock for enhanced stability or seepage control is not adequately understood.

#### Recommendations on Research Coordination

Continued and enhanced coordination between agencies is recommended in the general areas of geotechnical acoustic emissions monitoring, rockbolt (and similar) support systems, grout injection procedures and performance, automated data acquisition and interpretation, expert systems ("artificial intelligence"), chemically enhanced rock drilling, and fractal analysis.

#### Topics Involving Safety of Dams

- a. RM-1h: Selection of Remedial Seepage Control Measures. Expert system developed.
- b. RM-2a: Application of Water Jet Technology for Mining. Potential application to rock drain cleaning (RM-3c).
- c. RM-3a: Rock Erosion in Spillway Channels. Headward erosion controls understood and some remedial actions described in detail.
- d. RM-4a: Stability of Structures on Rock. Two structures/foundations heavily instrumented; behaviors being studied in detail.
- e. RM-4e: Geophysical Assessment of Structures/Foundations. Two structures/foundations investigated by a suite of surveys; seepage paths and faults have been delineated.
- f. RM-5e: Polyester Resin Grouted Rockbolts. Tests indicate proper installation of resin grouted bolts imperative to adequate performance; otherwise no inherent defects in resin anchor usage.

#### Topics Involving Technology Transfer

Production of public domain reports, papers, etc.:

- a. RM-2c: Designing Blasts for Safer Pitwalls
- b. RM-3a: Rock Erosion in Spillway Channels
- c. RM-3b: Dredgeability of Rock
- d. RM-4b: Parameters Controlling Roof Stability
- e. RM-4f: Acoustic Emissions of Tar Sand Production

Production of innovative equipment and/or software:

- a. RM-1c: Support for Highwall Stability (software)

- b. RM-1d: Computer Applications on Geotechnical Engineering (software)
- c. RM-1h: Selection of Remedial Seepage Control Measures (software)
- d. RM-2a: Application of Water Jet Technology for Mining (equipment)
- e. RM-4c: Grouting Practices for Rehabilitation (equipment and software)
- f. RM-5b: Roof Bolt Torque and Load (equipment)
- g. RM-5c: Uniformly Tensioned Roof Bolts (equipment)
- h. RM-5d: Short Rockbolt Feasibility (equipment)
- i. RM-5f: Fundamental Drill/Bolt Parameters (equipment)
- j. RM-6c: Flexible Distributed Load Support (equipment)

Direct coordination with Canadian agencies:

- a. RM-2a: Application of Water Jet Technology for Mining
- b. RM-2b: Enhanced Drilling Concepts
- c. RM-4a: Stability of Structures on Rock
- d. RM-4d: Acoustics to Determine Properties of Rock
- e. RM-4f: Acoustic Emissions of Tar Sand Production
- f. RM-5h: Flexible Tendon Ground Stabilization
- g. RM-6a: Mining with Backfill

Topics Involving Project Maintenance, Rehabilitation, and Life Extension

- a. RM-1d: Computer Applications in Geotechnical Engineering. General application.
- b. RM-1h: Selection of Remedial Seepage Control Measures. Provided method for selection of remedial action.
- c. RM-2a: Application of Water Jet Technology for Mining. Potential use in rehabilitating rock drains.
- d. RM-3a: Rock Erosion in Spillway Channels. Provided understanding and suggested life extension methods.
- e. RM-3b: Dredgeability of Rock. Improved maintenance methods.
- f. RM-3c: Rock Drains. Improved maintenance, rehabilitation, and life extension.
- g. RM-4a: Stability of Structures on Rock. Improved evaluation and rehabilitation methods.
- h. RM-4c: Grouting Practices for Rehabilitation. Improved rehabilitation and life extension.
- i. RM-4e: Geophysical Assessment of Structures/Foundations. Improved evaluation methods.
- j. RM-5d: Short Rockbolt Feasibility. Improved life extension.

- k. RM-5e: Polyester Resin Grouted Rockbolts. Improved life extension.

Conclusions and Recommendations

- a. During the session it became apparent that attendance/interest in the Rock Mechanics Session was decreasing. This was evident from the lack of topic statements from several member agencies. During a joint meeting with the Soil Mechanics Session, a recommendation was made to place the Soil, Rock, and Earthquake Sessions under the general umbrella of a Geotechnical Session. Concurrent work sessions could be held if, and when, desirable. Additionally, a recommendation was made to invite participation of some of the National Laboratories.\* This is seen as a particularly desirable move with respect to rock mechanics. All of those in attendance concurred with both recommendations.
- b. The participants concluded that the discussions during the session were very beneficial and agreed to continue to exchange information through informal contacts and discussions.

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\* Laboratory Points of Contact:

Los Alamos National Laboratory  
Earth and Space Sciences Division  
ATTN: Mr. Jim Blacic  
PO Box 1663  
Los Alamos, New Mexico 87545

Sandia National Laboratory  
Geomechanics Division, Div. G232  
ATTN: Mr. W. R. Wawersik  
Albuquerque, New Mexico 87185

Lawrence Livermore Laboratory  
ATTN: Dr. Francois E. Heuze, L 200  
PO Box 808  
Livermore, California 94550

## Soil Mechanics Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Leon Kempner**	BPA	Earl Edris**	WES
Richard Davidson	CEEC	Gus Franklin	WES
Ed Pritchett	CEEC	Paul Gilbert**	WES
Bill Roper**	CERD	Larry Johnson**	WES
Doug Bolstad**	USBM	Joseph Koester**	WES
Clifford Astill	NSF	Ellis Krinitzsky**	WES
Syed Ahmed	TVA	Daniel Leavell (Recorder)	WES
George Buchanan**	TVA	Jose Llopis**	WES
Bill Austin	USBR	LeRoy McAnear (Chairman)	WES
Bob Ledzian	USBR	Britt Mitchell**	WES
Frank McLean**	USBR	Edward Perry**	WES
		John Peters	WES
		Dick Peterson**	WES
		Vic Torrey**	WES
		Jerry Huie**	WES

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\* Addresses and phone numbers are given in Appendix B.

\*\* Part-time participants

### General

Twenty-eight soil mechanics and six earthquake related topic statements, covering six different subject areas, were submitted for discussion at the conference. Presentations were made for all topic statements. The focus was on management of research and development thrusts and coordination between agencies rather than technical details of research work units. The number of statements submitted in each of the subject areas was as follows:

- a. Laboratory Testing: 10
- b. In Situ Investigation Technology: 4
- c. Analytical/Design Studies: 5
- d. Special Studies and Correlations: 5
- e. Field Performance: 4
- f. Earthquake Engineering: 6

The detailed Agenda and the Topic Statements are given in Appendix I.

The topics dealt with a wide range of materials such as fine-grained cohesive soils, loess, soil containing large-size particles, granular filters, and soil-cement mixtures. A broad spectrum of material properties and soil behavior under project conditions is being investigated, such as compaction,

shear strength, consolidation, swelling, soil suction, water content, acoustic emissions, permeability, erodibility, hydraulic fracturing, and liquefaction.

The research topics also addressed soil test equipment and procedures, in situ testing equipment and techniques, probabilistic and risk analyses, sheet-pile wall performance and analysis, analysis and performance of existing structures, and soil behavior under complex loadings.

#### Areas of Duplication

No areas of unnecessary duplication were identified. Although some subject areas are being investigated by more than one agency, there is no duplication of effort since each agency is pursuing different aspects of the problem. However, some duplication was thought to be desirable for validation and reliability of research data.

#### Areas of Cooperation and Interest

There were several areas of investigation that indicated common interest and/or coordination among the agencies.

The USBR, TVA, and COE are evaluating compaction control methods for soils with large particles such as gravel and rock. TVA has completed the testing phase and compiled the test data. A final report will be prepared.

The USBR is in the process of rewriting the soil manual which includes approximately 130 testing procedures; most of the procedures are written in American Society for Testing and Materials (ASTM) format and being passed through ASTM for their agreement.

Interest was expressed by all agencies in the area of in situ technology. USBR would like to involve WES in a possible cooperative effort in developing in situ methods and procedures. Even though there has been a cooperative effort in this area on the project level, additional liaison needs to be established at the research level. USBR and TVA were interested in the technology and the pilot study to investigate the possible development of a large-scale stress cell for the Soil Mechanics Division (SMD), Geotechnical Laboratory (GL), at WES. Also, interest was expressed in the Small Business Innovative Research (SBIR) program from which funding was obtained for this pilot study.

TVA expressed an interest in geophysical methodology for assessment of existing structures and structural foundations even though they have no current research in this area.

USBR was advised that WES (Lawson Smith, CEWES-GR-GR, 601-634-2497) and

US Army Engineer District, Vicksburg, might be able to provide additional information on performance in loessial soil because of the stabilization work performed on the loess slopes along the Mississippi River in Natchez, Mississippi.

An interest was expressed by all agencies to participate in the Round Robin Testing Program that is being coordinated by WES.

A topic was inserted into the agenda on performance of current filter criteria. A video tape was shown by USBR of a contract study performed by Professor Frank Townsend at the University of Florida, Gainesville. The study indicated that possible modifications to the current COE filter design criteria should be considered. Further evaluation of this study needs to be performed to assess if further research is needed in this area.

Research is being contracted to the University of Colorado at Boulder by USBR to perform centrifuge and directional shear cell tests to determine the characteristics of liquefiable soils. Because of WES interest in both test types, liaison with USBR for possible sharing of these test data is required.

In the area of Earthquake Hazard Evaluations for Engineering Sites, the results of independent and project-related studies by COE and USBR were usually available to each other; however, more information exchange by the researchers during investigations that update or develop new state-of-the-art processes or position papers (e.g., geological-seismological evaluations of earthquake hazards) was suggested.

Mr. Cliff Astill provided insights into NSF programs in geomechanics, particularly the Earthquake Hazard Mitigation Program. Several areas of common interest and potential interaction were discussed; e.g., siting and geotechnical systems, structures, and earthquake hazards integration. The focus is on strong motion data, centrifuge testing, supercomputers, expert systems (e.g., onsite characterization), national test sites for geotechnical research, and liquefaction research. Of particular significance was the change in NSF policy favoring greater participation by Federal agencies, directly or through universities, in the NSF research program; a major need may exist in educating the review community to current NSF philosophy.

Instrumentation and automation are getting greater emphasis and expanded use by USBR/COE; both agencies have been exchanging information on equipment and field experiences.

The COE research using a laboratory centrifuge for soil property

determinations would be of a significant value to TVA in providing guidelines for determining consolidation and permeability properties of soft fly ash required for ash disposal at fossil plants.

All agencies are involved and interested in Computer Applications in Geotechnical Engineering (CAGE) type activities. Existing technology exchange needs to be expanded.

#### Areas of Needed Research

A national priority for COE research is related to geotechnical aspects of hazardous and toxic wastes, important in both civil and military missions. Water quality and chemistry problems are well recognized, but remedies are largely geotechnical. Historically these Interagency Research Coordination Conferences have focused on surface waters; it is now imperative to establish the ground-water connection to the surface water as well as the environmental connection. The soil-rock-ground-water-chemistry reaction must be integrated into geotechnical practice.

BPA encouraged more research in applications of probabilistic methods in soil mechanics. BPA described research needed for large-scale soil classification for projects such as thousand-mile transmission lines; a method to distinguish soil versus rock; and a geotechnical description of surface and near-surface (approximately 20 ft) soils based on reconnaissance without drilling. Research is needed in direct embedment of structures and grouting of soil anchors. BPA advocated liaison with geotechnical research by EPRI.

WES expressed a need for performance-based criteria in evaluating past and future performance of existing structures. USBR stressed a need for additional research in the areas of soil stabilization, soil-cement, and roller-compacted concrete.

TVA research needs were primarily related to material properties and stabilization and use and/or disposal of waste materials from nuclear and fossil fuel plants. However, the technology would be adaptable to other geotechnical applications. The research needs involved dam safety; foundation stability; calculations of soil-structure interaction; dynamic analyses; soil-cement; and static and dynamic properties of soils.

#### Recommendations on Research Coordination

Greater/more direct liaison with NSF was recommended; e.g., information was exchanged between WES and NSF on independent efforts toward a multi-language dictionary. Follow-up liaison and coordination are needed.

USBR stressed the need for information on the Standard Penetration Test (SPT) to be collected from agencies and disseminated. All agencies now use different test procedures, making it virtually impossible to correlate data from this test. COE cited the importance of a unified approach and identified urgent needs to address calibration of equipment (fundamental physics) and technical guidance on SPT to field offices. Technical guidance, even on an interim basis, is needed now based on information available. Problems exist with the equipment being used; nevertheless, many are running SPT, deriving N values, and making design decisions. A need exists to develop good resources (best available), uniformity, and a critical assessment of equipment and practice; current technology is too fragmentary. It was proposed that an ad hoc working committee be formed to support the development of a standard test procedure among the agencies. The committee members are tentatively Jim Farra (USBR), Bill Childress (TVA), Gus Franklin (WES), and Frank Worth (BPA). The committee will tentatively be headed by Jeng Chang (COE). FHWA should be invited as an observer/participant.

Work on constitutive equations is largely uncoordinated; models are easy to develop but harder to verify. Mutual support and coordination would be beneficial.

#### Topics Involving Safety of Dams

All the topics discussed had a bearing on the safety of dams: properties of materials, in-place conditions, methods of investigation, assessment of performance (past and future), and means of extending a structure's life. Initiatives by EPRI with respect to dam safety were noted.

#### Topics Involving Technology Transfer

Technology transfer was an area of major emphasis by all; some efforts are needed toward uniformity in guidelines and practice; most agencies anticipate greater emphasis in this area. Greater interaction is needed with universities/private practice. The mutual benefits derived from WES Inter-Governmental Personnel Act (IPA) and student contracts as well as research contracts (e.g., Broad Agency Announcement (BAA) system) were noted as highly worthwhile. The Geotechnical Engineering University Research Council meeting, Houston, Texas, 2-4 March 1987, seemed to be an excellent initiative toward greater unity in the geotechnical engineering community. BPA suggested teleconferencing between the PI's. The general consensus was that the interagency meetings were primarily for management and not technical details; the PI's



should be encouraged to talk anytime for better technology interchange. All agencies should compile a list of their current (past year or two) reports, data bases, etc., not necessarily published, that contain geotechnical data that would be of interest to the other agencies.

Manuals, technical guidelines, specifications, training courses, etc., are oriented to the specific requirements of each agency. In general, these publications and courses are readily accessible by other agencies and generic information is freely adapted. Many of the standards are coordinated with consensus groups, e.g., ASTM, and in effect, some interagency coordination is effected through membership and active participation in committees of standards-setting organizations.

A list of soil mechanics and earthquake engineering reports published by WES since the last meeting was distributed.

#### Topics Involving Project Maintenance, Rehabilitation, and Life Extension

COE has an ongoing research program, Repair, Evaluation, Maintenance, and Rehabilitation (REMR). A need for a better understanding of foundations under existing structures was voiced by TVA.

COE solicited modest financial support from the other agencies for a US-Japan Committee on Natural Resources (UJNR) workshop on remedial treatments of foundations susceptible to liquefaction to be held in the United States at Jackson Lake, Wyoming, in May 1988.

#### Conclusions and Recommendations

The Soil Mechanics Working Group has been inactive except for periodic casual discussions between committee leaders at professional or other incidental meetings. The committee recommends the working group be disbanded in favor of greater interaction between principal researchers involved in related investigations.

In a joint session between Soil Mechanics and Rock Mechanics it was resolved that the independent technical sessions be disbanded in favor of a single Geotechnical Session which is more relevant to professional practice and would provide a better forum for common interests. The number of topics addressed in research and development programs has diminished and the number of participants has decreased reflecting manpower constraints and budget limitations. The combined forum would be a more effective interdisciplinary activity.

The merits of extending invitations to appropriate national laboratories and agencies were discussed. Invitations to USGS, NBS, FHWA, MMS, DOT, SCS, NSF, and US Navy are encouraged, at least as observers. The work, criteria, and decisions of these agencies impact the work, procedures, and test methods of the agencies that presently attend these conferences.

The Interagency Research Coordination Conference (IRCC) provides an excellent opportunity for the hosting agency to train their personnel; all of WES PI's in the Soil Mechanics area were involved. USBR noted that the IRCC was an effective "management" forum that was well balanced in technical content (enough to make rational decisions, but not overburdened in details).

Much of the project-specific applied research requires greater visibility/dissemination. There also is a need for closeness of research and development and project application. Better visibility and information exchange on new capabilities within each agency are needed. Interdisciplinary interaction needs to be improved and expanded.

Many advancements since last meeting involved modern technology; the future in geotechnical engineering involves greater use of "high tech" developments, and an innovative research and development program is needed to exploit this technology. Advancements involved in the WES Soils Research Center program were shown to the participants after the formal sessions. Principal points of interest were a new directional shear device, rotation of principal stress systems, automation of microwave ovens, calibration chamber, MTS loading systems, large-particle testing apparatus, controlled-flow pumps, and the electronics and automation support systems.

## Water Quality and Ecology Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Lloyd O. Timblin, Jr.	USBR	Charles M. Cooper	USDA-ARS
Richard J. Ruane	TVA	George D. Ashton	CRREL
Myron L. Iwanski	TVA	Doug Gunnison	WES
David P. Buelow	COE	Bob Kennedy	WES
Jim Thomas	USBR	Mark Dortch	WES
Jim Wright	TVA	Bill Rushing	WES
Don Dycus	TVA	J. L. Mahloch (Chairman)	WES
Leon Bates	TVA	Bill Waldrop	TVA
Mike Gaydos	USGS	Sandy Bird	WES
Rosemarie Russo	EPA	Paul Schroeder	WES
Anne McDonald	WES	John Bushman	OCE
Richard Price	WES	Bevan Brown	TVA

\* Addresses and phone numbers are given in Appendix B.

### General

One-hundred-twenty topic statements were reviewed during this session. Because of the large number of topic statements, discussion was organized around the following 13 topic areas:

<u>Topic Area</u>	<u>Number of Topic Statements</u>
Water Quality Management	5
Contaminants	13
Ground Water	3
Reservoir Limnology	5
Water Quality Modeling	4
Reservoir Tailwaters	12
Aquatic Plant Control	32
Biological Resources	12
Vegetation/Habitat Management	8
Acid Rain/Acid Mine Drainage	5
Hydrologic Impacts/Water Supply	6
Waste Processing	8
Environmental Aspects, General	7

The detailed Agenda and the Topic Statements are given in Appendix J.

Among the unique features of this year's session was the attendance and participation of several observer agencies, most notably EPA, USGS, and USDA-ARS. Generally, there was a wide exchange of information on technology and

agency progress since the last meeting for a wide variety of fronts.

#### Areas of Duplication

No areas of duplication were discovered during the session. On the contrary, because of the success of coordination efforts, many examples of cooperative or complementary research and development were highlighted during the session.

#### Areas of Cooperation

Several key areas of excellent cooperation among the member agencies were brought out during the session:

Water Quality Management. This area appears to be a critical thrust for all agencies. TVA has historically been more involved in this area than the other agencies because of mission and authorities. COE initiated a comprehensive program in this area during fiscal year 1987, and USBR, because of recent changes in agency mission, will undoubtedly be more heavily involved in this area in the future. The enactment of the CWA 87 (Section 524-Dam Water Quality Study) and subsequent implementation by EPA have also provided a common area for coordination among the member agencies over the last 6 months. This is an area which touches many facets of agency programs, for example, water quality monitoring; consequently, coordination will be highly beneficial to all agencies.

Ground Water. Coordination has been pursued on many aspects of this research, especially as it relates to waste disposal and its impacts.

Water Quality Modeling. The USBR has made comparison runs on water quality models from COE and TVA. There was considerable discussion on model applicability and methods for evaluation.

Hydroacoustics. The USBR is currently employing technology initially developed by COE.

Aquatic Plant Control. Coordination continues to be excellent in this area, fostered primarily by the outstanding efforts of the working group. WES had performed herbicide/adjuvant evaluation studies in conjunction with TVA at TVA's Aquatic Research Laboratory during 1985 and 1986.

Fisheries Management. Work being performed by TVA in conjunction with aquatic plant control is a direct outgrowth of shared interest by COE.

Erosion Control. Work presented by USDA has been coordinated with COE, TVA, and USBR.

Hazardous Waste Management. There was interest by all agencies in this

area. COE and TVA have extensive coordination activities underway.

#### Areas of No Duplication

There were several areas where no duplication was noted, primarily as a result of unique agency mission. These areas include marine and dredging research and development by COE, work on acid rain by TVA and USBR, and work on irrigation return flow water quality by USBR.

#### Recommendations on Needed

##### Research and Development and Coordination

Several areas of needed research and development and coordination were highlighted during the session; these are an outgrowth of new requirements for technology due to shared environmental problems by the agencies.

Technology to Enhance Project Water Quality and Tailwater Ecology. This is an area of continuing interest by all agencies, especially as related to the thrust described in the paragraph "Water Quality Management." Notable areas are research on mixers and turbine aeration devices by TVA, a new work unit in the Water Quality Research Program on mixers and aerators for COE, and USBR research on reservoir aeration. Tailwater ecology is an area of critical concern to all agencies, particularly for pumpback hydropower projects. Research on all aspects of this area are required, and enormous benefits could accrue to all agencies.

Contaminants. All agencies have research ongoing in this area. Because of the costly nature of this research, it is imperative to maximize agency coordination to reduce costs. Coordination should also include EPA.

Data Exchange. Environmental data sets, especially field data, and data bases are expensive and time consuming to compile. Efforts to foster the exchange of these data would result in considerable savings for all agencies.

Hydrilla Control. USBR recommended continued coordination for this area, particularly with COE.

Plant Growth Regulators. This was of great interest to all agencies, and coordination should be stressed.

##### Topics Involving Project Safety

Two topic statements involved project safety:

- a. WQE-11a: Effects of Global Climate Change on Water Resources
- b. WQE-9a: Allowable Vegetation on Flood Control Levees. This work will be coordinated with USBR's program for control of vegetation on embankment dams and conveyance structures.

### Topics Involving Technology Transfer

Several excellent examples of technology transfer efforts were presented during the session:

TVA has published a "Catalog of Water Quality Educational Materials," which serves as an excellent technology transfer mechanism to the private sector.

The Federal Aquatic Plant Management Working Group has produced two excellent documents related to technology transfer. One is a compilation of all aquatic plant control research and development, and the other is a digest of State and local statutes on noxious plant control.

The use of "Expert Systems" is becoming very popular in all agencies for technology transfer. Several examples in the areas of aquatic plant control and environmental design were highlighted. All agencies viewed this as a promising area for future technology transfer developments.

TVA has an interactive video instruction program for wastewater treatment plant operators that shows a great deal of promise for application in technology transfer.

There were numerous examples of technology transfer to other Federal, State, local, and private agencies throughout the discussion of topic statements in this session. All agencies have a very serious commitment to technology transfer.

### Topics Involving Project Maintenance, Rehabilitation, and Life Extension

Several topic statements dealt with this subject in an indirect manner, mainly from consideration of the environmental aspects of project maintenance.

### Other Issues/Comments

Although the missions and responsibilities of the participating agencies vary widely, there were many examples of technology developed for an agency-unique problem that have applicability for the other agencies. There is a great deal of benefit from these sessions in terms of identifying these technology areas and establishing lines of coordination.

Participation by observer agencies was very important in this session and should be stressed in subsequent meetings, particularly for EPA, USGS, and USDA. As a result of the conference, TVA has contacted EPA about potential joint studies.

An effort will be made to reconstitute the Water Quality Modeling Work

Group. A meeting will be arranged this year with the goal of producing a document summarizing modeling work by all agencies.

A new Work Group on Tailwater Ecology was recommended. Coordination efforts will be initiated by USBR who will host a workshop in this area during the off year (1988).

As a result of the WES Laboratory tour, TVA researchers have contacted WES researchers to discuss methods for assessing ecological significance of pollutants in fish tissue.

## Joint Hydraulics/Water Quality Session

### Attendees

<u>Name</u>	<u>Agency*</u>	<u>Name</u>	<u>Agency*</u>
Lloyd O. Timblin, Jr.	USBR	Richard G. McGee	WES
Richard J. Ruane	TVA	George D. Ashton	CRREL
Myron L. Iwanski	TVA	Jeff Holland	WES
David P. Buelow	COE	Ely Driver	TVA
Jim Thomas	USBR	Phil Burgi	USBR
Jim Wright	TVA	Bill Rushing	WES
Don Dycus	TVA	J. L. Mahloch (Chairman)	WES
Leon Bates	TVA	Bill Waldrop	TVA
Richard Sager	WES	Dale Hart	WES
Jim Wuebben	CRREL	Bevan Brown	TVA
Dean Harshbarger	TVA	Al Costanzo	EMSI, LTD.
Steve Wilhelms	WES		

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\* Addresses and phone numbers are given in Appendix B.

### General

Eight topic statements were reviewed during this session. The detailed Agenda and the Topic Statements are given in Appendix K.

### Areas of Duplication

No areas of duplication were discovered during the session; however, because of extensive coordination efforts, several areas of complementary research and development were highlighted.

### Areas of Cooperation

Reaeration of project releases to attain water quality objectives is very popular among all the agencies. Excellent coordination and exchange of technology and data have occurred, primarily through the efforts of the Work Group on Reaeration.

Hydraulic design to attain water quality objectives is a key area of research, particularly for COE and TVA.

Modeling research on emergency response to spills is being coordinated between COE and TVA.

### Areas of No Duplication

TVA is currently pursuing a Turbine Aeration Research Program with private manufacturers. Although the potential exists for cooperative efforts, this is an area being researched chiefly by TVA.



Recommendations on Research and Coordination

None

Topics Involving Safety of Dams

None

Topics Involving Technology Transfer

All agencies are vitally committed to technology transfer, and several excellent examples were discussed during the session.

Topics Involving Project Maintenance,  
Rehabilitation, and Life Extension

None

## Work Group Reports

Several work groups (called specialty groups in the Charter) meet at times and locations other than those of the main coordination conference. Brief reports of activities of the Interagency R&D Steering Committee on Water Quality and Ecology and the Aquatic Plant Management Working Group are given in Appendix L. The Water Quality Modeling and Field Studies Work Group is obtaining field data from the USBR Flaming Gorge project for comparison with models developed by COE and TVA. Some of the work groups have been inactive during the past 2 years. The session chairmen will be reviewing their work group activity and making recommendations whether to continue work group activities in their areas. Part of the reason for inactivity appears to be lack of funding to support travel to work group meetings. The paradox was noted that when funds are tight, the need for coordination to maximize return on the research dollar is perhaps the greatest, but funds for coordination activities are at a minimum. Other ways of conducting work group business such as teleconferencing, computer bulletin boards, or piggybacking work group meetings with other conferences may be alternatives. At a minimum, there should continue to be an exchange of reports between the agency members of the work groups to assure that research is coordinated. The session chairmen may also need to assign specific tasks to the work groups for accomplishment during the 2-year period between conference meetings. If no tasks are given, the need for work group activity is diminished. The Steering Committee will review the recommendations of the technical session chairmen regarding the status of their work groups and decide which ones will remain active.

The Soil Mechanics Work Group has been inactive except for periodic casual discussions between committee leaders at professional or other incidental meetings. The Soil Mechanics Session recommended the work group be disbanded in favor of greater interaction between principal researchers involved in related investigations. The apparent duplication of water quality modeling work groups in both the Hydraulics and the Water Quality and Ecology technical areas will be eliminated.

Work groups existing at the time of this Fifteenth Conference and those proposed for activities in the coming 2 years approaching the Sixteenth Conference are noted in Appendix M, along with their respective chairmen.

### Accomplishments

This conference, like its predecessors, was judged to be extremely beneficial in illuminating areas of research being done by the principal agencies, in assuring that no unnecessary duplication occurs, and in strengthening communication among the research personnel. It helped give direction to future research to make efforts complementary, and it encouraged a continuous flow of research reports, ideas, and mutually beneficial assistance. The 436 topic statements at this conference exceeded those at the prior conference by 20 percent.

More specifically, the Interagency Research Coordination Conferences:

- a. Provide a no-nonsense, systematic exchange of research ideas in a setting not duplicated by any other meeting or activity
- b. Serve to coordinate research programs and to avoid unnecessary duplication
- c. Provide the catalyst for jointly funded and cooperative research projects
- d. Set the stage for more deliberate discussions in special areas through work group meetings
- e. Issue a highly visible report documenting the results of the conference
- f. Permit personal contacts between peers, thus disseminating new research techniques, instrumentation, ideas, theories, experiences, etc.
- g. Provide management at all levels an opportunity to participate in research activities if they so desire
- h. Serve as a vehicle to permit a considerable number of host-agency researchers to participate more fully with some of their peers from the other agencies and provide growth experiences for younger staff

### Next Meeting

The Bonneville Power Administration will host the next (Sixteenth) Conference in Portland, Oregon, October 17-19, 1989. An Organizational Personnel Directory for the Fifteenth and Sixteenth Conferences is given in Appendix M.

APPENDIX A  
INTERAGENCY CONFERENCE CHARTER

INTERAGENCY CONFERENCE CHARTER FOR  
COORDINATION OF FEDERAL WATER  
RESOURCES AND FLOOD CONTROL  
RESEARCH ACTIVITIES

PREAMBLE

This document sets forth basic purposes and policies for guidance and conduct of periodic research coordination conferences initially organized in 1959 by mutual agreement of the Corps of Engineers (CE), US Bureau of Reclamation (USBR), and Tennessee Valley Authority (TVA) and subsequently joined by Bonneville Power Administration (BPA).

SECTION I: ESTABLISHMENT

A. Purpose. The purpose of the conferences is to achieve coordination of research activities among those Federal agencies primarily involved in water resources and hydropower development and flood control.

B. Objective. Primary objective is to exchange information on current and proposed research so as to identify areas of mutual interest, encourage cooperative efforts, improve intercommunication, and eliminate undesirable duplication. Secondary objective is the exchange of information on research activities among the member agencies and observer representatives from other Federal agencies.

C. Definition. "Research," regardless of the source of funding, covers the entire spectrum of scientific and engineering investigations ranging from basic to applied. It covers all types of technical investigations regardless of whether they are directed simply toward an increase in scientific knowledge without necessarily a specific objective, or whether they are the application or extension of known facts, principles and techniques in solving specific problems. It excludes those investigations and other activities occurring routinely in the course of business that consist of collecting data and/or testing of materials, instruments, and designs aimed only at the numerical determination of their properties, without accompanying efforts toward technological progress. (Amendment 2. See SECTION VI-D.)

SECTION II: PARTICIPATING AGENCIES

A. Full Member. Full direction and participation in the organization and conduct of the periodic conferences is jointly vested in CE (Civil Works), USBR, TVA, and BPA. These organizations will be identified as full member agencies.

B. Other. Upon request, and with the concurrence of each full member agency, other Federal agencies or departments engaged in technical research activities may be invited to be represented by a limited number of individuals at technical sessions during the conference. At the request of any one of the full member agencies, invitations to attend, observe, or participate in the conferences may be issued to qualified technical specialists or to departments or offices of the Executive or Legislative Branches of the Federal Government concerned with the programming and management of research programs.

SECTION III: ORGANIZATION

A. Meeting Frequency and Location. Formal coordination conferences will be held during each even-numbered fiscal year. Sites will be rotated among the principal member agencies.

B. Specialty Groups. Upon agreement among the full member agencies, separate technical specialty conferences may be held at times and locations other than the main coordination meetings. Summary reports of the separate specialty conferences will be furnished to the current steering committee chairman for inclusion in the subsequent report of the main coordination conference.

C. Steering Committee. Preparation for the organization and conduct of each main coordination conference will be carried out by a steering committee. Each full member agency will be represented on the committee, and the representative of the next host agency will be designated as chairman. The steering committee will be responsible for establishing the conference dates, selecting the technical subjects to be covered during the conference, issuing invitations to other than the full member agencies, and establishing the detailed activity schedule for the main coordination conference.

#### SECTION IV: CONDUCT OF CONFERENCES

A. Technical Sessions. Presentation of technical research plans of the full member agencies will be carried out in designated specific basic technical sessions. Where appropriate, special technical sessions, covering highly specialized technical or multi-discipline subjects, may be organized. A chairman will be designated for each basic and special subject, usually from the staff of the host agency, who will be responsible for the conduct of his session discussions. At the final general session of the conference each basic and special session chairman will present a summary of the conclusions and agreements reached and will provide to the steering committee chairman a written summary of these actions for inclusion in the conference report.

B. Topic Statements. Prior to the conference, the steering committee chairman will solicit from each of the full member agencies summaries of current and planned research projects. Emphasis will be directed toward future research activities rather than past accomplishments or results. Format of the topic statements will be as established by the steering committee. The chairman of the steering committee will furnish to each designated technical and specialty session chairman those topic statements relating to the session subject as a basis for session discussions.

C. Administration. The host agency, through its steering committee representative, is responsible for conference accommodations, housing reservations for participants, conference facilities, and related details. Administrative costs incurred will be borne by the host agency. Individual participants will be responsible through their agencies for all costs incident to their transportation and subsistence.

#### SECTION V: REPORT

A. Conference Report. At the conclusion of each full interagency conference a formal report will be prepared, presenting the results of the technical session and specialty session discussions, and indicating agreements or similar actions to be taken relative to achieving research coordination among the full member agencies. The formal report will include summaries of the separate specialty conferences.

B. Conference Assessment. At the close of each periodic full member coordination conference the accomplishments will be assessed and recommendations made as to the need and direction of conference activities.

#### SECTION VI: AMENDMENTS

A. Amendments. Changes to any of the provisions herein may be proposed by any of the full member agencies and, upon unanimous agreement among the full members, will become an amendment to this document.

B. Initial Amendment. One amendment is issued concurrently with this charter document:

Amendment 1 - Listed by reference below are the letter agreements exchanged among the Federal agencies which established the periodic research coordination conferences relating to water resources activities:

Chief of Engineers, Department of Army, to Commissioner, USBR, November 10, 1959.

Commissioner, USBR, to Chief of Engineers, Department of Army, November 23, 1959.

Chief of Engineers, Department of Army, to Chairman of the Board, TVA, March 25, 1960.

Director of Civil Works, CE, to Administrator, BPA, June 17, 1965.

C. Charter Date. This charter document was adopted November 11, 1975.

D. Subsequent Amendments. Amendment 2 - SECTION I-C. Definition - was adopted April 17, 1987.

APPENDIX B  
LIST OF ATTENDEES

LIST OF ATTENDEES

Name and Title	Address	Telephone
<u>Corps of Engineers</u>		
<u>Office, Chief of Engineers</u>		
Fred A. Anderson, Civil Engineer	Commander US Army Corps of Engineers 20 Massachusetts Avenue, NW Washington, DC 20314-1000	(202) 272-0223
David Buelow, Hydraulic Engineer	↓	(202) 272-8512
John Bushman		(202) 272-0132
Richard F. Davidson, Supervisory Engineer		(202) 272-8683
Lucian Guthrie, Structural Engineer		(202) 272-8673
Tony C. Liu, Structural Engineer		(202) 272-8672
Ed Pritchett		(202) 272-0207
William E. Roper		(202) 272-0257
Mohan Singh, Chief, Elec.-Mech. Br.		(202) 272-0211
<u>Waterways Experiment Station</u>		
Bob Anderson, Engineering Technician	US Army Engineer Waterways Experiment Station PO Box 631 Vicksburg, MS 39810-0631 (601) 634-3111	(601) 634-3245
David Bennett, Civil Engineer	↓	(601) 634-3974
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Sandra Bird		(601) 634-3783
Sam Boakye, IPA		(601) 634-3974
Tony Bombich		(601) 634-3238
Marden B. Boyd, Supervisory Res. Hyd. Eng.		(601) 634-3293

(Continued)



LIST OF ATTENDEES (Continued)

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Deborah Cooper		(601) 634-3558
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Earl V. Edris, Jr.		(601) 634-3378
Bob Fletcher, Hydraulic Engineer		(601) 634-2622
Ray Franco, Electronics Engineer		(601) 634-3814
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Sharon Garner, Civil Engineer		(601) 634-2750
John F. George, Supervisory Research Hyd. Eng.		(601) 634-3346
Paul A. Gilbert, Research Civil Eng.		(601) 634-2797
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Douglas Gunnison		(601) 634-3873
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(Continued)

LIST OF ATTENDEES (Continued)

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Mark Howard, Civil Engineer		(601) 634-3047
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Jerry S. Huie, Chief, RMAG		(601) 634-2613
Tony Husbands, Chemist		(601) 634-3275
John J. Ingram, Research Hyd. Eng.		(601) 634-2195
Lawrence D. Johnson, Research Civil Eng.		(601) 634-3840
Wayne Jones		(601) 634-3758
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(Continued)

LIST OF ATTENDEES (Continued)

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Bryant Mather, Chief, Structures Lab		(601) 634-3264
James H. May		(601) 634-3395
Steve T. Maynard, Research Hyd. Engr., PI		(601) 634-3284
LeRoy McAnear, Chief, Soil Mechanics Div.		(601) 634-2228
Bill McCleese, REMR Program Manager		(601) 634-2512
Willie E. McDonald		(601) 634-3893
Richard G. McGee, Research Hyd. Eng.		(601) 634-3581
Clark McNair, Research Hyd. Engineer		(601) 634-3674
Wendell O. Miller, Civil Engineer		(601) 634-3147
Britt Mitchell		(601) 634-2640
Reed Mosher, Research Civil Engineer		(601) 634-3956
Billy Neeley, Civil Engineer		(601) 634-3255
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C. Dean Norman, Research Civil Engineer		(601) 634-2250

(Continued)

LIST OF ATTENDEES (Continued)

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Carl Pace		(601) 634-3221
Edward B. Perry		(601) 634-2670
John F. Peters		(601) 634-2590
Richard W. Peterson, Research Civil Engr.		(601) 634-3737
Glenn Pickering, Supervisory Res. Hyd. Eng.		(601) 634-3344
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Toy S. Poole, Chemist		(601) 634-3261
Richard Price, Physical Scientist		(601) 634-2667
Steve Ragan, Supervisory Civil Engineer		(601) 634-3253
William N. Rushing		(601) 634-3542
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LIST OF ATTENDEES (Continued)

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Doug Shields, Research Civil Engineer		(601) 634-3707
Hardy J. Smith, Civil Engineer		(601) 634-2431
Phillip Stewart, General Engineer		(601) 634-4113
Dick Stowe, Supervisory Geologist		(601) 634-3254
William E. Strohm, Jr., Research Civil Engineer		(601) 634-2604
H. M. Taylor, Jr., Research Civil Engineer		(601) 634-3454
Tony Thomas, Research Hyd. Eng.		(601) 634-2511
Henry Thornton		(601) 634-3797
Vic Torrey, Research Civil Engineer		(601) 634-2619
Lillian Wakeley, Geologist		(601) 634-3215
Terry Waller, Research Hyd. Eng.		(601) 634-3731
James B. Warriner		(601) 634-3610
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(Continued)

LIST OF ATTENDEES (Continued)

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<u>US Army Engineer District, Vicksburg</u>		
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Name and Title	Address	Telephone
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John L. Deets, Civil Engineer	c/o Singleton Materials Engineering Laboratory Summit Hill Drive Knoxville, TN 37902	(615) 632-2771
Don L. Dycus, Biologist	124 SPB Tennessee Valley Authority Knoxville, TN 37902	(615) 632-3722
E. Dean Harsbarger, Head, Fluid Systems, Physical Analysis Group	PO Drawer E Norris, TN 37828	(615) 494-7137 (615) 632-1947
Myron L. Iwansky, Supervisor, Environmental R&D	Room 208, Summer Place Building Knoxville, TN 37828	(615) 632-6604
John E. Kirkland, Jr., Principal Mechanical Engineer	400 West Summit Hill Drive W3 B105 Knoxville, TN 37902	(615) 632-2595
William M. Pearse, Staff Engineer	400 West Summit Hill Drive W3 D225 Knoxville, TN 37902	(615) 632-3818
Richard J. Ruane, Program Manager Special Project/Water Quality Br.	270 Haney Building Chattanooga, TN 37401	(615) 751-7323
Graham R. Siegel, Program Manager	2S33A Missionary Ridge Place Chattanooga, TN 37402-2801	(615) 751-6122
William R. Waldrop, Assistant Chief, Engineering Lab	PO Drawer E Norris, TN 37828	(615) 632-1905
James R. Wright, Manager, Special Projects Research	125 Summer Place Building Knoxville, TN 37902	(615) 632-4071
<u>Bonneville Power Administration</u>		
Leon Kempner, Jr., Structural Eng.	PO Box 3621 Portland, OR 97208	(503) 230-5563 FTS 429-5563
Marvin Klinger, Senior Assistant Administrator for Power Facilities	PO Box 3621 Portland, OR 97208	503/230-3062 FTS 429-3062

(Continued)



LIST OF ATTENDEES (Continued)

Name and Title	Address	Telephone
<u>Bonneville Power Administration (Concluded)</u>		
Walter E. Myers, R&D Manager	PO Box 3621 Portland, OR 97208	(503) 230-4009 FTS 429-4009
James J. Ray, Manager, Research Application	PO Box 3621 Portland, OR 97208	(503) 230-3802 FTS 429-3802
Paul Schaad, Chief, Stability Controls Section	PO Box 3621 Portland, OR 97208	(503) 230-3701 FTS 429-3701
<u>Federal Energy Regulatory Commission</u>		
Robert A. Crowley, Civil Engineer	825 North Capitol Street, NE Washington, DC 20002	(302) 376-9801
<u>National Science Foundation</u>		
Clifford J. Astill, Program Director	1800 G Street NW Room 1132 Washington, DC 20550	(202) 357-9500
<u>US Bureau of Mines</u>		
Douglas D. Bolstad, Research Director	E. 315 Montgomery Spokane, WA 99207	(509) 484-1610
<u>US Department of Agriculture-Agriculture Research Service</u>		
Neil L. Coleman, Director, USDA-NSL	PO Box 1157 Oxford, MS 38655	(601) 232-2900
Charles M. Cooper, Supervisory Ecologist	PO Box 1157 Oxford, MS 38655	(601) 232-2935
<u>US Department of Energy</u>		
Kenneth W. Klein, Director	Forrestal Building, CE-32 Washington, DC 20585	(202) 586-2826
<u>US Environmental Protection Agency</u>		
Rosemarie C. Russo, Director, Environmental Research Lab	College Station Road Athens, GA 30613	(406) 546-3134 FTS 250-3134

(Continued)

LIST OF ATTENDEES (Continued)

Name and Title	Address	Telephone
<u>US Geological Survey</u>		
Mike Gaydos	100 W. Capitol Street Suite 710 Jackson, MS 39269	(601) 965-5595
<u>Electric Power Research Institute</u>		
Rick Shumar	3412 Hillview Avenue PO Box 10412 Palo Alto, CA 94303	(415) 855-2978
Frank Young	3412 Hillview Avenue PO Box 10412 Palo Alto, CA 94303	(415) 855-2335
Gordon Yeo	1019 19th Street NW Suite 1000 Washington, DC 20036	(202) 872-5245
<u>Western Area Power Administration</u>		
Greg Vaselaar, Electrical Engineer	PO Box 3402 (ATTN: A2400) Golden, CO 80401	(303) 231-7571
<u>Committee on Energy and Natural Resources, United States Senate</u>		
Russell R. Brown, Senior Professional Staff	Room SD-364 Washington, DC 20510	(202) 224-2366
<u>EMSI, Ltd.</u>		
Albert C. Costanzo, Senior Consultant	3800 N. Fairfax Drive, Suite #7 Arlington, VA 22203	(703) 525-4875

APPENDIX C  
SCHEDULE OF SESSIONS

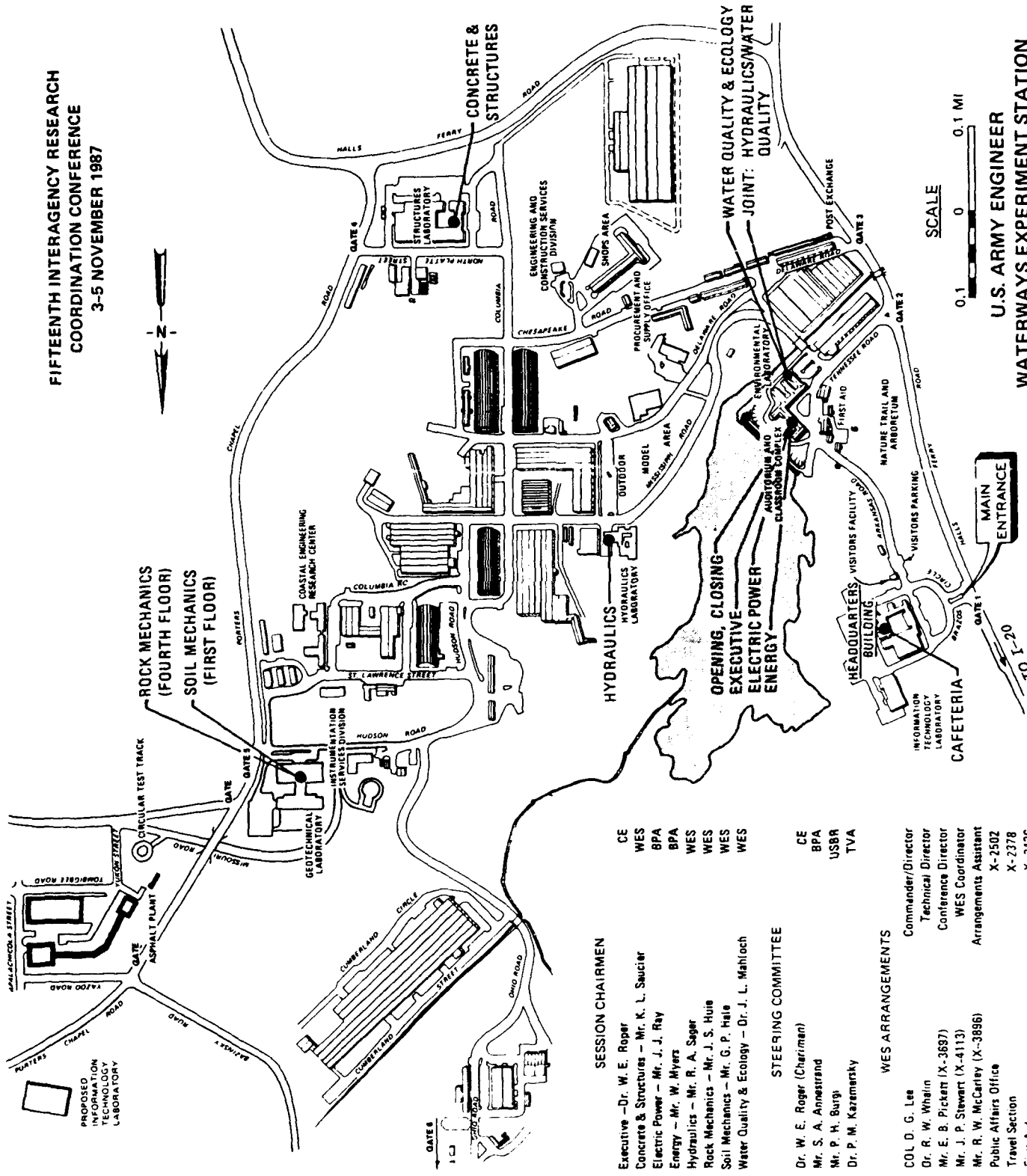
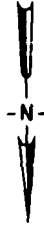
Fifteenth Interagency Research Coordination Conference  
Waterways Experiment Station, 3-5 November 1987

SCHEDULE OF SESSIONS

T 0745	Bus from Motel to WES (See Note 1)								
u 0815	0815-0900 OPENING SESSION preceding the concurrent technical committee sessions								
e to 1230	Executive	Energy	Electric Power	Hydraulics	Water Qual & Ecology	Concrete & Structures	Soil Mechanics	Rock Mechanics	
3 1330	Cont'd	1330 to 1530 Joint	EN Cont'd	Cont'd	Cont'd	Cont'd	Cont'd	Cont'd	Cont'd
to 1700			EN Cont'd						
N 1715	Bus From WES to Motel			1530-1700 Joint					
o 1830	Bus from Motel to Shrimp Boil at WES Cafeteria (Bus to Motel at about 2130)								
v 0745	Bus From Motel to WES (See Note 1)								
w 0815		Energy	Electric Power	Hydraulics	Water Qual & Ecology	Concrete & Structures	Soil Mechanics	Rock Mechanics	
to 1230	--								
4 1330	Prepare Session Reports								
to 1700	Tours: WES Laboratories, Vicksburg Battlefield, etc., to be arranged on basis of interest and availability.								
N 1715	Bus from WES to Motel								
o 1715	"Conferees' Choice: - Attitude adjustment, depolarization, etc."								
v 1715	Bus from Motel to WES (See Note 1)								
T 0745	CLOSING SESSION - Technical and executive session reports; discussion; plans for next conference.								
h 0815									
u to 1100	Tour to projects on Lower Mississippi River or depart from Vicksburg. (A bus schedule to the Jackson Airport can be arranged on the basis of needs and flight schedules, perhaps involving some waiting at WES or at the Airport.)								

NOTES: 1. Transportation will be scheduled from Motel in mornings, to Motels following afternoon sessions, to and from cafeteria for lunch, and for joint sessions. Convenient parking of cars at WES may be a problem. Transportation of individuals during Technical Sessions may involve minor delays (maybe ten minutes). Therefore, "session hopping" may be ineffective. Session aides will arrange transportation on request.

**FIFTEENTH INTERAGENCY RESEARCH  
COORDINATION CONFERENCE  
3-5 NOVEMBER 1987**



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**U.S. ARMY ENGINEER  
WATERWAYS EXPERIMENT STATION  
VICKSBURG, MISSISSIPPI**

**SESSION CHAIRMEN**

- Executive - Dr. W. E. Roper
- Concrete & Structures - Mr. K. L. Saucier
- Electric Power - Mr. J. J. Ray
- Energy - Mr. W. Myers
- Hydraulics - Mr. R. A. Sager
- Rock Mechanics - Mr. J. S. Huie
- Soil Mechanics - Mr. G. P. Hale
- Water Quality & Ecology - Dr. J. L. Mahloch

**STEERING COMMITTEE**

- Dr. W. E. Roper (Chairman)
- Mr. S. A. Annettstrand
- Mr. P. H. Burgi
- Dr. P. M. Kazemansky

**WES ARRANGEMENTS**

- COL D. G. Lee
- Dr. R. W. Whalin
- Mr. E. B. Pickett (X-3897)
- Mr. J. P. Stewart (X-4113)
- Mr. R. W. McCarthy (X-3896)
- Public Affairs Office
- Travel Section
- First Aid

- Commander/Director
- Technical Director
- Conference Director
- WES Coordinator
- Arrangements Assistant
- X-2502
- X-2378
- X-2426

- CE
- WES
- BPA
- BPA
- WES
- WES
- WES

- CE
- BPA
- USBR
- TVA

APPENDIX D  
AGENDA AND TOPIC STATEMENTS  
CONCRETE AND STRUCTURES SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987  
Vicksburg, Mississippi

AGENDA

CONCRETE AND STRUCTURES SESSION

<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u>	<u>Agency</u>	<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u>	<u>Agency</u>
		<u>Materials and Methods</u>					
Tuesday, Nov. 3				Tuesday, Nov. 3 (cont'd)			
8:15 a.m.	CS-1	Use of Cementitious Materials Other Than Portland Cement	WES	CS-16	MOBA/MOUT Live-Fire Training Villages, Targets and Ranges	WES	
	CS-2	Fly Ash Cements - Alternative to Alkali-Aggregate Reaction	USBR	CS-17	Computer Application in Engineering; Laboratory Automation	WES	
	CS-3	Development of Materials and Proportioning Criteria for Roller-Compacted Concrete Pavements	WES	CS-18	Mechanical Splicing of Reinforcing Steel	USBR	
	CS-4	Development of Bond Strength Between Lifts of Roller-Compacted Concrete	USBR	CS-19	Dynamic Properties of Concrete	USBR	
	CS-5	Concrete Materials System Research	USBR	CS-20	Structural Behavior of Sheet Pile Cellular Cofferdams	WES	
	Break			CS-21	Soil-Structure Interaction Studies	WES	
1:30 p.m.				CS-22	Walls and U-Frame Structures The Impact of Active Underground Mining on Surface Structure	USBR	
	CS-6	Longtime Concrete Studies	USBR	Break			
	CS-7	Superplasticizers and Flowable Concrete	USBR	CS-23	Response of Concrete to Multiaxial Stress States	WES	
	CS-8	Verification of Deleterious Levels of Calcium Sulfate Concentration	USBR	CS-24	Incremental Construction Analysis Procedures for Mass Concrete	WES	
	CS-9	High-Strength, Non-Shrinking Grouts and Concretes	WES	CS-25	Structural Analysis of Lock and Dam #1	WES	
	CS-10	Portland Cement Grouting Studies	USBR	CS-26	Strength Design of Concrete Circular Conduits	WES	
	Break			CS-27	Concrete Pipe Research	USBR	
3:40	CS-11	Stability of Components of Grout and Concrete in a Salt Environment	WES	Break			
	CS-12	Recommendations for Grouting in Basalt	WES	CS-28	Improved Nondestructive Testing Techniques for Concrete Structures	WES	
	CS-13	Curing Compounds for Concrete	WES	CS-29	Underwater Survey Techniques	WES	
	CS-14	Field Exposure Durability Studies	WES	CS-30	Development and Evaluation of Continuous Monitoring System for Structural Safety	CERL	
	CS-15	Technical Assistance in Development of Engineering Criteria and Requirements for Alternative Near-Surface Methods for Disposing LLW	WES	CS-31	Dam Safety Instrumentation (1-6)	USBR	
				CS-32	Improved Instrumentation for Older Structures	WES	
				CS-33	Seismic Response of Concrete Dams	WES	

<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u>	<u>Agency</u>
<u>Wednesday, Nov. 4</u>			
8:15 a.m.	CS-34	<u>Maintenance, Repair, Rehabilitation</u>	
		Evaluation of Existing Maintenance Materials and Methods	WES
	CS-35	Techniques for Underwater Concrete Repairs	WES
	CS-36	Repair of Erosion-Damaged Structures	WES
	CS-37	In Situ Repair of Deteriorated Concrete	WES
	CS-38	Techniques for Joint Repair and Rehabilitation	WES
9:30	Break		
9:40	CS-39	Rehabilitation of Navigation Locks	WES
	CS-40	Application of New Technology to Maintenance and Minor Repair	WES
	CS-41	Concrete Cracking Research	WES
	CS-42	Unsolved Problems Relating to Alkali-Silica Reaction in Concrete	WES
	CS-43	Repair of Concrete Affected by Alkali-Aggregate Reaction	USBR
10:50	Break		
11:00	CS-44	Stability of Existing Concrete Structures on Rock	WES
	CS-45	Predicting Concrete Service Life	WES
	CS-46	Maintenance and Repair Management System for Civil Work Structures	CERL
	CS-47	Surface Treatments to Minimize Concrete Deterioration	WES
	CS-48	Flood Proofing Buildings	WES
	CS-49	Application of X-ray Diffraction to Residual Stress	WES
	CS-50	Techniques for Removal of Deteriorated Concrete	WES
	CS-51	Computer-Aided Structural Engineering (CASE)	WES



TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-1  
 Subject Area Concrete and Structures  
 Project Title Use of Cementitious Materials Other Than Portland Cement  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-4271  
 Investigator A. D. Buck, PO Box 631, Vicksburg, MS (601) 634-3271  
 (Name) (Address) (Telephone)  
 Starting Year FY 84 Estimated Completion Year FY 87

Technical Objectives: Determine a basis for providing written guidance for Corps use of silica fume, granulated iron-blast furnace slag, and cementitious fly ash.

Technical Approach: Determination of the most effective amount of each material to minimize deleterious alkali-silica reaction or sulfate attack or both was accomplished.

General Progress in Last Two Years: A simple procedure to evaluate prozzolan or slag was developed. It was prepared as a draft EIL in Jan 87. A version of this work was presented at the Mather Conference in Atlanta in Apr 87. A technical report has been prepared and is being reviewed.

Plan for Next Twelve Months (FY 88): Project was completed Sep 87.

Coordination of Cooperation with Another Agency: They were aware of this project.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-2  
 Subject Area Concrete and Structures  
 Project Title Fly Ash Cements - Alternative to Portland Cement (DR-451)  
 Performing Organization U.S. Bureau of Reclamation, E&R Center  
 Principal (FTS) 776-6109  
 Investigator R. Drahushak-Crow, D-1511 Denver CO 80225 (303) 236-6109  
 (Name) (Address) (Telephone)  
 Starting Year FY 1980 Estimated Completion Year FY 1987

Technical Objectives: To evaluate fly ash-sulfate formulations as a cementitious material for concrete in lieu of portland cement. The effect of chemistry of the fly ash and the percentage of ash used will be examined.

Technical Approach: A continual review of the existing literature and state of the art is ongoing. Properties of concrete utilizing 10 to 100 percent lignite and subbituminous fly ash as part of the cementitious materials will be investigated. Tests will include strength, freeze-thaw durability, sulfate resistance, alkali-aggregate reaction, and setting characteristics.

General Progress in Last Two Years: An extensive mix design study was accomplished incorporating a Class F, a mid-range class C with regard to calcium content, and a high lime class C ash. Fly ash replacement percentages were 10, 30, 50, 75, and 100 for each fly ash, resulting in 30 mixes. In addition, five control mixes were tested with cement contents ranging from 139 to 855 pounds. Evaluation of the specimens included compressive strength, freeze-thaw durability, sulfate resistance, and alkali reactivity.

Plans for Next 12 Months (FY88): Complete mix design study and testing, and summarize data in a final report.

Coordination of Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-3  
 Subject Area Concrete and Structures  
 Project Title Development of Materials and Proportioning Criteria for Roller Compacted Concrete Pavements (RCC)  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3253  
 Investigator Steven A. Ragan PO Box 631, Vicksburg, MS (601) 534-3253  
 (Name) (Address) (Telephones)

Starting Year FY 86 Estimated Completion Year FY 89

Technical Objectives: To develop recommended materials selection and proportioning guidelines which will enable the user to produce RCC pavement mixtures capable of achieving the required strength and durability as economically as possible.

Technical Approach: Laboratory investigation is currently being conducted to investigate various methods for proportioning RCC pavement mixtures and to determine if an effective air-void system can be entrained in RCC which will cause it to be immune to frost damage. A test section will be constructed to validate laboratory results.

General Progress in Last Two Years: Samples have been obtained from a number of existing RCC pavements and tested in accordance with standard ASTM freezing and thawing tests and to determine the parameters of air-void systems. Results of these tests indicated the majority of samples had some degree of frost resistance. Procedures for selecting RCC pavement mixture proportions are also being developed.

Plan for Next Twelve Months (FY 88): Continue laboratory investigation to finalize recommended proportioning and specimen fabrication methods. Develop an effective means of entraining air in RCC pavement mixtures. Evaluate the potential for scaling of RCC pavements due to freezing and thawing.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams X Technology Transfer None  
None Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-4  
 Subject Area Concrete and Structures  
 Project Title Development of Bond Strength Between Lifts of Roller Compacted Concrete (DR-457)  
 Performing Organization U.S. Bureau of Reclamation, E&R Center  
 Principal PO Box 25007 (FTS) 776-6107  
 Investigator I. P. Dolan Denver CO 80225 (303) 236-6107  
 (Name) (Address) (Telephone)

Starting Year FY 1984 Estimated Completion Year FY 1988

Technical Objectives: To investigate the factors which affect bonding between lifts of RCC (roller compacted concrete). This includes investigating factors which affect compaction of RCC in the fresh state and methods of treating RCC joints to improve bond strength. By developing bond strength parameters and improving specifications, the most efficient design of RCC structures can be achieved.

Technical Approach: The goals of this program will be to first identify the properties of fresh concrete which influence consolidation of lifts of RCC and secondly to find the most cost effective means of supplemental joint treatment required to provide sufficient bond strength of RCC. Phase I will investigate the compactibility of fresh RCC by varying frequency and amplitude of vibration to optimize the compactive effort applied to RCC. Work will be performed in the vibration laboratory. Phase II will examine the bond strength of construction joints of RCC with different methods of joint treatment including sand blasting, applying a layer of grout, a bedding mix, or layer of dry cement, for mix designs with different cementitious materials content. Work will be performed on laboratory cylinders and cores from RCC test blocks.

General Progress in Last Two Years: Phase I - A loading frame has been fabricated which is capable of varying frequency, amplitude, and applied load, to investigate RCC compaction parameters. Phase II - Mixes with 150 and 300 lb/yd<sup>3</sup> cementitious materials content have been tested for fresh and hardened concrete properties including density, workability, and compressive, tensile, and shear strength.

Plans for Next 12 Months (FY88): Phase I - Complete fresh concrete compaction testing in the vibration laboratory. Phase II - Complete data summarization and the draft final report.

Coordination or Cooperation with Another Agency: A cooperative agreement between the Bureau of Reclamation and the Portland Cement Association was initiated in 1985. Full-scale test sections were constructed followed by a core testing program in 1986. The final report has been submitted to the Bureau of Reclamation.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams X Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-5  
 Subject Area Concrete and Structures  
 Project Title Concrete Materials Systems Research (DR-256)  
 Performing Organization U.S. Bureau of Reclamation, EBR Center  
 Division of Research and Laboratory Services  
 Principal W. G. Smoak, D-1512 PO Box 25007 (FTS) 776-6103  
 Investigator D. O. Arney, D-1512 Denver CO 80225 (303) 226-6103  
(Address) (Telephone)  
 Starting Year FY 1982 Estimated Completion Year Continuing program

Technical Objectives: To develop techniques for preparing and using new engineering materials or improving the use of existing materials; to determine physical, mechanical, and chemical properties of these materials; to evaluate specific applications; and to develop design and construction criteria - in effect to provide the Bureau with advantages of new materials technology for construction, maintenance, and repair of concrete. This program was combined with DR-380, Improved Repair Systems, in FY85.

Technical Approach: To study the potential of new engineering materials and processes for use in Bureau construction and repair using a system approach. This includes basic mix design studies to optimize the physical, chemical, mechanical, and durability properties; special requirements for processing and applications; evaluation of performance and economic factors; development of design and construction criteria; and field trials and evaluations. Efforts at this point of the program are directed to data collection for specific Bureau applications.

General Progress in Last Two Years: A progress report on the silica fume studies and one on applications development of concrete polymer materials were issued. Additional evaluation tests of silica fume concrete are being performed. Tests of concrete sealers have been started in the laboratory and are being scheduled for field sites. Screening tests of epoxy systems and polyester polymer concrete systems are being scheduled.

Plans for Next 12 Months (FY88): Continue evaluation tests of new materials and sealers. Perform field applications tests of silica fume concrete and penetrating sealers. Evaluate freeze-thaw performance of silica fume concretes. Screening tests of flexible polyester polymer concrete systems.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Areas(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-6  
 Subject Area Concrete and Structures  
 Project Title Longtime Concrete Studies (DB-14A)  
 Performing Organization U.S. Bureau of Reclamation, EBR Center  
 Division of Research and Laboratory Services  
 Principal P. G. Gray, D-1511 PO Box 25007 (FTS) 776-6106  
 Investigator M. G. Gray, D-1511 Denver CO 80225 (303) 236-6106  
(Address) (Telephone)  
 Starting Year FY 1961 Estimated Completion Year FY 1996

Technical Objectives: To investigate and evaluate changes from previous tests of properties of inservice mass concretes over long periods of time, and to better understand their inservice structural behavior. Structures selected for concrete evaluation are large dams containing different types and amounts of pozzolans, admixtures, maximum size aggregate, and strength levels. These data are used for analyses of existing and future dams, and are essential in selecting design parameters, evaluating the condition of existing dams, and predicting future behavior of concrete in large dams.

Technical Approach: Extract 255-mm diameter cores at 1, 5, 10, and 20 years of age after concrete placement. All sets of cores are taken from approximately identical locations in the dams. Testing will determine compressive, tensile and shear strengths; elasticity properties; and bond strength at construction joints. Comparison of the current data with earlier data collected will determine behavioral patterns of concretes in these dams.

General Progress in Last Two Years: Reports on properties of concrete through 10 years of age have been published for Glen Canyon, Flaming Gorge, Yellowstone, and Morrow Point dams. Reports have been published at 1 year's age for Grand Coulee Forebay, Crystal, and Pueblo Dams. Cores from Pueblo and Crystal dams have been extracted and tested at 10 years' age. Reports have been completed at 5 years' age for American Falls Dam, at 10 years' age for Grand Coulee Dam, and at 20 years' age for Glen Canyon Dam. Draft reports have been completed for Pueblo and Crystal Dams at 10 years' age. Cores have been extracted from American Falls Dam at 10 years' age.

Plans for Next 12 Months (FY88): Publish reports from Pueblo and Crystal Dams at 10 years' age. Test cores from American Falls Dam at 10 years' age. Extract and test cores from Yellowstone Dam at 20 years' age.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Areas(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-7  
 Subject Area Concrete and Structures  
 Project Title Superplasticizers and Flowable Concrete (DR-428)  
 Performing Organization U.S. Bureau of Reclamation E&R Center  
 Division of Research and Laboratory Services  
 Principal Investigator T. P. Dolan, D-1511 (FTS) 776-6107  
Denver CO 80225 (303) 236-6107  
 (Address) (Telephone)  
 Starting Year FY 1980 Estimated Completion Year FY 1987

**Technical Objectives:** To investigate the use of superplasticizers as a chemical admixture to produce flowing concrete. Superplasticizers have been used in Japanese and European concrete construction for several years; however, their performance has not been fully substantiated in all environments. Additional information is necessary to determine the viability of permitting the use of these admixtures, specifically more data on freeze-thaw resistance, causes, and means of minimizing slump loss, and the properties of concrete when used with fly ash. Permitting superplasticizers for use in concrete construction should benefit the Bureau through reduced construction costs due to added workability for difficult concrete placements and lower O&M costs by reducing repair costs.

**Technical Approach:** Phase I - Resistance of various mixes to freezing and thawing will be evaluated. Petrographic studies will be used to analyze the air void system in hardened concrete. Six different superplasticizers (two naphthalene formaldehyde, one malamine formaldehyde, one modified lignosulfonate, and two set-retarded naphthalene formaldehyde) have been analyzed. Additional air void analyses and correlations with a simulated field placement will be performed. Phase II - Mix designs will be developed using fly ash as fines and as a partial substitute for cement in flowable concrete. Strength gain, freeze-thaw resistance, air-void system, and slump loss will be evaluated to determine the optimum percentage of fly ash and superplasticizer for normal strength concrete. Phase III - Flowable concrete reportedly reduces line pressures in pumped concrete and increases pressures exerted on formwork. A literature search will be performed to investigate these properties of flowable concrete. If necessary, a field test program will be implemented to measure the pressures on pumps and formwork at job placements.

**General Progress in Last Two Years:** Work has essentially been completed.

**Plans for Next 12 Months (FY88):** Complete data summarization and final report.

**Coordination or Cooperation with Another Agency:** None.

**General Research or Problem Areas(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-8  
 Subject Area Concrete and Structures  
 Verification of Deteriorous Levels  
 Project Title of Calcium Sulfate Concentration (DR-434)  
 Performing Organization U.S. Bureau of Reclamation, E&R Center  
 Division of Research and Laboratory Services  
 Principal Investigator W. F. Kepner, D-1511 (FTS) 776-9279  
Denver CO 80225 (303) 236-9279  
 (Address) (Telephone)  
 Starting Year FY 1981 Estimated Completion Year FY

**Technical Objectives:** This program investigates the relative effects of various types and concentrations of naturally occurring sulfate water on the rate of deterioration of concrete. The purposes of this program are: (1) to identify conditions where we presently use cement/pozzolan combinations which are more resistant than necessary to sulfate attack, (2) to determine whether calcium sulfate is as deleterious to concrete as sodium sulfate and magnesium sulfate, (3) to determine whether the severity of deterioration from calcium sulfate is limited by its low solubility, and (4) to determine whether sulfates can be quantitatively analyzed to accurately determine the concentrations of each type of sulfate.

**Technical Approach:** Concrete cylinders, 3 by 6 inches, are being soaked in a saturated (0.4 percent) calcium sulfate solution and in a supersaturated solution. Cylinders are also being soaked in magnesium sulfate and sodium sulfate solutions at the same concentrations as the calcium. Lengths and weights of the specimens are measured periodically to check for deterioration. The Chemistry Section is developing methods for identifying the different types of sulfate as they occur naturally in our environment.

**General Progress in Last Two Years:** All specimens are immersed in solution and are being carefully observed. Specimens are expanding, but on the average are far from failure. Deterioration is a slow process.

**Plans for Next 12 Months (FY88):** Planned work in the next 12 months includes continued monitoring of specimens, continued sulfate identification studies, and literature research.

**Coordination or Cooperation with Another Agency:** None.

**General Research or Problem Areas(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-9  
 Subject Area Concrete and Structures  
 Project Title High-Strength, Non-shrinking Grouts and Concretes  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 342-3215  
 Investigator Lillian D. Wakeley, PO Box 631, Vicksburg, MS (601) 634-3215  
 (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives: High-strength grouts and concretes, formulated with silica fume, usually undergo volume reduction (shrink) as they cure. Some uses at the Nevada Test Site (NTS) require grouts and concrete that have high strength yet are non-shrinking. Mixtures with the required properties are outside the realm of normal concrete practice. They require carefully tailored combinations of mineral and chemical admixtures. Design and testing of these materials for NTS is ongoing at WES.

Technical Approach: Formulate grouts with several combinations of expansive admixture, silica fume, and fly ash, with various set-retarding and water-reducing admixtures. Find field-placeable combinations to optimize strength, expansion, and working time.

General Progress in Last Two Years: Mixtures have been screened using silica fume in amounts ranging from 5 to 15 percent of cementitious solids, with several fly ashes and different cements, and proprietary expansive agents. Strength of up to 12,000 psi with volume increase has been attained.

Plans for Next Twelve Months (FY 88): Match or exceed previous strength and expansion in concrete with more desirable placement characteristics.

Coordination or Cooperation with Another Agency: Defense Nuclear Agency, Sandia National Laboratories

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-10  
 Subject Area Concrete and Structures  
 Project Title Portland Cement Grouting Studies (DF-12)  
 Performing Organization U.S. Bureau of Reclamation, EAR Center  
 Principal Division of Research and Laboratory Services  
 Investigator M. G. Smoak, D-1512 PO Box 25007 (FTS) 776-6103  
 (Address) (Telephone)  
 Starting Year FY 1981 Estimated Completion Year FY 1988

Technical Objectives: To gain increased knowledge of portland cement grouting materials and systems used to seal, stabilize, and consolidate dam foundations to increase the effectiveness of Bureau grouting practices.

Technical Approach: Conduct literature review, laboratory, and in situ field tests. The program has been developed with five phases:

1. Review of Bureau grouting procedures, including field and laboratory tests to determine grout curtain efficiency.
2. Development of a downhole injection pressure gauge
3. Comparison tests of rotary and percussion drilling
4. Evaluation of a high speed colloidal type grout mixer
5. Jointly funded program with COE (Corps of Engineers), WES (Waterways Experiment Station), Vicksburg, Mississippi

General Progress in Last Two Years: A state-of-the-art review of analytical grout flow equations and theory has been performed and the report is being published. Studies of the effects of high-range water-reducing agents, silica fume, and microfine cement have been started and are continuing. The Bureau and the COE are already utilizing these results in the field. The grout mixer evaluation report was published.

Plans for Next 12 Months (FY88): Continue studies of grouts made with microfine and silica fume. Continue the contract research with COE of downhole pressure distribution. Conduct cooperative field studies with COE on grout flow behavior in foundations.

Coordination or Cooperation with Another Agency: We have a jointly funded program with the COE at WES, to refine the downhole pressure gauge and to evaluate the flow behavior of grout under field conditions.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-11  
 Subject Area Concrete and Structures  
 Project Title Stability of Components of Grout and Concrete in a Salt Environment  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3215  
 Investigator Lillian D. Wakeley, PO Box 631, Vicksburg, MS (601) 634-3215  
 (Name) (Address) (Telephones)

Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives: Current plans call for use of cement-based concretes and grouts as a component of shaft seals for an underground repository for radioactive wastes near Carlsbad, New Mexico. This repository, called the Waste Isolation Pilot Plant (WIPP), is located in bedded rock salt. The cementitious materials used in construction and sealing of shafts must maintain chemical and structural integrity in contact with rock salt or anhydrite. Studies are being conducted to delineate the performance of candidate materials in these environments.

Technical Approach: Chemical and other analyses have been performed on candidate grouts, to determine phase compositional and chemical stability of cementitious components in anticipated environmental conditions.

General Progress in Last Two Years: Candidate grout formulated and physical properties determined. Phase composition related to environmental conditions, dissolution, and physical properties.

Plan for Next Twelve Months (FY 88): Tailor materials to specific environmental conditions. Determine potential for reactivity with aggregate from the field operations.

Coordination or Cooperation with Another Agency: Department of Energy, Sandia National Laboratories

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-12  
 Subject Area Concrete and Structures  
 Project Title Recommendations for Grouting in Basalt  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3215  
 Investigator Lillian D. Wakeley, PO Box 631, Vicksburg, MS (601) 634-3215  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives: An exploratory shaft at the proposed radioactive waste repository at Hanford, Washington, will require grouting of the shaft liner. This grout also may serve as a component of the permanent shaft seal. WES is responsible for recommendations on candidate grout or concrete materials that are the most promising for achieving design and construction requirements for the exploratory shaft at this site, to be constructed during 1988-89.

Technical Approach: Summarize appropriate previous experience with appropriate materials in development of grouts and concretes with related property requirements (published literature and WES experience).

General Progress in Last Two Years: Reviewed A/E grouting specifications and site characteristics.

Plan for Next Twelve Months (FY 88): Recommend candidate materials and appropriate testing program to demonstrate that candidate formulations satisfy requirements.

Coordination or Cooperation with Another Agency: Department of Energy, Richland Operations Office

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Concrete and Structures 1987 Session Number CS-13  
 Subject Area Concrete and Structures  
 Project Title Curing Compounds for Concrete  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3275  
 Investigator Tony Husbands, PO Box 631, Vicksburg, MS (601) 634-3275  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives: To determine effectiveness of various curing compounds meeting the requirements of both ASTM C 309 and CRD-C 300 for curing concrete so that a cost effective decision can be made to determine the specification to be used by the Corps.

Technical Approach: Curing compounds having different water retention values (covering a wide range) which meet the requirements of ASTM C 309 and CRD-C 300 will be obtained for evaluation. The effectiveness of the curing compounds will then be determined using a proposed ASTM test methods and other test methods.

General Progress in Last Two Years: Laboratory testing completed and draft report prepared.

Plan for Next Twelve Months (FY 88): Publish report

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Concrete and Structures 1987 Session Number CS-14  
 Subject Area Concrete and Structures  
 Project Title Field Exposure Durability Studies  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3797  
 Investigator Henry Thornton, PO Box 631, Vicksburg, MS (601) 634-3797  
 (Name) (Address) (Telephones)

Starting Year 1986 Estimated Completion Year continuous

Technical Objectives: To continue the exposure of research programs and collect data on the durability and performance of concrete containing special materials or systems which have been or are planned to be used in concrete. To refine criteria used in selecting materials, mixtures, and construction practices, and evaluating severity of exposures. To evaluate the effects of new materials and processes on the durability and performance of concrete, and provide a natural field laboratory where no size limitation is placed on the exposed specimens.

Technical Approach: The capability for testing and continuous monitoring of the performance of active research programs and the capability for fabricating and installing new programs will be maintained. Annual testing, data collection, and biennial inspections will be continued. Analysis of selected data accumulated over the years will be accomplished and reported.

General Progress in Last Two Years: Severe exposure testing of concrete fabricated with project materials from Divisions and Districts engaged in this type of construction has been performed. Annual testing and data collection by WES and biennial inspections by representatives from OCE, WES, Divisions, and Districts, interested private industry and other government agencies have been conducted. Reports of results have been issued.

Plan for Next Twelve Months (FY 88): Inspection, testing, and data collection will be initiated on the new research programs installed. The testing of concrete mixtures recently installed representing new technology will continue. Specimens representing new materials and procedures resulting from the REMR research program will be installed. The biennial review of programs will be conducted. A 1-day field trip will be conducted to this facility in connection with the "Second International Conference on Concrete in Marine Environment," August 22-26, 1988, St. Andrews, New Brunswick, Canada.

Coordination or Cooperation with Another Agency: The U.S. Bureau of Reclamation, Mobil Oil Research Division, and the Canada Centre for Mineral and Energy Technology have research programs installed at the Treat Island, Maine, facility.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Concrete and Structures 1987 Session Number CS-15  
 Subject Area Concrete and Structures  
 Project Title Technical Assistance in Development of Engineering Criteria and Requirements for Alternative Heat-Surface Methods for Disposing LLW  
 Performing Organization U.S. Army Engineer Waterways Experiment Station and Huntington District  
 Principal (FTS) 542-3206  
 Investigator Bob Denson, PO Box 631, Vicksburg, MS (601) 634-3206  
 (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88  
 Technical Objectives: The U.S. Army Corps of engineers (WES and HND) is providing technical assistance and support to the NRC by performing tasks related to the structural design of below ground vaults, earth mounded concrete bunkers and shafts. It will be in a form suitable for use by the NRC staff in developing regulatory design criteria, Standard Review Plans and Regulatory Guides.

Technical Approach: WES and HND are providing assistance and written communications to be used in the development of general design criteria and specific design review criteria for the three alternatives. The recommendations, structural design and analyses, material quality and durability, construction and operations, quality assurance, performance monitoring, filters and strains, and waste cover systems.

General Progress in Last Two Years: The general design criteria for all alternatives are complete. The specific criteria for the below-ground vault is 100 percent complete and those for the earth-mounded concrete bunkers are 25 percent complete.

Plan for Next Twelve Months (FY 88): Finish remaining tanks and participate in open seminars on LLW disposal at NRC's request.

Coordination or Cooperation with Another Agency: The work is sponsored and directed by NRC and WES is in a cooperative effort, for part of the work, with Brookhaven National Laboratory.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Concrete and Structures 1987 Session Number CS-16  
 Subject Area Concrete and Structures  
 Project Title MOBA/MOUT Live-Fire Training Villages: Targets and Ranges  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3206  
 Investigator Bob Denson, PO Box 631, Vicksburg, MS (601) 634-3206  
 (Address) (Telephones)

Starting Year FY 79 Estimated Completion Year continuous  
 Technical Objectives: Provide a material and system, conducive to the use of troop labor, that will prevent spalling and ricochets for use in live-fire training; serve as material for target construction; serve as barrier for safety and protection to target mechanisms.

Technical Approach: Provide laboratory and field support in R&D efforts to upgrade facilities that can be served by material and system.

General Progress in Last Two Years: Live-fire tests and evaluation at (a) Ft. Bragg (M-16); (b) Ft. Benning (M-16 and live hand grenades; and (c) tank mockup targets at Ft. Hood.

Plan for Next Twelve Months (FY 88): (a) Upgrade known distance ranges in Germany (safety and protection barriers), and (b) R&D on saturated and frozen SACON material.

Coordination or Cooperation with Another Agency: Cooperative efforts with HND, DART, TRADOC, DA, USAREUR Engr, EUD.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-17  
 Subject Area Soil Mechanics (Concrete and Structures) (Rock Mechanics)  
 Project Title Computer Applications in Geotechnical Engineering: Task Group on Laboratory Automation  
 Performing Organization CEMES  
 Principal W. E. Strohm, Jr., CEMES-GR (FTS) 542-2604  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2604  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: To improve the efficiency and capabilities of CE materials testing laboratories through the use of computers.

Technical Approach: A prioritized list of possible computer applications in the laboratory will be formulated. Existing programs will be surveyed to ascertain their usefulness and technical experts hired to perform modifications or create new programs as needed to meet established goals. Task group will formulate goals for data acquisition and test control and draw on in-house and outside experts as necessary to complete guidance documents for use by all CE laboratories.

General Progress in Last Two Years: New start in Summer 1987: Initial meeting prioritized task group goals. Existing microcomputer based programs for data reduction have been surveyed and selected programs have been distributed for review by participating laboratories.

Plans for Next Twelve Months (FY 88): (1) Refine existing data reduction programs; (2) complete development of interim laboratory management program; (3) begin development of criteria for data acquisition systems.

Coordination or Cooperation with Another Agency: None to date - Anticipate contacting other agencies regarding experience with data acquisition systems.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-18  
 Subject Area Concrete and Structures  
 Project Title Mechanical Splicing of Reinforcing Steel  
 Performing Organization U.S. Bureau of Reclamation, E&R Center  
 Principal M. T. Peabody, D-1512 PO Box 25007 (FTS) 776-6104  
 Investigator Denver CO 80225 (303) 236-6104  
 (Name) (Address) (Telephone)  
 Starting Year FY 1987 Estimated Completion Year FY 1989

Technical Objectives: To investigate the effectiveness of mechanical splicing of rebar as compared to conventional splicing methods. An effective mechanical splice offers potential advantages of lower cost and ease of application due to elimination of the splice length and the increased constructability of mechanical splices in areas of limited space.

Technical Approach: Test various proprietary mechanical splicing devices on rebar of various diameters, and compare with unspliced control specimens. Strain gauges would be used to measure the elongation of spliced specimens. Data analyses would include stress-strain diagrams, comparisons of yield points and failure, and examination for slippage.

General Progress in Last Two Years: New program.

Plans for Next 12 Months (FY88): Conduct literature search, obtain manufacturer's information, and start test program.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number CS-19  
 Subject Area Concrete and Structures  
 Project Title Dynamic Properties of Concrete (DB-12)  
U.S. Bureau of Reclamation, E&R Center  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator F. J. Jackmau, D-1512 Denver CO 80225 (FTS) 776-6102  
 (Name) (Address) (303) 236-6102  
 (Telephone)  
 Starting Year FY 1975 Estimated Completion Year FY 1987

Technical Objectives: Objective of this study is to determine the tensile strengths and stress-strain relationships as functions of rate of loading on large mass concrete specimens. Data obtained from such tests would be compared to theoretical results and lead to a more economical design of large mass concrete structures.

Technical Approach: Uniaxial tension specimens (12 by 36 inches) of various strengths will be cast along with companion cylinders (6 by 12 inches) for standard 28-day static compression tests and rapid splitting tension tests. Tension specimens will then be instrumented with strain gauges and acoustic emission equipment and subjected to failure within 0.10 sec. Loads and strains will be monitored as function of time.

General Progress in Last Two Years: Testing has been essentially completed and a preliminary draft report was prepared.

Plans for Next 12 Months (FY88): Issue report.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Areas(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

Fifteenth Interagency Research Coordination Conference  
 3-5 November  
 TOPIC STATEMENT

Agency CE Priority 1 1987 Session No. CS-20  
 Subject Concrete and Structures  
 Project Title Structural Behavior of Sheet Pile Cellular Cofferdams  
 Performing Organization Engineering Application Office, WES  
 Principal Investigator CEWESKA-E, P.O. Box 631 (FTS) 542-3956  
Investigator Reed Mosher, Vicksburg, MS 39180 (601) 634-3956  
 Starting Year FY 86 Estimated Completion Year FY 87

Technical Objectives: The objective is to develop a more comprehensive and rational design method for sheet pile cellular cofferdams based on the experimental and analytical studies conducted for the Lock and Dam No. 26 (Replacement) cofferdam.

Technical Approach:

Many of the complexities involved in the analyses of cellular cofferdams that earlier investigators had to ignore or approximate can be accounted for by the use of the finite element methods. Two and three dimensional finite element models are used for calibration studies of actual instrumented cofferdams. Once calibrated, these models are used to perform parametric studies to evaluate the influence of variations in soil and pile properties, cell shape and dimensions, and construction. Based on these studies new design procedures will be established.

General Progress in Last Two Years: The reports have been completed on the finite element interlock connection model and summaries of cofferdam instrumentation data. Completion of the Theoretical Manual for Sheet Pile Cellular Cofferdams.

Plans for Next Twelve Months (FY 88):

Finite element study on sheet pile interlock connections pull tests. Investigation of sheet pile cellular cofferdam using 3-D finite element analysis. Parametric studies for cofferdam filling.

Coordination or Cooperation with another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference  
3-5 November

TOPIC STATEMENT

Agency CE Priority 1 1987 Session No. CS-21  
Subject Concrete and Structures  
Project Title Soil-Structure Interaction Studies Walls and U-Frame Structures  
Performing Organization Engineering Application Office, WES  
Principal CEMESKA-E, P.O. Box 631 (FTS) 542-3956  
Investigator Reed Mosher, Vicksburg, MS 39180 (601) 634-3956  
Starting Year FY 87 Estimated Completion Year FY 91

Technical Objectives: The objective will be to develop guidance and simplified analytical procedures for design/analysis of hydraulic structures using soil-structures interaction (SSI) principles. Three specific types of structures have been targeted in this research program: sheet piles, reinforced concrete retaining walls, and U-frame structures. The application SSI principles to these structures has the potential for substantial pay back for future PL 99-662 projects. Engineers using SSI techniques could design more economical structures without compromising safety requirements. Improved analytical models using SSI techniques will give designer's better understanding of the actual behavior of the structure.

Technical Approach: For sheet pile walls, the research effort will concentrate on developing a design method based on SSI procedures and improving procedures for determining soil response (Q-W) curves. For retaining walls, the research effort will focus on the use of the FEM to refine the overturning and sliding stability criteria, the investigation of deep seated stability of pile founded walls, and the development of procedures to better define earth pressures acting on the walls. For U-frame structure, the research effort will concentrate on the adaptation of a simplified SSI techniques to represent the foundation.

General Progress in Last Two Years: FY 87 is the first year of this work unit.

Plans for Next Twelve Months (FY 88):

1. Survey of Available Test Results on Foundation Pressures
2. Finite Element Study of Gravity Walls Founded on Rock
3. Study Deep Seated Stability of Pile Founded Walls
4. Finite Element Study of Sheet Pile Walls

Coordination or Cooperation with Another Agency: None  
General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency U,BM Priority \_\_\_\_\_ 1987 Session Number CS-22  
Subject Area Concrete and Structures  
Project Title The Impact of Active Underground Mining on Surface Structure  
Performing Organization Pittsburgh Research Center, USBM  
Principal Cochrans Mill Road, P.O. Box (FTS) 723-6545  
Investigator Jeffrey S. Walker 18070, Pgh., PA 15236 (412) 892-6545  
(Name) (Address) (Telephones)  
Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives: To determine the nature of the transfer of ground deformations into surface structures.

Technical Approach: The concept of this effort is to monitor the movements of both existing and specifically designed structures in response to mining-induced subsidence. Once an understanding of this mechanism is established, it may be possible to modify existing subsidence prediction models to also predict induced strains in surface structures.

General Progress in Last Two Years: Five simple surface structures have been constructed over two longwall panels. Four of the structures have been undermined and the effects of subsidence has been measured. The basis of analysis is the comparison of measurements taken from structures and compared to the predictions made from the subsidence models.

Plans for The Next Twelve Months (FY 88): Additional structures positioned over longwall operations will be instrumented and studied. The geometry of the structure will vary from simple walls to more the complex with induced load.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None

Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-23  
 Subject Area Concrete and Structures

Project Title Response of Concrete to Multiaxial Stress States

Performing Organization U.S. Army Engineer Waterways Experiment Station

Principal C. D. Norman (FTS) 542-2752

Investigator M. I. Hammons, PO Box 631, Vicksburg, MS (601) 634-2752  
 (Name) (Address) (Telephones)

Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: To develop an extensive data base of multiaxial test data for concrete (especially for high-strength concretes, i.e. f'c 6,000 psi) and grout. This data would be used in calibrating and verifying modern constitutive models.

Technical Approach: WES is currently conducting multiaxial tests using two conventional triaxial test devices capable of confining stresses up to 40,000 psi and 100,000 psi, respectively. Also, truly triaxial tests are being conducted in a unique test fixture which incorporates fluid cushion technology to minimize surface shear tractions. Principal stresses and strains are being recorded during these tests and transferred to a data base for computational purposes.

General Progress in Last Two Years: WES has brought on line the 100,000 psi triaxial test chamber and the fluid cushion test device. A series of cylindrical triaxial tests have been conducted on the three high-strength concretes. A series of truly triaxial tests have been conducted on a high-strength concrete, and plane strain tests have been conducted on a low-strength concrete.

Plan for Next Twelve Months (FY 88): WES will bring on line a 6-in. cubical triaxial test fixture capable of applying through fluid cushions three independent principal stresses up to a maximum stress level of 60,000 psi. This device will be used to conduct multiaxial tests along complex load paths in stress space. The device will be capable of operating in displacement or load control.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-24

Subject Area Concrete and Structures

Project Title Incremental Construction Analysis Procedures for Mass Concrete

Performing Organization U.S. Army Engineer Waterways Experiment Station

Principal C. Dean Norman (FTS) 542-3238

Investigator Anthony Bombich, PO Box 631, Vicksburg, MS (601) 634-3238  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: To determine and evaluate key parameters affecting incremental construction analysis procedures for mass concrete structures. To develop and verify improved and more effective incremental construction analysis procedures.

Technical Approach: A recently developed aging, viscoplastic concrete material model with cracking capabilities has been implemented into a general purpose heat transfer and structural analysis finite element code. The incremental formulation is being used to determine effects of key parameters on incremental construction based on laboratory and generic model mass concrete structures.

General Progress in Last Two Years: Strains, temperatures and displacements were measured during the incremental construction of a generic model lock wall at WES. This data has been analyzed and placed in a format for comparison with finite element analysis predictions.

Plan for Next Twelve Months (FY 88): Test results from the model lock wall and other laboratory as well as prototype structure experiences will be used to verify and improve the incremental construction analysis formulation.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: CE Priority 2 1987 Session Number CS-25  
 Subject Area Concrete and Structures  
 Project Title Strength Design of Concrete Circular Conduits  
 Performing Organization Waterways Experiment Station, Structural Mechanics Division  
 Principal Investigator R. L. Hall, P.O. Box 631, Vicksburg, MS (FTS) 842-3758  
 (601) 834-3758 (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 89  
 Technical Objectives:

Correlation field measurements from Lock and Dam No. 1 on the Red River with results from numerical models. The final objective will be to determine the amounts of additional silt loads (beyond original design), the U-frame lock on the Red River can withstand.

Technical Approach:

The instrumentation data will be reduced and compared with design calculations. A series of linear elastic structure response calculations will be made using the measured loads for the instrumented structure. A series of nonlinear calculations will be made to predict earth pressures due to addition silt loads and corresponding structural response.

General Progress in Last Two Years:

Instrumentation data has been reduced. Initial structure response calculations are presently being completed.

Plans for Next Twelve Months (FY 88):

Complete structure response calculations and compare with strain gage reading from the actual structure.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: CE Priority 2 1987 Session Number CS-26  
 Subject Area Concrete and Structures  
 Project Title Strength Design of Concrete Circular Conduits  
 Performing Organization Waterways Experiment Station  
 Principal Investigator R. L. Hall, P.O. Box 631, Vicksburg, MS (FTS) 842-3758  
 (601) 834-3758 (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 87  
 Technical Objectives:

The overall objective of this investigation is to develop realistic strength design methodology for reinforced concrete circular conduits.

Technical Approach:

The determination of the strength of circular sections will be based on theoretical plastic theory. The limitation and applicability of this theory will be determined by comparison of analytical and experimental results.

General Progress in Last Two Years:

A test program of model reinforced concrete rings simulating culvert sections under radial loads has been completed and compared with results from nonlinear finite-element analyses. A theoretical plastic theory has been developed into a design procedure based on these experimental and numerical results.

Plans for Next Twelve Months (FY 88):

Complete investigation of shear and radial tension in reinforced concrete sections.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number CS-27  
 Subject Area Concrete and Structures  
 Project Title Concrete Pipe Research  
 Performing Organization U.S. Bureau of Reclamation, E&R Center  
 Division of Research and Laboratory Services  
 Principal M. T. Peabody, D-1512 PO Box 25007 (FIS) 8-776-6104  
 Investigators J. R. Thurston, D-272 Denver CO 80225 (FIS) 8-776-3954  
 (Name) (Address) (Telephone)  
 Starting Year FY 1987 Estimated Completion Year FY 1989

Technical Objectives: To reevaluate the engineering assumptions used in design, the test procedures used to determine the quality of materials, the quality assurance procedures used in manufacturing and construction techniques, and the preventive measures used to protect the pipe from destructive environments.

Technical Approach: Laboratory and field tests will be conducted to measure the in situ strain in the pipe components before, during, and after the prestressing process for prestressed concrete pipe, and before, during, and after backfilling for reinforced concrete pipe. Comparisons will be made between measured and theoretical values. Studies of concrete tensile strength and cracking as it relates to pipe design will also be pursued using acoustic emissions techniques. Studies to determine the effectiveness of corrosion prevention methods such as cathodic protection and epoxy coating will also be examined in the laboratory and the field.

General Progress in Last Two Years: New program.

Plans for Next 12 Months (FY88): Work on the field testing programs to determine in situ strain in the pipe components before, during, and after the prestressing process for prestressed concrete pipe, and before, during, and after backfilling for the reinforced concrete pipe. Comparisons between measured and theoretical values, studies of concrete tensile strength and cracking as it relates to pipe design.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number CS-28  
 Subject Area Concrete and Structures  
 Project Title Improved Nondestructive Testing Techniques for Concrete Structures  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FIS) 542-3797  
 Investigator Henry Thornton, PO Box 631, Vicksburg, MS (601) 634-3797  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives: Provide equipment and procedures for nondestructively detecting the presence, depth, and extent of rebar, cracks, or inferior quality material within concrete structures; locating voids within or beneath structures; and providing indicators of in situ structural integrity.

Technical Approach: Current technology to be investigated for potential application to in situ evaluation will include laser and ultrasonic holography, ultrasonic pulse-echo, dynamic deflection, radiographics, acoustic emission, electrical resistivity, impulse-radar, infrared, and eddy currents. Areas where additional research is required include transducer design and evaluator, stress wave generation, signal enhancement and processing, and data storage and analysis.

General Progress in Last Two Years: (a) A report REMR-CS-10, "NDT Testing Systems for Evaluation of Concrete Structures," is in final draft form. (b) Developed an ultrasonic pulse-echo, pitch-catch system for nondestructive testing of concrete structures. (c) The WES-developed ultrasonic pitch-catch system was field tested on a concrete sea wall. Results indicate that the system facilitates delineation of sound concrete, poor quality concrete, and deteriorated concrete. Preliminary tests also indicate that the system is capable of detecting interfaces at reinforcing steel, at voids and cracks, and at voids caused by corrosion of rebar. (d) Data were collected on improved NDT forensic procedures on concrete structures by using a point-contact exponential horn transducer which allows evaluation of rough, jagged surfaces (chipped). (e) Field tests at Waco Dam using Texas A&M sonar equipment produced reflections from interfaces in concrete from a depth of 85 ft.

Plans for Next Twelve Months (FY 88): Implement a real time digital signal processor on NDT systems. Fabricate a field-worthy impact-echo system. Publish NDT reports. Complete Texas A&M work on sonar probing of concrete.

Coordination or Cooperation with Another Agency: The Texas A&M Research Foundation has worked under contract to WES in testing a linear sonar system for testing large concrete structures. The US Bureau of Reclamation was a partner to WES in early stages of development.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-29  
Subject Area Concrete and Structures  
Project Title Underwater Survey Techniques  
Performing Organization U.S. Army Engineer Waterways Experiment Station  
Principal (FTS) 542-3797  
Investigator Henry Thornton, PO Box 631, Vicksburg, MS (60D) 634-3797  
(Name) (Address) (Telephones)

Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: Provide accurate and relatively inexpensive underwater survey systems by which a comprehensive assessment can be made concerning the extent of damage and the need of a structure.

Technical Approach: The advantages and limitations of a variety of surface cleaning tools will be determined for potential application to Civil Works structures. In addition to visual and tactile examination by divers, closed-circuit underwater television cameras, video tape recorders, a variety of still cameras, and nondestructive testing techniques (ultrasonic, computerized tomography, etc.) are being evaluated. The use of remotely controlled equipment will be investigated. Systems and technology applicable to mapping and profiling of surfaces underwater (airborne laser systems, acoustic profilers, downward-looking radar, etc.) are being investigated. New equipment will be developed for sampling and in situ testing of concrete underwater.

General Progress in Last Two Years: (a) Requested approval to print REMR-CS-8, "Procedures and Devices for Underwater Cleaning of Civil Works Structures." (b) TR REMR-CS-9, "Underwater Inspection of the Engineering Condition of Concrete Structures," was drafted. (c) A Technical Note on Underwater Video/TV was drafted. (d) A Technical Note on Underwater Use of Subsurface Radar is being prepared. Condition of articulated concrete matting was detected. (e) An ultrasonic pulse-echo transmitter using a new piezoelectric material (PVPF) was designed and fabricated. (f) Collected data on new tools and techniques for the Underwater Inspection of Concrete Structures from NCEL including ultrasonics, rebound hammer, and R-meter.

Plan for Next Twelve Months (FY 88): (a) WES/NCEL put together ultrasonic pulse-echo system and Rov Minirover for remote tests of concrete. (b) Prepare technical notes on Underwater Inspection Tools and Techniques (NCEL). (c) Final test radar for underwater application. (d) Prepare technical note on Seattle District underwater inspection repair system.

Coordination or Cooperation with Another Agency: Naval Civil Engineering Laboratory and Argonne National Laboratory have been under contract. U.S. Bureau of Reclamation was a cooperative agency. Naval Coastal Systems Center and Naval Ocean Systems Center have been involved.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-30  
Subject Area Concrete and Structures  
Project Title Development and Evaluation of Continuous Monitoring System for Structural Safety  
Performing Organization US Army Engineer Topographic Labs  
Principal (FTS) 385-2816  
Investigator Stephen DeLoach CEFTL-TL-SP Ft. Belvoir, VA (202) 355-2816  
(Name) (Address) (Telephones)  
Starting Year FY 86 Estimated Completion Year FY 89

Technical Objectives: The objective is to develop a system to continually and automatically monitor structural deformations.

Technical Approach: The NAVSTAR Global Positioning System (GPS) may be used in a translocation mode to obtain very precise relative measurements of position. This system will serve as the basis for designin, and implementing an automatic and continuous monitoring system.

General Progress in Last Two Years:

A GPS system was purchased for use in a number of programs.

A conceptual design was performed in-house.

A procurement package has been submitted for software enhancements. Plans for Next Twelve Months (FY 88):

Contract for software enhancements.

Begin data link development.

Prototype testing.

Coordination or Cooperation with Another Agency:

All cooperative efforts concerning the GPS are currently through the Federal Geodetic Control committee.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number CS-31  
 Subject Area Concrete Technology (Dam Safety)  
 Project Title Dam Safety Instrumentation (I-6)  
 Performing Organization USBR, E&R Center, Denver, CO  
 Principal Investigator Mr. Lynn R. Carpenter, MC-3350, PO box 25007 (FTS) 776-8514 (303) 236-8514  
 (Address) Denver, CO 80225 (Telephones)  
 Starting Year FY 79 Estimated Completion Year FY 89

Technical Objectives: Dam safety concerns require that our past reliance on manual reporting and processing of structural behavior data from dams, reservoirs, landslides and appurtenant structures be replaced with state-of-the-art automatic reporting systems. The purpose of this project is to develop, test and validate sensors, automated acquisition and processing equipment, transmission paths and analysis software that will perform the monitoring and early warning functions at close to real time rates. The reduction in personnel ceilings throughout the Government and the transfer of dams to irrigation districts makes it more difficult to have qualified field forces available to record and transmit data required by designers and dam safety personnel in a timely and accurate manner.

Technical Approach: Develop sensor systems to electronically record data previously available only through visual observations. Application and evaluation of transducers and data acquisition systems at selected Bureau sites. Development of reduction, analysis and display software to handle structural behavior data at central site computers.

General Progress in Last Two Years: Installation of systems at Glen Canyon, Morrow Point, Crystal, Flaming Gorge, Monticello, Yellowstone and Navajo dams. Upgrades of plumbline, landslide and dam monitor systems. Software development and testing of miniature piezoelectric transducers.

Plans for Next Twelve Months (FY 88): Completion of transducer and satellite transmitter installation at all dams presently undergoing automation. Development of central site display and analysis software. Evaluation of landslide monitor systems at Morrow Point and Yellowstone dams. Complete tiltmeter vs plumbline comparison testing at Morrow Point Dam.

Coordination or Cooperation with Another Agency: Consulted with COE-WES on Liberty Dam instrumentation and monitoring. Transducer testing under joint USBR-REMR funding with COE-WES.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number CS-32  
 Subject Area Concrete and Structures  
 Project Title Improved Instrumentation for Older Structures  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principals Investigator Edward F. O'Neil, PO Box 631, Vicksburg, MS (FTS) 542-3268 (601) 534-3268  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year 87  
 Technical Objectives: Develop improved procedures for handling large amounts of data; also, to develop new instrumentation or improved uses of existing instrumentation for older structures where original instrumentation has failed or is no longer adequate.

Technical Approach: Based on a survey of Corps field offices, a report will be compiled that will describe problems and solutions to Corps instrumentation situations. This information will be used to determine the areas of concentration for improving the instrumentation. Solutions will include: development of totally automated data collection, dissemination of information about existing instrumentation for concrete structures, and development of new solutions to problems either inadequately addressed or not addressed at all.

General Progress in Last Two Years: A survey of field offices at the District level was accomplished. Also three reports were published which can be used by District and Division instrumentation personnel to help them understand instrumentation automation and the hardware and software necessary to accomplish the task of automation. An instrumentation automation demonstration was started at Beaver Dam which will demonstrate several methods of automating data collection.

Plan for Next Twelve Months (FY 88): Program is scheduled to terminate at the end of FY 87.

Coordination or Cooperation with Another Agency: Activities have been coordinated with Cold Regions Research and Engineering Laboratory and Bureau of Reclamation.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None



TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number CS-33  
 Subject Area Concrete and Structures  
 Project Title Seismic Response of Concrete Dams  
 Performing Organization Waterways Experiment Station  
 Principal Investigator R. L. Hall, P.O. Box 631, Vicksburg, MS  
 (FTS) 542-2758  
 (601) 634-2758  
 (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives: The published Corps criteria for the seismic analysis of concrete dams permits these structures to be analyzed using simple procedures with loads determined by the seismic coefficient method. Recent research indicates that published Corps criteria does not adequately consider the dynamic behavior of the structure, the hydrodynamic response of the reservoir, or the dynamic effect of the foundation.

Technical Approach: This work involves studies to define the effects of the dynamic behavior of the structure, the hydrodynamic response of the reservoir, and the dynamic behavior of the foundation. These studies include theoretical analyses, model experiments, and prototype tests.

General Progress in Last Two Years: Data obtained from the vibration tests on R. B. Russell Concrete Dam have been completed and corresponding reports prepared. Also, load calculated from Chopra simplifed method presented in 1978, has been combined with finite-element analyses to produce reliable stresses for a simplified procedure.

Plans for Next Twelve Months (FY 88): Add elastic foundation for development of a simplified procedure and complete development of simplified procedure for overflow sections.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

Coordination or Cooperation with Another Agency: Cooperation with Ontario Hydro on concrete repair materials.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-35  
 Subject Area Concrete and Structures  
 Project Title Techniques for Underwater Concrete Repairs  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3251  
 Investigator K. L. Saucier, PO Box 631, Vicksburg, MS (601) 634-3251  
 (Address) (Telephones)

Starting Year FY 85 Estimated Completion Year FY 88  
 Technical Objectives: Develop guidance for rehabilitation conducted underwater to allow a District to evaluate that option when selecting techniques to be used on a given structure. Develop necessary guidance for materials, equipment, procedures, inspection, and evaluation to insure that satisfactory results will be obtained.

Technical Approach: The use of tremie concrete and preplaced concrete to repair abrasion damage in stilling basins will be evaluated. Construction procedures and equipment will be developed. Various products for repairing cracks, patching spalls, attaching dowels, bolts, etc., or any other underwater maintenance and repair task will be evaluated. The use of precast concrete elements and prefabricated steel elements to accomplish repairs underwater will be investigated. Techniques for monitoring and evaluating repairs made underwater will be examined.

General Progress in Last Two Years: A Corps-wide workshop was held to determine current practice in underwater concrete repair within the Corps. A study was also conducted of tremie and preplaced aggregate concrete used for repair worldwide. A study was conducted on use of precast concrete elements and prefabricated steel elements for underwater repair. An investigation was completed on the various proprietary products used for underwater concrete work including superplasticizing admixtures, thixotropic-setting agents and "anti-wash" out admixtures. A study was initiated in the laboratory to investigate several placement methods using mixtures containing the aforementioned admixtures including inclined tremie, bucket and concrete pump.

Plan for Next Twelve Months (FY 88): Complete laboratory work on techniques of placement; conduct field demonstration of an underwater placement; publish report on work.

Coordination or Cooperation with Another Agency: The U.S. Navy conducted the investigation on the use of precast concrete elements and prefabricated steel elements for underwater repair.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-36  
 Subject Area Concrete and Structures  
 Project Title Repair of Erosion-Damaged Structures  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3230  
 Investigator James E. McDonald, PO Box 631, Vicksburg, MS (601) 634-3230  
 (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 89  
 Technical Objectives: Identify materials and techniques for repair of structures subjected to erosion damage.

Technical Approach: Current practice in repair of erosion-damaged structures is being reviewed to identify shortfalls. Laboratory tests will be initiated to supplement existing technology for repair of abrasion-erosion damage. Based on the assessment of current practice, relationships between concrete strength, aggregate type, surface treatments, etc., and cavitation resistance will be developed. Based on laboratory test results, selected materials will be used in prototype demonstration repairs.

General Progress in Last Two Years: Structures experiencing cavitation damage were identified and collection of information for report on current repair practices was initiated. Tests to determine the effect of fly ash on abrasion resistance of concrete were initiated.

Plan for Next Twelve Months (FY 88): (a) Publish current practices report,  
 (b) Initiate laboratory tests to determine cavitation resistance of selected repair materials, and (c) Complete and report results of abrasion-erosion tests.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-37Subject Area Concrete and StructuresProject Title In Situ Repair of Deteriorated ConcretePerforming Organization U.S. Army Engineer Waterways Experiment StationPrincipal \_\_\_\_\_ (FTS) 542-3230Investigator James E. McDonald, PO Box 631, Vicksburg, MS (601) 634-3230  
(Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_Starting Year FY 85 Estimated Completion Year FY 89Technical Objectives: Identify materials and methods which will allow in situ treatment of deteriorated concrete without the necessity for removal.

Technical Approach: Polymers and associated pressure injection techniques for in situ treatment of existing concrete are being evaluated. Low-viscosity monomers that will penetrate into small cracks and voids are receiving particular attention. Impregnation techniques (injection and vacuum) which are applicable to a variety of hydraulic structures are being evaluated. Drilling, grouting, and reinforcement installation techniques for "poststrengthenment" of deteriorated concrete will be evaluated.

General Progress in Last Two Years: A feasibility study on in situ repair of deteriorated concrete in hydraulic structures was completed and reported. Work to evaluate and characterize eight monomers and resins selected for evaluation as impregnates and injection adhesives was completed. Laboratory-scaled impregnation studies to evaluate the effectiveness of four impregnants in protecting sound concrete from water penetration were completed. Laboratory-scaled tests were initiated to evaluate the effectiveness for five injection adhesives to repair highly deteriorated, cracked concrete under dry and wet conditions.

Plan for Next Twelve Months (FY 88): Complete laboratory tests on pressure injection and vacuum impregnation materials and techniques. Conduct field demonstration of pressure injection repair.

Coordination or Cooperation with Another Agency: Work is being conducted by Brookhaven National Laboratory through a Support Agreement with the Department of Energy.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None

Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-38Subject Area Concrete and StructuresProject Title Techniques for Joint Repair and RehabilitationPerforming Organization U.S. Army Engineer Waterways Experiment StationPrincipal \_\_\_\_\_ (FTS) 542-3230Investigator James E. McDonald, PO Box 631, Vicksburg, MS (601) 634-3230  
(Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_Starting Year FY 85 Estimated Completion Year FY 89Technical Objectives: Develop basic repair and replacement materials and techniques which can be adapted to a variety of joint repair situations.

Technical Approach: Current practice in (a) repair of waterstop failures, (b) monolith joint reconstruction, and (c) repair of intake towers and conduits is being reviewed and evaluated. Laboratory test apparatus will be designed and constructed to allow systematic evaluation of crack and joint repair systems prior to prototype installation.

General Progress in Last Two Years: Current practice report on repair of waterstop failures was published. Current practice report on maintenance and repair of intake structures and conduits was drafted. Current practice in monolith joint reconstruction was surveyed and drafting of report initiated. Design of a test method and apparatus to evaluate seepage crack repairs was completed. Design of a remedial waterstop test facility was completed and construction initiated.

Plan for Next Twelve Months (FY 88): (a) Publish report on maintenance and repair intake structures and conduits, (b) Publish current practice report on monolith joint reconstruction, and (c) Complete construction of remedial waterstop test facility and initiate laboratory testing.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None

Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-39  
 Subject Area Concrete and Structures  
 Project Title Rehabilitation of Navigation Locks  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3230  
 Investigator James E. McDonald, PO Box 631, Vicksburg, MS (601) 634-3230  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: Develop new and improved materials and techniques for use in navigation lock rehabilitation.

Technical Approach: Recent and current lock rehabilitation projects are being reviewed and analyzed to determine areas which could benefit from research. Areas already identified as requiring research include cracking in replacement concrete and lock downtime associated with rehabilitation. Variations in concrete materials, mixture proportions, and construction procedures are being evaluated for potential control or elimination of the cracking problem.

General Progress in Last Two Years: A report on current practice and problems in lock wall rehabilitation was drafted. An aging constitutive model for concrete which includes creep, shrinkage, and cracking was developed and used in a heat transfer and structural analysis finite element code to predict response of concrete overlays with varying thickness and placement conditions. A precast concrete stay-in-place forming system was designed for lock wall resurfacing. The constructibility of the system was demonstrated on two one-half side simulated lock monoliths.

Plan for Next Twelve Months (FY 88): (a) Publish case history report on lock rehabilitation. (b) Publish analysis of cracking in lock wall resurfacing concrete. (c) Publish reports on design and constructibility of precast stay-in-place forming system. Complete video report on constructibility demonstration. (d) Demonstrate underwater application of precast panels.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-40  
 Subject Area Concrete and Structures  
 Project Title Application of New Technology to Maintenance and Minor Repair  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3230  
 Investigator James E. McDonald, PO Box 631, Vicksburg, MS (601) 634-3230  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: Identify new and improved materials and techniques for maintenance and repair of concrete and steel.

Technical Approach: Recent advancements in materials technology are being reviewed to identify those materials and techniques with possible application in concrete and steel maintenance. Selected materials and techniques are being evaluated in laboratory and field tests to determine their potential for maintenance and repair of concrete and steel structures.

General Progress in Last Two Years: Results of a literature search and limited laboratory tests on latex admixtures for portland cement concrete and mortar were published. Laboratory tests to determine pertinent engineering properties of silica fume concrete were completed and drafting of the report was initiated. Tests on anchor grouting systems were initiated. Screening tests were completed on 22 materials for spall repair of wet concrete surfaces. Eight materials were selected for further evaluation through laboratory testing.

Plan for Next Twelve Months (FY 88): Publish report on silica fume concrete. Complete long-term tests on anchor grouting systems and draft report. Complete laboratory evaluation of materials for spall repair of wet concrete surfaces. Initiate evaluation of high energy mixing system.

Coordination or Cooperation with Another Agency: Work on anchor grouting systems and materials for spall repair of wet concrete is being conducted by TVA through a Support Agreement.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-41Subject Area Concrete and StructuresProject Title Concrete Cracking ResearchPerforming Organization U.S. Army Engineer Waterways Experiment StationPrincipal C. Dean Norman (FTS) 542-2250Investigator Sharon Garner, PO Box 631, Vicksburg, MS (601) 634-2230  
(Name) (Address) (Telephones)Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: To determine and evaluate factors that are critical in the early- and later-time cracking of mass concrete structures and to incorporate those factors into a constitutive model for mass concrete in a general purpose finite element computer program.

Technical Approach: Material property tests are being conducted on various mass concrete mixtures to determine early-time shrinkage, creep, elastic modulus, and thermal properties. The importance of autogenous shrinkage at very early times (prior to 1 day) is being evaluated for representative concrete mixtures. Two- and three-dimensional concrete material models which incorporate the effects of aging, creep, shrinkage and cracking have been implemented into the ABAQUS finite element program, and predictions are being evaluated against model structures and laboratory tests.

General Progress in Last Two Years: The two-dimensional model has been successfully used to predict the behavior of overlays for mass concrete structures and other generic structures.

Plan for Next Twelve Months (FY 88): (a) Conduct further test of concrete mixtures. (b) Continue to verify and refine materials models based on test results and on comparisons of predictions with data collected from model lock wall structure.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
X Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number CS-42Subject Area Concrete and StructuresProject Title Unsolved Problems Relating to Alkali-Silica Reaction in ConcretePerforming Organization U.S. Army Engineer Waterways Experiment StationPrincipal \_\_\_\_\_ (FTS) 542-3273Investigator G. S. Wong, PO Box 631, Vicksburg, MS (601) 634-3273  
(Name) (Address) (Telephones)Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives: Study and find solutions for unsolved alkali-silica reaction (ASR) problems; these include (a) effect of  $C_3A$  in sea water or equivalent, (b) other sources of alkali such as micas and fieldspars, (c) use of alkali on mass per unit volume basis, (d) alkali limits based on combination of cement and slag or pozzolans.

Technical Approach: Each problem area will be studied separately by use of mortar mixtures followed by confirmatory testing of concrete.

General Progress in Last Two Years: Full funding started in FY 86 but there was no funding in FY 87. Full funding for FY 88 is anticipated. Questions (a) through (c) have been addressed.

Plan for Next Twelve Months (FY 88): Emphasis will be shifted to considerations of level of aggregate reactivity rather than as just reactive or non-reactive.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority Concrete and Structures 1987 Session Number CS-43  
 Subject Area Concrete and Structures  
 Project Title Repair of Concrete Affected by Alkali-aggregate Reaction (OR-441)  
 Performing Organization U.S. Bureau of Reclamation, EBR Center Division of Research and Laboratory Services  
 Principal G. W. DePuy, D-1512 PO Box 25007 (FTS) 776-2766  
 Investigator T. E. Rutenbeck, D-1512 Denver CO 80225 (303) 776-2766  
 (Name) (Address) (Telephone)  
 Starting Year FY 1984 Estimated Completion Year FY 1989

Technical Objectives: To investigate alkali-aggregate reaction in concrete structures and to develop concrete repair or rehabilitation methods for affected structures.

Technical Approach: Review of literature and available information, and field inspection of structures affected by alkali reaction to assess the situation and identify potential candidates for repair. Conduct laboratory tests to determine the extent of the reaction and potential for further reaction. Conduct field tests to determine the feasibility and benefits of different repair methods.

General Progress in Last Two Years: Field investigations of five dams in southwestern and four dams in southeastern United States were conducted. Laboratory studies conducted included petrographic examination, expansion tests for reactive potential, and chemical conditions conducive to the reaction.

Plans for Next 12 Months (FY88): Continue with investigations of field structures in northern climates and development of laboratory methods to determine if the reaction has stopped or if further expansion and cracking is likely. Further studies at Stewart Mountain Dam and Friant Dam are being conducted to develop a possible repair program.

Coordination or Cooperation with Another Agency: Contracts with Construction Technology Laboratory, University of Aston, U.K., and Department of Scientific Research, New Zealand, were issued. Structures from the Corps of Engineers and Tennessee Valley Authority are included in the program.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency CE Priority Concrete and Structures 1987 Session Number CS-44  
 Subject Area Concrete and Structures  
 Project Title Stability of Existing Concrete Structures on Rock  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-2512  
 Investigator W. F. McCleese, PO Box 631, Vicksburg, MS (601) 634-2512  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: (a) Specify the limitations of the present methods of stability analysis. (b) Recommend alternative analytical methods of analysis where current methods cannot be applied. (c) Develop a methodology for assessing the actual in-place stability of existing structures which do not meet current stability criteria by present analysis methods.

Technical Approach: Review of ongoing stability investigations was conducted. Problem areas, shortfalls, and limitations were identified where current methods of analysis are inadequate; other analysis being evaluated through field investigations, lab work and analytical methods. Loads on the structures will be identified and qualified. Displacements and deformations will be measured during loading cycles. Stability criteria will be evaluated and improvements recommended. Three technical notes were prepared for the RMR Notebook which provide guidance on stability analysis procedures. A report was prepared on the use of Fractal Analysis for characterizing the asperities (surface roughness) of potential sliding planes. Uplift data was collected on existing gravity structures on rock from the Corps, USBR, and TVA for comparison with the Corps' uplift criteria. Completed literature search and developed a testing plan for determining pressures exerted by backfill. Two field sites have been selected for stability instrumentation and monitoring. Instrumentation is being installed at Snell Lock on the St. Lawrence Seaway.

General Progress in Last Two Years: Snell and Little Goose Locks will be instrumented and data collected and analyzed to determine the cause and extent of distress of these locks. The objective of this effort will be to develop a methodology that can be used at other locks which are experiencing distress or which don't meet existing stability criteria to determine if there is really a stability problem.

Plans for Next Twelve Months (FY 88): TVA, Bureau of Reclamation, and FERC all had participants at the first workshop and are kept informed of the progress of the work and will receive all products produced.

Coordination or Cooperation with Another Agency: ERROR IN GROUP 6

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number CS-45  
 Subject Area Concrete and Structures  
 Project Title Predicting Concrete Service Life  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 342-3261  
 Investigator Toy S. Poole, PO Box 631, Vicksburg, MS  
(601) 634-3261  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 89  
 Technical Objectives: Develop methodologies for predicting remaining concrete service life of concrete structures suffering from frost damage as a major form of degradation.

Technical Approach: Estimate rates of degradation from field and laboratory test data and to apply reliability theory to produce a probabilistic estimate of remaining service life.

General Progress in Last Two Years: Have corings from several structures that represent a variety of exposure and service conditions. Depth of deterioration has been measured and data analyzed for correlations with these conditions.

Plan for Next Twelve Months (FY 88): To obtain data from other field exposures, develop laboratory approaches to the problem, and explore use of reliability theory to concrete applications.

Coordination or Cooperation with Another Agency: None  
 General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams  
X Project Maintenance, Rehabilitation and Life Extension Technology Transfer None

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number CS-46  
 Subject Area Concrete and Structures  
 Project Title Maintenance and Repair Management System for Civil Works Structures  
 Performing Organization U.S. Army Construction Engineering Research Laboratory  
 Principal P.O. Box 400  
 Investigator Anthony M. Kao Champaign, Illinois 61820-1305  
(217) 373-7238  
 (Name) (Address) (Telephones)

Starting Year FY 85 Estimated Completion Year FY 89  
 Technical Objectives:

To develop a Maintenance and Repair Management System for Civil Works Structures that will provide engineers with a practical decision making procedure for indentifying cost effective maintenance and repair on civil works structures.

Technical Approach:

The Management System is a computerized system and consists of four modules; data management, condition rating, life cycle cost analysis, maintenance and repair guide lines and consequence modules. The system provides its users with many capabilities such as data storage and retrieval, inventory of structures/facilities, structure condition rating procedures, determination of maintenance and repair needs and methods, economic analysis, project prioritization, and budget planning.

General Progress in Last Two Years:

Data management and life cycle cost analysis modules have been completed. Preliminary Uniform evaluation and condition rating procedures of steel sheet piles, miter gates, concrete lock walls, and timber training dikes have been completed.

Plans for Next Twelve Months (FY 88):

Continue development and refinement of the total management system.  
 Conduct field validation tests of the completed modules.

Coordination or Cooperation with Another Agency:

Rupert Bullock of TVA has been developing the condition rating procedures for concrete lockwalls. The procedure, when completed, will be incorporated into the management system.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-47  
 Subject Area Concrete and Structures  
 Project Title Surface Treatments to Minimize Concrete Deterioration  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3275  
 Investigator Tony Husbands, PO Box 611, Vicksburg, MS (601) 534-3275  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89

**Technical Objectives:** The objective of this work unit is to develop information on selection and application of surface treatments used for protecting and repairing concrete subjected to aggressive agents in the environment.

**Technical Approach:** A survey was made of previous surface treatments of concrete structures to determine reasons for failures or successes, and to rate the performance of various types of surface treatments. Based on the results of the survey, a selection of surface treatment materials will be obtained and evaluated in the laboratory. A selection and application guide for surface treatments of concrete in various environments will be developed.

**General Progress in Last Two Years:** A draft report was prepared on the survey on existing treatment materials, field applications and performance, and laboratory test reports. Laboratory testing was started and 106 materials have been tested or are in the process of being tested. Tests have been made to evaluate latex-modified shotcrete and thin overlay materials. A field test at Brandon Road Lock and Dam was made to evaluate two concrete sealers, a 1/2-in. latex-modified mortar overlay and latex-modified shotcrete.

**Plan for Next Twelve Months (FY 88):** (a) Complete testing of materials. (b) Continue field test of materials. (c) Publish report on Laboratory test.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams  Technology Transfer None  
None Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-48  
 Subject Area Concrete and Structures  
 Project Title Flood Proofing Buildings  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3221  
 Investigator Carl Pace, PO Box 631, Vicksburg, MS (601) 634-3221  
 (Name) (Address) (Telephones)  
 Starting Year FY 76 Estimated Completion Year FY 92

**Technical Objectives:** To determine expedient, feasible, effective and safe ways of protecting buildings from floodwaters. The average cost of flood damage per flooded home is \$20,000 and is much greater for industrial buildings. Homes can be protected from floodwaters for \$8,000 to \$15,000. Since the flooding of buildings is repetitive, billions of dollars can be saved by protecting them from floodwaters.

**Technical Approach:** Determine workable systems and materials which can be activated in 30 minutes to an hour and protect buildings from floodwaters. Develop a report on the state-of-the-art techniques for raising and moving buildings and present innovative techniques for raising and moving buildings easier, faster and less expensive.

**General Progress in Last Two Years:** Systems have been developed which for approximately \$8,000 can protect homes from floodwaters. There are some details to finalize; but the project is 85 percent complete.

**Plan for Next Twelve Months (FY 88):** The preferable methods for flood proofing are permanently raising or moving buildings which are in high risk flood areas. A report will be prepared presenting the state-of-the-art techniques for raising and moving buildings and innovative techniques presented which will make raising and moving buildings easier, faster and less expensive.

Coordination or Cooperation with Another Agency: National Flood Proofing Committee (OCE), FEMA.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams  Technology Transfer None  
None Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-49  
 Subject Area Concrete and Structures  
 Project Title Application of X-ray Diffraction to Determine Residual Stress  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-3273  
 Investigator G. S. Wong, PO Box 631, Vicksburg, MS (601) 634-3273  
 (Name) (Address) (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 87

Technical Objectives: Using aggregates or constituents of the portland cement past determine stress in concrete based on the strains in the mineral constituents of the concrete.

Technical Approach: At high-strength concrete and load specimens of rock and concrete to specific loads and correlate residual stress of rock and concrete to stress applied.

General Progress in Last Two Years: Obtained residual stress device, cast and tested concrete specimens under loads of 15 and 30 ksi.

Plan for Next Twelve Months (FY 88): None

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number CS-50  
 Subject Area Concrete and Structures  
 Project Title Techniques for Removal of Deteriorated Concrete  
 Performing Organization U.S. Army Engineer Waterways Experiment Station  
 Principal (FTS) 542-2814  
 Investigator Roy L. Campbell, PO Box 631, Vicksburg, MS (601) 634-2814  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year 89

Technical Objectives: The objective of this work unit is to evaluate and improve current methods of concrete removal for use in maintenance and repair work at Corps projects.

Technical Approach: Current practices for concrete removal are identified through contacts with Corps personnel and product vendors and through a review of current literature. Removal techniques identified are evaluated to determine their applicability for various types of removal work at Corps projects while noting their advantages and disadvantages. Selected techniques are refined, when possible, and further evaluated through laboratory and field demonstrations.

General Progress in Last Two Years: A search to determine the current practices for concrete removal was made and the results used to develop technical notes for the REMR Notebook. A video tape was made of a vendor sponsored demonstration at WES documenting the use of the water jet removal of deteriorated concrete from bridge decks.

Plan for Next Twelve Months (FY 88): Develop technical notes for the REMR Notebook on techniques used to determine removal limits and on guidelines for determining surface readiness for concrete placement and to conduct laboratory demonstrations to evaluate selected techniques of removal for field application and demonstration. Demonstrations planned include using water jet for removal of concrete underwater and using water jet for removal of concrete from vertical surfaces.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference  
3-5 November  
TOPIC STATEMENT

Agency CE Priority 1 1987 Session No. CS-51

Subject Concrete and Structures

Project Title Computer-Aided Structural Engineering (CASE)

Performing Organization Waterways Experiment Station

Principal N. Radhakrishnan CEWESIM-Z, P.O. Box 631  
Investigator Paul Senter, Vicksburg, MS 39180 (601)634-3956  
Starting Year FY 80 Estimated Completion Year N/A

**Technical Objectives:** To develop new (or adapt existing) computer programs for design/analysis of reinforced concrete retaining and floodwalls, conduits and culverts, pile foundations, sheet pile walls and cells, generalized 3-D stability analysis, finite element analysis, U-frame structures, miter gates, building systems, computer-aided drafting, and blast-resistant analysis.

**Technical Approach:** The Corps' future requirements for structural computer programs have been analyzed. Existing Corps, university, and commercially available codes are reviewed for application when a new computer program is needed. In all cases detailed engineering and computer programming criteria is prepared to reflect the specific needs, procedures and techniques that are required. The final product is carefully evaluated against these criteria.

**General Progress:** As a result of efforts in this project, 50 final programs have been released. Sixteen of these programs existed before, but were adapted, modified, and documented for Corps-wide use. Thirty-four new programs have been developed to meet Corps-wide criteria established by the CASE technical task groups. Fifty-five reports have been published presenting technical bases and user's guides. The programs have been used 150,00 times in over 900 structures for over 800 projects and realized an estimated \$39 million total savings in cost of design and many years reduction.

Plans for Next Twelve Months (FY 88):

1. File Interference Checking Program
2. Enhanced Pile Stiffness Program
3. Input and Design Modules for Powerhouse - 3DSAD
4. Phase II - FEM Guidelines for Analysis of Gravity Dams

**Coordination or Cooperation with Another Agency:** Navy Civil Eng. Lab., FERC, and USDA - Soil Conser. Ser.  
**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
Technology Transfer

APPENDIX E  
AGENDA AND TOPIC STATEMENTS  
ELECTRIC POWER SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987  
Vicksburg, Mississippi

AGENDA

ELECTRIC POWER SESSION

J. J. Ray, Chairman  
Dr. R. A. Franco, Recorder

<u>Time</u>	<u>Topic</u>	<u>Topic Statement</u>	<u>Agency</u>	<u>Time</u>	<u>Topic</u>	<u>Topic Statement</u>	<u>Agency</u>
					<u>JOINT ELECTRIC POWER/ENERGY SESSION</u>		
				13:30	Magnetic Field Effects		DOE EPRI Agencies
				14:15	Superconductivity		DOE EPRI Agency Roundtable
				15:00			
				15:30	BREAK		
					<u>RESURGE ELECTRIC POWER SESSION</u>		
					<u>SUBSTATION EQUIPMENT</u>		
				15:45	EP-3a EP-3b EP-3c EP-3d	Advanced Technology Breaker Demonstration 500-kV Breaker Reliability Improvement 230-kV Advanced Load Interruption Power Quality Issues for Sensitive Loads	BPA BPA BPA TVA
					<u>CONTROLS &amp; COMMUNICATIONS</u>		
				16:25	EP-4a EP-4b EP-4c	Series Capacitor Control Improvement Develop Digital Out-of-Step Relaying Digital Protective Relaying	BPA BPA TVA
					<u>WEDNESDAY, November 4</u>		
					<u>CONTROLS &amp; COMMUNICATIONS CONTINUED</u>		
				8:15	EP-4d EP-4e EP-4f EP-4g EP-4h EP-4i EP-4j	Directional Harmonic Current Relay High Impedance Fault Detection System Relay Evaluation System Develop System for Testing Real Time High Speed Digital Controls Digital Fault Recorder Evaluation Communications Alarm Processor Integrated Microwave Transfer Trip Package	USBR BPA BPA BPA BPA BPA BPA
					<u>STABILITY</u>		
				9:45	EP-5a EP-5b EP-5c EP-5d	Estimators for Power System Control Power System Dynamics Signal Processor Intertie Performance Monitor Dynamic Interact. Monitor Network for Western Power System	BPA BPA BPA BPA
				10:35	BREAK		
					<u>POWER PLANTS</u>		
				9:00 a.m.	EP-1a EP-1b EP-1c EP-1d	Efficiency Algorithm for Loading Hydroelectric Generators Evaluation of an Automatic Index Test Box to Optimize the Efficiency of Kaplan Turbines Study to Improve the Efficiency of the Cross-Flow Turbine Generator Stator End Turn Insulation Evaluation Techniques Hydraulic Turbine Avation Project (presented by title only at this session, will be presented at the Joint Hydraulics/Water Quality Session)	USBR BPA BPA USBR
					<u>TRANSMISSION</u>		
				10:00	EP-2a EP-2b	Lightning Location Lightning Monitor System	TVA BPA
				10:20	BREAK		
				10:30	EP-2c EP-2d	Wind Loading on a Lattice Transmission Tower Transmission Line Galloping Conductor Monitor	BPA USBR
					<u>STRUCTURES</u>		
					<u>Longitudinal Impact Loading on Transmission</u>		
					<u>Transmission Engineering Workstation</u>		
					<u>Line Rover Transmission Line Inspection</u>		
					<u>Robot</u>		
					<u>Personal Protective Ground Jumpers</u>		
					<u>Long Distance Free-air Optical Temperature</u>		
					<u>Sensor</u>		
					<u>High-Voltage Direct-Current Cable Test</u>		
					<u>Technique Development</u>		
					<u>Joint HVDC Agricultural Study</u>		
					<u>Magnetic Field Exposure</u>		
				12:30	LUNCH		

AGENDA CONTINUED

<u>Time</u>	<u>Topic</u>	<u>Topic Statement</u>	<u>Agency</u>
10:45	EP-5e	Transient Excitation Boosting	USBR
	EP-5f	Evaluate Digital Pwr. Syst. Stabilizer	USBR
	EP-5g	Evaluation of Programmable Controllers as Remedial Action Controls	BPA
	EP-5h	Static Var Control for Pwr. Syst. Damping	BPA
	EP-5i	Stabilize Through Reactive Pwr. Modulation	BPA
	EP-5j	System Stability Prediction and Control Based on On-Line Phasor Measurement	BPA
	EP-5k	Application of Precise Time Synchronization	BPA
	EP-5l	Integrated CAD Software for Stability Control Application	BPA

12:30  
ADJOURN

Update of Projects Presented at the 1985 Conference  
(presented by title only - Topic Statements will be provided)

<u>Topic</u>	<u>Title</u>	<u>Agency</u>
EP-6a	Variable-Speed Machines	USBR
EP-6b	Variable-Speed Hydro Turbine	BPA
EP-6c	Goodnoe Hills MOD-2 Test Program	BPA
EP-6d	Generator Unbalanced Stator Winding Investigation	USBR
EP-6e	Installation and Testing of Marine Bow Thruster	BPA
EP-6f	Corona Probe Monitors for Generator Insulation	USBR
EP-6g	Generator Hot Coil Monitor	USBR
EP-6h	EHV Insulation Study	BPA
EP-6i	Tower Steel Fracture Criteria	BPA
EP-6j	Electrical Transmission Tower Limit States Analysis	BPA
EP-6k	Direct Current Insulation Contamination	BPA
EP-6l	Long Term DC Insulator Contamination Test	BPA
EP-6m	Non-Ceramic Insulator (NCI) Salt-Fog Arcing Chamber	BPA
EP-6n	HVDC Trans. Line Electric Field and Ion Modeling	BPA
EP-6o	HVDC Electric Field and Ion Measurement Program	BPA
EP-6p	Magneto Optic Current Transducer (MOCT)	TVA
EP-6q	Optical Powerline Measurement System	BPA
EP-6r	Microprocessor-Based Monitoring	TVA
EP-6s	Digital Frequency Transducer	USBR
EP-6t	Ground Mat and Step Potential Investigations	BPA
EP-6u	Adaptive Power Factor Controller	USBR
EP-6v	Self-Aligning Power System Stabilizer	USBR
EP-6w	Synchronous Machine Constants	USBR
EP-6x	Adaptive Speed Governing of Hydro Generators	USBR
EP-6y	Adaptive Excitation Control for Hydro Generation	USBR
EP-6z	Gas Insulated Substation Investigations	BPA
EP-6aa	Field Test of a Breaker Synchronous Closing Device	USBR
EP-6bb	Out-of-Step Relay	USBR
EP-6cc	Photovoltaic Evaluations	BPA

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-1a  
 Subject Area Electric Power  
 Project Title Efficiency Algorithm for Loading Hydroelectric Generators  
 Performing Organization USBR, Electric Power Branch  
Division of Research and Laboratory Services  
 Principal Investigator Steve Stitt (Name) PO Box 25007, Code D-1552 (FTS) 776-6065  
Denver CO 80225-0007 (Address) (303) 235-6055 (Telephones)  
 Starting Year FY83 Estimated Completion Year FY89

Technical Objectives: To develop a system to maximize powerplant efficiency (i.e., maximum energy from minimum water) for a given powerplant load and spinning reserve. Extend concept to predict maximum efficiency of reservoir use to allow utilization in river efficiency calculations.

Technical Approach: Design a modeling system to simulate a multi-unit powerplant, including turbine curves and generator losses. Develop an algorithm to maximize efficiency. Design, construct, and test a powerplant controller that incorporates the algorithm in a real-time scheduling mode. Perform additional studies to further improve efficiency as needed.

General Progress in Last Two Years: A load and voltage controller incorporating the efficiency algorithm was designed, constructed, tested, and installed at Hoover Powerplant. Initial results indicate that the predicted efficiency increase from the efficiency algorithm controller (i.e., 5 to 6 percent) will be realized.

Plans for Next Twelve Months (FY88): Continue to monitor the results of installing the load and voltage controller at Hoover Powerplant. Perform studies to determine if a controller incorporating the efficiency algorithm at other powerplants is warranted.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-1b  
 Subject Area Electric Power  
 Project Title Evaluation of an Automatic Index Test Box to Optimize the Efficiency of Kaplan Turbines.  
 Performing Organization BPA Generation Engineering Branch  
 Principal Investigator Lee Sheldon (Name) BPA, P.O. Box 3621 (FTS) 429-3448  
Portland, OR 97208 (Address) (503) 230-3448 (Telephone)  
 Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives:

Install, test, and evaluate an Index Test Box recently developed by Woodward Governor Co. which will automatically provide for the optimum performance and efficiency of Kaplan hydraulic turbines.

Technical Approach

The device will be installed at a private utility's hydroplant and its results compared with an index test conducted in the labor intensive, conventional manner.

General Progress in Last Two Years

All procurement and installation contracts have been negotiated and equipment fabrication is in process.

Plans for Next Twelve Months

Installation and testing are scheduled for September and October 1987.

Coordination or Cooperation with Another Agency:

Discussing possible applications with the U.S. Corps of Engineers.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 2 1987 Session Number EP-1C

Subject Area Electric Power

Project Title Study to improve the efficiency of the Cross-Flow Turbine

Performing Organization Clemson University

Principal Investigator George Darr and Lee Sheldon  
(Name) BPA, P.O. Box 3621 (FTS) 429-3448  
Portland, OR 97208 (503) 230-3448  
(Address) (Telephone)

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

To perform a hydraulic study aimed at improving the efficiency of the cross flow turbine.

Technical Approach

Flow pattern will be documented at various nozzle positions, entry arcs, and rotor speeds, with the aim of determining the optimum nozzle configuration. A collector to increase the efficiency of the turbine's second stage (water passing from inside to outside) will be designed and tested.

General Progress in Last Two Years

Project has just begun.

Plans for Next Twelve Months

Complete model study and report.

Coordination or Cooperation with Another Agency:

None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation, and Life Extension
- None

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number EP-1d

Subject Area Electric Power

Project Title Generator Stator End Turn Insulation Evaluation Techniques

Performing Organization USBR, Electric Power Branch  
Division of Research and Laboratory Services

Principal Investigator B. Milano PO Box 25007, Code D-1551 (FTS) 776-6055  
(Name) Denver CO 80225-0007 (303) 236-6055  
(Address) (Telephones)

Starting Year FY86 Estimated Completion Year FY88

Technical Objectives: To develop a fairly quick and easy-to-use go-no go test for use in evaluating stator end turn insulation.

Technical Approach: Develop or purchase a small portable high-voltage d-c power supply that can be quickly passed over each end turn. Evaluate the use of the device both in the lab and field.

General Progress in Last Two Years: An electrostatic hand-held gun capable of generating up to 20 KV d.c. has been procured and evaluated in the laboratory.

Plans for Next Twelve Months (FY88): We are currently waiting for an opportunity to evaluate the device in the field.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency TVA Priority Electric Power 1987 Session Number EP-2a  
 Subject Area Lightning Location  
 Project Title Lightning Location  
 Performing Organization Tennessee Valley Authority, Energy Demonstrations & Technology  
 Principal 2N 39A Missionary Ridge Place (FTS)  
 Investigator Sell James, Jr., 1101 Market Street, Chattanooga, TN (615) 751-5686  
 (Name) (Address) (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 92

Technical Objectives:

To acquire and demonstrate technology to locate and document real-time cloud-to-ground lightning strokes. To utilize information gained to develop detailed and cumulative ground flash density maps for transmission line design and power system operation. To develop procedures and methodology to utilize system.

Technical Approach:

The system will allow a more detailed analyses of lightning strokes (magnitude, location, polarity and multiplicity) compared to the isokeraunic map method. Data collected with the system will be used for: 1) Flash density map generation; 2) post fault analyses to verify relay operations, failure modes, transmission line designs and reliability and etc; 3) real-time alerts for various operations; 4) statistical analyses, e.g. polarity vs. intensity; intensity vs. seasons and mean amplitudes; 5) Transmission line siting and design.

General Progress in Last Two Years:

A on-site demonstration by prospective vendor was held. Initially, it was TVA's intent to purchase its own base-line detection system. However, with cosponsorship from EPRI, the State University of New York at Albany has expanded its East Coast System westward to include, among other areas, the TVA service area. Data collected by the network has been made available to TVA via telephone line and, most recently, via satellite.

Plans for Next Twelve Months (FY 88):

1. Demonstrate the system to power distributors and others
2. Collect and analyze cloud-ground lightning data
3. Post fault analyses for design and equipment failure analyses.

Coordination or Cooperation with Another Agency: None

None

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: None

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority Power 1987 Session Number EP-2b  
 Subject Area Electric  
 Project Title Lightning Monitor System 846733  
 Performing Organization BPA

Principal Investigator Gerald Lee (Name) EO (Address) (FTS) 429-4436  
(503) 230-4436 (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives: Develop a system to process data from the Bureau of Land Management and Forest Service lightning locator system. The system will provide real time graphical display of lightning stroke location and compile statistical data on ground stroke density and peak stroke current for use in designing lightning protection for power system facilities.

Technical Approach: Establish communication link to BLM and USFS systems. Acquire microcomputer hardware. Develop software.

General Progress in Last Two Years:

Plans for Next Twelve Months (FY 88): Assess similar work being done by Montana State University for applicability to BPA needs. Proceed with inhouse development or award contract as appropriate.

Coordination or Cooperation with Another Agency: BLM and USFS

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: None

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency EPA Priority 2 1987 Session Number EP-2c

Subject Area Electric Power

Project Title Wind Loading on a Lattice Transmission Tower

Performing Organization EPA

Principal Investigator Ann Kemmer P.O. Box 3621 Portland, Ore. 97203 (FTS) 429-5563

(Name) (Address) (Telephone)

Starting Year FY83 Estimated Completion Year FY88

Technical Objectives:

To evaluate field data of wind response of an electrical transmission lattice steel tower. Compare the results obtained from the measured data to that obtained from a state-of-the-art prediction technique.

Technical Approach:

Determine the validity and usefulness of the field measured data. Perform analytical studies and comparisons.

General Progress in Last Two Years:

The validity and usefulness of the measured data is completed. Analytical/statistical analysis of the data has been used to characterize the measured response.

Plans for Next Twelve Months (FY 88):

Complete comparison with a state-of-the-art prediction technique for the response of electrical transmission towers to wind loading.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams AT Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number EP-2d

Subject Area Electric Power

Project Title Transmission Line Galloping Conductor Monitor

Performing Organization USBR, Electric Power Branch

Principal Investigator M. L. Jacobs (Name) PO Box 25007, Code D-1551 (FTS) 776-6059

(Address) Denver CO 80225-0007 (Telephone) (303) 236-6059

Starting Year FY86 Estimated Completion Year FY88

Technical Objectives: To develop a transmission line galloping conductor monitor for detection of galloping lines.

Technical Approach: To reduce cost and outages associated with conventional load cell type monitors. A low cost, easily installed ground level field sensor monitor will be developed.

General Progress in Last Two Years: Computer studies to evaluate the feasibility of a ground stationed E-field detector were very promising and indicated that a ground sensor located in the correct position could detect several different modes of galloping in any of the three phases of a line. A prototype was designed, built, and field tested under various conditions. The design was finalized and the units built.

Plans for Next Twelve Months (FY88): Complete report and assist in the installation. Write a technical paper on the project.

Coordination or Cooperation with Another Agency: This work was performed for Western under a joint research agreement.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-2e  
 Subject Area Electric Power  
 Project Title Longitudinal Impact Loading on Transmission Structures  
 Performing Organization BPA  
 Principal Ed Bennett/ (FTS) 429-5563  
 Investigator Leon Kemper, P.O. Box 3621, Portland, OR 97208 (503) 230-2563  
 (Name) (Address) (Telephones)  
 Starting Year FY86 Estimated Completion Year FY88

Technical Objectives:

To investigate BPA's containment failure philosophy for electrical transmission structures. The results will be used to verify/update BPA's existing loading criterion and to determine the reliability of existing towers.

Technical Approach:

A scaled model and analytical computer program is being used to collect data necessary for evaluation of the existing criterion.

General Progress in Last Two Years:

The scaled model was developed along with the necessary instrumentation. Preliminary tests were conducted to study the sensitivity of the modeling parameters. Preliminary analytical computer runs were completed and compared to the scaled model results.

Plans for Next Twelve Months (FY 88):

Complete data collection, analytical studies and make recommendations for BPA's longitudinal impact loading criterion.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams XX Technology Transfer      None  
 Project Maintenance, Rehabilitation and Life Extension     

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority 2 1987 Session Number EP-2f  
 Subject Area Electric Power  
 Project Title Transmission Engineering Workstation  
 Performing Organization Engineering Applications Section (EPRC)  
 Principal      P.O. Box 3621 (FTS) 429-4167  
 Investigator Arnold L. Wagner Portland, OR 97208 (503) 230-4167  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY89

Technical Objectives:

To develop an integrated hardware/software system for transmission line engineering.

Technical Approach:

Software developed at BPA, along with software developed by the Electric Power Research Institute (EPRI), is being implemented on a MicroVAX II processor.

General Progress in Last Two Years:

Hardware has been installed and several EPRI programs have been implemented.

Plans for Next Twelve Months (FY 88):

Continued evaluation of EPRI software.

Coordination or Cooperation with Another Agency:

Electric Power Research Institute

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams      X Technology Transfer      None  
 Project Maintenance, Rehabilitation and Life Extension

TOPICS STATEMENT

Agency IVA Priority 1 1987 Session Number EP-2g  
 Subject Area Electric Power  
 Project Title Line Rover Transmission Line Inspection Robot  
 Performing Organization IVA ED&T  
 Principal Investigator Ronald W. Reese, MR 2N 45A, Chattanooga, TN 37402-2801 (615)751-5281  
 Starting Year FY97 Estimated Completion Year FY91

Technical Objectives:

The objective is to develop a robotic system that can inspect power transmission lines. Power companies use various methods of manual inspection to determine the condition of their power system. Three commonly used methods are aerial walking, and "climbing" inspections. The goal of the Line Rover is to provide a less costly way to inspect transmission lines and to provide information that is not economically practical using present manual methods. Temperature of conductors and splices, ground clearance measurements, insulator inspection and gradient measurements, fault location, and right-of-way inspection is a few of the objectives identified so far.

Technical Approach:

A contract has been placed with Transition Research Corporation to develop the Line Rover. The development work will consist of a concept study, engineering analysis, engineering drawings, and a powered scale model of the device. The next step will be the development of the actual di-electric arms used to negotiate around insulators. The development of the electronics, vision, and sensor packages will also begin after completion of the model.

General Progress in Last Two Years:

Work is in progress on the concept study, engineering analysis, engineering drawings, and the model. Completion of the model is expected in March FY88.

Plans for Next Twelve Months (FY88):

Delivery of the model should be in March of FY88. The development of the arms for the robot will begin next and the arm should be complete by the end of FY88.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number EP-2h  
 Subject Area Electric Power  
 Project Title Personal Protective Ground Jumpers  
 Performing Organization USBR, Electric Power Branch  
 Division of Research and Laboratory Services  
 Principal Investigator P. Atwater PO Box 25007, Code D-1551 (FTS) 776-6058  
 (Name) Denver CO 80225-0007 (303) 236-6058  
 (Telephones)

Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To evaluate personal protective ground jumper adequacy with respect to use, ratings, applications, and testing.

Technical Approach: Review current thinking involving methods and philosophy of use, testing, and currently applicable calculations. Perform actual short circuit field tests to reconfirm and/or support results of the review.

General Progress in Last Two Years: The review and a detailed reevaluation has been made. Lab investigation and short circuit field tests have recently been completed and two preliminary reports drafted dealing with (1) the necessary theoretical considerations and calculations, and (2) the results of the general investigation.

Plans for Next Twelve Months (FY88): Develop an electronic device to improve O&M acceptance testing of the cables. Finalize the findings and possibly perform an additional test series. A technical paper(s) dealing with the results will also be written.

Coordination or Cooperation with Another Agency: This work was performed jointly with Western under a joint research agreement.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension

TOPICS STATEMENT

Agency IVA Priority 3 1987 Session Number EP-21  
 Subject Area Electric Power  
 Project Title Long Distance, Free-air, Optical Temperature Sensor  
 Performing Organization IVA ED&T  
 Principal Investigator Ronald W. Reese, MR 2N45A, Chattanooga, TN, 37402-2801 (615)751-5286  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives:

The objective is to develop an accurate, free-air temperature sensor that can be used to measure the temperature of stationary and rotating objects. The sensor will measure temperatures over long ranges (about 75 feet) and can be used as a portable instrument to check the temperatures of high voltage apparatus or difficult to reach areas.

Technical Approach:

The sensor is being developed by Martin Marietta at the Oak Ridge National Laboratory. The sensor uses a temperature dependent phosphor as a sensing element and a laser/receiver to interrogate the sensor. This approach eliminates the need to know emissivity of the object being measured.

General Progress in Last Two Years:

A prototype lab model has been built and delivered to TVA. The device has been tested and the next phase, the development of a field version, has begun.

Plans for Next Twelve Months (FY88):

The field version will be designed, developed, built and tested by the manufacturer. Upon delivery to TVA, the sensor will be tested in field applications to evaluate the device.

Coordination or Cooperation with Another Agency:

Department of Energy  
 General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_  
 Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number EP-23  
 Subject Area Electric Power  
 Project Title High-Voltage Direct-Current Cable Test Technique Development  
 Performing Organization USBR, Electric Power Branch  
 Principal Investigator R. C. Arbour (Name) P.O. Box 25007, Code D-1551 (Address) (FTS) 776-6057 Denver CO 80225-0007 (Telephone) (303) 235-6057

Starting Year FY82 Estimated Completion Year FY89

Technical Objectives: To develop a test technique and procedure to minimize stray corona loss-related currents so that the metered test current is representative of the actual cable leakage current up to 400 kV to 500 kV. Initially, corona losses prevented us from obtaining meaningful current readings above 150 kV.

Technical Approach: (1) Obtain and modify a conventional high-voltage d-c test set to improve basic test performance. (2) Develop and refine a complete corona shielding system to reduce losses. (3) Design and install into the test system a high quality current meter that can be installed at the cable pothead to reduce the effects of corona loss on the cable leakage current measurements.

General Progress in Last Two Years: A quality set was procured and modified accordingly. A complete PVC-type corona shield for all high-voltage terminal bus work and potheads has been designed and refined over the years. The 1987 improvements have resulted in our being able to obtain meaningful current data records up to 350 kV at over 8,500 feet above sea level.

Plans for Next Twelve Months (FY88): Initiate the development of a fiber optic current meter for direct current measurement of the current at the cable pothead.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_  
 Technology Transfer X \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_  
 None \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-2k  
 Subject Area Electric Power  
 Project Title Joint HVDC Agricultural Study  
 Performing Organization BPA/Oregon State University  
 Principal Investigator Jack M. Lee P.O. Box 3621 Portland, OR (FTS)429-4530 (503)230-4530 (Address) 97208 (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives:

To determine if a 500 KV d-c transmission line has any significant effects on the growth or reproduction of beef cattle or on the production of wheat or alfalfa.

Technical Approach:

One hundred beef cows and four crop plots are located on the d-c line right-of-way. Data on growth and reproduction from this treatment group are compared to data from a similar group raised in a control area away from the line.

General Progress in Last Two Years:

The experimental research area was successfully constructed and routine data collection is underway. Two annual progress reports on the study have been issued.

Plans for Next Twelve Months (FY 98):

Data collection is expected to be completed by November 1987 and a final project report is scheduled for completion by September 1988.

Coordination or Cooperation with Another Agency:

The Agricultural Study is being co-sponsored by BPA and nine other utility organizations from the U.S. and Canada.

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-2l  
 Subject Area Electric Power  
 Project Title Magnetic Field Exposure  
 Performing Organization Division of Laboratories BPA  
 Principal Investigator V. L. Chartier P.O. Box 91, Vancouver, WA 98666 (FTS)425-2615 (206)690-2615 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 87

Technical Objectives:

There is a growing interest in the possible link between magnetic fields and worker health. The initial objective is the development of a monitor for magnetic field exposure. The second objective is to monitor the exposure of substation workers to magnetic fields.

Technical Approach:

The BPA developed electric field exposure monitor (EFEM) was modified for use in monitoring exposure to magnetic fields. After laboratory calibration, the monitors were utilized in a study of substation workers.

General Progress in Last Two Years:

The project is essentially finished. Exposure for three substation workers for three days each has been measured. Also, nine exposure days from three "non-exposed" office workers has been obtained.

Plans for Next Twelve Months (FY 98):

Collected data will be analyzed to identify the resolution of the instrument and evaluate its performance. Final report will be written.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EP-3a  
 Subject Area Electric Power  
 Project Title Advanced Technology Breaker Demonstration 346642  
 Performing Organization BPA  
 Principal Investigator Alan Courts EO (FTS)429-4418  
 (Name) (Address) (503)230-4418 (Telephones)  
 Starting Year FY 36 Estimated Completion Year FY 90

**Technical Objectives:** To demonstrate reliability and economy of a new generation 500-kv live-tank explosion-proof breaker and to develop the concept of controlling line switching overvoltages with metal-oxide surge arresters on the line terminal rather than closing resistors on the line breaker.

**Technical Approach:** Install special 1.5 per unit arresters on new generation breaker without closing resistors on a 180-mile long line and conduct switching tests. Evaluate long-term reliability of arresters and breaker.

**General Progress in Last Two Years:** The special 1.5 per unit metal-oxide arresters have been delivered and installed on the 224-mile long Ashe-Marion 500-kv line. Closing resistors were removed from line breakers and switching tests were conducted.

**Plans for Next Twelve Months (FY 88):** Install the new prototype breaker at Hanford Substation. Install 1.5 per unit arresters on the 180-mile long Hanford-Strander 500-kv line. conduct line switching tests.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
     Safety of Dams      Technology Transfer      None  
     Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EP-3b  
 Subject Area Electric Power  
 Project Title 500-kv Breaker Reliability Improvement 846725  
 Performing Organization BPA  
 Principal Investigator John Brunke EO (FTS)429-4435  
 (Name) (Address) (503)230-4435 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88

**Technical Objectives:** Improve the reliability and safety of 500-kv power circuit breakers on the BPA system.

**Technical Approach:** Analyze maintenance records and failure history of 500-kv power circuit breakers to determine design deficiencies that have contributed to major failures. Develop modifications to reduce probability of failure.

**General Progress in Last Two Years:** A consultant is analyzing the maintenance records and will submit his findings in August 1987.

**Plans for Next Twelve Months (FY 88):** Complete the study and develop modifications.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
     Safety of Dams      Technology Transfer      None  
     Project Maintenance, Rehabilitation and Life Extension

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-3c  
 Subject Area Electric Power  
 Project Title 230-kV Advanced Load Interrupter 8468XX  
 Performing Organization BPA  
 Principal Investigator Randy Suhrbier EO (FTS) 429-3903  
 (Name) (Address) (503) 230-3903 (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 90

Technical Objectives: To demonstrate the application of low-cost SF<sub>6</sub> load interrupters at 230 kv.

Technical Approach: [Identify application, acquire newly developed 230 kv load interrupter from S&C Electric, install and evaluate.

General Progress in Last Two Years: Not applicable.

Plans for Next Twelve Months (FY 88): Acquire and install switch.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**  
 TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number EP-3d  
 Subject Area Electric Power  
 Project Title Power Quality Issues for Sensitive Loads  
 Performing Organization TVA in cooperation with Power Electronics Applications Center  
 Principal Investigator W. C. Irwin, TVA, 18A Missionary Ridge Place, (FTS)  
 (Name) (Address) (Chatt., TN) 615-751-6118 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 91  
 Technical Objectives: Identify technical and policy issues and develop programs, plans, and projects to identify problem areas and find the most effective means to develop satisfactory solutions for the electronic customer and utilities.

Technical Approach:  
 1. Furnish a Power Quality Testing Laboratory at the Power Electronics Applications Center (PEAC) for benchmarking power conditioning equipment under various types of disturbances.  
 2. Develop guidelines on equipment selection, standard customer needs, utility support for customers (information, advise, education, etc.)

General Progress in Last Two Years:

1. The power quality laboratory equipment is being purchased by PEAC and plans for the laboratory are being finalized.
2. Meetings are being held with the industrial, academic, governmental and research/standards organizations for collaborative R&D on power quality.

Plans for Next Twelve Months (FY 88):

1. Formulate TVA programs on power quality.
2. Prepare draft policy on power quality.
3. Prepare guidelines for utilities, customers, and equipment manufacturers.
4. Evaluate and coordinate TVA work with PEAC and associated organizations.

Coordination or Cooperation with Another Agency:

Ad-Hoc Interagency Group on Power Semiconductors Switches and Materials. Others as needed.

General Research or Problem Area(s) in this Topic that are Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4a  
 Subject Area Electric Power  
 Project Title Series Capacitor Control Improvement 8467XX  
 Performing Organization BPA  
 Principal Investigator Gerald Lee E0 (FTS) 429-4436  
 (Name) (Address) (503) 230-4435 (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 90

Technical Objectives: Improve series capacitor bank reliability and maintainability.

Technical Approach: Apply recently developed light-fired thyristors and passive optical current transducers to eliminate the need for power supplies and control and protection systems on the energized capacitor platform.

General Progress in Last Two Years:

Plans for Next Twelve Months (FY 88): Contract with series capacitor manufacturer to supply equipment for installation and evaluation on BPA system.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer X None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4b  
 Subject Area Electric Power  
 Project Title Develop Digital Out-of-Step Relaying Scheme  
 Performing Organization BPA, Division of Substation and Control Engineering  
 Principal Investigator Jules Esztergalyos, BPA, Portland, Oregon 97208 (FTS) 429-5038  
 (Name) (Address) (503) 230-5038 (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives:

To develop out-of-step relaying based on the phase angle and its rate of change.

Technical Approach:

This relay is based on a microcomputer, Type SEL-68; to take advantage of the flexibility provided by hardware and software.

General Progress in Last Two Years:

The relay prototype is built by Schweitzer Engineering Laboratories; was delivered to BPA for testing.

Plans for Next Twelve Months (FY 88):

Testing is scheduled in the laboratories in FY88.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency IWA, Priority 2 1987 Session Number EP-4C  
 Subject Area Electric Power  
 Project Title Digital Protective Relaying  
 Performing Organization IWA, EPRI and EPR  
 Principal Investigator I. W. Cass, MR 2N 44A, Chattanooga, TN, 37402-2801 (615) 751-5282  
 Starting Year FY 1987 Estimated Completion Year FY 1991  
 Technical Objectives: The objective is to demonstrate/evaluate a set of Digital Protective Relaying (DPR) from each of two vendors. Much of TVA's existing electromechanical relays are in excess of 40 years old and will need replacing in the near future.

Technical Approach: TVA has entered into a cooperative research agreement with EPRI to demonstrate a set of DPR from each of two vendors. EPRI has prime responsibility for developing the equipment with the vendors. TVA will install the equipment in two switchyard and evaluate the two systems for a period of two lighting seasons.

General Progress in Last Two Years: TVA and EPRI entered into a formal agreement in February 1987. Prior to that TVA had been participating in preliminary design reviews for three years.

Plans for Next Twelve Months (FY 88): The testing on the equipment will continue for two lighting seasons. At the end of the testing TVA will make a decision as to whether to install the equipment on a permanent basis.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency USBR, Priority 2 1987 Session Number EP-4d  
 Subject Area Electric Power  
 Project Title Directional Harmonic Current Relay  
 Performing Organization USBR, Electric Power Branch  
 Division of Research and Laboratory Services  
 Principal Investigator B. Milano PO Box 25007, Code 0-1551 (FTS) 776-6055  
 (Address) Denver CO 80225-0007 (Telephone)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To develop a directional harmonic current relay to protect the a-c system and several steam units in the Sidney, Nebraska, area from possible resonance problems involving the Sidney D-C Link.

Technical Approach: A special solid-state directional harmonic current relay of the time overcurrent type will be designed, tested, and installed at the Sidney Substation adjacent to the Sidney D-C Link.

General Progress in Last Two Years: New project.

Plans for Next Twelve Months (FY88): The relay will be designed and built in the near future. In early FY88 the device will be tested in the lab and shortly thereafter installed at Sidney.

Coordination or Cooperation with Another Agency: This work will be performed for Western under a joint research agreement.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4a  
 Subject Area Electric Power  
 Project Title High Impedance Fault Detection System  
 Performing Organization EPRI  
 Principal Investigator Harry Ng, P.O. Box 10412, Palo Alto, Calif. 98303 (FIS)  
 (Name) \_\_\_\_\_ (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_  
 Starting Year FY 88 Estimated Completion Year FY 90

Technical Objectives:

Detection of high resistance faults on HV transmission lines.

Technical Approach:

Contract was not awarded as of July 15, 1987.

General Progress in Last Two Years:

N/A

Plans for Next Twelve Months (FY 88):

Award study contract

Coordination or Cooperation with Another Agency:

Jules Esztergalyos—BPA was assigned as the Industry Advisor.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4f  
 Subject Area Electric Power  
 Project Title Relay Evaluation System  
 Performing Organization Division of Laboratories, Instrumentation Standards Branch  
 Principal Investigator Jerry Nordstrom P.O. Box 491, Vancouver, WA 98666 (FIS) 425-2643  
 (Name) \_\_\_\_\_ (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_  
 Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives:

To utilize computer generated simulations of power system transients to test the response of control and protection equipment. This testing is performed in a laboratory environment.

Technical Approach:

Using the electro-magnetic transients program (EMTP) simulate faults on the power distribution system. The digital data is converted to analog form and applied to the devices under test. Field data gathered from actual faults can also be used as the source.

General Progress in Last Two Years:

The system has been used successfully. It is currently being revised to provide better signal to noise ratio for the outputs plus higher power output amplifiers.

Plans for Next Twelve Months (FY 88):

The system will be operational by Jan. 1988 and used to evaluate protection and control equipment.

Coordination or Cooperation with Another Agency:

none

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4g  
Subject Area Electric Power  
Project Title Develop Test System for Testing Real Time High Speed Digital Controls  
Performing Organization BPA, Division of Substation and Control Engineering  
Principal Investigator Deanna Sterett, P.O. Box 3621, Portland, OR 97208 (FTS) 429-3706 (503) 230-3706  
(Name) \_\_\_\_\_ (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_

Starting Year FY 85 Estimated Completion Year FY 87

### Technical Objectives:

Develop a generic test system that can be programmed to provide digital and analog inputs to test real time controls before their installation in the power system. It shall be possible to program the test system using straightforward procedures to represent the expected responses that the tested real time controls will see in the real world.

### Technical Approach:

This work is based on previous developments used to test the master controls for the Pacific Northwest High Voltage DC Intertie.

### General Progress in Last Two Years:

Basic design of system has been completed, hardware has been purchased, and software construction is approximately 60% complete.

### Plans for Next Twelve Months (FY 88):

Complete software and perform integration tests with final of project results to develop new dedicated test units for use with HVDC Master Control System.

### Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer X None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-4h  
Subject Area Electric Power  
Project Title Digital Fault Recorder Evaluation  
Performing Organization BPA, Division of Substation and Control Engineering  
Principal Investigator Paul Schaad, P.O. Box 3621, Portland, OR 97208 (FTS) 429-3701 (503) 230-3701  
(Name) \_\_\_\_\_ (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_

Starting Year FY 85 Estimated Completion Year FY 87

### Technical Objectives:

Evaluate digital fault recording technology and develop a specification for procurement of such to replace aging light beam oscillographs for power system monitoring.

### Technical Approach:

Test and evaluate prototype units.

### General Progress in Last Two Years:

Two systems were procured for evaluation. With the aid of the evaluation results, a specification was developed. Procurement of replacement oscillographs is now underway.

### Plans for Next Twelve Months (FY 88):

None--complete.

### Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer X None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-41  
Subject Area Electric Power  
Project Title Communications Alarm Processor 346730  
Performing Organization Division of Maintenance, Office of R.O., Div. of SCE.  
Principal Investigator Ken Hemmelman, P.O. Box 491, Vancouver, WA 98666 (308) 690-2005 (FTS) 425-2005 (Telephones)  
Starting Year FY 86 Estimated Completion Year FY 89 or 90

Technical Objectives: A system that will process a large volume of alarm data, suppress meaningless or trivial alarms, and present failure information to the user. The goal is to spend less time analyzing data, and more time fixing the equipment.

Technical Approach: We plan to implement the prototype system using an expert system shell and a commercial data base management system running on a general purpose computer (tentatively a micro-VAX II).

General Progress in Last Two Years: We have developed many of the basic concepts of the system. We asked Oak Ridge National Laboratory (ORNL) to study our situation and offer thoughts as to the overall concepts of the project. They finished the study and have supported our basic concepts and offered a plan to begin developing the prototype.

Plans for Next Twelve Months (FY 88): In conjunction with ORNL, we plan to begin development of a prototype system. It will be completed about the end of CY 1988.

Coordination or Cooperation with Another Agency: Oak Ridge National Laboratory has been a advisor to us on the CAP Project.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams / Technology Transfer None  
? Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-4j  
Subject Area Electric Power  
Project Title Integrated Microwave Transfer Trip Package  
Performing Organization BPA, Division of Substation and Control Engineering  
Principal Investigator Brant Crabbe, P.O. Box 3671, Portland, OR 97208 (503) 230-5073 (Name) (Address) (Telephones)  
Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives: Develop tone signalling equipment which integrates monitoring, test, self-test, and signalling functions into a single unit.

Technical Approach: Specify, procure, and test a prototype system.

General Progress in Last Two Years: A specification has been developed and procurement of a prototype is underway.

Plans for Next Twelve Months (FY 88): Complete testing of the prototype system with emphasis on the self-testing features.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams / Technology Transfer X None  
? Project Maintenance, Rehabilitation and Life Extension

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EP-5a  
 Subject Area Electric Power  
 Project Title Estimators for Power System Control 3467XX  
 Performing Organization BPA  
 Principal Investigator John Hauer FO (FTS) 429-4098  
 (Name) (Address) (503) 230-4098 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89

**Technical Objectives:** Develop dynamic state estimators suitable for use in power system damping control. It is not required that the estimation process used in transient damping be of the same nature as that used for damping under normal system conditions.

**Technical Approach:** Review technical literature pertinent to dynamic observers, with special attention to observers that do not require direct knowledge of exogenous system inputs. Assess value of accessory probing signals. Review literature and available software for extended Prony methods (transient damping only).

**General Progress in Last Two Years:** Not applicable.

**Plans for Next Twelve Months (FY 88):** Preliminary work in this area will be performed under contract by Montana State University, in association with research into adaptive control methods. BPA expects to do some initial experiments with observer/controller designs that incorporate Doyle-Stein Loop transfer recovery (for normal operating conditions), and is in the process of evaluating Prony methods for fitting complex-exponential series to transient swing data.

**Coordination or Cooperation with Another Agency:**

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams            Technology Transfer X None             
 Project Maintenance, Rehabilitation and Life Extension           

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EP-5b  
 Subject Area Electric Power  
 Project Title Power System Dynamics Signal Processor 846647  
 Performing Organization BPA  
 Principal Investigator John Hauer EO (FTS) 429-4098  
 (Name) (Address) (503) 230-4098 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88

**Technical Objectives:** To develop a portable, microprocessor-based transducer system to derive real and reactive power, frequency, and apparent resistance signals from bus voltage and line current in real time for system response testing.

**Technical Approach:** Develop efficient processing algorithms, write software, and build hardware.

**General Progress in Last Two Years:** System and software designs have been completed.

**Plans for Next Twelve Months (FY 88):** Complete project by November 87.

**Coordination or Cooperation with Another Agency:**

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams            Technology Transfer X None             
 Project Maintenance, Rehabilitation and Life Extension

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-5c  
 Subject Area Electric Power  
 Project Title Intertie Performance Monitor 846732  
 Performing Organization BPA  
 Principal Investigator Alan Courts EO (FTS) 429-4418  
 (Name) (Address) (503) 230-4418  
 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88

**Technical Objectives:** Develop a computer based data recording system to monitor AC and DC intertie interaction. Assess impact of various utility feedback controllers on dynamic performance of the western power system.

**Technical Approach:** Contract for development of the monitoring system. Install system at the Celilo HVDC converter terminal. Collect and analyze data.

**General Progress in Last Two Years:**

**Plans for Next Twelve Months (FY 88):** Award contract.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-5d  
 Subject Area Electric Power  
 Project Title Dynamic Interact. Monitor Network for West. Pwr. Syst. - 8469XX  
 Performing Organization BPA  
 Principal Investigator John Hauer EO (FTS) 429-4098  
 (Name) (Address) (503) 230-4098  
 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89

**Technical Objectives:** Develop a technical base for coordinated monitoring of dynamic interactions within the western power system. This base is to include hardware, mathematical methods, software, and operating procedures.

**Technical Approach:** Extend the capabilities of BPA's RODS-based Power System Disturbance Monitor, in essence making it a demonstration project for general-purpose monitoring. Develop dedicated monitor for AC/DC interactions to be installed at Celilo converter station and coordinated with the RODS PSDM. Extend signal analysis and system test methods for extracting information from the power system. Develop data links and protocols for coordinating BPA monitors with monitors at other utilities.

**General Progress in Last Two Years:** Numerous enhancements have been made to the RODS PSDM and its software links to signal analysis packages. Progress has been such that energizing the Chief Joseph dynamic brake and processing the results into frequency responses is essentially a routine operation. The development of a Celilo interactions monitor is in the hardware selection stage. Several other utilities are acquiring or extending monitor facilities and are discussing signal exchanges with BPA.

**Plans for Next Twelve Months (FY 88):** Continue present activities.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-5e  
 Subject Area Electric Power  
 Project Title Transient Excitation Boosting  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator Charles Lennon (Name) PO Box 25007, Code D-1552 (FTS) 776-6044  
Denver CO 80225-0007 (Address) (303) 236-6044 (Telephones)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To improve the transient voltage stability in the Pacific Northwest during severe system disturbances on the Pacific Northwest-Southwest Intertie; after the high-voltage d-c intertie is upgraded to 3100 MW in February 1989.

Technical Approach: Design, construct, laboratory test, install, and field test the hardware necessary to implement a transient excitation boosting function on each of six hydro-generators at Grand Coulee Third Powerplant. The transient excitation boosting function is based on the premise that suppressing the PSS (power system stabilizer) and increasing excitation for a brief period of time will compensate for the frequency drop and corresponding drop in terminal voltage from a major system disturbance (e.g., a bipole trip).

General Progress in Last Two Years: None. This project has not been started.

Plans for Next Twelve Months (FY88): Completion of the project.

Coordination or Cooperation with Another Agency: Work is being performed for and in conjunction with the BPA (Bonneville Power Administration). BPA will supply the signal indicating that a major disturbance has occurred. USBR will supply the transient excitation boosting function.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 4 1987 Session Number EP-5f  
 Subject Area Electric Power  
 Project Title Evaluation of a Digital Power System Stabilizer  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator Charles Lennon (Name) PO Box 25007, Code D-1552 (FTS) 776-6044  
Denver CO 80225-0007 (Address) (303) 236-6044 (Telephones)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To evaluate the performance of a commercially available digital power system stabilizer and compare the results with that of a typical analog stabilizer.

Technical Approach: Purchase a commercially available power system stabilizer and test its characteristics by using an analog computer programmed to simulate a single generator connected to an infinite bus with a complete static automatic voltage regulator and electronic governor. Write a technical report. Install the stabilizer in a powerplant and record performance over time.

General Progress in Last Two Years: A digital power system stabilizer was purchased.

Plans for Next Twelve Months (FY88): Laboratory test the digital power system stabilizer and write a technical report comparing the response characteristics to that of an analog stabilizer.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-5g  
Subject Area Electric Power  
Project Title Evaluation of Programmable Controllers as Remedial Action Controls  
Performing Organization BPA, Division of Substation and Control Engineering  
Principal Investigator Brant Crabbe, P.O. Box 3621, Portland, OR 97208 (FTS) 429-5073 (503) 230-5073 (Address) (Telephones)  
Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives:

Determine the applicability of programmable controller technology to remedial action scheme controls.

Technical Approach:

Examine the performance characteristics of programmable controllers and test and evaluate actual systems.

General Progress in Last Two Years:

Several systems have been briefly evaluated. Speed of the controllers is limiting in some cases. Several fault tolerant systems have been examined for applications where security and reliability are key requirements.

Plans for Next Twelve Months (FY 88):

Complete further evaluation of equipment and develop guidelines for the procurement and application of programmable controllers for remedial action scheme controls.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-5h  
Subject Area Electric Power  
Project Title Static Var Control for Power System Damping 846740  
Performing Organization BPA  
Principal Investigator John Hauer EO (FTS) 429-4098 (503) 230-4098 (Address) (Telephones)  
Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: To develop control strategies for the modification of reactive power sources (static VAR system, generator excitation systems) to damp power system oscillations.

Technical Approach: Evaluate recent developments in applicable control technology. Develop low-order models and test cases. Develop and evaluate robust stability controllers.

General Progress in Last Two Years: A 2-year research project by Montana State University on applying adaptive control technology to power system control problems will be completed September 1987. This initial research laid the ground work for the VAR control project.

Plans for Next Twelve Months (FY 88): Award contract to Montana State University, start project

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_



**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-51  
 Subject Area Electric Power  
 Project Title Reliable Stabilization Through Reactive Pwr. Modulation - 8468XX  
 Performing Organization BPA  
 Principal Investigator John Hauer (FTS) 429-4098  
 (Address) EO (503) 230-4098  
 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

**Technical Objectives:** Develop methods, standards, and certification procedures for engineering of major damping control systems. Key issues are assurance of adequate controller performance in damping of transient oscillations, and avoidance of adverse controller interactions during normal power system conditions.

**Technical Approach:** Determine which dynamic modes of the western power system are likely to require accessory damping, and the operating conditions under which this need arises. Determine where and how this accessory damping can be applied effectively and economically. Assess the controller robustness needs of each option with due allowance for technology limitations. Develop guidelines for performance/robustness tradeoffs. Develop standards and certification procedures that avoid undue risks associated with major controllers that are improperly tuned or poorly coordinated with other controllers.

**General Progress in Last Two Years:** Troublesome dynamics near 0.7 Hz have been examined in some detail using both computer simulations and information acquired from the power system during disturbances or staged tests. Damping control options and robustness needs have been surveyed and published. The western utilities have been informed of these results, the supporting methodology, and the need to revise practices in the area of damping control. Appropriate design methods are being developed inhouse and under contract (MSU).

Plans for the Next Twelve Months: Continue present activities.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-51  
 Subject Area Electric Power  
 Project Title Power System Stability Prediction and Control Based on On-Line Phasor Measurement 343643  
 Performing Organization Virginia Polytechnic Institute and State University  
 Blacksburg, VA 24061-8694  
 Principal Investigator Prof. A. G. Phadke (FTS) (703) 961-5283  
 (Address) Dept. of Elec. Engrg. (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 90

**Technical Objectives:** Investigate the feasibility of developing advanced techniques to predict stability performance of the power transmission system and to optimally control the power system.

**Technical Approach:** The project has three phases:

Phase I - Design 2 laboratory tests, three phasor measurement systems, and field test in BPA system.

Phase II - Analytical work on investigation of on-line stability/instability prediction.

Phase III - Dynamic state estimation and measurement based optimal control.

General Progress in Last Two Years: Work on Phase I is underway.

Plans for Next Twelve Months (FY 88): Complete Phase I.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ X \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-51  
 Subject Area Electric Power  
 Project Title Integrated CAD Software for Stability Control Application - 8467XX  
 Performing Organization BPA  
 Principal Investigator John Hauer (Name) EO (Address) (FTS) 429-4098  
(503) 230-3098 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89

**Technical Objectives:** Develop integrated CAD software package for design of major feedback stability controllers. Emphasis is upon controller robustness in a disturbance-prone operating environment that is poorly modeled and poorly instrumented. Multivariable control of special interest, to allow controller coordination and the examination of interactions.

**Technical Approach:** Closely review of technical literature and available software, paying special attention to proven aerospace products. Consult outside experts as appropriate. Promote cross-technology venturers. Acquire more promising products, evaluate them inhouse, and adapt or extend as appropriate.

**General Progress in Last Two Years:** Acquired NASA programs ORACLS and SAMSAN. These have since been combined into a command-driven design package for observer-based MIMO controllers. Models and data input have been made consistent with those for BPA programs SIGPAK, SYSFIT, and PALS.

**Plans for Next Twelve Months (FY 88):** Evaluate singular value methods provided by SAMSAN. Review latest extensions of MATRIX-X. Follow up on aerospace contacts.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-5k  
 Subject Area Electric Power  
 Project Title Application of Precise Time Synchronization to the BPA System  
 Performing Organization BPA, Division of Substation and Control Engineering  
 Principal Investigator Jules Esztergalyos/Robert Day (Name) (FTS) 429-5038  
(503) 230-5038 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 90

**Technical Objectives:**

To develop a system stability control scheme based on synchronous time measurement of the voltage phase angle between generating plants.

**Technical Approach:**

Use synchronous clocks of instrument accuracy.

**General Progress in Last Two Years:**

Testing of the clocks is underway. Negotiations with other utility is in the preliminary stage.

**Plans for Next Twelve Months (FY 88):**

Prove the performance of the clock. Initiate a comprehensive project outline.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6a

Subject Area Electric Power

Project Title Variable-Speed Machines  
USBR, Electric Power Branch

Performing Organization Division of Research and Laboratory Services

Principal PO Box 25007, Code D-1551 (FTS) 776-6055

Investigator B. Milano (Name) Denver CO 80225-0007 (303) 236-6055 (Telephones)

Starting Year FY78 Estimated Completion Year FY88

Technical Objectives: To investigate variable-speed machine operation for hydroelectric applications.

Technical Approach: Create a 30-hp model to evaluate variable-speed feasibility limitations and design requirements. Scale concepts up to allow specifications to be written.

General Progress in Last Two Years: A 1/2-hp model has been shown successful. A 30-hp model is being assembled using commercial components where possible. A specially designed doubly fed motor has been constructed and initial performance tests completed. Several different control schemes have recently been successfully tested on the 1/2-hp model.

Plans for Next Twelve Months (FY88): The 30-hp model will be completed and various design aspects and factors evaluated.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-6b

Subject Area Electric Power

Project Title Variable Speed Hydro Turbine

Performing Organization Oregon State University

Principal Lee H. Sheldon BPA, P.O. Box 3621 (FTS) 429-4524

Investigator Nicholas G. Butler Portland, OR 97208 (503) 230-4524 (Name) (Address) (Telephone)

Starting Year FY 1984 Estimated Completion Year FY 1988

Technical Objectives: To investigate the feasibility of increasing energy production from hydro plants by employment of variable speed constant frequency (VSCF) generation systems.

Technical Approach To perform hydraulic machinery analysis to identify turbine types and performance criteria necessary for optimum energy gain.

General Progress in Last Two Years Perform electric machinery analysis and evaluation of control strategies necessary for either new or retrofit installations. Develop conceptual designs for demonstration facility. Fabricate, install, and field test prototype design at existing plant.

Plans for Next Twelve Months Hydraulic machinery analysis completed to identify turbine types, head ranges, and speed ranges where energy gains would be maximized. Technical papers written.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP 6c  
 Subject Area Electric Power  
 Project Title Goodnoe Hills MOD-2 Test Program  
 Performing Organization BPA  
 Principal Investigator Ronald H. Holeman BPA, P.O. Box 3621 (FTS)429-3444  
 (Name) Portland, OR 97208 (503)230-3444  
 (Address) (Telephone)  
 Starting Year FY 1980 Estimated Completion Year FY 1987

Technical Objectives:

To perform research oriented operational field testing of three MOD-2 wind turbine (WT) units at Goodnoe Hills, near Goldendale, WA.

Technical Approach

The USDOE sponsored a program of wind turbine field test and research to determine the technical and economic feasibility of wind generation. In early 1986, SERI succeeded NASA LeRC as the Large Horizontal Axis Wind Turbine Program Manager. Under the coordination of NASA/SERI, staged testing and data gathering was performed by the co-participants or their contractors.

General Progress in Last Two Years

The 3-machine cluster has accumulated over 16,000 MWh of energy production. Following low speed shaft replacement, the wind turbines continued to be available for operation, and were run whenever wind conditions permitted. Emphasis was placed on "mapping" the wind flow over the site and further investigation of WT performance and machine interaction.

Plans for Next Twelve Months

The wind turbine systems are being advertised for sale, for removal from site, by CSA. The bid opening is scheduled for September 10, 1987, with machine take down expected by year end.

Coordination or Cooperation with Another Agency:

Co-participation with Battelle-Pacific Northwest Laboratories, Boeing, NASA, SERI, and DOE.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams X Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number EP-6d  
 Subject Area Electric Power  
 Project Title Generator Unbalanced Stator Winding Investigation  
 Performing Organization USBR, Electric Power Branch  
 Division of Research and Laboratory Services  
 Principal Investigator B. Milano PO Box 25007, Code D-1551 (FTS) 776-6055  
 (Name) Denver CO 80225-0007 (303) 235-6055  
 (Address) (Telephone)  
 Starting Year FY84 Estimated Completion Year FY89

Technical Objectives: To develop a technique and exacting computer model for evaluating generator performance involving unbalanced conditions resulting from bypassing failed generator coils.

Technical Approach: Develop a detailed model of the generator and implement the model in a computer program to analyze generator unbalance performance.

General Progress in Last Two Years: A general evaluation of the problem has been made and a simple computer program developed. An actual field test evaluation on an unbalanced generator has been performed. Some of the field test data have been reduced and analyzed. An in-house technical paper on the basics was written and presented.

Plans for Next Twelve Months (FY88): Continue the data reduction and analysis of the field test data and develop a more detailed model for computer implementation.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer X None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority I 1987 Session Number EP-6e  
 Subject Area Electric Power  
 Project Title Installation & testing of marine bow thruster as a Hydroelectric Turbine.  
 Performing Organization BPA Generation Engineering Branch  
 Principal Investigator Lee Sheldon BPA, P.O. Box 3621 (FTS)429-3448  
 (Name) Portland, OR 97208 (503)230-3448  
 (Address) (Telephone)  
 Starting Year FY 1983 Estimated Completion Year FY 1987

Technical Objectives:

Install, test, and evaluate the use of a marine bow thruster as a low head, small scale, hydroelectric turbine.

Technical Approach

A low head, small scale, hydroelectric project utilizing a marine thruster was constructed at a U.S. Fish and Wildlife fish hatchery.

General Progress in Last Two Years

Construction is completed, the marine thruster has been tested, and the project is operational. A final report has been published and is available from NTIS.

Plans for Next Twelve Months

None, except for providing preventive maintenance and repair support services.  
Coordination or Cooperation with Another Agency:

Interagency Agreement with U.S. Fish and Wildlife Service.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams X Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension \_\_\_

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6f  
 Subject Area Electric Power  
 Project Title Corona Probe Monitors for Generator Insulation Evaluation USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator B. Milano PO Box 25007, Code D-1551 (FTS) 776-6055  
 (Name) Denver CO 80225-0007 (303) 236-6055  
 (Address) (Telephones)  
 Starting Year FY81 Estimated Completion Year FY88

Technical Objectives: (1) To develop an improved hand-held corona probe meter, (2) To develop an online real-time rotating corona probe monitor, (3) To develop an online real-time stationary (coil specific) corona probe monitor.

Technical Approach: In each instance, the approach is to modernize (through redesign) the standard hand-held corona probe. This device will then be adopted accordingly for each application.

General Progress in Last Two Years: A new type hand-held meter has been designed and field tested. Several revisions and modifications per user feedback have been made. The device has been adopted for use in the other specified applications. Online rotating corona probe data have been obtained from a machine before and after a major rewind. Data correlation with the conventional hand-held meter is excellent. The same holds true for the online stationary probe system.

Plans for Next Twelve Months (FY88): Current plans are to finalize the hand-held design and produce several for O&M use in the Bureau. In addition, a technical paper(s) will be written documenting our success with the two online probes.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer X \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_

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TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number EP-68  
 Subject Area Electric Power  
 Project Title Generator Hot Coil Monitor  
 Performing Organization USBR, Electric Power Branch  
Division of Research and Laboratory Services  
 Principal Investigator B. Milano (Name) PO Box 25007, Code D-1551 (FTS) 776-6055  
Denver CO 80225-0007 (Address) (303) 236-6055 (Telephones)  
 Starting Year FY81 Estimated Completion Year FY88

Technical Objectives: To develop an online generator stator coil monitor to be mounted on the rotor of a synchronous machine. The unit will detect hot coils that may occur during normal machine operation.

Technical Approach: The hot coil infrared sensors are mounted on the rotor of the generator. The sensor outputs are transmitted from the rotor to the stationary receiver. A smart stationary processor analyzes the data and alarms as necessary.

General Progress in Last Two Years: The package has been developed and installed on an actual generator known to have slot discharges and possibly a hot coil. Excellent results have been obtained regarding the rotating corona probe performance. The unit operated favorably on a unit before and after a scheduled stator rewind. In 1986, the Electric Power Research Institute expressed interest in this project, and, as a result, a technology transfer of our work to date was made to an EPRI contractor.

Plans for Next Twelve Months (FY88): Due to the major thrust now being made by EPRI, and the difficulty in finding a generator that actually is known to have a hot coil, work on this project has stopped. A technical addendum on this project may be attached to a related technical paper in the near future.

Coordination or Cooperation with Another Agency: Technology transfer to EPRI was made in early 1986.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6h  
 Subject Area Electric Power  
 Project Title EHV Insulation Study  
 Performing Organization Division of Laboratories (BPA)  
 Principal Investigator Stephen H. Sarkinen (Name) (FTS)  
206 K00-2406 (Telephones)  
 Starting Year \_\_\_\_\_ FY \_\_\_\_\_ Estimated Completion Year \_\_\_\_\_ FY \_\_\_\_\_

Technical Objectives:

Perform electrical investigations including quality control, design development and evaluation, and failure analysis of high voltage ac and dc transmission line and substations and to pursue improved test methods, procedures, state-of-the-art instrumentation or measurement techniques.

Technical Approach:

Applied research is conducted as unique problems arise in the operation and maintenance of the operating power system.

General Progress in Last Two Years:

An extensive investigation has been conducted to determine the cause of unexplained outages occurring on EHV transmission lines. Electric field sensors and fiberoptic data channels have been utilized for improved measurements in noisy high voltage environments. A portable surge generator has been specified to improve the quality of GTS equipment testing and for other tests on the system.

Plans for Next Twelve Months (FY 88):

Coordination or Cooperation with Another Agency:

The unexplained outage study is a joint effort with EPRI and other utilities in the Northwest.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

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TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-61  
 Subject Area Electric Power  
 Project Title Tower Steel Fracture Criteria  
 Performing Organization BPA  
 Principal Investigator Leon Kempner, P.O. Box 3621, Portland, OR 97208  
 (Name) (Address) (FIS) 429-5563 (FIS) 429-5563  
 (503) 230-5563 (503) 230-5563  
 (Telephones) (Telephones)  
 Starting Year FY86 Estimated Completion Year FY88

Technical Objectives:

To investigate the fracture toughness of typical electrical transmission tower steel angle members. The results will be used to develop a fracture toughness criterion for tower steel purchasing and evaluation of in-place tower steel with cracks or the potential of crack initiation.

Technical Approach:

Investigation of existing fracture toughness data, fracture criteria, and fracture toughness evaluation techniques. Laboratory testing of typical tower steel angles are being performed to characterize their fracture toughness properties.

General Progress in Last Two Years:

Completed literature research and selected a technique to evaluate the fracture toughness of angle steel using instrumented Charpy testing, completed testing for determining the fracture toughness properties of the tested tower steel angles.

Plans for Next Twelve Months (FY 88):

Perform service tests on tower steel angles and establish a fracture toughness criterion and in-service tower steel evaluation procedure.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams XX Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency EPA Priority 1 1987 Session Number EP-61  
 Subject Area Electric Power  
 Project Title Electrical Transmission Tower Limit States Analysis  
 Performing Organization EPA  
 Principal Investigator Stam Reichardt, P.O. Box 3621, Portland, Or. 97208  
 (Name) (Address) (FIS) 429-4616 (FIS) 429-4616  
 (503) 230-4616 (503) 230-4616  
 (Telephones) (Telephones)  
 Starting Year FY 79 Estimated Completion Year FY 86

Technical Objectives:

To develop an analytical computer program for determining the reserve structural strength of an electrical transmission tower due to the post buckling capacity of tower members and the redundancy of the tower.

Technical Approach:

Perform structural tests to establish typical post buckling behavior of angle members. Develop a computer program to account for member behavior in the post buckling range. Conduct full-scale tower tests to evaluate the developed analytical technique.

General Progress in Last Two Years:

Completed second tower test and evaluation of test results. Started the transformation of the research analytical computer program to a design/production analysis tool.

Plans for Next Twelve Months (FY 88):

Complete the development of a limit states design/production analysis computer program. Finish the computer program documentation.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams XX Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

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TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6k  
 Subject Area ELECTRIC POWER  
 Project Title DIRECT CURRENT INSULATION CONTAMINATION  
 Performing Organization ELECTRICAL INVESTIGATIONS BRANCH, DIVISION OF LABORATORIES  
 Principal Investigator PHILIP BENNER, P.O. Box 491, Vancouver, WA 98666 (FIS) 425-2647  
 (Address) (206) 690-2637 (Telephones)  
 Starting Year 1985 FY 1986 Estimated Completion Year 1988 FY 1988

Technical Objectives:

To define what mechanical and electrical parameters control the accumulation of natural contamination on DC insulation, what contamination levels effect electrical operation and to identify maintenance practices and mitigation practices required to improve system operation.

Technical Approach:

In co-operation with Electric Power Research Institute and manufacturers, a test yard was established where contamination and operation is being monitored for prototype designs. In addition, the operating system is being monitored for both contamination and outages.

General Progress in Last Two Years:

The contamination levels have been obtained for some designs, outage causes identified and the effect of some design characteristics identified for the highest system voltage.

Plans for Next Twelve Months (FY 88):

Rates of accumulation, the effect of varied voltages found in a single station and electrical tests of naturally contaminated insulators in an artificial fog environment are planned. New design insulation developed by EPRI will be used to replace less successful designs.

Coordination or Cooperation with Another Agency:

Our work is closely coordinated with EPRI and through meetings with other utilities with direct current facilities and similar problems. This includes Canadian agencies and utilities.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6i  
 Subject Area Electric Power  
 Project Title Long Term DC Insulator Contamination Test  
 Performing Organization Bonneville Power Administration  
 Robert L. Brown  
 Principal Investigator Bonneville Power Administration - ETKF (FIS) 429-5556  
P.O. Box 3621, Portland, OR 97208-3621 (Address) (503) 230-5556 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 91

Technical Objectives:

To determine if any of the currently available or new prototype DC insulators will provide significantly better contamination performance than older types. Rank the relative performances of the new types of DC insulators relative to contamination performance in a natural environment rather than a laboratory fog chamber.

Technical Approach:

Thirteen types of DC insulators including prototypes, ceramics, NCI's will be installed on 20 towers at BPA's The Dalles HVDC 5-mile test line. A string length of 105 inches will be used which represents the NESC minimum clearance to steel for 1.7 p.u. switching surge. The insulators will be energized at +500 kv for 4 years in the fall and spring, during high moisture periods, the voltage will be changed to negative polarity and raised in 50 kv steps up to 800 kv. flashover and ESDD data will be collected. Contamination monitors developed by HVTRF will be evaluated as part of the study.

General Progress in Last Two Years:

The project was only recently approved. Materials are being ordered for construction. The test plan has been finalized. This project is being completed as part of a larger coordinated EPRI project involving Pacific Gas & Electric (PGE), High Voltage Transmission Research Facility (HVTRF) and others. The insulators were installed in the Spring of 1986 and energized at 500 kv DC. ESDD readings will be obtained from NCI's on HVDC Intertie for comparison to results from test line.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_



**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6m  
 Subject Area Electric Power  
 Project Title Non-Ceramic Insulator (NCI) Salt-Fog Arcing Chamber  
Bonneville Power Administration  
 Performing Organization Division of Transmission Engineering - ETKF  
Robert L. Brown  
 Principal Bonneville Power Administration - ETKF (FTS) 429-5556  
 Investigator P.O. Box 3621, Portland, OR 97208-3621 (503) 230-5576  
 (Name) (Address) (Telephones)  
 Starting Year FY 83 Estimated Completion Year FY 87

**Technical Objectives:**  
 1) Develop an NCI test chamber to investigate shed deterioration from erosion, tracking, hydrolysis, and ultra-violet. 2) Attempt to determine general relationships between actual on-line aging and the controlled chamber test.  
 3) Use the chamber to establish an acceptance test to include in the NCI procurement standard.

**Technical Approach:**  
 A six-foot cubed chamber of 1/2 inch reinforced plexiglass, with a 34.5 kV bushing is utilized. A humidifier system is used to create a heavy salt-fog in the chamber. Short samples of NCIs (i.e., one to two feet in length) are hung from the top of the chamber and energized from the 34.5 kV source. The voltage is raised until a nearly continuous dry band arcing is formed on part of the shed. The insulator is then tested continuously for 60 days. Following this, the insulator is inspected and analyzed for deterioration.

**General Progress in Last Two Years:**  
 The test chamber has been constructed. The results are encouraging. Several types of deterioration have been replicated. Final report has been written.

**Plans for Next Twelve Months (FY 88):**  
 Project terminated October 1986. Facility turned over to BPA Laboratories.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

**Fifteenth Interagency Research Coordination Conference, 3-5 November 1987**

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6n  
 Subject Area Electric Power  
 Project Title HVDC Trans Line Electric Field and Ion Modelling Development  
Bonneville Power Administration  
 Performing Organization Division of Transmission Engineering - ETKF  
Monty W. Tuominen, P.E.  
 Principal Bonneville Power Administration - ETKF (FTS) 429-5298  
 Investigator P.O. Box 3621, Portland, OR 97208-3621 (503) 230-5298  
 (Name) (Address) (Telephones)  
 Starting Year FY85 Estimated Completion Year FY88

**Technical Objectives:**

To investigate, verify and improve computer modelling techniques for calculating the electric field and ionic space charge concentrations beneath and near HVDC transmission lines. Emphasis will be on modelling wind effects and calculating concentrations off the right-of-way out to 1/2 mile.

**Technical Approach:** The project entails:

- 1) A review of all current literature and reports on the subject relative to both calculation and measurement; 2) comparing various calculation techniques to measurements and evaluating limitations and advantages of various calculation techniques; 3) exploring and recommending new methods and; 4) implementing the best method into a user-friendly computer prediction program.

**General Progress in Last Two Years:**

Three ion measuring devices are being investigated at Washington State University via inter-governmental contract; the devices are being subjected to calibrated levels of ions to determine accuracy and are due to be wind-tunnel tested. Several computer programs and techniques have been compared for relative accuracy.

**Plans for Next Twelve Months (FY 88):**

Implement wind-tunnel tests on hardware; determine best technique in computer software.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency BPA Priority 1987 Session Number EP-6a  
 Subject Area Electric Power  
 Project Title HVDC Electric Field and Ions Measurement Program  
Bonneville Power Administration  
 Performing Organization Division of Transmission Engineering - ETX  
Allen L. Burns, P.E.  
 Principal Bonneville Power Administration - ETX (FIS) 429-5667  
 Investigator P.O. Box 3621, Portland, OR 97208-3621 (Address) (503) 230-5667 (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 87

Technical Objectives:  
 To measure variations in the electric field strength and air ion levels on and off the right-of-way of the Pacific Northwest-Southwest 500 kV DC line.

### Technical Approach:

An electrical test station has been installed beneath the DC intertie to make long-term measurements of the DC electric field (E), ion current density (J), and space charge density (P). General Electric space-charge cages are used to measure total space charge at 500 feet and 1000 feet from the line. Field Mills developed by IREQ are used to measure the DC electric field both on and off the ROW. Dev ion counters measure small ion concentrations under the line.

General Progress in Last Two Years: Wilson plates are used to measure ionic current density. An HP9920 data acquisition systems stores one minute averages.

The test site began collecting data in December of 1984. Some improvements have been made to instruments and the data acquisition system since then. Data is being collected on a nearly continual basis except during routine maintenance and extreme weather conditions (e.g., heavy rain). Preliminary data analysis will continue Plans for Next Twelve Months (FY 88): until collection is terminated.

Continue to make measurements until September 15, 1987. Site will be dismantled. More extensive analysis will commence.

Coordination or Cooperation with Another Agency: None

None

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

# Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

## TOPIC STATEMENT

Agency IWA Priority 1987 Session Number EP-6p  
 Subject Area Electric Power  
 Project Title Magneto-Optic Current Transducer (MOCT)  
 Performing Organization IWA, ED&I and Westinghouse  
 Principal Investigator L. W. Grease, MR. 2N 44A, Chattanooga, TN, 37402-2801 (615) 731-3282  
 Starting Year FY 1985 Estimated Completion Year FY 1988  
 Technical Objectives: The objective is to develop an alternative to conventional oil-filled current transformers (CT). TVA has had a large number of CTs fail in a catastrophic manner. TVA has also taken a large number of CTs out of service in anticipation of them failing.

Technical Approach: TVA entered into a contract with Westinghouse to design and deliver a single phase 161-kV Magneto-Optic Current Transducer (MOCT). That MOCT is now under going evaluation testing in TVA's Chickamauga Dam 161-kV switchyard.

General Progress in Last Two Years: The MOCT was installed in June 1986 and testing/evaluation has been going on since then. Several problems have been identified and solutions found to those problems.

Plans for Next Twelve Months (FY 88): The testing on the single phase unit will continue and TVA has placed a contract for a three-phase MOCT with integral optical voltage sensing to be delivered in December 1988.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EP-6q  
Subject Area Electric Power  
Project Title Optical Powerline Measurement System  
Performing Organization National Bureau of Standards  
Principal Investigator Louis Y. Lee Division of Laboratories - ERFG (FTS) 25-2682  
(Name) (209 590-2682)  
(Address) (Telephone)  
Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives:

To investigate the technical and economic feasibility of optical systems for powerline voltage and current measurements, with primary interest in energy metering and power system relaying applications.

Technical Approach:

The technical study focuses on identifying the long and short term sources of error in those optical sensor configurations which offer greatest technical and commercial promise. The economic study identifies user acceptability and potential markets for this technology.

General Progress in Last Two Years:

The study is complete and final reports will be issued by the end of 1987. A 3 day workshop on this subject will be held at NBS in Gaithersburg, MD, September 16/18, 1987.

Plans for Next Twelve Months (FY 88):

Publish final report. Examine the need for additional work based on report findings and recommendations.

Coordination or Cooperation with Another Agency:

Co-funding agencies: NBS; Electric Power Research Institute; Empire State Electric Energy Research Corp.  
Coordination with TVA through its role as project adviser to EPRI.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams            Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension            None

## Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

### TOPIC STATEMENT

Agency TVA Priority            1987 Session Number EP-6r  
Subject Area Electric Power  
Project Title Microprocessor-Based Monitoring  
Performing Organization TVA, Energy Demonstrations & Technology  
Principal Investigator Sell James, Jr. 1101 Market Street (FTS)  
(Name) MR 2N 39A-1;Chatt., TN 37402-2801 615 751-5686  
(Address) (Telephones)  
Starting Year FY 84 Estimated Completion Year FY

Technical Objectives:

To configure and demonstrate microprocessor-based systems applications to power system.

Technical Approach:

Microprocessor-based systems have been installed at our Cordova and Concord substations to monitor voltages and currents and to: 1) compute capacitor bank impedances for failed capacitor detection purposes at Cordova substation. 2) compute watts and vars for capacitor bank switching purposes at Concord substation. Additionally, a microprocessor-based transmission line parameter monitoring system called "power donut" is being procured from a vendor for general progress in last two years.

Data analyses and evaluation of the Cordova and Concord system; results reported at the 86<sup>th</sup> Power Conference in Chicago. Planning for multi-station integrated and coordinated multi-microprocessor based volt/var monitoring and capacitor bank control and protection system. Procurement of transmission line parameter monitoring system (power donut).

Plans for Next Twelve Months (FY 88):

Demonstration, testing and evaluation of "power donut" refinements to both capacitor bank protection and capacitor bank control schemes.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension            None

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number EP-6t  
 Subject Area Electric Power  
 Project Title Ground Mat and Step Potential Investigations  
 Performing Organization USBR, Electric Power Branch  
Division of Research and Laboratory Services  
 Principal Investigator P. Atwater (Name)  
PO Box 25007, Code D-1551 (FTS) 776-6058  
Denver CO 80225-0007 (303) 736-6058  
 (Address) (Telephones)  
 Starting Year FY85 Estimated Completion Year FY88

Technical Objectives: To evaluate current Bureau and IEEE ground mat and step potential design practices and guidelines with the object of incorporating needed changes in Bureau procedures as required.

Technical Approach: Both ground mat and step potential measurements were performed in the Grand Coulee 500-KV Switchyard. Measurements were made during line-to-ground staged fault tests. Additional step and touch potential measurements were obtained in 1987 on a Western transmission line during related staged fault tests.

General Progress in Last Two Years: Additional tests may be scheduled in late FY87. However, the majority of the testing has been completed and a preliminary evaluation made.

Plans for Next Twelve Months (FY88): Complete the testing planned for late 1987 and write a report on the results of the testing and make changes to Bureau practices, if required. EPRI, IEEE, and/or any industry seminar or conference may also be considered.

Coordination or Cooperation with Another Agency: Some of the 1987 testing was performed for Western under a joint research agreement.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams Technology Transfer X None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 4 1987 Session Number EP-6a  
 Subject Area Electric Power  
 Project Title Digital Frequency Transducer  
 Performing Organization USBR, Electric Power Branch  
Division of Research and Laboratory Services  
 Principal Investigator J. Agee (Name)  
PO Box 25007, Code D-1552 (FTS) 776-6045  
Denver CO 80225-0007 (303) 736-6045  
 (Address) (Telephones)  
 Starting Year FY85 Estimated Completion Year FY87

Technical Objectives: To develop a digital frequency deviation transducer in order to improve performance and reduce adjustment requirements of currently used analog transducers.

Technical Approach: Design and construct a single-board digital transducer using a single-chip microprocessor and high-performance A/D (analog-to-digital) and D/A (digital-to-analog) converters. Laboratory test and write technical report.

General Progress in Last Two Years: The transducer has been designed, constructed, and laboratory tested.

Plans for Next Twelve Months (FY88): Write technical report.

Coordination or Cooperation with Another Agency:  
 None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams Technology Transfer X None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-6u  
 Subject Area Electric Power  
 Project Title Adaptive Power Factor Controller  
 Performing Organization University of Washington, Southern California Edison  
 Principal Investigator Nicholas G. Butler (Name) BPA, P.O. Box 3621 (Address) (FTS)429-4524 (Telephone) (503)230-4524  
 Starting Year FY 1983 Estimated Completion Year FY 1989

Technical Objectives:

To demonstrate a cost effective means of minimizing utilities supplied reactive power and reactive energy consumption of a variety of typical induction generators on small hydro, geothermal, wind turbine, and other dynamic reactive loads/generators.

Technical Approach

- o Survey conducted to develop performance envelop for induction machines to be controlled.
- o Survey conducted advantages and drawbacks of existing power factor controllers developed for induction motors.
- o Design, test, and evaluate concepts and control strategies evaluated to achieve goals of modularity, operation at almost unity power (without over excitation and over voltage) and able to adapt to dynamic reactive changes.

General Progress in Last Two Years

- o Conceptual control and design strategy developed for optimized adaptive power factor controller for induction generators.
- o Control and design concepts verified on 7.5 kW induction generators. Reports and technical papers written.
- o 50 kVAR installation fabricated and field tested at SCE Devers test site employing DAP 50 kW vertical axis wind turbine (VAWT).
- o 350 kVAR installation fabricated and field tested at third party owned wind farm (SCE).

Plans for Next Twelve Months

- o Reports and technical paper preparation, 350 kVAR installation.
- o Conceptual design for 15 kv class prototype controller for utility distribution feeders.
- o Commission fabrication of 15 kv class controller.

Coordination or Cooperation with Another Agency:

Southern California Edison.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number EP-6v  
 Subject Area Electric Power  
 Project Title Self-aligning Power System Stabilizer  
 Performing Organization USBR, Electric Power Branch  
 Principal Investigator Charles Lennon (Name) PO Box 25007, Code D-1552 (Address) (FTS) 776-6044 (Telephone) (303) 235-8044  
 Starting Year FY87 Estimated Completion Year FY90

Technical Objectives: This project will develop a power system stabilizer using adaptive control techniques in order to improve performance and reduce realignment requirements. The stabilizer will continuously perform tests to determine the optimum filter frequencies and gains and will use the results to modify the parameters for the stabilizer functions. The new stabilizer will provide increased stability through optimum performance under varying system conditions and will not require periodic alignment.

Technical Approach: Design, construct, and test a board-level microcomputer with a non-adaptive power system stabilizer function. Implement various frequency domain analysis techniques with microcomputer technology (e.g., Fast Fourier Transforms, Kalman filtering, etc.) and select the most practical frequency domain technique. Perform study of adaptive control techniques. Design, construct, and test a board-level microcomputer with the adaptive power system stabilizer function using techniques learned from frequency domain and adaptive control studies.

General Progress in Last Two Years: None. Project has not started.

Plans for Next Twelve Months (FY88): Design, construct, and test board-level microcomputer with non-adaptive power system stabilizer function. Begin implementation of various frequency domain analysis techniques with microcomputer technology.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6w  
 Subject Area Electric Power  
 Project Title Synchronous Machine Constants  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator B. Milano (Name) PO Box 25007, Code D-1551 (FIS) 776-6055  
Denver CO 80225-0007 (Address) (303) 236-6055 (Telephones)  
 Starting Year FY85 Estimated Completion Year FY89

**Technical Objectives:** To obtain more accurate machine constants for use in steady state dynamic and transient computer modeling applications.

**Technical Approach:** Review and evaluate the currently accepted test methods as well as several new proposed test methods. The results of the evaluation will be used to formulate an approach for us to take in both completing and updating our machine constants data files. It is difficult to determine if one of the tests would be adopted or if a modified new or composite test would emerge from this investigation.

**General Progress in Last Two Years:** Several of the current and new tests have been reviewed. A field test to obtain the first machine constants data using several different test methods is being formulated.

**Plans for Next Twelve Months (FY88):** Evaluate and review test methods, perform the first test, and reduce test data.

**Coordination or Cooperation with Another Agency:** None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6x  
 Subject Area Electric Power  
 Project Title Adaptive Speed Governing of Hydro Generators  
University of Illinois and USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator Terry Whittemore (Name) PO Box 25007, Code D-1550A (FIS) 776-6048  
Denver CO 80225-0007 (Address) (303) 236-6048 (Telephones)  
 Starting Year FY84 Estimated Completion Year FY87

**Technical Objectives:** This project will apply optimal control techniques to more states of the speed governing system. Through the inclusion of additional states, such as penstock and draft tube pressures, and the use of advanced control techniques, enhanced performance is expected. Water hammer and other hydraulic phenomena will be reduced while providing better speed or load response. A significant reduction in mechanical activity and the associated wear on the mechanical system will result from the discontinuous nature of the digital control scheme.

**Technical Approach:** A digital prototype of present control methods will be developed and tested for suitability and reliability in the hydro generator environment. Performance to be optimized and required modes of operation will be identified. Adaptive optimal control methods will be identified and implemented inside the digital prototype hardware. The hardware will be tested against machine/system models under laboratory conditions. Finalized prototype hardware will be installed on an operating hydro generator of approximately 125 megawatts where operation will be analyzed and evaluated.

**General Progress in Last Two Years:** The digital prototype was developed, laboratory tested, and field tested at New Melones Powerplant in California. Development of a prototype using adaptive optimal control methods was started and testing of this prototype is scheduled for late summer.

**Plans for Next Twelve Months (FY88):** Limited funds will terminate University of Illinois involvement in this project. The project will be continued by USBR, however. Field testing of the prototype adaptive governor controller will be performed. Refinements will be made to the prototype as needed.

**Coordination or Cooperation with Another Agency:**

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6Y  
 Subject Area Electric Power  
 Project Title Adaptive Excitation Control for Hydro Generation  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal PO Box 25007, Code D-1550A (FIS) 776-6048  
 Investigator Terry Whittemore Denver CO 80225-0007 (303) 238-6048  
 (Name) (Address) (Telephones)  
 Starting Year FY88 Estimated Completion Year FY91

**Technical Objectives:** This project will develop a microcomputer-based synchronous machine regulator which will perform adaptive optimal control of excitation control system. Existing regulators use the same control under all conditions except where limiters provide rudimentary modification of the control scheme. The adaptive regulator will permit different methods of control under different operating conditions. For example, operation during a fault will be controlled quite differently from operation during load rejection. Because the control can be adapted to specific operation, it can be optimized for each operation, whereas the present regulator must provide generic control that can accommodate all modes of operation without optimization.

**Technical Approach:** The limitations of existing excitation control system methods will be identified and the objectives of optimization identified. Adaptive algorithms for various modes of operation will be created to optimize a specific response appropriate to each mode of operation. The algorithms will be implemented in prototype hardware which will be tested with models of the synchronous machine and power system under laboratory conditions. The completed prototype will be installed on an operational machine of approximately 125 megawatts where actual operation will be analyzed.

**General Progress in Last Two Years:** None. Project has not started.

**Plans for Next Twelve Months (FY 88):** The limitations of existing excitation control system methods will be identified and the objectives of optimization identified. Adaptive algorithms for various modes of operation will be created to optimize a specific response appropriate to each mode of operation.

**Coordination or Cooperation with Another Agency:**

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EP-6Z  
 Subject Area Electric Power  
 Project Title Gas Insulated Substation Investigations  
 Performing Organization Division of Laboratories (BPA)  
 Principal Stephen R. Sarkinen P.O. Box 491, Vancouver, WA (FIS)  
 Investigator (Name) (Address) 98666 (Telephones)  
 Starting Year \_\_\_\_\_ FY \_\_\_\_\_ Estimated Completion Year \_\_\_\_\_ FY \_\_\_\_\_

**Technical Objectives:**  
 Provide testing capabilities and perform electrical investigations associated with reliability, maintainability, and safety considerations of SF<sub>6</sub> insulated substation equipment.

**Technical Approach:**

A 500-kV single phase test pole including buswork, circuit breaker, isolators, ground switches, arrester, potential transformer, and bushings has been installed for testing purposes. Studies are performed to evaluate commission testing methods, fault locating methods, transient voltages associated with GIS equipment, modeling characteristics of GIS components, and to evaluate maintenance practices for GIS equipment.

**General Progress in Last Two Years:**

Evaluated commissioning test procedures. Provided training for maintenance personnel in working with GIS equipment. Developed instrumentation for, and performed measurements of transients in GIS when switches are operated.

**Plans for Next Twelve Months (FY 88):**

- Efforts will continue to evaluate fault locating methods for reducing the down-time related to failures in gas insulated systems.
- Modeling of GIS components for computer simulations.
- Evaluate new gas density monitors and moisture indicators for monitoring the condition of GIS equipment.

**Coordination or Cooperation with Another Agency:**

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EP-6aa  
 Subject Area Electric Power  
 Project Title Field Test of a Breaker Synchronous Closing Device  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator B. Milano PO Box 25007, Code D-1551 (FTS) 776-6055  
(Name) Denver CO 80225-0007 (303) 236-6055  
(Address) (telephones)  
 Starting Year FY87 Estimated Completion Year FY89

Technical Objectives: To evaluate the performance of a 500-kV breaker in conjunction with the Bureau's first synchronous closing device scheme to limit line switching transients. Particular attention will be given to the long term versus short term timing stability of both the breaker and synchronizing device.

Technical Approach: Perform field tests on the subject equipment shortly after installation.

General Progress in Last Two Years: None.

Plans for Next Twelve Months (FY88): Perform the subject tests next spring or summer and document the findings.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number EP-6bb  
 Subject Area Electric Power  
 Project Title Out-of-Step Relay  
USBR, Electric Power Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator Terry Whittemore, PO Box 25007, Code D-1550 (FTS) 776-6048  
(Name) Denver CO 80225-0007 (303) 236-6048  
(Address) (telephones)  
 Starting Year FY85 Estimated Completion Year FY92

Technical Objectives: To determine the feasibility of implementing a synchronous generator loss of synchronism detection scheme which is based on the Direct Method of Liapunov.

Technical Approach: To design and construct analog and digital versions of the out-of-step relay for laboratory and field testing.

General Progress in Last Two Years: The analog version has been designed, constructed, and laboratory tested.

Plans for Next Twelve Months (FY88): The analog version will be field tested. The digital version will be designed and constructed.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EP-6cc

Subject Area Electric Power

Project Title Photovoltaic Evaluations

Performing Organization BPA Generation Engineering Branch

Principal Investigator Nicholas G. Butler (Name) BPA, P.O. Box 3621 (Address) (503)230-4524 (Telephone) (FTS)429-4524

Starting Year FY 1980 Estimated Completion Year FY 1987

Technical Objectives:

To complete evaluation of 10 photovoltaic Demonstration Projects (aggregating 20.9 MW nameplate capacity) installed in various applications in BPA service area. Two of these installations (aggregating 13 kW) are grid connected.

Technical Approach

All installations had recording data collection systems monitoring critical parameters of the system performance. In addition, BPA maintained a system of regional insolation stations to allow PV system evaluations to be made for various sub-regions of the system.

General Progress in Last Two Years

All systems are in operation. Intensive data gathering terminated in mid-FY 1986. Regional insolation stations were decommissioned at the end of FY 1985.

Plans for Next Twelve Months

Final reports on regional insolation conclusions and on future regional specific PV R&D directions being prepared (to be issued in FY 88).

Coordination or Cooperation with Another Agency:

Coparticipation with USDOE.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X Technology Transfer \_\_\_ None  
\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

APPENDIX F  
AGENDA AND TOPIC STATEMENTS  
ENERGY SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987  
Vicksburg, Mississippi

AGENDA

ENERGY SESSION

W. Myers, Chairman  
A. S. Lessem, Recorder

Agency

Time Topic No. Topic Statement

Tuesday, November 3rd, 1987

\*\*\* EFFICIENCY \*\*\* ( NEW TECHNOLOGY )

9:00 a.m.	EN-1a	Improved Electric Motors	TVA
	EN-1b	Induction Motor ASD vs Brushless	TVA
	EN-1c	DC Motor Drive	TVA
	EN-1d	Demo: 600 hp ASD at Columbia Waste Water Treatment Plant	BPA
	EN-1e	Natural Draft Fabric Dry Cooling Tower	BPA
	EN-1f	Screw Compressor Supermarket Refrigeration System	BPA
	EN-1g	Adaptive Power Factor Control, Dem.	BPA
	EN-1h	Amorphous Steel Transformer Demo.	BPA
	EN-1i	Reflective Foil Insulation	BPA
	EN-1j	Vacuum Window - Phase II	BPA
	EN-1k	High "R"/low "a" Window - Phase II	BPA
	EN-1k	Energy Efficient Dessiccant Dehumidifier	BPA
	EN-1l	Adjustable Speed Drives: Applications	BPA

F3

10:30 a.m.

10:45 a.m.	EN-1m	Break	BPA
	EN-1n	NOLA-Type Power Factor Controller Distribution System Efficiency Improvement Computer Program	BPA
	EN-1o	Window Thermal Performance Testing	BPA
	EN-1p	Japanese Refrigerator Field Test Directory of Energy-Efficient Software for Industrial Sector	BPA
	EN-1q	Energy Savings in a Silicon Furnace Through Improved Reductants	BPA
	EN-1r	Flow Meter Evaluation	BPA

12:30 p.m.

Lunch

\*\*\* SOLAR TECHNOLOGY \*\*\*

1:30 p.m.	EN-2a	E1 Paso Solar Pond Test Project	USBR
	EN-2b	USBR Solar Photovoltaic Projects	USBR
	EN-2c	Nonconnecting Salt Grad. Solar Pond	TVA
	EN-2d	Solar-Driven Fixed-Bed Dessiccant System with Solar Heating	TVA

\*\*\* BIOMASS UTILIZATION \*\*\*

EN-3a	Specialized Equipment for Converting Small Diameter Trees to Chips	BPA
EN-3b	Hogged fuel	BPA
EN-3c	Biomass Gasification Trials Pacific Northwest and Alaska Regional Bioenergy Program	BPA

\*\*\* MISCELLANEOUS \*\*\*

3:30 p.m.	EN-4a	Energy Storage Technology Assess.	TVA
	EN-4b	Effects of Global Climate Change on Water Resources	TVA
	EN-4c	Radon vs House Tightening	BPA
	EN-4d	Radon 3-month/12-month Study	BPA
	EN-4e	Radon Soils & Siting	BPA
	EN-4f	Deficit Irrigation	BPA
	EN-4g	Improved Selection Procedures for Irrigation Procedures	BPA
3:30 p.m.		Joint Session with Electric Power Presentation by EPRI	
Wednesday, November 4th, 1987			

\*\*\* CONSERVATION \*\*\* ( NEW WAYS TO USE EXISTING TECHNOLOGY )

8:15 a.m.	EN-5a	Residential Heat & Cool Storage	TVA
	EN-5b	Restaurant Waste Heat Recovery	TVA
	EN-5c	Hot Water Saver	TVA
	EN-5d	Radiant Barrier	TVA
	EN-5e	Shower Bath Economizer	BPA
	EN-5f	Energy Edge Building Design Eval.	BPA
	EN-5g	Ventilation Air Tempering for Commercial Buildings	BPA
	EN-5h	Industry Heat Pump Applications	BPA
	EN-5i	Electric Heat Pump Study	BPA
	EN-5j	Conservation Voltage Reduction	BPA
	EN-5k	MCS Wall Moisture Study	BPA
	EN-5l	Pneumatic Conveying Improvements	BPA
	EN-5m	Electrolytic Hydrogen Production	BPA

Break

Design Methods for Small Commercial Building Contractors

EN-5n	Very Low Pressure Irrigation	BPA
EN-5o	Exhaust Air Heat Pump Study	BPA
EN-5p	Inspection of Crawls Spaces	BPA
EN-5q	In-Situ Window U-Value Testing	BPA
EN-5r	Dehumidifier Field Test	BPA
EN-5s	Wall Moisture Diffusion Mathematical Model	BPA
EN-5t	Underfloor Insulation Study	BPA
EN-5u	Multi-Family Air Exchange Study	BPA
EN-5v	Ventilation Test-bed Study	BPA
EN-5w	Low Pressure Nozzles for Set System	BPA
EN-5x	Heat Pump Water Heater in Multi-Family Housing Test	BPA
EN-5y	Microcomputer Control of Irrigation and Pump Scheduling	BPA

10:00 a.m.

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number EM-1a  
 Subject Area Energy  
 Project Title Improved Electric Motors  
 Performing Organization TVA  
 Principal Investigator Steve H. Jan (FIS)  
 (Name) HR 2S 37A-C (615) 751-6117  
 (Address) (Telephones)  
 Starting Year FY 80 Estimated Completion Year FY 89

Technical Objectives:

To test various energy saving devices for improving electric motor efficiency. This includes power factor controllers (PFC) and adjustable speed drives (ASD).

Technical Approach:

A 5 Hp and 500 Hp motor test facility have been established by TVA. TVA will test energy saving devices at the test facility, lab and industrial sites. The savings will be quantified.

General Progress in Last Two Years:

A 500 Hp dynamometer has been installed to test motors up to 500 Hp at TVA's Electric Motor Test Facility.

Plans for Next Twelve Months (FY 88):

TVA will test motors from 25 up to 500 Hp for baseline and retest with energy saving devices at 10% loading increment for energy comparison.

Coordination or Cooperation with Another Agency:

BPA will be kept informed of key results.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams  Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EM-1b  
 Subject Area Energy  
 Project Title Efficiency Comparison of Induction motor ASD and Brushless DC motor Driv  
 Performing Organization TVA-University of Kentucky Research Foundation  
 Principal Investigator Steve H. Jan (FIS)  
 (Name) HR 2S 37A-C (615) 751-6117  
 (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives:

To compare efficiency of inverter-fed induction motor adjustable speed drives (ASD) and brushless DC motor drives (BDCD).

Technical Approach:

A 10 Hp induction motor with 10Hp ASD was tested against a 10 Hp brushless dc motor using a 15 Hp dynamometer. The tests were conducted at 25, 50, 75 and 100% load level and at various frequencies.

General Progress in Last Two Years:

The test has been completed. A report is available upon request (TVA/OR/ED6T-86/44)

Plans for Next Twelve Months (FY 88):

Additional task to optimize ASD slip control is being investigated.

Coordination or Cooperation with Another Agency:

Co-funding is being considered by Power Electronics Application Center established by EPRI.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams  Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EN-1c  
 Subject Area Energy  
 Project Title Demonstration of 600 Hp ASD at Columbia Waste Water Treatment Plant (CMWTP)  
 Performing Organization TVA-EPRI-CRS Sirtine - City of Columbia - Emerson  
 Principal Investigator Steve H. Jan (Name) VR 25 37A-C (Address) (615) 751-6117 (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives:  
 To demonstrate a 600 Hp ASD at CMWTP to control two 300 Hp induction motors for energy saving and processing improvement.

Technical Approach:

TVA provided CMWTP a 600 Hp ASD manufactured by Emerson. CRSS, funded by EPRI, performed feasibility study and designed the system. The City of Columbia will install and monitor the ASD with automation control system.

General Progress in Last Two Years:

ASD was installed. Tests were performed and data has been collected by CMWTP.

Plans for Next Twelve Months (FY 88):

A report is being prepared by CRSS for TVA and EPRI. The report will be released in April 1988.

Coordination or Cooperation with Another Agency:

EPRI

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-Id  
 Subject Area Energy  
 Project Title Natural Draft Fabric Dry Cooling Tower  
 Performing Organization R.D. Mitchell & Associates  
 Principal Investigator Douglas B. Seely (Name) BPA, P.O. Box 3621 (Address) (503) 230-4523 (Telephone)  
 Starting Year FY 1984 Estimated Completion Year FY 1987

Technical Objectives:

To investigate the feasibility of utilizing a fabric, cable stayed, natural draft tower, direct air-cooled condenser system for binary cycle geothermal power plant applications through estimates of performance and cost for towers of sufficient capacity to handle waste heat rejection from two different size binary cycle plants sited in a Northern Nevada and Southeast Oregon environment.

Technical Approach

- o Develop tower configurations based on variables in plant size, ambient dry bulb conditions, and air velocities through condenser.
- o Develop operating curves of net system output as designed for optimum conditions as a function of dry bulb temperature.
- o Calculate net plant electric generation with variations in air velocity through condenser.
- o Develop cost estimates for tower configurations.

General Progress in Last Two Years

All work has been completed relative to the technical approach.

Plans for Next Twelve Months

Publish final report (EPRI publication)  
 Coordination or Cooperation with Another Agency:

Cooperating entities: EPRI, Sierra Pacific Power.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA High 1987 Session Number EN-1e

Subject Area Energy

Project Title Development and Test of a Screw Compressor Supermarket Refrigeration System

Performing Organization Aspen System, Inc.

Principal Investigator Bob Guddat BPA, P.O. Box 3621 - EPC (FTS)429-3000  
 (Name) Portland, OR 97208 (503)230-3000  
 (Address) (Telephone)

Starting Year 1985 Estimated Completion Year FY 1988

Technical Objectives:

This project will demonstrate the technical feasibility and reliability of this new technology supermarket refrigeration system. This project will also confirm, by test results, substantial energy savings compared to the conventional supermarket refrigeration system.

Technical Approach

Laboratory testing in the contractor facilities. Pre-production demonstration testing of a screw compressor supermarket refrigeration system in a Northwest supermarket.

General Progress in Last Two Years

Laboratory testing of system was completed July 1986. BPA final report on laboratory testing published in November 1986.

Plans for Next Twelve Months (FY 88)

Test the system in a Northwest supermarket.

Coordination or Cooperation with Another Agency

Test results from Northwest supermarket will be compared with results from system testing in a New York State supermarket. Testing will be conducted in New York for the New York State Energy Research and Development Authority. (NYSERDA)

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1f

Subject Area Energy

Project Title Adaptive Power Factor Controller Demonstration

Performing Organization CH2M Hill

Principal Investigator Barry Kennedy BPA, P.O. Box 3621 - EPC (FTS)429-3463  
 (Name) Portland, OR 97208 (503)230-3463  
 (Address) (Telephone)

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

To improve the efficiency of distribution systems by the application of fixed and automatically switched shunt capacitors.

Technical Approach

The study is being conducted in three phases as follows:

- Phase I: Develop a computer model of fixed and automatically switched shunt capacitors application on three feeders.
- Phase II Based on Phase I findings, select three demonstration sites for the application of shunt capacitors.
- Phase III Develop "Application Guidebook" for utility engineers and mechanics.

General Progress in Last Two Years

Phase I will be completed in October 1987.

Plans for Next Twelve Months (FY 88)

Due to budget cuts, Phase II and III portions of the study have been postponed indefinitely.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1g

Subject Area Energy

Project Title Amorphorous Steel Transformer Demonstration

Performing Organization Bonneville Power Administration

Principal Investigator Barry Kennedy BPA, P.O. Box 3621 - EPC (FTS)429-3463  
(Name) Portland, OR 97208 (503)230-3463

(Telephone)

Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives:

To test loss reduction and reliability at twelve 25-KVA amorphorous steel distribution transformers.

Technical Approach

Under an agreement with the Electric Power Research Institute, BPA received twelve 25-KVA amorphorous steel distribution transformers in 1985 to replace twelve existing standard station service transformers in several BPA substations. BPA will perform diagnostic no load loss measurement tests before installation, one year, and two years after installation

General Progress in Last Two Years

Tests were performed prior to installation in January 1986. A units have been installed. Field tests are scheduled for two units in August 1987.

Plans for Next Twelve Months (FY 88)

Field tests are scheduled for two units in August 1987.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1h

Subject Area Energy

Project Title Reflective Foil Insulation Study

Performing Organization Oak Ridge National Laboratory

Principal Investigator Joe Flores BPA, P.O. Box 3621 - EPC (FTS)429-3000  
(Name) Portland, OR 97208 (503)230-3000

(Telephone)

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

To develop a thermal testing procedure for reflective insulation that is acceptable to all parties.

Technical Approach

Various reflective insulation will be tested in guarded hot boxes. The data obtained will be used in an effort to determine and develop a thermal testing procedure for reflective insulation.

General Progress in Last Two Years

None - New Project.

Plans for Next Twelve Months

Proceed with the work as planned.

Coordination or Cooperation with Another Agency

Oak Ridge National Laboratory - cofunding.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-11  
 Subject Area Energy  
 Project Title Vacuum Window - Phase II  
 Performing Organization Solar Energy Research Institute  
 Principal BPA, P.O. Box 3621 - EPC (FTS)429-3000  
 Investigator Joe Flores Portland, OR 97208  
 (Name) (Address) (Telephone)  
 Starting Year FY 1988 Estimated Completion Year FY 1989

Technical Objectives:

Field and laboratory test vacuum windows fabricated in the Solar Energy Research Institute facilities under a technique developed in Phase I.

Technical Approach

Phase II will emphasize fabrication and engineering scale test of pre-prototype components. Field testing will be included to the extent that it is advisable and affordable. Some refinement of component design will be included where particularly attractive opportunities for building performance improvements were identified.

General Progress in Last Two Years

Phase I - The necessary facilities for fabricating vacuum windows have been built and tested. The various components of the vacuum window have been analyzed and prototypes have been developed.

Plans for Next Twelve Months

Award Phase II and proceed as planned.

Coordination or Cooperation with Another Agency

DOE - funding development of the high-vacuum welding chamber.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-11  
 Subject Area Energy  
 Project Title High - R/Low e Window - Phase II  
 Performing Organization Lawrence Berkeley Laboratory  
 Principal BPA, P.O. Box 3621 - EPC (FTS)429-3000  
 Investigator Joe Flores Portland, OR 97208  
 (Name) (Address) (Telephone)  
 Starting Year FY 1988 Estimated Completion Year FY 1989

Technical Objectives:

Conduct a field test in BPA sponsored homes to show that these windows use significantly less heating energy than conventional windows and performs better than an insulated wall over a heating season in Pacific Northwest climates.

Technical Approach

Industry collaboration will be sought and utilized in the production of a Phase II prototype which will be used in this demonstration. Laboratory and field testing will continue to assess durability of gas filling options and structural performance of inner glazing layer.

General Progress in Last Two Years

Phase I - The various window components have been analyzed and a prototype developed.

Plans for Next Twelve Months

Get the contract awarded and proceed as planned.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None  
Project Maintenance, Rehabilitation, and Life Extension



TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1k

Subject Area Energy

Project Title Development of an Energy Efficient Desiccant Dehumidifier (EEDD)

Performing Organization ITT Research Institute

Principal Investigator Jim Lynch

(Name) BPA, P.O. Box 3621 - EPC  
(Address) Portland, OR 97208  
(Telephone) (503)230-3461

Starting Year FY 1987 Estimated Completion Year FY 1989

Technical Objectives:

To develop an Energy Efficient Desiccant Dehumidifier System which employs infrared heating to regenerate the desiccant.

Technical Approach

The study will be conducted in two phases: Phase I will survey the Industrial and Agricultural Sectors in the BPA service area and determine applications for the Desiccant Dehumidifier technology; Phase II (conditional on findings of Phase I) design, build, and test an EEDD prototype and test its performance.

General Progress in Last Two Years

None - contract award is expected by August 1987.

Plans for next Twelve Months

Phase I is expected to be completed during FY 1988; providing the findings are favorable, Phase II should commence late in FY 1988.

Coordination or Cooperation with Another Agency: None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams None Technology Transfer X None

Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1l

Subject Area Energy

Project Title Study the Performance of Adjustable Speed Drives with Emphasis on a Practical Application

Performing Organization Oregon State University

Principal Investigator Jim Lynch

(Name) BPA, P.O. Box 3621 - EPC  
(Address) Portland, OR 97208  
(Telephone) (503)230-3461

Starting Year FY 1985 Estimated Completion Year FY 1988

Technical Objectives:

Investigate and compare the performance of an established induction motor adjustable speed drive (ASD) with that of two emerging technology ASD's: The switched reluctance motor drive and the permanent magnet motor drive.

Technical Approach

Investigate performance of the established induction motor ASD in both a laboratory and an existing work setting. The three alternatives will be studied in a laboratory setting only. Performance will address electrical and mechanical parameter measurements throughout duty cycle, with special attention given to electrical and acoustical noise, energy savings, and life-cycle costs.

General Progress in Last Two Years

Performance studies of the established induction motor ASD is complete.

Plans for Next Twelve Months (FY 88)

To continue investigation of the switched reluctance motor and the permanent magnet motor and compare results back to induction motor drive system.

Coordination or Cooperation with Another Agency: None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams None Technology Transfer X None

Project Maintenance, Rehabilitation, and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1m

Subject Area Energy

Project Title NOLA - Type Power Factor Controller

Performing Organization Knudson Engineering, Inc.

Principal BPA, P.O. Box 3621 - EPC (FTS)429-3461  
Investigator Jim Lynch Portland, OR 97208 (503)230-3461  
(Name) (Address) (Telephone)

Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives:

To improve the efficiency of 3 Phase induction motors by varying the input voltage as a function of motor load.

Technical Approach

The study is being conducted in three phases as follows:

- Phase I: Conduct a survey of existing three-phase PFC installations, obtain available performance data, and assess regional application potential.
- Phase II Based on Phase I findings, select one or more PFC's for demonstration of performance at existing cooperating host sites.
- Phase III Develop "Application Guidebook" for plant operators and condensed Summary Report for wider readership.

General Progress in Last Two Years

Phase I will be completed in July 1987

Plans for next Twelve Months

Begin Phase II by collecting field data from one or more demonstration sites selected in Phase I. Investigate voltage ramp-up response to sudden load increases. Prepare a definitive technical report and guidebook which will cover all relevant performances of each controller studied.

Coordination or Cooperation with Another Agency: None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None

Project Maintenance, Rehabilitation, and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1n

Subject Area Energy

Project Title Distribution System Efficiency Improvement Computer Program

Performing Organization To be determined

Principal BPA, P.O. Box 3621 - EPC (FTS)429-3463  
Investigator Barry Kennedy Portland, OR 97208 (503)230-3463  
(Name) (Address) (Telephone)

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

To develop an IBM PC compatible computer program with a user's manual that can be used by BPA Staff and utility customer staff to evaluate alternative measures for improving the efficiency of utility customer distribution systems.

Technical Approach

Convert the existing computer program for use on the IBM mainframe to use on the IBM PC. This project will complete the work started with the development of the Distribution System Efficiency Improvement Guidebook.

General Progress in Last Two Years

The IBM mainframe program was developed in 1985. Work on the IBM PC program is expected to begin by August 1987.

Plans for Next Twelve Months (FY 88)

Program and user's manual are expected to be distributed to BPA's utility customers by June 1988.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None

Project Maintenance, Rehabilitation, and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority Energy 1987 Session Number EN-10  
Subject Area Energy  
Project Title Window Thermal Performance Testing  
Performing Organization Pacific Inspection and Research Laboratory  
Principal Investigator Renee LaMore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

This study is to test various retrofit window products used in the Regional Residential Weatherization Program to determine the relative thermal performance of those products.

Technical Approach:

Contractor tested twelve window configurations used the AAMA 1503.1 test procedures. The results were compared to prime window replacements which are required to be tested and meet or exceed a minimum performance standard for use in the Program.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement and testing.

Plans for Next Twelve Months (FY 88):

Report is pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an competitive procurement between BPA and Pacific Inspection and Research Laboratory.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority Energy 1987 Session Number EN-1p  
Subject Area Energy  
Project Title Japanese Refrigerator Field Test  
Performing Organization Bonneville Power Administration  
Principal Investigator Renee LaMore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-87 Estimated Completion Year FY-89

Technical Objectives:

This study is to determine the energy consumption of energy-efficient refrigerators in the field. The information will be used to adjust the supply curves in the future.

Technical Approach:

Bonneville placed 12 refrigerators in homes and will be monitoring the energy consumption and door openings of the refrigerators for eighteen months. The field results will be compared with the laboratory findings and determine trends if any.

General Progress in Last Two Years:

Project design, participant selection, and refrigerator placement.

Plans for Next Twelve Months (FY 88):

Test is in progress. Test will be complete in January 1989 and the report available after that date.

Coordination or Cooperation with Another Agency:

This study is being conducted in-house. No contract staff has been used.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-1q  
Subject Area Energy  
Project Title Directory of Energy-Efficient Software for Industrial Sector  
Performing Organization Not Yet Determined  
Principal Investigator Renee LaMore - BPA Portland, OR 97208  
(Name) (Address) (FIS) 429-4360  
(Telephone) (503) 230-4360  
Starting Year FY-87 Estimated Completion Year FY-88

Technical Objectives:

This project is to compile, publish and distribute a directory of energy-efficient software for the Industrial Sector.

Technical Approach:

The scope of work includes conducting a literature search and telephone survey to determine and availability of appropriate software. Contractor will organize the software by Standard Industrial Code.

General Progress in Last Two Years:

Project design.

Plans for Next Twelve Months (FY 88):

Competitive procurement is in progress. Directory will be available in Spring 1989.

Coordination or Cooperation with Another Agency:

This study is a competitive procurement.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-1r  
Subject Area Energy  
Project Title Energy Savings in a Silicon Furnace through Improved Reductants  
Performing Organization Dow Corning Corporation  
Principal Investigator Alan Budnar  
(Name) (Address) (FIS) 429-3000  
(Telephone) (503) 230-3000  
Starting Year FY 1986 Estimated Completion Year FY 1987

Technical Objectives:

Improve the electrical efficiency of obtaining silicon from its raw materials.

Technical Approach:

Run a plant test on three new raw materials which have a promise of increased efficiency.

General Progress in Last Two Years:

First test has been completed. Coalchar, the new raw material shows the possibility of about a 5% cost reduction.

Plans for next Twelve Months:

None. Project ends FY 87.

Coordination or Cooperation with Another Agency:

None  
General Research or Problems Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-1s

Subject Area Energy

Project Title Flow Meter Evaluation

Performing Organization Oregon State University

Principal Investigator Alan Bucher BPA, P.O. Box 3621 - EPC (FTS)429-3460  
(Name) Portland, OR 97208 (Address) (503)230-3460  
(Telephone)

Starting Year FY 1985 Estimated Completion Year FY 1988

Technical Objectives:

Determine availability of a non-intrusive flowmeter suitable for irrigation measurements.

Technical Approach

Survey market for suitable, non-intrusive flowmeter, and test likely candidates for accuracy and usefulness.

General Progress in Last Two Years

A thorough survey of the market resulted in testing two sonic doppler-effect flowmeters. These meters, however, have proven unreliable. At this time a meter based on the transit-time principle appears attractive.

Plans for Next Twelve Months

The transit-time meter is available at present only in a configuration suitable for fixed installations. Ways will be explored to encourage the manufacturer to package the instrument as a survey device.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams None Technology Transfer X None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number EN-2a

Subject Area Energy

Project Title El Paso Solar Pond Test Project

Performing Organization University of Texas at El Paso (UTEP)

Principal Investigator Bill Boegli, USBR, PO Box 25007 (FTS) 776-6205  
Code D-1523C, Denver CO 80225-0007 (303) 236-6205

Starting Year FY83 Estimated Completion Year FY88

Technical Objectives: To perform technical studies related to solar ponds to determine the technical and economic feasibility of using solar salt-gradient ponds in Bureau projects to control salinity, to generate project power, and to produce fresh water.

Technical Approach: UTEP, Bruce Foods, El Paso Electric, and the Bureau are performing studies in an industry/government effort to evaluate a solar salt-gradient pond for their specific applications. Phase I consists of converting an existing 0.8-acre lined pond to a solar pond and testing its thermal performance while providing process heat; Phase II consists of installing and testing an electric power module; and Phase III consists of installing and testing a desalination system.

General Progress in Last Two Years:

The solar pond has operated year-round up to a peak temperature of 195 °F. The first 100 kW solar pond power system in the U.S. was put into operation on September 19, 1986, and the first 5,000 gal/day solar pond desalting system was put into operation on June 23, 1987.

Plans for Next Twelve Months (FY88):

- Continue testing the solar pond while providing process heat.
- Continue testing the organic Rankine power system.
- Continue testing the multi-stage flash desalting system.

Coordination or Cooperation with Another Agency: Cooperative efforts are underway with TVA, DOE, WAPA, DOE, and SERI, with exchanges of progress reports, data, and site visits.

In addition, several technical papers have been published and presentations have been given to DOE, SERI, WAPA, DOD, Army, Navy, AF, NASA, and representatives from many foreign countries at various conferences.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams X Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number EN-2b  
 Subject Area Energy  
 Project Title Status of Bureau's Solar Photovoltaic Projects  
 Performing Organization USBR - Division of Research and Laboratory Services  
 Principal Investigator Harry E. Remmers, USBR, PO Box 25007 (FTS) 776-5997  
Code D-1500E, Denver CO 80225-0007 (303) 236-5997  
 (Telephones)  
 Starting Year FY80 Estimated Completion Year FY88

Technical Objectives: Determine the technical and economic feasibility of using solar photovoltaic power systems in applications where small-scale power generation is required within the Bureau of Reclamation. Funding of these projects has been cost-shared with the Bureau's Project Offices and the Department of Energy under the Federal Photovoltaic Utilization Program.

Technical Approach: Install and test PV power systems for the following applications:

- Groundwater pumping plant
- Microwave relay station
- Electrolysis desalination system
- Cathodic protection systems
- Limnological monitoring stations
- Meteorological monitoring stations
- Dam safety instrumentation
- Weed control feeder
- Obstruction lighting systems

General Progress in Last Two Years: All of the PV systems are now operational, with some having been in operation for more than 7 years. To date, each has proven to be an economical and reliable source of electrical power. Due to the success of these test systems, the Project Offices are constructing additional systems on their own without any assistance from the Division of Research and Laboratory Services.

Plans for Next Twelve Months (FY 88):

Evaluate the performance and publish a report on the results of the solar photovoltaic projects.

Coordination or Cooperation with Another Agency:

Results shared with DOE, WAPA, COE, TVA, BPA, and PV system manufacturers.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None
- Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number EN-2c  
 Subject Area Energy  
 Project Title Nonconvecting Salt Gradient Solar Pond Project  
 Performing Organization TVA, Division of Energy Demonstrations & Technology  
 Principal Investigator William C. Irwin, 2S 38A Missionary Ridge, Chatt., TN (615) 751-6118 (FTS)  
 (Name) (Address) 37402-2001 (Telephones)

Starting Year FY 1981 Estimated Completion Year FY 1987  
 Technical Objectives: 1. To demonstrate the technical and economic feasibility of the nonconvecting solar pond concept for producing direct heat for agricultural, buildings, and industrial process applications in the TVA region; 2. To determine if the nonconvecting solar pond could provide heat at a sufficiently high temperature to permit feasible electrical power generation by low-temperature power cycles in the TVA region; 3. To assist industries in designing, sizing, simulating, and operating solar ponds.

Technical Approach: Record weather conditions, pond and ground temperatures, pond salinity profiles, and other selected pond physical parameters (optical transmittance, salinity gradient profile, pH, etc.) Calculate pond's energy balance and performance when energy is extracted according to an industry simulated schedule. Document results and disseminate the information to pond researchers and potential users of pond technology. As requested, host experiments for pond researchers.

General Progress in Last Two Years: Salt gradient was established, and a peak no-load temperature of 201°F was reached in May 1986. Before that time, energy extraction experiments were conducted on 8 hr/day and 24-hr/day bases. Rates of up to 1.6-million Btu/hr were attained. Other performance data and operating experience has been gained. These include experiments on pond water classification methods, water surplus (rain-induced) management and saline water treatment studies with a reverse osmosis unit.

Plans for Next Twelve Months (FY 88): Since all TVA funds have been expended for this project, alternate funding and/or operating organizations are being sought for continuing the experimental and demonstration work. The University of Tennessee at Chattanooga is investigating this possibility. If these arrangements cannot be effected, decommissioning plans, already being developed, will be implemented.

Coordination or Cooperation with Another Agency:

Information is exchanged with other agencies as requested and as needed.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None
- Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency IVA Priority 2 1987 Session Number EM-2d

Subject Area Energy  
 Project Title Simulation & Prototype Testing/Evaluation of a Solar-Driven Fixed-Bed Desiccant Cooling System with Solar Heating

Performing Organization IVA, Division of Energy Demonstrations & Technology  
 Principal (FTS)  
 Investigator William C. Irwin, 25 38A Missionary Ridge, Chatt., TN (615) 751-6118  
 (Name) J740Z-2801 (Telephones)

Starting Year FY 1982 Estimated Completion Year FY 1988

Technical Objectives: To assist in the development and testing of cost-effective solar waste-heat powered air-conditioning systems beneficial to the TVA power system and consumers.

Evaluation and comparative assessment of desiccant, absorption, and Rankine cycle cool on residential, commercial, and industrial installations in which waste heat or solar energy is available. Evaluate the systems' economic feasibility compared to convention  
 Technical Approach: vapor compression air conditioning.

Conduct technical and economic assessments comparing the various solar/waste heat-powered cooling cycles to conventional vapor compression systems. Demonstrate the solar-powered cross-cooled desiccant dehumidifier cooling system as developed by Z. Levant of IIT. Phases of the demonstration include completion of computer code simulations followed by field testing of a prototype unit in the Tennessee Valley climate, design optimization studies, and an overall, economic and technical assessment. An existing liquid desiccant dehumidifier is also being evaluated. It is installed at the Science Museum of Virginia.

General Progress in Last Two Years:  
IIT System prototype has been installed and preliminary test runs have started for collection and analysis of summer performance.

Problems developed with the data selected measurements for the liquid desiccant system at the Science Museum of Virginia; these have been corrected and new data is being received.

Plans for Next Twelve Months (FY88):  
Performance data will be collected throughout the summer for analysis and evaluation. From this, the performance will be determined.

New data from the Science Museum of Virginia is being collected for analysis. The performance will be determined from the data and analysis.

Coordination or Cooperation with Another Agency:

Information will be exchanged with the DOE and other agencies working in these similar areas.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-3a

Subject Area Energy

Project Title Acquisition & Development of Specialized Equipment for Converting small Diameter trees to chips & hogged fuel.  
 Performing Organization Hermann Bros. Logging & Construction, Inc.

Principal BPA, P.O. Box 3621 (FTS) 429-3444  
 Investigator Gary Insley Portland, OR 97208 (503) 230-3444  
 (Name) (Address) (Telephone)

Starting Year FY 1985 Estimated Completion Year FY 1987

Technical Objectives:

This project developed demonstrated and monitored a woody biomass shredder to produce hogged fuel for energy from overstocked forests.

Technical Approach

The principal investigator developed shredder from separate, commercially available components. This device is part of an integrated operation to produce sawlogs, clean paper quality chips, and hogged fuel from all biomass available on a site. The recovery of biomass is the key to economic viability of the operation, because of increased production, increased revenue, reduced maintenance costs, and reduced residue disposal costs.

General Progress in Last Two Years

The project has been implemented and completed.

Plans for Next Twelve Months

Publish and distribute final technical report. Principal investigator will continue technology transfer.

Coordination or Cooperation with Another Agency:

This project was performed with the cooperation and in-kind support of the U.S. Forest Service. Additionally, the Forest Service is performing several studies of related subjects such as site productivity and nutrient impacts.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer X None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-3b  
 Subject Area Energy  
 Project Title Biomass Gasification Trials  
 Performing Organization Lurgi GmbH Frankfurt, West Germany  
 Principal BPA, P.O. Box 3621 (FTS)429-3467  
 Investigator Gary C. Insley Portland, OR 97208 (503)230-3467  
 (Name) (Address) (Telephone)  
 Starting Year FY 1984 Estimated Completion Year FY 1988

Technical Objectives:

To obtain baseline performance and cost information on a biomass fueled low BTU gasification system.

Technical Approach

In conjunction with EPRI, an operational circulating fluid bed gasification system developed by Lurgi was selected for conduct of gasification trials utilizing Pacific Northwest "hog fuel" prepared from yardable unmerchantable material (YUM) available from logging operations in the region, (8500-8700 Btu/lb, RHV, dry).

General Progress in Last Two Years

- Test conducted.
  - Preliminary technical analysis of test results completed.
- Plans for Next Twelve Months
- Conduct engineering economic analysis of test results implication (EPRI).
  - Publish final test report (analysis, results, future implications) (EPRI).

Coordination or Cooperation with Another Agency:

EPRI

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation, and Life Extension  None

WP-EPG-0310C

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-3c  
 Subject Area Energy  
 Project Title Pacific Northwest & Alaska Regional Bioenergy Program  
 Performing Organization BPA Generation Engineering Branch  
 Principal BPA, P.O. Box 3621 (FTS)429-4523  
 Investigator Douglas Seely Portland, OR 97208 (503)230-4523  
 (Name) (Address) (Telephone)  
 Starting Year FY 1979 Estimated Completion Year (On Going)

Technical Objectives:

To promote efficient and environmentally sound utilization of biomass for energy and other applications.

Technical Approach

With assistance from Federal and State land management, resource development, energy, and environmental agencies, BPA provides overall management, expertise, financial and technical support, key demonstrations, and information; identifies environmental issues and limitations; and assists in development of reliable infra-structure.

General Progress in Last Two Years

Funded by the USDOE, this multiagency program has existed since USDOE regional office closed in August 1981. There are numerous biomass-related projects underway now from Anchorage to Boise. BPA has assisted in the establishment of other regional bioenergy programs in the US; 49 states are covered by a program.

Plans for Next Twelve Months

As a result of our most recent RFP, BPA will award several contracts in resource development and recovery, technology application and environmental impact identification and mitigation.

Coordination or Cooperation with Another Agency:

Tennessee Valley Authority, Council of Great Lakes Governors, Coalition of Northeastern Governors, Western Area Power Administration, U.S. Forest Service, Bureau of Land Management, Environmental Protection Agency, State Energy offices and Department of Natural Resources.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation, and Life Extension  None



TOPIC STATEMENT

Agency IVA Priority 1 1987 Session Number EN-4a  
 Subject Area Energy  
 Project Title Overall Energy Storage Technology Assessment  
 Performing Organization Tennessee Valley Authority (TVA)  
25 38A Missionary Ridge Place (FTS)  
 Principal Investigator James A. Hall 1101 Market Street; Chattanooga, TN (615) 751-6120  
 (Name) (Address) (Telephone)  
 Starting Year FY 88 Estimated Completion Year FY 88

Technical Objectives:

Assess the current technical and economic feasibility of various central station and end use storage technologies.

Technical Approach:

A detailed literature search and survey of the current status of the many storage technologies will be conducted. The technologies will be evaluated so that as much as possible they can be compared on a common basis.

General Progress in Last Two Years:

This is a new project.

Plans for Next Twelve Months (FY 89):

This assessment will be conducted during the next 12 months.

Coordination or Cooperation with Another Agency:

None, except to learn of similar work which may be underway.

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number EN-4b  
 Subject Area Water Quality and Ecology/Energy  
 Project Title Effects of Global Climate Change on Water Resources  
 Performing Organization TVA  
 Principal Investigator Barbara Miller ENG LAB-N (FTS)  
 (Name) (Address) (Telephone)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives:

To predict how changes in global weather which are expected to occur as a result of increased concentrations of carbon dioxide in the atmosphere may affect the availability and utilization of water resources in the Tennessee Valley.

Technical Approach:

Climatologists of NOAA and NASA will use global weather models to provide TVA with changes in rainfall and temperatures expected throughout the next century. The ENG LAB will evaluate how these changes in weather might influence reservoir operations, hydropower generation, water quality, and industrial operations on the Upper Holston River Basin in northeastern Tennessee.

General Progress in Last Two Years:

New project.

Plans for Next Twelve Months (FY88):

Rainfall and temperature data generated by NOAA and NASA will be incorporated into existing computer models designed to plan water utilization and compute environmental effects. Three climate scenarios will be evaluated.

Coordination or Cooperation with Another Agency:

Supported by EPA.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-4c  
 Subject Area Energy  
 Project Title Radon vs House Tightening  
 Performing Organization Not yet determined  
 Principal BPA, P.O. Box 3621 - EPC (FTS)429-3000  
 Investigator Brad Miller (503)230-3000  
 (Name) (Address) (Telephone)  
 Starting Year 1988 Estimated Completion Year FY 1989

Technical Objectives:

The objective of this study is to determine the relationship between house-tightening measures and radon levels for housing stock in the Northwest.

Technical Approach:

Analyze existing radon monitoring data from Residential Weatherization Program (additional data collection may be required, such as house characteristics, and measures installed). Alternatively, investigate before/after monitoring of inside air pressure, radon, soil gas pressure, wind, etc. The study will analyze the various effects of house tightening measures on the transport mechanism of radon.

General Progress in Last Two Years:

None. New project.

Plans for Next Twelve Months (FY 88)

No specific plans have been established yet.

Coordination or Cooperation with Another Agency:

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation, and Life Extension

Agency BPA Priority 1 1987 Session Number EN-4d  
 Subject Area Energy  
 Project Title Radon 3-Month/12-Month Study  
 Performing Organization Ronson Management Corporation  
 Principal (FTS) 429-3464  
 Investigator Brad Miller - BPA Portland, OR 97208  
 (Name) (Address) (Telephone)  
 Starting Year FY-86 Estimated Completion Year FY-88

Technical Objectives:

The objective of this study is to develop a set of mathematical equations that will convert any three month period of known indoor radon concentration into an annual average amount of exposure.

Technical Approach:

300 Pacific Northwest homes will be monitored for a period of fourteen months for radon. The monitoring is designed such that at the end of the monitoring period, a total of twelve consecutive three month readings and one fourteen month control will have been collected on each household. By using analytical computerized statistical models, this data will be manipulated to develop a set of mathematical algorithms that will predict a twelve month annual average radon level from any three month detection period.

General Progress in Last Two Years:

Project design, contract procurement, and initial work on study. The site audits have been performed and the first four months worth of monitors have been dispersed. The first three month detection period has been completed with those alpha-track detectors being returned for analysis.

Plans for Next Twelve Months (FY 88):

Work will continue as planned with detectors being dispersed and returned at pre-determined intervals.

Coordination or Cooperation with Another Agency:

Not Applicable

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-4e  
Subject Area Energy  
Project Title Radon Soils and Siting  
Performing Organization United States Geological Survey  
Principal Investigator Brad Miller - BPA Portland, OR 97208  
(Name) (Address) (FTS) 429-3464  
(503) 230-3464  
(Telephone)  
Starting Year FY-87 Estimated Completion Year FY-88

Technical Objectives:

The objective of this study is to locate and identify, on a regionwide basis, specific areas of potentially high and low levels of radon emission from the soil.

Technical Approach:

The study will involve extensive analysis of the existing NURE, geological, and indoor radon level information to determine points of location of ground source radon. Radon susceptibility maps will be developed for the Bonneville Service Area.

General Progress in Last Two Years:

Project design, contract negotiations, and contract procurement (still pending).

Plans for Next Twelve Months (FY 88):

The bulk of the requirements in the work statement will be carried out during the next twelve months.

Coordination or Cooperation with Another Agency:

This will be a partially co-funded interagency agreement between BPA and the USGS. BPA will fund the majority of the costs with USGS assisting with some in-house FTE support.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

None  Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-4f  
Subject Area Energy  
Project Title Deficit Irrigation  
Performing Organization Northwest Economic Associates  
Principal Investigator Alan Budner BPA, P.O. Box 3621 - EPC  
(Name) (Address) Portland, OR 97208  
(Telephone) (503) 230-3460  
Starting Year 1985 Estimated Completion Year FY 1987

Technical Objectives:

To determine the feasibility of irrigation for maximum profit rather than for maximum crop yield.

Technical Approach:

Collection of costs and revenues for a wide range of farming practices for wheat, corn, and potatoes.

General Progress in Last Two Years:

Collection and analysis of data. General conclusion is that deficit irrigation can be profitable if used under the proper conditions.

Plans for Next Twelve Months:

Project ends in FY 1987

Coordination or Cooperation with Another Agency:

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-48

Subject Area Energy

Project Title Improved Selection Procedures for Irrigation Sprinklers

Performing Organization Washington State University

Principal Investigator Alan Budner (Name)  
BPA, P.O. Box 3621 - EPC (FTS)429-3460 (Address)  
Portland, OR 97208 (503)230-3460 (Telephone)

Starting Year 1987 Estimated Completion Year FY 1988

Technical Objectives:

Develop relationship between sprinkler droplet flux, depth of water application, and surface storage for irrigated soils in the Northwest.

Technical Approach

Obtain soil samples and measure energy flux and time for ponding.

General Progress in Last Two Years

No award as yet.

Plans for Next Twelve Months (FY 88)

See Above

Coordination or Cooperation with Another Agency

None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams None Technology Transfer X None  
None Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EM-5a

Subject Area Energy

Project Title Residential Heat and Cool Storage

Performing Organization Tennessee Valley Authority (TVA)

Principal Investigator James A. Hall (Name)  
25 38A Missionary Ridge Place (FTS) (Address)  
1101 Market Street; Chattanooga, TN (615) 751-6120 (Telephone)

Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives:

Assess the technical and economic feasibility of residential heat and cool (H&C) storage (TES) systems now on the market or under development. Determine needed technology improvements and provide R&D support as appropriate.

Technical Approach:

Conduct detailed testing on systems that are on the market or under development to determine the technical readiness and improvements that are needed.

General Progress in Last Two Years:

This is a new project. One residential H&C system now on the market is being purchased so that we can conduct performance tests.

Plans for Next Twelve Months (FY 88):

Conduct performance tests on the above-mentioned H&C system. Follow the development of another residential H&C storage system now under development.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

None Safety of Dams X Technology Transfer None  
None Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EN-5b  
 Subject Area Energy  
 Project Title Restaurant Waste Heat Recovery  
 Performing Organization Tennessee Valley Authority (TVA)  
 Principal 25 38A Missionary Ridge Place (FTS)  
 Investigator James A. Hall 1101 Market Street; Chattanooga, TN (615) 751-6170  
 (Name) (Address) (Telephone)  
 Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:

The Electric Power Research Institute developed a computer model that, with some easy-to-obtain inputs, can predict whether it is economical to use waste heat from air conditioners to heat hot water in a givr. restaurant. This project will assess the accuracy of this model.

Technical Approach:

Several RWHR sites will be monitored and the data from these sites will be compared to the predictions of the computer model.

General Progress in Last Two Years:

Two sites have been monitored for one year and one site for two months. Two more sites are now being instrumented.

Plans for Next Twelve Months (FY 88):

Complete installation of instrumentation at the last two sites. Analyze data from all sites and assess the EPRI model's accuracy.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EN-5c  
 Subject Area Energy  
 Project Title Hot Water Saver  
 Performing Organization Tennessee Valley Authority (TVA)  
 Principal 25 38A Missionary Ridge Place (FTS)  
 Investigator James A. Hall 1101 Market Street; Chattanooga, TN (615) 751-6120  
 (Name) (Address) (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 88

Technical Objectives:

Assess the reliability of a novel hot water conservation device called the hot water saver (HWS). When hot water is used anywhere in a house, the energy in the hot water in the pipe is dissipated after the use stops. The HWS returns this hot water in the pipe to the water heater so that the heat is not lost.

Technical Approach:

A test stand will be built so that three HWS units can undergo life cycle tests at the same time. The units will be operated so that the pistons (the key component in terms of reliability) will be continuously cycled.

General Progress in Last Two Years:

A test plan has just recently been approved.

Plans for Next Twelve Months (FY 88):

The testing will be conducted during the next three months.

Coordination or Cooperation with Another Agency:

BPA will be kept informed of key results.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 2 1987 Session Number EN-5d  
 Subject Area Energy  
 Project Title Radiant Barrier  
 Performing Organization Tennessee Valley Authority (TVA)  
 Principal James A. Hall 2S 38A Missionary Ridge Place (FTS)  
 Investigator James A. Hall 1101 Market Street; Chattanooga, TN (615) 751-6120  
 (Name) (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives:

Assess the technical and economic feasibility of using radiant barriers, in conjunction with conventional insulation, in attics to reduce heat gain/loss in the summer and winter, respectively.

Technical Approach:

- Using 5 small (about 7' by 7') test cells in Chattanooga, the following subjects have (or are) being addressed: A. The performance of various attic locations of RBs when used with various types and R-values of attic insulation; B. The effect of dust build-up on RB performance; C. The performance of innovative RB products; D. The performance of RBs when used with ridge versus gable attic venting.
- We have contracted with ORNL to examine the performance of various attic locations of RBs at actual size (1,200 ft.<sup>2</sup>) houses with various insulation R-values during summer and winter. We are also planning to contract with ORNL to develop a comprehensive validated computer model that can predict RB performance under various conditions.

General Progress in Last Two Years:

Testing of TVA's test cells for the summers and winters of 1985 and 1986 have been completed. A report was prepared covering 1985 testing. A report is being prepared to summarize 1986 testing. Testing on dust and attic ventilation is now underway. ORNL has completed all testing at the actual size houses and model development should be in the near future.

Plans for Next Twelve Months (FY 88):

- Develop a comprehensive model under contract to ORNL that can predict RB performance under various conditions.
- Analyze results from dust/attic ventilation testing at TVA's test cells.
- Conduct testing to address the potential problem of condensation on the RB when placed directly over conventional attic insulation.

Coordination or Cooperation with Another Agency:

Contract work with ORNL has been conducted and further work is planned.

General Research or Problem Area(s) in this Topic that are of Current Special

Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency TVA Priority 3 1987 Session Number EN-5e  
 Subject Area Energy  
 Project Title Shower Bath Economizer (SBE)  
 Performing Organization TVA  
 Principal Dr. S.R. Sizerel MR 2S 33A, 1101 Market St., (FTS)  
 Investigator Dr. S.R. Sizerel (Name) (Address) Chatt., TN 37402-2801 (Telephone)  
 Starting Year FY 84 Estimated Completion Year FY 87

Technical Objectives:

Determine the technical and economic feasibility of the SBE. The SBE is a novel heat exchanger that is placed directly in the drain line from a shower and which transfers heat from the warm shower drain water to the cold incoming water.

Technical Approach:

Field and lab tests were done to assess the SBE's susceptibility to clogging and its long-term energy saving performance.

General Progress in Last Two Years:

Field and lab testing were completed.

Plans for Next Twelve Months (FY 88):

A final report will be completed by the end of FY 87.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at This Conference:

Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency BPA High 1987 Session Number EN-5f  
 Subject Area Energy  
 Project Title Energy Edge Building Design Evaluation  
 Performing Organization BPA  
 Principal Investigator Tom White BPA, P.O. Box 3621 - EPC (FTS)429-  
 (Name) Portland, OR 97208 (503)230-5867  
 (Address) (Telephone)  
 Starting Year 1986 Estimated Completion Year FY 1988

Technical Objectives:

Demonstration of conservation techniques in commercial buildings.

Technical Approach

Modeling and monitoring of newly constructed commercial buildings.

General Progress in Last Two Years

Selection of 15 buildings for study.

Plans for Next Twelve Months (FY 88)

Complete selection of nine remaining buildings. Begin monitoring of selected buildings.

Coordination or Coordination with Another Agency

Much of the work is sub-contacted to State Energy Offices, a non-profit organization, and a utility.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA High 1987 Session Number EN-5g  
 Subject Area Energy  
 Project Title Ventilation Air Tempering for Commercial Buildings  
 Performing Organization Graig Spolek and Associates  
 Principal Investigator Graig Spolek BPA, P.O. Box 3621 - EPC (FTS)429-  
 (Name) Portland, OR 97208 (503)230-  
 (Address) (Telephone)  
 Starting Year 1987 Estimated Completion Year FY 1988

Technical Objectives:

To determine the value of ventilation air tempering of commercial buildings as a conservation resource.

Technical Approach

Gathering of data to characterize building in the region and study of typical system costs.

General Progress in Last Two Years

Estimate of size of resource.

Plans for Next Twelve Months (FY 88)

Study of economic and institutional restrictions and of specific opportunities for use. A typical system design will be produced.

Coordination or Coordination with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-5h

Subject Area Energy

Project Title Industry Heat Pump Applications Study

Performing Organization To be determined

Principal Investigator Barry Kennedy  
(Name) BPA, P.O. Box 3621 - EPC (FTS)429-3463  
Portland, OR 97208 (Address) (503)230-3463  
(Telephone)

Starting Year FY 19 Estimated Completion Year FY 19

Technical Objectives:

Assessment study of the potential application of industrial pumps for industries served by BPA and BPA's preference customers.

Technical Approach

The study is being conducted as follows:

1. Review and summarize literature on the applicability of industrial heat pumps.
2. Develop a methodology for assessing the potential application of industrial heat pumps.
3. Develop supply function showing the potential application of industrial heat pumps.

General Progress in Last Two Years

Preliminary investigation has shown a significant potential application of industrial heat pumps. Negotiations with Idaho National Engineering Laboratories are almost complete with an expected award to begin the assessment in August 1987.

Plans for Next Twelve Months (FY 88)

Complete the assessment by August 1988.

Coordination or Cooperation with Another Agency

Idaho National Engineering Laboratories due office of Industrial Programs.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-5i

Subject Area Energy

Project Title Electric Arc Furnace Study

Performing Organization Bonneville Power Administration

Principal Investigator Barry Kennedy  
(Name) BPA, P.O. Box 3621 - EPC (FTS)429-3463  
Portland, OR 97208 (Address) (503)230-3463  
(Telephone)

Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives:

To improve the efficiency of electric arc furnace by studying and possibly modifying the arc furnace electrode.

Technical Approach

Perform voltage and current waveform measurements at the Oregon Steel Mills during operation of the electric arc furnace.

General Progress in Last Two Years

Special equipment to perform the tests was designed and produced in FY 1986. The tests are scheduled for August 1987.

Plans for Next Twelve Months (FY 88)

The Bureau will analyze and report on the results of the tests at the Oregon Steel Mills.

Coordination or Cooperation with Another Agency

BPA is providing test equipment and personnel for the Bureau. The Bureau, in turn, will provide BPA technical expertise dealing with the metals industry.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ \_\_\_ Technology Transfer \_\_\_ X \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension



TOPIC STATEMENT

Agency BPA \_\_\_\_\_ Priority 1 1987 Session Number EN-51

Subject Area Energy

Project Title Conservation Voltage Reduction (CVR) Research

Performing Organization Battelle Pacific Northwest Laboratories

Principal Investigator Barry Kennedy BPA, P.O. Box 3621 - EPC (FTS)429-3463  
(Name) (Address) (Telephone) (503)230-3463

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

Study and analyze the results of various conservation voltage reduction programs currently in effect in various utilities. Based on this study, determine if this is a viable conservation measure and the extent of its application in the BPA region.

Technical Approach

Phase I of the study is being conducted in four tasks as follows:

1. Provide the general technical background of the theory for assessing the cost-effectiveness of CVR.
2. Provide information on equipment, systems, load data, and computer modeling the utility industry uses for assessing the cost-effectiveness of CVR.
3. Provide a supply function that describes conservation potential and cost of implementing CVR.
4. Provide conclusions and recommendations derived from Tasks 1 - 3.

General Progress in Last Two Years

The study will be completed in September 1987.

Plans for Next Twelve Months (FY 88)

Due to budget cuts no future work is planned beyond Phase I.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA \_\_\_\_\_ Priority 1 1987 Session Number EN-5k

Subject Area Energy

Project Title MCS Wall Moisture Study

Performing Organization Seton, Johnson and Odell

Principal Investigator Joe Flores BPA, P.O. Box 3621 - EPC (FTS)429-3000  
(Name) (Address) (Telephone) (503)230-3000

Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives:

- Determine the moisture content of wood members in walls built to MCS within the Pacific Northwest.
- Determine whether the wall moisture content depends on the local climate or the type of vapor barrier used.
- Develop a methodology to objectively evaluate the source and magnitude of moisture problems that have occurred in the houses of the Residential Standards Demonstration Program (RSDP) and have been reported to the supporting energy agencies.

Technical Approach

This project is a two phase survey and field examination of house walls in different PM climatic situations which have highly insulated walls (R19+). Moisture related problems will be reported.

General Progress in Last Two Years

All field testing was completed.

Plans for Next Twelve Months

Complete any analysis.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None

\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 1 1987 Session Number EN-51  
 Subject Area Energy  
 Project Title Pneumatic Conveying Improvements  
 Performing Organization Carroll, Hatch, & Associates  
 Principal Investigator Craig Wohlgemuth BPA, P.O. Box 3621 - EPC (FTS)429-3445  
 (Name) (Address) (Telephone)  
 Starting Year FY 1987 Estimated Completion Year FY 1989

Technical Objectives:

To analyze, design, and demonstrate three or more techniques for reducing electrical energy consumption in pneumatic conveying systems in the wood products industry.

Technical Approach:

The study will be conducted in three phases. Phase I is devoted to research, selection, and design. Phase II devotes itself to demonstration of the proposed technologies. Phase III addresses economic evaluation and technology transfer.

General Progress in Last Two Years:

Contract award is expected by September 1987.

Plans for Next Twelve Months (FY 1988):

Phase I is planned to be completed by June 1988. Phase II, demonstration, is expected to be underway 6 months later.

Coordination or Cooperation with Another Agency: None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ X \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 2 1987 Session Number EN-5m  
 Subject Area Energy  
 Project Title Electrolytic Hydrogen Production Studies  
 Performing Organization BPA Generation Engineering Branch  
 Principal Investigator Norman E. Fuller BPA, P.O. Box 3621 (FTS)429-3780  
 (Name) (Address) (Telephone)  
 Starting Year FY 1983 Estimated Completion Year FY 1988

Technical Objectives:

The objective of this project is to demonstrate utilization of seasonal and surplus hydroelectric energy by producing electrolytic hydrogen for use as a chemical feedstock or for storage and use as a fuel.

Technical Approach

A survey of the current state-of-the-art study was performed by Bio-Systems, Inc. and the Institute of Gas Technology (IGT). A market survey for new hydrogen and oxygen supplies was performed by IGT. A study of hydrogen usage in oil refineries is being performed.

General Progress in Last Two Years

The state-of-the-art review and the market survey are complete break even hydrogen production costs as a function of natural gas and electricity prices have been completed.

Plans for Next Twelve Months

Issue final report of oil refinery hydrogen usage.

Coordination or Cooperation with Another Agency:

None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Low Priority 1987 Session Number EN-5n

Subject Area ENERGY

Project Title Design Methods for Small Commercial Building Contractors

Performing Organization \_\_\_\_\_

Principal Investigator BPA, P.O. Box 3621 - EPC (FTS)429-Portland, OR 97208 (503)230- (Address) (Telephone)

Starting Year 1988 Estimated Completion Year FY 1989

Technical Objectives:

Study the design process for small commercial buildings to determine opportunities to improve building energy-efficiency.

Technical Approach

Determine sources of plans for small commercial buildings.

General Progress in Last Two Years

None, new project.

Plans for Next Twelve Months (FY 88)

No specific plans have been established yet.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation, and Life Extension

TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-5o

Subject Area Energy

Project Title Very Low Pressure Irrigation

Performing Organization Agricultural Research Service - USDA

Principal Investigator Alan Budner BPA, P.O. Box 3621 - EPC (FTS)429-3000 Portland, OR 97208 (503)230-3000 (Address) (Telephone)

Starting Year FY 1986 Estimated Completion Year FY 1987

Technical Objectives:

To adopt very low pressure sprinklers to Northwest center pivot irrigation system.

Technical Approach

Laboratory measurements and field measurements of sprinkler pressures and patterns and spray losses. Also evaluation of the place of special tillage practices with low pressure sprinklers.

General Progress in Last Two Years

Currently available pressure regulators are satisfactory. Uniformity can be as high as with high pressure systems. Spray losses can be minimal. Reservoir tillage is effective with low pressure sprinklers. Furrow bubblers are not recommended.

Plans for next Twelve Months

None. Project ends FY 1987.

Coordination or Cooperation with Another Agency: None

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation, and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority      1987 Session Number EN-5p  
Subject Area Energy  
Project Title Exhaust Air Heat Pump Study  
Performing Organization Lawrence Berkeley Laboratory  
Principal      (FT  
S) 429-3464  
Investigator Brad Miller - BPA Portland, OR 97208 (503) 230-3464 (Te  
lephone)      (Address)       
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

The objective of this study was to test the ventilation effectiveness and applicability within the Pacific Northwest of using exhaust air heat pumps with potable hot water heat recovery.

Technical Approach:

Phase I was a laboratory testing and analysis of three different types of exhaust air heat pumps. Each unit was tested and monitored to determine operation characteristics, energy usage, and over effectiveness. Phase II was taken over by the Residential Conservation Demonstration Project (RCDP) and involves in-situ monitoring. Phase III was to be a regional analysis and assessment of exhaust air heat pumps utilizing all the data from Phases I and II as input to a computer model. Phase III was cancelled due to lack of funds.

General Progress in Last Two Years:

All Phase I laboratory work has been completed. The draft final report for Phase I has been received and reviewed by Bonneville. The Phase II field demonstration is underway through the RCDP with eleven units being monitored.

Plans for Next Twelve Months (FY 88):

Continue with the field monitoring and finalize the Phase I report.

Coordination or Cooperation with Another Agency:

Not Applicable

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

     Safety of Dams      X      Technology Transfer  
     None  
     Project Maintenance, Rehabilitation and Life Extension

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Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority      1987 Session Number EN-5q  
Subject Area Energy  
Project Title Inspection of Crawl Spaces  
Performing Organization Battelle Pacific Northwest Laboratory  
Principal      (FT  
S) 429-4360  
Investigator Renee LaMore - BPA Portland, OR 97208 (503) 230-4360 (Te  
lephone)      (Address)       
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

This study is to determine whether moisture and/or insect infestations are more common within residences with underfloor insulation than without underfloor insulation.

Technical Approach:

Contractor inspected about 350 homes with and without underfloor insulation for moisture and/or insect infestations. The Contractor is conducting a detailed inspection of about 100 homes to determine the cause of the moisture and/or insect infestation.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement and inspection.

Plans for Next Twelve Months (FY 88):

Report is pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an cooperative agreement between BPA and Battelle Pacific Northwest Laboratory.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

     Safety of Dams      X      Technology Transfer  
     Project Maintenance, Rehabilitation and Life Extension      None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EN-5r  
Subject Area Energy  
Project Title In-Situ Window U-Value Testing  
Performing Organization Lawrence Berkeley Laboratory  
Principal Investigator Renee Lahore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

This study is to test selected windows in LBL's Mobil Window Thermal Testing Facility (MOWITT) to obtain a clear understanding of their performance in the field compared to the laboratory.

Technical Approach:

Contractor tested five windows in MOWITT and determine the winter season thermal performance of the windows compared to each other and to the laboratory test results from AAMA 1503.1. The effect of orientation will also be examined during this study.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement and testing.

Plans for Next Twelve Months (FY 88):

Report is pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an interagency agreement between BPA and Lawrence Berkeley Laboratory.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

\_\_\_\_ Safety of Dams X Technology Transfer \_\_\_\_\_ None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EN-5s  
Subject Area Energy  
Project Title Dehumidifier Field Test  
Performing Organization Portland State University  
Principal Investigator Renee Lahore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

This study is to determine the effectiveness of residential dehumidifiers as an energy conservation device in the winter season in this region.

Technical Approach:

Contractor installed a dehumidifier in a home in the Portland area and monitor the relative humidity, indoor and outdoor air temperature, the energy consumption, and the amount of moisture removed from the air.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement and testing.

Plans for Next Twelve Months (FY 88):

Report is pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an interagency agreement between BPA and Portland State University.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

\_\_\_\_ Safety of Dams X Technology Transfer \_\_\_\_\_ None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA \_\_\_\_\_ Priority \_\_\_\_\_ 1987 Session Number EN-5t  
Subject Area \_\_\_\_\_ Energy  
Project Title Wall Moisture Diffusion Mathematical Model  
Performing Organization Portland State University  
Principal Investigator Renee LaNore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-88

Technical Objectives:

This study is to develop a computerized mathematical model to identify conditions leading to condensation within various wall constructions. The mathematical model simulates moisture migration through the various wall components. The model will be used in evaluating new construction methods proposed for use in the Model Conservation Standards (MCS).

Technical Approach:

Contractor will develop the computer simulation and run the simulation on four typical wall constructions in three climates typical for this region.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement.

Plans for Next Twelve Months (FY 88):

Simulation development is in progress. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an interagency agreement between BPA and Portland State University.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ X Technology Transfer \_\_\_\_\_ None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA \_\_\_\_\_ Priority \_\_\_\_\_ 1987 Session Number EN-5u  
Subject Area \_\_\_\_\_ Energy  
Project Title Underfloor Insulation Study  
Performing Organization Portland State University  
Principal Investigator Renee LaNore - BPA Portland, OR 97208 (FTS) 429-4360  
(Name) (Address) (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-87

Technical Objectives:

This study examines the relative effectiveness of different underfloor insulation configurations. The data may be used to modify basement heat loss assumptions in the Standard Heat Loss Method (SHLM, Residential Standards Demonstration Programs (RSDP), and Model Conservation Standards (MCS).

Technical Approach:

Contractor installed underfloor insulation in a home in the Portland area in five different configurations. Heat flux during the winter season is compared between configurations to determine the most effective methods.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement, and testing.

Plans for Next Twelve Months (FY 88):

Report is still pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an interagency agreement between BPA, Portland State University and Manville.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

\_\_\_\_ Safety of Dams \_\_\_\_\_ X Technology Transfer \_\_\_\_\_ None  
\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EN-5v  
Subject Area Energy  
Project Title Multi-Family Air Exchange Study  
Performing Organization Battelle Pacific Northwest Labs  
Principal Investigator Renee Lahore - BPA Portland, OR 97208 (FTS) 429-4360  
(503) 230-4360 (Telephone)  
Starting Year FY-86 Estimated Completion Year FY-88

Technical Objectives:

The objectives of this study is to determine the air exchange rate in MCS multi-family dwelling units with the goal of developing a model for predicting heat loss in these types of building. The study will determine the air exchange rates both between units and outdoors.

Technical Approach:

Contractor placed a series of PFT sources and detectors in adjoining units to determine the air exchange rate during the winter season.

General Progress in Last Two Years:

Project design, contract negotiations, contract procurement, and testing of 27 of the 39 units.

Plans for Next Twelve Months (FY 88):

Final testing and report is still pending. All efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study is an interagency agreement between BPA and Battelle Pacific Northwest Labs.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

         Safety of Dams          X Technology Transfer          None  
         Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency BPA Priority            1987 Session Number EN-5w  
Subject Area Energy  
Project Title Ventilation Test-Bed Study  
Performing Organization Battelle Pacific Northwest Labs  
Principal Investigator Brad Miller - BPA Portland, OR 97208 (FTS) 429-3664  
(503) 230-3664 (Telephone)  
Starting Year FY-87 Estimated Completion Year FY-88

Technical Objectives:

The objectives of Phase I of this proposed study is to (1) perform a literature search to gather all information available regarding infiltration and ventilation research; experimentation, and demonstration, (2) recommend to BPA further research that might be needed in these areas and that are pertinent to the agency, and (3) develop, through a consortium of interested groups, agencies, and individuals, a promotional package that would attract potential supporters and participants into continued research.

Phase II would be any research and experimentation recommended as the result of Phase I efforts and approved by BPA. This Phase is not scheduled to be negotiated unless indicated as necessary by Phase I and found acceptable by BPA planning staff.

Technical Approach:

Task One will be the literature search intended to gather all information currently available on the world market regarding infiltration and ventilation technology.

Task Two will be to develop a consortium of individuals that would be interested in supporting any future research undertaken by BPA and to develop a promotional package that would be used to acquire such funds and services.

General Progress in Last Two Years:

Project design, contract negotiations, and contract procurement (still pending).

Plans for Next Twelve Months (FY 88):

All Phase I efforts would be completed within the next twelve months.

Coordination or Cooperation with Another Agency:

This study (Phase I only) will be an interagency agreement between BPA and Battelle Pacific Northwest Labs.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

         Safety of Dams          X Technology Transfer          None  
         Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-5x  
 Subject Area Energy  
 Project Title Evaluation of Low Pressure Nozzles for Set System  
 Performing Organization Washington State University  
 Principal Investigator Alan Budner BPA, P.O. Box 3621 - EPC (FTS)429-3000  
 (Name) (Address) (Telephone)  
 Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives:

Evaluate low pressure impact nozzles for irrigation systems of the set type (not center pivot) to determine which can be used instead of high pressure nozzles with a minimum of management changes.

Technical Approach

Measurement of throw radius, uniformity, flow exit angle, wind effect, minimum pressure needed, and other characteristics.

General Progress in Last Two Years

Development of a research plan.

Plans for next Twelve Months

Conduct research and make recommendations for suitable systems.

Coordination or Cooperation with Another Agency: None

General Research or Problems Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams \_\_\_\_\_ Technology Transfer X None

\_\_\_\_\_ Project Maintenance, Rehabilitation, and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
 TOPIC STATEMENT

Agency BPA Priority \_\_\_\_\_ 1987 Session Number EN-5y  
 Subject Area Energy  
 Project Title Heat Pump Water Heater in Multi-Family Housing Test  
 Performing Organization United Industries Corporation  
 Principal Investigator Brad Miller - BPA Portland, OR 97208 (FTS) 429-3464  
 (Name) (Address) (Telephone)  
 Starting Year FY-86 Estimated Completion Year FY-88

Technical Objectives:

The objective of this study is to monitor, collect, and analyze information regarding the energy usage and efficiency of commercial sized air-co-water heat pumps for multi-family residential applications. This information will be evaluated to address the effectiveness of heat pump application as compared to standard resistance and boiler methods of providing potable hot water.

Technical Approach:

The study will look at two separate ten story apartment buildings that have been converted to heat pump water heating as the primary supply source. Monitoring equipment will be installed and data collected for a period of not less than 12 consecutive months. Each of the buildings is also controlled by a computerized energy management system that is designed to optimize the system efficiency.

General Progress in Last Two Years:

Project design, contract negotiations and procurement, and development of the monitoring plan.

Plans for Next Twelve Months (FY 88):

The monitors and sensors are now being installed. Data collection will begin and be carried out for the next 12 months.

Coordination or Cooperation with Another Agency:

Not applicable

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

\_\_\_\_\_ Safety of Dams X Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency BPA Priority 3 1987 Session Number EN-5z

Subject Area Energy

Project Title Microcomputer Control of Irrigation and Pump Scheduling

Performing Organization Colorado State University

Principal Investigator Alan Budner BPA, P.O. Box 3621 - EPC (FTS)429-3460  
(Name) Portland, OR 97208 (503)230-3460  
(Address) (Telephone)

Starting Year 1987 Estimated Completion Year FY 1988

Technical Objectives:

Use advanced optimization techniques for irrigation scheduling to save the maximum amount of water and energy.

Technical Approach

Develop and test computer software for an actual irrigation system and compare against practice without this optimization.

General Progress in Last Two Years

No award as yet.

Plans for Next Twelve Months

See above.

Coordination or Cooperation with Another Agency

None.

General Research or Problems Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams \_\_\_\_\_ Technology Transfer X None

Project Maintenance, Rehabilitation, and Life Extension

APPENDIX G  
AGENDA AND TOPIC STATEMENTS  
HYDRAULICS SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987

Vicksburg, Mississippi

AGENDA

Hydraulics Session

Richard A. Sager, Chairman  
E. Dale Hart, Recorder

<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u>	<u>Agency</u>
1. Agenda			
Tuesday, Nov. 3		(ten minutes per topic)	
9:00 a.m.	H-1	<u>Debris/Ice Control</u>	
	H-1A	Investigation of Weed Collection Problem Behind a Floating Boom Intake Structure	TVA
	H-1B	Floating Debris Control Systems	USACE
	H-1C	Ice Passage at Submergible Tainter Gates	USACE
	H-1D	Hydraulic and/or River Modifications to Control Ice and Floating Debris	USACE
			Riprap Ice Effects on Riprap Structures Effect of Water Flow on Riprap Flood Channels Flow over Low Embankments USACE USACE USBR
9:40 a.m.	H-2	<u>Gates/Valves</u>	
	H-2A	Emergency Closure of Turbine Intake Gates	TVA
	H-2B	Emergency Gate Closures	USBR
	H-2C	Throttling Valve for High Head Applications	USBR
	H-2D	Cavitation Free Slide Gate Design	USBR
	H-2E	Cavitation Research	USBR
10:30 a.m.	Break		
10:45 a.m.	H-3	<u>Navigation</u>	
	H-3A	Measurement of Selected Tow-Induced Physical Effects	TVA
	H-3B	Evaluation of Channel Reaches with High Accident Rates	USACE
	H-3C	Minimizing the Effect of Hydropower Generation on Navigation	USACE
	H-3D	Lock Gate Impact Barriers	USACE
	H-3E	Precise Photogrammetric Mapping of Undulating Water Surfaces	USACE
11:35 a.m.	Break		
			<u>Predictive Techniques (Continued)</u> Pump Station Inflow-Discharge Hydraulics Scaling Dynamic Pressures Gravel Packs and Well Screens USACE USBR USBR
			<u>Predictive Techniques</u> Fish Entrainment Induced by Flow Transition in a Thermal Discharge Channel Predictive Techniques for Approach Flow Conditions to Spillways and Other Structures Hydraulic Analytical Techniques Dam Failure Hydrographs and Downstream Flood Routing Water Measurement Methods TVA USACE USBR USBR USBR

Wednesday  
Nov. 4

(Ten Minutes per Topic)

8:15 a.m.	11-6	<u>Sedimentation</u>	
	H-6A	Geomorphic factors Affecting Sediment Transport and Deposition in Northern Rivers	USACE
	H-6B	Simplified Sediment Transport	USACE
	H-6C	Stable Flood Control Channels	USACE
	H-6D	Mechanisms and Prediction Methods for Concentrated Flow Erosion	USDA
	H-6E	Prediction Models and Control Practices for Upland Erosion and Runoff	USDA
	H-6F	Develop and Evaluate Upland Erosion Control Practices and Systems	USDA
	H-6G	Yazoo Basin Erosion Control Research Project (Hydraulics)	USDA
	H-6H	Develop and Evaluate Erosion Control Conservation Tillage Systems	USDA
	H-6I	Principles of Sediment Transport in Upland Sand Bed Channels	USDA
	H-6J	Water Measurement	USBR
9:55 a.m.	Break		
10:10 a.m.	H-7	<u>Spillways/Stilling Basins</u>	
	H-7A	Stepped Spillway	USBR
	H-7B	Labyrinth Spillways	USBR
	H-7C	Stilling Basin Damage Due to Erosion	USBR
	H-7D	Scour Downstream from Stilling Basins	USACE
	H-7E	Combined Hydraulic Jump-Flip Bucket Energy Dissipator	USBR
	H-7F	Damage to Spillway Plunge Pools	USBR
	H-7C	Model Study of Unsteady Supercritical Flow Conditions in Open Channel Distribution Systems	USBR
11:20 a.m.	Break		
11:40 a.m.	H-8	<u>Turbines</u>	
	H-8A	Analyses of Hydroturbine Vibrations	TVA
	H-8B	Cavitation Studies	TVA
	H-8C	Evaluation of Turbine Operation	USBR
	H-8D	Online Hydroturbine Efficiency Monitoring and Optimization	TVA
	H-8E	Hydroturbine Flow Measurement Using the Pressure-Time Method	TVA

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency TVA Priority            1987 Session Number H-1a  
Subject Area             
Project Title Investigation of Weed Collection Problem Behind a Floating Boom Intake Structure  
Performing Organization TVA  
Principal Investigator Vahid Alavian (FIS)             
(Name) ENG LAB-N (615) 632-1851  
(Address) (Telephones)  
Starting Year FY87 Estimated Completion Year FY88

Technical Objectives:

To determine effective alternatives to move large amounts of neutrally buoyant weeds past a floating boom at the mouth of a 300-foot intake structure at bypass to intake ratios much less than one

Technical Approach:

A 1:200 scale model was constructed for preliminary investigation of the flow pattern in the vicinity of the intake. Various floating boom configurations are investigated. The promising alternatives would be closely examined in a proposed 1:90 scale model for determination of design parameters.

General Progress in Last Two Years:

Project started in mid-FY87. The 1:200 scale preliminary investigation is completed.

Plans for Next Twelve Months (FY88):

A 1:90 scale model is proposed for detailed study of the promising alternatives.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

           Safety of Dams            Technology Transfer            None  
           Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority            1987 Session Number H-1b  
Subject Area Hydraulics  
Project Title Floating Debris Control Systems  
Performing Organization USACRREL  
Principal Investigator Roscoe E. Perham, USACRREL (FIS) None  
(Name) 72 Lyme Road, Hanover, NH 03755-1290 (603) 646-4309  
(Address) (Telephones)  
Starting Year FY 85 Estimated Completion Year FY 87  
Technical Objectives:  
To provide more functional structures, equipment and methods for controlling and removing floating debris from rivers, lakes, and streams.

Technical Approach:

Identify floating debris, floating debris problems, and the various structures, methods, and equipment used to contain, remove, and dispose of floating debris through literature searches and on site visits. Conduct field studies and laboratory studies as needed to improve debris control.

General Progress in Last Two Years:

Field work - instrumented a major C of E debris boom - presently obtaining data

Laboratory - conducted boom performance studies

Plans for Next Twelve Months (FY 88):

Extension of field study, complete reports

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

           Safety of Dams            X Technology Transfer            None  
           Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number H-1c  
 Subject Area Hydraulics (Structures)  
 Project Title Ice Passage at Submergible Tainter Gates  
 Performing Organization USACRREL  
 Principal Jon E. Zufelt, USACRREL (FTS) None  
 Investigator 72 Lyme Road, Hanover, NH 03755-1290 (603) 646-4325  
 (Name) (Address) (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:

To determine gate openings required for passage of ice (and/or debris) over and under submergible tainter gates. Develop guidelines for operation of gates in submerged mode where vibration has been a reported problem.

Technical Approach:

A literature search will identify installations where submergible gates exist and identify problems of vibration in the submerged mode. Model studies will provide data (supplemented by field data) on required openings for ice passage. Threshold vibration submergences will be identified through model studies.

General Progress in Last Two Years:

A general compendium of submerged gate experience within the Corps was completed with vibration problems noted at several installations. Model studies looking at minimum gate openings in raised and submerged modes for ice passage were conducted. Model studies begun investigating threshold vibration gate submergence.

Plans for Next Twelve Months (FY 88):

Continued analysis of gate opening vs. head water/tailwater/submergence in cases where vibration was noted.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams XX Technology Transfer None  
XX Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number H-1d  
 Subject Area Hydraulics  
 Project Title Hydraulic and/or River Modifications to Control Ice and Floating Debris  
 Performing Organization USACRREL  
 Principal Jon E. Zufelt, USACRREL (FTS) None  
 Investigator 72 Lyme Road, Hanover, NH 03755-1290 (603) 646-4325  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 88

Technical Objectives:

To perform analytic and physical model studies for determining feasible methods for re-directing surface flow, and thus ice and debris, away from lock approach areas.

Technical Approach:

Using physical models, the effects of hydraulic surface jets, flow developers, submerged groins, and air bubbleurs on the surface flow characteristics in the vicinity of a lock approach will be investigated. Analysis of cost of methods and effects on navigation will determine feasibility.

General Progress in Last Two Years:

General tests on jets in a cross flow were conducted. The effects of submerged groins, air bubbleurs and hydraulic jets on surface flows in physical navigation models were documented. A 1:25 scale model was constructed and calibrated for continued testing of hydraulic jets and flow developers. Effects on navigation investigated.

Plans for Next Twelve Months (FY 88):

Complete analysis of jets in crossflow  
 Complete physical model testing

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams            Technology Transfer             
XX Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number H-2a  
 Subject Area Hydraulics  
 Project Title Emergency Closure of Turbine Intake Gates  
 Performing Organization TVA  
 Principal Investigator Ted Fain (Name) ENG LAB-N (Address) (615) 632-1953 (FTS) (Telephones)  
 Starting Year FY82 Estimated Completion Year Continuing

Technical Objectives:

Develop a turbine intake gate and lifting beam configuration that will allow the gates to be seated during wicket gate failure and simultaneous turbine generation load rejection.

Technical Approach:

Approximately 1:12 scale model facility with instrumented lifting beam and gate. Supplemental field tests for determination of prototype friction factors and for verification of performance of modified lifting beams and/or gates.

General Progress:

Solution developed for Melton Hill Dam was field tested. Analysis of closure problems at Nickajack Dam completed.

Plans for Next Twelve Months:

Design and test modifications for Wilson and Fort Patrick Henry Dams.

Coordination or Cooperation with Another Agency:

Consulted with Henry Falvey of USBR to review technical approach.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-2b  
 Subject Area Hydraulics  
 Project Title Emergency Gate Closures  
 Performing Organization Bureau of Reclamation  
 Principal Investigator K. Warren Frizell (Name) PO Box 25007, MC D-1532 (Address) (FTS) 776-6156 (303) 236-6156 (Telephone)  
 Starting Year FY86 Estimated Completion Year FY89

Technical Objectives: To establish design and test procedures for operation of outlet works guard gates under unbalanced head conditions. In particular to evaluate air demand for air vent design, and to determine hydraulic downpull for hoist load capacity tests.

Technical Approach: Performed hydraulic model studies on a 1:12 scale model of a typical outlet works configuration. Collected two sets of field measurements at a prototype installation. A mathematical model will be written to aid designers in determining air demand.

General Progress in Last Two Years: Finished hydraulic model studies and collected two sets of prototype data at Silver Jack Dam. Discovered several interesting items, including additional maintenance considerations which could have serious implications.

Plans for Next Twelve Months (FY88): Take one additional set of hydraulic downpull measurements for a flat bottomed gate. Finish math model and reevaluate Bureau structures with emergency gates using the new math model.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H-2d  
Subject Area Hydraulics

Project Title Cavitation Free Slide Gate Design

Performing Organization Bureau of Reclamation  
Principal Investigator Brent W. Mefford PO Box 25007, MC D-1532 (FIS) 776-6166  
Thomas J. Isbester Denver CO 80225 (303) 236-6166  
(Name) (Address) (Telephone)

Starting Year FY-new Estimated Completion Year FY

Technical Objectives: Develop a cavitation free slide gate design which provides aeration to the sidewalls and invert of the downstream gate frame. Development should also include field renewable bottom seat and side seal seats.

Technical Approach: Include a 45° chamfer attached to the bottom seat (size to be investigated) and extensions to the side seal seats (size to be investigated) which will provide adequate aeration around the sides and invert of the jet. In addition, modify the downstream frame at the air vent to eliminate small holes which may be plugged by debris. Design the slot to minimize the effects of instabilities from vortex action. The design would be investigated and refined using the high-head pump and/or the low ambient pressure test facilities in the hydraulic laboratory.

General Progress in Last Two Years: None (New project)

Plans for Next Twelve Months (FY88): As described above.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: None Technology Transfer None  
X Safety of Dams Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-2c  
Subject Area Hydraulics

Project Title Throttling Valve for High Head Applications

Performing Organization Bureau of Reclamation  
Principal Investigator Thomas J. Isbester PO Box 25007, MC D-1532 (FIS) 776-6146  
and Hilaire Peck Denver CO 80225 (303) 236-6146  
(Name) (Address) (Telephone)

Starting Year FY87 Estimated Completion Year FY89

Technical Objectives: To develop a valve which can withstand long term operation at high differential heads and which requires a minimum of installation space, is simple to operate, and is inexpensive to construct.

Technical Approach: Utilizing data available for submerged jets, a configuration was developed which meets the above requirements.  
The valve has been used at differential heads as high as 350 feet with no adverse cavitation erosion to the valve or to the pipe downstream.

General Progress in Last Two Years: A 6-inch version of the valve has been designed and fabricated of stainless steel. A patent for the U. S. Government is being applied for. A number of applications have developed for a valve which is suitable for the high head range.

Plans for Next Twelve Months (FY88): Plans to perform extended time operational tests at high heads to document the valve's ability to operate over a long period of time without sustaining damage.

Coordination or Cooperation with Another Agency: We expect other agencies to have need for this type of valve.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: None Technology Transfer None  
X Safety of Dams Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number B-2a  
 Subject Area Hydraulics  
 Project Title Cavitation Research  
 Performing Organization Bureau of Reclamation  
 Principal P.O. Box 25007, MC D-1532 (FIS) 776-6157  
 Investigator Brent W. Mefford Denver CO 80225 (303) 236-6157  
 (Name) (Address) (Telephone)  
 Starting Year FY65 Estimated Completion Year FY90

Technical Objectives: Conduct research on cavitation in hydraulic structures. Develop semiempirical relationships to improve the prediction of cavitation and cavitation related damage.

Technical Approach: Conduct laboratory experiments in the Bureau of Reclamation's LPPC (low ambient pressure chamber) to systematically identify cavitation and measure the associated flow field.

General Progress in Last Two Years: We have investigated cavitation inception and development on fixed cone valves, jet flow gates, multiple orifice valves, isolated surface irregularities and uniformly distributed roughnesses.

Plans for Next Twelve Months (FY88): During FY88 we will be investigating the correlations between skin friction and cavitation inception. Semiempirical correlations developed by R.E.A. Arndt at the University of Minnesota will be verified experimentally with the objective of extending the work to include quasi-uniformly rough surfaces typical of those found in hydraulic structures.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number H-3a  
 Subject Area \_\_\_\_\_  
 Project Title Measurement of Selected Tow-Induced Physical Effects  
 Performing Organization TVA  
 Principal Investigator Vahid Alavian ENG LAB-N (FTS)  
 (Name) (Address) (615) 632-1851  
 (Telephone)  
 Starting Year FY87 Estimated Completion Year FY87

Technical Objectives:

To establish a quantitative data base which can be used to predict environmental impacts of an altered increment of river traffic resulting from improvement of one or more locks and dams on a system.

Technical Approach:

Selected tow-induced physical effects will be characterized through simultaneous, computer controlled measurement of a group of parameters throughout a typical main channel cross-section, a back island area, and a drained tributary.

General Progress in Last Two Years:

Instrument packages capable of measuring 2-directional velocity, turbidity, and temperature are being assembled for installation at various positions in the channel cross-section. A sophisticated microcomputer based data acquisition system is being developed for use in the field.

Plans for Next Twelve Months (FY88):

Upon completion of the test scenarios, data will be inspected and prepared for use in an energy flow mathematical model.

Coordination or Cooperation with Another Agency:

The work is being performed under an interagency agreement with the Corps of Engineers, Huntington District in the Marmet Pool, Kanawha River, WV.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency COE Priority 17 1987 Session Number B-3b  
 Subject Area Evaluation of Channel Reaches with High Accident Rates  
 Project Title USAE Waterways Experiment Station  
 Performing Organization USAE Waterways Experiment Station  
 Principal Investigator Larry L. Daggert (Name) (601) 542-2259 (Address) (601) 542-2259 (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives:  
 A recent study showed that accidents on inland waterways were clustered in particular river reaches. The objective of this project is to improve the safety of tow operations and to reduce repair and maintenance costs to navigation structures by reducing ramblings and grounding in those waterway reaches with historically high accident rates.

Technical Approach:  
 An in-depth review of accident reports and statistics will identify those reaches with high accident rates. Specific reaches will be selected for further analysis based on accident causes and the potential for improving the operating conditions. Simulations and/or model studies will be designed to further identify probable causes and potential rehabilitation schemes that can improve the operational safety of each reach.

General Progress in Last Two Years:  
 Accident records from the U.S. Coast Guard CASMAIN data base for 1981-1984 have been reduced and high accident rate reaches on the nation's inland waterways have been identified. The location and general accident type category have been mapped on available navigation charts to identify the general waterway characteristics of these reaches. The accident reaches that will be studied have been grouped from 106 on 17 waterways to 24 on 7 waterways. The accident rates in the reaches vary from 3 to 11 per mile with approximately 150 accidents per year.

Plans for Next Twelve Months (FY 88):  
 The high accident reaches will be grouped based on common characteristics and select reaches analyzed in more detail. Accident reports will be reviewed to identify dominant causes and contributing factors. Potential improvements will be identified.

Coordination or Cooperation with Another Agency:  
 This work has been closely coordinated with the U.S. Coast Guard.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency COE Priority 17 1987 Session Number H-3c  
 Subject Area Hydraulics  
 Project Title Minimizing the Effect of Hydropower Generation on Navigation  
 Performing Organization COE  
 Principal Investigator C. M. Holmes (Name) CEWES-HR-N Vicksburg, MS (Address) (601) 542-2634 (Telephones)  
 Starting Year FY 81 Estimated Completion Year FY 89

Technical Objectives:  
 To develop design criteria and guidelines that can be used in the development of hydropower at existing and future navigation projects considering location and structures to eliminate or reduce adverse effects on navigation.

Technical Approach:  
 A 1:70 scale physical model is being used to test various hydroplant locations, channel sizes, and remedial structures to determine the effects on a model towboat.

General Progress in Last Two Years:  
 Study was contracted to University of Iowa. Testing of a 200-ft-wide channel with a powerhouse opposite the lock and adjacent to the spillway was completed.

Plans for Next Twelve Months (FY 88):  
 Contract study will be completed.

Data will be evaluated and relationships will be developed and presented.  
 Coordination or Cooperation with Another Agency:  
 None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number H-3d  
 Subject Area Hydraulics  
 Project Title Lock Gate Impact Barriers  
 Performing Organization USAWES, Hydraulics Laboratory  
 Principal (FTS) 542-2693  
 Investigator Sandra K. Martin, PO Box 631, Vicksburg, MS (601) 624-3581  
 Starting Year FY 85 Estimated Completion Year FY 89  
 Technical Objectives:

To develop effective methods of protecting lock gates from vessel impact with a minimum sacrifice of lock chamber length.

Technical Approach:

A literature search will be conducted on methods presently in use on lock structures for the prevention of accidents at lock gates. A physical model of a typical lock approach and chamber with gates will be used for the study. A free-running towboat and barges will be used to investigate the forces involved at impact. Several barrier types will be selected and tested for suitability to various shaped bows.

General Progress in Last Two Years:

The literature search has been completed. Numerous types of barriers were found to be common on locks abroad. However, most barriers were designed or are suitable for snags only. The model lock and tow have been constructed on a 1:25-scale. Instrumentation has been installed which records the speed and position of the towboat as it impacts a steel cable which has load cells mounted on the ends to record the tension in the cable. Testing has begun to determine the force-time history of a high-mass, low-velocity vehicle upon impact of an elastic cable.

Force history data will be evaluated to design several types of barriers (concepts of which were found from literature search). A model barrier(s) will be constructed. A qualitative analysis of the barrier(s) will be performed to determine any adverse effects it may have on the filling and emptying times, and the arrest of a barge train.

Coordination or Cooperation with Another Agency:

The Structures Laboratory, WES, will provide structural expertise on the design of the barriers.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number H-3e  
 Subject Area Hydraulics  
 Project Title Precise Photogrammetric Mapping of Undulating Water Surfaces  
 Performing Organization Waterways Experiment Station and Univ. of Washington  
 Principal Richard G. McGee, USAEMES, P.O. Box 631 (FTS) 542-3581  
 Investigator CEWESHIS-H, Vicksburg, MS 39180-0631 (601) 624-3581  
 Starting Year FY 86 Estimated Completion Year FY 91

Technical Objectives: Comparatively evaluate operating and performance characteristics of different navigation lock filling and emptying system designs. Specifically, accurately map the changing lock water surface during filling and emptying operations to determine severity of water-surface oscillations generated during operation.

Technical Approach: The Waterways Experiment Station (WES) will conduct comprehensive prototype studies of navigation locks of various filling and emptying system designs. Presently, a Close-Range Photogrammetric Mapping System is being developed to measure the undulating lock water surface during operation. The use of photogrammetry as a measurement technique will provide measurements in 3-Dimensional space with unprecedented accuracies for hydraulic measurements. The system seems to have a high potential for use in other hydraulic measurement applications.

General Progress in Last Two Years: A contract to develop the photogrammetry system was awarded to Prof. Sandor Veress of the University of Washington. The software has been developed and camera and test area evaluations have been completed. Relative accuracies in all directions (x,y,z) are in the range of 1/100,000 to 1/200,000.

Plans for Next Twelve Months (FY 88): The instrumentation development should be completed by December 1987. One, or possibly two, locks will be tested in FY 88. The respective reports will be published in the following FY.

Coordination or Cooperation with Another Agency: None at this time.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency CE \_\_\_\_\_ Priority \_\_\_\_\_ : 987 Session Number R-6a  
 Subject Area Hydraulics  
 Project Title Ice Effects on Riprap Structures  
 Performing Organization USACRREL  
 Principal James L. Vuebber, USACRREL (FTS) None  
 Investigator 72 Lyme Road, Hanover, NH 03755-1290 (603) 646-4418  
 (Name) Address/ (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 93

Technical Objectives:

To investigate the interaction of ice and associated hydraulic forces with riprap shore protection and river training structures. Such structures will include revetments, submerged sills, groins, and canal linings.

Technical Approach:

Initially a field monitoring program will be conducted to monitor ice and associated hydraulic forces on a variety of riprap structures. This will be followed by physical modeling and field test installations.

General Progress in Last Two Years:

This is a new start.

Plans for Next Twelve Months FY 89:

Gather information on types of structures involved and modes of ice action. Locate field sites for monitoring program to begin in FY89.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE \_\_\_\_\_ Priority I \_\_\_\_\_ : 987 Session Number R-4b  
 Subject Area Hydraulics  
 Project Title Effect of Water Flow on Riprap Flood Channel  
 Performing Organization USAHEES, Hydraulics Laboratory  
 Principal: FTS 142-1284  
 Investigator S. I. Maynard, PO Box 631, Vicksburg, MS (601) 634-3284  
 (Name) Address/ (Telephones)  
 Starting Year FY 76 Estimated Completion Year FY 91

Technical Objectives:

To develop improved criteria for design of stable riprap protective lining for flood channels.

Technical Approach:

Physical model investigations are being used to determine stable riprap size on the bed and banks of straight and curved channels. The effects of riprap gradation, thickness and shape are also being evaluated.

General Progress in Last Two Years:

Results from the tilting flumes studies that were conducted at WES and under contract at Colorado State University have been reported at recent symposia. A new design procedure based on these results and on results from a curved channel at WES has been developed and compared to available prototype data. Numerical studies were initiated to determine velocity distribution and scour depth in open channels. A large scale test facility was constructed.

Plans for Next Twelve Months FY 89:

The new design procedure will be used to update the CE manual on riprap design. Testing will be initiated in the Riprap Test Facility to determine the stability of a wider range of riprap gradation, thickness, and shape. Numerical studies will continue on velocity distribution and scour depth in open channels.

Coordination or Cooperation with Another Agency:

Results are being published in symposia to inform all agencies of this research. No other agencies have been identified that are conducting research in this area.

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-4c  
 Subject Area Hydraulics  
 Project Title Flow Over Low Embankments  
 Performing Organization Bureau of Reclamation  
 Principal Investigator Thomas J. Rhone (Name) PO Box 25007, MC D-1531 (Address) (303) 236-6164 (Telephone)  
 Starting Year FY84 Estimated Completion Year FY

Technical Objectives: Study the hydraulics of flow over low embankments and possible alternate ways of protecting embankments such as roller compacted concrete, riprap, gabions, crest caps, grass and others.

Technical Approach: Stress full size studies, to determine the nature of steep shallow flow and to help determine erosion and damage potential to protective treatments. Conduct smaller qualitative laboratory studies to gain further insight.

General Progress in Last Two Years: Finished report on 1:15 scale laboratory study of flow over low embankments. Helped monitor outside contract studies. Some hydraulic model studies were conducted simulating stepped roller compacted concrete spillway.

Plans for Next Twelve Months (FY88): Publish report on 1:15 scale model study. Continue studies of flow over stepped roller compacted concrete.

Coordination or Cooperation with Another Agency: Cooperation with Federal Highway Administration in regard to outside contract work.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_ None \_\_\_\_\_

TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number II-5a  
 Subject Area \_\_\_\_\_  
 Project Title Fish Entrainment Induced by Flow Transition in a Thermal Discharge Channel  
 Performing Organization TVA  
 Principal Investigator Vahid Alavian (Name) ENG LAB-N (Address) (615) 632-1851 (Telephones)  
 Starting Year FY87 Estimated Completion Year FY87

Technical Objectives:

To characterize velocity distribution in the thermal discharge channel of a power plant as the plant transitions from fully open cycle to a fully closed cycle mode.

Technical Approach:

The first phase of the study was to conduct a field investigation where the velocity patterns in a geometrically irregular channel were measured at various plant operation modes. The second phase of the study was to numerically simulate the flow patterns using a two-dimensional (depth-averaged) hydrodynamic model. The results are useful in identifying and numerically testing various fish reduction or exclusion schemes from the discharge channel.

General Progress in Last Two Years:

The study is completed.

Plans for Next Twelve Months (FY88):

Coordination or Cooperation with Another Agency

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_ None \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number B-5b  
 Subject Area Hydraulics  
 Project Title Predictive Techniques for Approach Flow Conditions to Spillways & other Structures  
 Performing Organization USAMES, Hydraulics Laboratory  
 Principal (FIS) 542-2491  
 Investigator R. S. Bernard, PO Box 611, Vicksburg, MS (601) 634-2491  
 Address Telephones  
 Starting Year FY 84 Estimated Completion Year FY 89  
 Technical Objectives:

To develop numerical predictive techniques for computing approach flow fields near hydraulic structures which are accurate and efficient.

Technical Approach:

Existing multidimensional hydrodynamic modeling approaches will be evaluated for efficiency. From these, one holding the most promise will be selected, modified as needed, and documented in order to provide field personnel with a usable numerical tool for approach flow calculation.

General Progress in Last Two Years:

A two-dimensional hydrodynamic model, STREMR, has been modified and developed. Evaluation of the code has shown it to be accurate and relatively efficient. The code comes complete with a coordinate system generator and plotting codes. Draft documentation on the model, and final documentation on the grid generator, is available.

Plans for Next Twelve Months (FY 88):

Documentation of the model will be completed and distributed. More sophisticated case studies will be tested with the model. Evaluation of more rigorous turbulence closure models will be conducted.

Coordination or Cooperation with Another Agency:

USBR has requested this model. CE personnel have provided USBR-Denver personnel with a one week training course on the model, documentation, and the model itself.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_ None  
 Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number B-5c  
 Subject Area Hydraulics  
 Project Title Hydraulic Analytical Techniques  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1532 (FIS) 776-6166  
 Investigator Cassie Klumpp Denver CO 80225 (303) 236-6166  
 (Name) (Address) (Telephone)

Starting Year FY85 Estimated Completion Year FY90

Technical Objectives: The objective of this research is to obtain methods to analytically determine flow conditions through hydraulic structures for application to USBR structures. The use of hydraulic analytical techniques will, in some cases, eliminate the need for expensive physical model studies.

Technical Approach: The Navier-Stokes equations of motion can be integrated after a term expressing the rate of energy production and energy dissipation is introduced into the equations. This makes it possible to solve several problems including velocity distributions in rectangular canals, flow velocities in bends, and motions of buoyant plumes.

Two computer programs will be developed to apply these new concepts to Bureau problems. The first will be a two-dimensional model that will allow analysis of problems where either a plan view or elevation view of the flow will suffice showing flow patterns in two dimensions. The second model will be a three-dimensional model to investigate flows toward intakes, tunnel spillways and stratified flows around selective structures. Each model will be verified using available data from physical models or field installations.

General Progress in Last Two Years: The current model simulates two-dimensional flow with viscosity, bottom resistance and vorticity. Six programs were developed by the Corps of Engineers which generate the grid, solve the fluid flow problem and plot the results. These programs were used in a 40-hour short course taught by Dr. Robert Bernard from MES July 6-10, 1987, for Bureau personnel.

Plans for Next Twelve Months (FY88): The plan in the next 12 months is to test the model on different problems within the Hydraulics Branch. Obtain all updates on the computer code from the Corps of Engineers and incorporate into the USBR's version of the computer code. The computer code will also be converted to run on an IBM compatible AI computer including conversion of all of the plot codes from TEMPLATE to PLOT88 or some other graphics software.

Coordination or Cooperation with Another Agency: The USBR has worked closely with the Corps of Engineers on these programs. This has saved the USBR both time and money since the program was originally going to be developed through a contract award.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_ None  
 Safety of Dams  Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency Reclamation Priority 1987 Session Number H-5d  
 Subject Area Dam Safety - Dam Failure Inundation Mapping  
 Project Title Dam Failure Hydrographs and Downstream Flood Routing  
 Performing Organization Bureau of Reclamation, Engineering & Research Center  
 Principal Wayne J. Graham, Bureau of Reclamation, Mail Code D-753 (FTS) 776-3785  
 Investigator P.O. Box 25007, Denver, CO 80225-0007 (303) 236-3735  
 (Name) (Address) (Telephones)  
 Starting Year FY 80 Estimated Completion Year FY 89

**Technical Objectives:**  
 Knowledge of the maximum outflow resulting from a dam breach as well as the rate of peak discharge attenuation with time and distance from the dam is needed to determine the dam failure flooded area. Technical objectives include: (1) quantifying the peak discharges that have been recorded from actual failures, (2) improving techniques for estimating breach outflow hydrographs, and (3) improving techniques for predicting flood wave travel times and peak discharge attenuation.

**Technical Approach:**

1. Literature search on breaching characteristics of failed dams and previously developed analytical models.
2. Literature search on previously conducted laboratory modeling of dam breaches and resulting flood wave analysis.
3. Literature search on methods for presenting inundation information and risk information to the public, public safety officials, and decision makers.
4. Utilize selected existing analytical models, improve them or prepare new computer models to describe the hydrodynamic forces within the reservoir at the breach opening, and to route this failure hydrograph dynamically downstream.
5. Develop guidance on the use of existing analytical models prepared by the National Weather Service.

**General Progress in Last Two Years:**

- The appendix, "Determination of Inundated Areas for Decision Analysis," was published in the Guidelines to Decision Analysis, AGER Technical Memorandum No. 7.
- Breach parameters and flooded area data were collected for recent dam failures.
- Improvements were made in the techniques used to estimate peak dam failure outflows.
- Guidance on the use of existing analytical dam break models was developed.

**Plans for Next Twelve Months (FY 88):**

Further improvement in techniques used for determining the magnitude of dam breach outflows and resultant downstream flooding.

**Coordination or Cooperation with Another Agency:**

Some coordination has taken place with individuals at other agencies involved in similar research.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H-5a  
 Subject Area Hydraulics  
 Project Title Water Measurement Methods  
 Performing Organization Bureau of Reclamation  
 Principal P.O. Box 25007, MC D-1532 (FTS) 776-6166  
 Investigator Cassie Klumpp Denver CO 80225 (303) 236-6166  
 (Name) (Address) (Telephone)  
 Starting Year FY83 Estimated Completion Year FY90

**Technical Objectives:** The objective of this research is to develop cost effective mathematical models for analyzing flow through water measurement structures such as Parshall flumes and ramp flumes. These methods could be useful for future design of water measurement structures.

**Technical Approach:** The approach for the project is to develop a mathematical model to analyze flow through water measurement structures using a momentum balance. The model is to be verified with existing physical model data, field tests and comparison to energy model results. A user's manual will be published to describe the program and the required input data to the model.

**General Progress in Last Two Years:** A momentum computer model has been tested with physical model data from a trapezoidal flume and from data collected on a ramp flume located at the A Canal in Klamath, Oregon. The results of the model calibration studies indicate that the momentum balance will not work for rapidly varying flow regimes. The model cannot predict the water surface elevations through measurement flumes especially as critical depth is approached. The model use will be limited to applications on canal contractions or expansions or any other applications where an energy model would work.

**Plans for Next Twelve Months (FY88):** The user's manual for the momentum model will be published. A report describing the results of the Klamath field studies on the A-Canal will also be completed. The use of other two- or three-dimensional computers models will be explored to see if these models can handle flow through hydraulic structures where rapidly varying flow exists.

**Coordination or Cooperation with Another Agency:** The U. S. Army Corps of Engineers will be contacted to determine their approach on modeling flow through hydraulic structures. Their new program WESPC may be tested on a hydraulic measurement structure, but preliminary information shows that it cannot be used because of limitations on Froude number and Reynolds number.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority I 1987 Session Number H-5g

Subject Area Hydraulics

Project Title Scaling Dynamic Pressures

Performing Organization Bureau of Reclamation (FIS) 776-6156  
 Principal Investigator K. Warren Fritzel PO Box 25007 MC D-1532 (303) 236-6156  
 (Name) (Address) (Telephone)

Starting Year FY85 Estimated Completion Year FY90

**Technical Objectives:** The main objective is to gain more knowledge so that accurate prototype information can be gained from hydraulic scale models concerning dynamic pressure fluctuations. In particular, the spectral content and magnitude of the model vs. the prototype are needed.

**Technical Approach:** Measurements have been made in a 1:40 scale model and a prototype tunnel spillway (Glen Canyon). These have shown large differences. A series of tests will now be run to look at relative effects (due to scale) in the turbulent boundary layer of a pipe flow.

**General Progress in Last Two Years:** One set of model-prototype measurements have been taken and analyzed.

**Plans for Next Twelve Months (FY88):** Additional analysis of the model-prototype measurements needs to be done. Planning and execution of the next set of laboratory tests will be done.

**Coordination or Cooperation with Another Agency:**

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority I 1987 Session Number H-5f

Subject Area Hydraulics

Project Title Pump Station Inflow-Discharge Hydraulics

Performing Organization USARMS, Hydraulics Laboratory (FIS) 542-2622  
 Principal Investigator B. P. Fletcher PO Box 631 Vicksburg, MS (601) 634-2622  
 (Name) (Address) (Telephone)

Starting Year FY82 Estimated Completion Year FY 88

**Technical Objectives:** The study will produce new and improved guidance for design of sumps and pump intakes. This will provide reliable flood-control facilities and reduce costs for design, construction, operation and maintenance of local and corps-operated pumping stations.

**Technical Approach:**

Physical model investigations in a generalized facility and data analysis will be conducted to determine the effects of a variety of approach flow conditions, sump, and pump intake geometries on the hydraulic inflow characteristics.

**General Progress in Last Two Years:**

A system has been developed for a acquisition in the research facility. Test results obtained with the formed suction inlet (FSI) provided design guidance to the St. Louis, Memphis, and Vicksburg Districts on the Alton, Huxtable, and Yazoo Backwater Pumping Stations.

**Plans for Next Twelve Months (FY 88):**

Conduct physical model tests to develop design guidance for FSI. The design guidance will include divider wall length, angle of approach flow, submergence, and flow rate. Prepare a letter report describing tests and results.

**Coordination or Cooperation with Another Agency:**

Pumping station research has been discussed with the Aiken Laboratory.

**General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None

Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number R-5h  
Subject Area Hydraulics  
Project Title Gravel Packs and Well Screens  
Performing Organization Bureau of Reclamation  
Principal E. R. Zeigler PO Box 25007, MC D-1531 (FIS) 776-6155  
Investigator C. P. Suvalski Denver CO 80225 (303) 236-6155  
(Address) (Telephone)

Starting Year FY72 Estimated Completion Year FY89  
Technical Objectives: To determine optimum thickness of well screen gravel packs for various screen types, pack gradations, and aquifer gradations. To evaluate well development methods and improve when possible.

Technical Approach: Use a section model to investigate: (a) 3-in, 6-in, and 9-in gravel pack thicknesses with two gravel pack gradations and two well screen types; (b) evaluate well development methods, such as high velocity water jetting, surge block, raw hiding both singly and in combination.

General Progress in Last Two Years: Have completed part (a) Report issued - REC-ERC-86-7. Studies continuing with a coarse aquifer and optimum gravel pack thickness previously determined. Current studies are also defining best well development method for a coarse gravel-sand aquifer.

Plans for Next Twelve Months (FY88): Finish current phase and write report. Implement program to evaluate well development techniques and determine improvements as indicated.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USACRREL Priority \_\_\_\_\_ 1987 Session Number B-6a  
Subject Area Hydraulics  
Project Title Geomorphic Factors Affecting Sediment Transport and Deposition in Northern Rivers  
Performing Organization USACRREL  
Principal USACRREL, 72 Lyme Road (FIS) None  
Investigator Dr. D. Lawson Hanover, NH 03755-1290 (603) 646-1344  
(Name) (Address) (Telephone)  
Starting Year FY 82 Estimated Completion Year FY 92

Technical Objectives: Analyze the geomorphic factors determining the quantity, location and timing of sediment aggradation, degradation and channel migration in northern rivers and evaluate the effects of structural and non-structural modifications on sediment aggradation and degradation.

Technical Approach:

Existing field techniques are evaluated and methodology developed. Field measurements and observations are being made seasonally at selected locations on northern rivers (Tanana and Matanuska) to quantitatively analyze sediment sources, hydrologic parameters and geomorphic factors in relation to sediment transport, deposition, erosion and channel migration.

General Progress in Last Two Years:

Preliminary data indicate frazil ice deposits and sub-ice channels are critical factors determining bed scour rates and major shifts in river channels before breakup. The evolution and morphology of frazil deposits have been analyzed; in 1986, two frazil ice samplers were developed for this purpose. An underwater television camera was used to estimate frazil ice transport and deposition rates. Geophysical techniques were used to measure channel morphology and ice thickness and growth.

Plans for Next Twelve Months (FY 88):

Complete the Winter Field observations for the Tanana River on the frazil ice deposit and document their influence on bed migration during the winter period.

Coordination or Cooperation with Another Agency:

WES, HEC, USGS, MRD-OMAHA

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number H-6b  
 Subject Area Flood Control Hydraulics  
 Project Title Simplified Sediment Transport  
 Performing Organization USAE Waterways Experiment Station  
 Principal Investigator William A. Thomas (FTS) 542-2511  
 (Name) (Address) (601) 634-2511 (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 88

Technical Objectives:

Provide a capability that can be used to calculate sedimentation in small flood control channels within the time available to respond to customers' schedules.

Technical Approach:

Streamline HEC-6 Network Version to simplify input, redesign output, and eliminate awkward computation algorithms. Design the simplified model for small computers, rapid IO and graphics.

General Progress in Last Two Years:

N/A

Plans for Next Twelve Months (FY 88):

Provide the simplified approach and documentation.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency Corps of Engineers Priority 1 1987 Session Number B-6c  
 Subject Area Hydraulics  
 Project Title Stable Flood Control Channels  
 Performing Organization USAE Waterways Experiment Station, Hydraulics Laboratory  
 Principal Investigator J. J. Ingram (FTS) 542-2195  
 (Name) (Address) (601) 634-2195 (Telephones)  
 Starting Year FY 82 Estimated Completion Year FY Continuing

Technical Objectives:

Develop stable flood control channel design guidance for use in the design offices of the Corps of Engineers.

Technical Approach:

Data pertaining to channel improvements and stabilization measures for various types of streams encountered in the Corps of Engineers local flood protection projects will be collected, analyzed, correlated, and published as technical guidance.

General Progress in Last Two Years:

A nationwide inventory of local flood protection projects within the Corps of Engineers has been completed to determine the field needs and to assist in establishing priorities for development of design guidance. Data on the response of sand-bed streams to various channel improvement methods is being collected for evaluation.

Plans for Next Twelve Months (FY 88):

Analyze the response of sand-bed streams to channel improvement schemes and prepare design guidance document.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 6 1987 Session Number B-6d

Subject Area Hydraulics

Project Title Mechanisms and Prediction Methods for Concentrated Flow Erosion

Performing Organization USDA National Sedimentation Laboratory

Principal Investigator Earl Grissinger, Soil Scientist (FTS) None  
USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
(Name) (Address) (Telephone)

Starting Year FY1983 Estimated Completion Year FY1988

Technical Objectives: Understand the mechanisms and develop the means for predicting the occurrence of gullies and other concentrated flow erosion.

Technical Approach: Identify cohesive soil erosion processes and mechanisms, and conditions that influence the probability of gully occurrence. Develop a gully erosion sediment production predictor.

General Progress in Last Two Years: An ephemeral gully study site has been established in the Goodwin Creek Research Watershed. Data collection is progressing.

Plans for Next Twelve Months (FY 88): Continue the program at a reduced level. Effort of the investigators has been diverted to other upland erosion control research having a higher Agency priority.

Coordination or Cooperation with Another Agency: Close consultation with the SCS, which originally requested this research.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 7 1987 Session Number B-6a

Subject Area Hydraulics

Project Title Prediction Models and Control Practices for Upland Erosion and Runoff

Performing Organization USDA National Sedimentation Laboratory

Principal Investigator L. D. Meyer, Research Leader, (FTS) None  
USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
(Name) (Address) (Telephone)

Starting Year FY 1983 Estimated Completion Year FY 1988

Technical Objectives: Develop mathematical models for soil detachment, transport, deposition, erosion, and infiltration for major soils, cropping systems, topographic, and rainstorms. Perform experiments to define model parameters. Develop new and improved control practices.

Technical Approach: Study erosion/runoff rates and soil sealing methods experimentally. Develop soil erosion predictors. Develop new erosion control techniques involving runoff reduction and sediment entrapment by field microtopography or texture.

General Progress in Last Two Years: Rill erosion along row furrows has been evaluated for different rainstorm sequences, furrow gradients, and runoff rates. Conditions inhibiting furrow erosion are being identified. The CREAMS model was adapted to simulate the erosion-reducing effect of upslope diversions.

Plans for Next Twelve Months (FY 88): Continue the program.

Coordination or Cooperation with Another Agency: Close consultation with SCS; cooperative agreement with Mississippi State University; research planned for direct support of DEC (Demonstration Erosion Control) Project.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 8 1987 Session Number H-6f  
 Subject Area Hydraulics  
 Project Title Develop and Evaluate Upland Erosion Control Practices and Systems  
 Performing Organization USDA National Sedimentation Laboratory  
 Principal L. D. Meyer, Research Leader, (PTS) None  
 Investigator USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
 (Name) (Address) (Telephone)  
 Starting Year FY 1987 Estimated Completion Year FY 1992

Technical Objectives: Design, develop, and evaluate cultural practices to maximize infiltration, minimize runoff, and maximize on-field trapping of sediments carried in runoff.

Technical Approach: Develop and evaluate practical field cultural techniques that are cost-effective for farmers and that dissipate rindrop energy, reduce runoff, increase infiltration, trap eroded sediment, and lengthen runoff paths. Develop and evaluate row cropping systems combining such techniques. Define practice effectiveness by field studies, laboratory studies, and simulation.

General Progress in Last Two Years: Project started February 1, 1987. Field test sites have been acquired, and the starting series of treatments and practices for tests have been designed and approved.

Plans for Next Twelve Months (FY 88): Begin effective implementation of the program.

Coordination or Cooperation with Another Agency: Research in support of SCS and Corps of Engineers. Collaboration controlled through the DEC (Demonstration Erosion Control) Task Force Committee.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 5 Set of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 2 1987 Session Number H-6g  
 Subject Area Hydraulic  
 Project Title Yazoo Basin Erosion Control Research Project (Hydraulics)  
 Performing Organization USDA National Sedimentation Laboratory  
 Principal W. C. Little, Coordinator, DEC/TAP Project, (PTS) None  
 Investigator USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
 (Name) (Address) (Telephone)  
 Starting Year FY 1984 Estimated Completion Year FY 1988

Technical Objectives: Develop rapid watershed-scale methods of assessing erosion and flood damage in the six watersheds of the Demonstration Erosion Control Project in the Yazoo Basin.

Technical Approach: Stereo-photogrammetry and imaging analysis will be used to monitor the responses of the demonstration watersheds to various control measures, and information on the useful application of technology developed by the Sedimentation Laboratory and other sources will be synthesized for use in decision making.

General Progress in Last Two Years: An expanded topographic analysis facility has been installed at the Sedimentation Laboratory. Tape-stored maps of land use, soil and slope classification have been completed for Otoucalofa watershed and are being compiled for the other watersheds.

Plans for Next Twelve Months (FY 88): Continue enhancing topographic analysis capability and provide more kinds of watershed analysis for watershed management and planning.

Coordination or Cooperation with Another Agency: Total cooperation with Mississippi SCS and Vicksburg District, COE through participation in DEC Task Force operations. Collaboration documented through 3-way Interagency Memorandum of Understanding.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 4 1987 Session Number B-6h

Subject Area Hydraulics

Project Title Develop and Evaluate Erosion Control Conservation Tillage Systems

Performing Organization USDA National Sedimentation Laboratory

Principal Investigator C. K. Mutchler, Research Leader (FTS) None  
USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
 (Name) (Address) (Telephone)

Starting Year FY1984 Estimated Completion Year FY1989

Technical Objectives: Develop and evaluate conservation tillage systems for erosion control, farm profitability, and farmer usability; support erosion control in DEC watersheds; provide knowledge about erosion control under mid-south conditions for use in conservation/production system management models.

Technical Approach: Use year-round test plot observation to quantify soil loss and sediment yield from corn, soybean, and sorghum conservation tillage systems. Evaluate capability of conservation tillage systems to maintain productivity.

General Progress in Last Two Years: Research was done using erosion plots with natural and simulated rainfall. More detailed research on effects of crop residue placement was done in controlled indoor laboratory experiments.

Plans for Next Twelve Months (FY 88): Recent data and other data bases will be used to evaluate the capability of current watershed models to predict the influence of conservation tillage systems.

Coordination or Cooperation with Another Agency: Collaboration with Mississippi SCS, MAFES, and Delta Council, as well as DEC task force.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USDA-ARS Priority 5 1987 Session Number B-6i

Subject Area Hydraulics

Project Title Principles of Sediment Transport in Upland Sand Bed Channels

Performing Organization USDA National Sedimentation Laboratory

Principal Investigator J. C. Willis, Research Hydraulic Engineer (FTS) None  
USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
 (Name) (Address) (Telephone)

Starting Year FY1983 Estimated Completion Year FY1988

Technical Objectives: Relate transport of fine sediment, sands, and gravels to land use, channel stability and other watershed and hydrologic factors for use in watershed management procedures; develop mechanics of sediment transport through flow transitions for use in routing schemes; maintain a sediment transport data base for DEC use.

Technical Approach: Conduct laboratory and field studies. Use flume experiments and field studies in a heavily instrumented research watershed to study coarse sediment transport. Formulate sediment transport principles for calculating watershed sediment production and offsite damage assessment.

General Progress in Last Two Years: Laboratory experiments showed that vortex stretching in channel constrictions suppressed sediment suspension. Instrumentation for continuous measurement of bedload transport in Goodwin Creek Research Watershed has been developed. New analytical methods of extracting general trends from stochastic field data are being developed.

Plans for Next Twelve Months (FY 88): Continue program.

Coordination or Cooperation with Another Agency: Collaboration with SCS and Vicksburg District, COE, through operation of the Goodwin Creek Research Watershed.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H-6J

Subject Area Hydraulics

Project Title Water Measurement

Performing Organization Bureau of Reclamation  
 Principal Investigator Russell A. Dodge PO Box 25007, MC D-1531 (FIS) 776-6153  
 (Name) Denver CO 80225 (303) 236-6153  
 (Address) (Telephone)

Starting Year FY87 Estimated Completion Year FY90

Technical Objectives: Study new measuring devices to help provide reliability, accuracy and cost information to planners, designers, and operators. Revise parts of Water Measurement Manual.

Technical Approach: Install water measuring devices in laboratory flumes, nozzle facility, or pipe test stand and compare performance with specifications, Venturi meter, or volumetric-time measurements.

General Progress in Last Two Years: Finished laboratory sediment tests with ramp flume. Set up nozzle test facility for testing and calibrating small velocity probes. Checked flow meters and probes in pipe test stand and nozzle facility. Drafted new sections and some revisions for Water Measurement Manual.

Plans for Next Twelve Months (FY88): Revise Water Measurement Manual. Both laboratory and field checks of closed conduit and open channel measuring devices. Report of ramp flume sediment studies will be finished.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-7A

Subject Area Hydraulics

Project Title Stepped Spillway

Performing Organization Bureau of Reclamation  
 Principal Investigator Kathleen Houston PO Box 25007, MC D-1531 (FIS) 776-6159  
 (Name) Denver CO 80225 (303) 236-6159  
 (Address) (Telephone)

Starting Year FY-new Estimated Completion Year FY

Technical Objectives: Stepped spillways are often used with (RCC) roller compacted concrete dams. The increased interest in RCC dams has prompted the need for standardized stepped spillway design criteria. Of primary interest is the optimum energy dissipation possible down the spillway and how reservoir head above the crest and the spillway slope effects the energy dissipation.

Technical Approach: A literature search from existing structures and, where possible, data from laboratory and field studies. A model will be built that will permit changing the spillway slope from about 3:1 to 0.3:1. Tests will be performed to determine step geometry for optimum energy dissipation and the maximum head-discharge relationship that will maintain full contact of the jet with the spillway.

General Progress in Last Two Years: New

Plans for Next Twelve Months (FY88): Depends on funding.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number 8-7b

Subject Area Hydraulics

Project Title Labyrinth Spillways

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1531 (FIS) 776-6159  
 Investigator K. L. Houston Denver CO 80225 (303) 236-6159  
 (Name) (Address) (Telephone)

Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To prepare a design report of labyrinth spillways. Report will include design curves for labyrinth weirs based on design discharge, reservoir head, and available channel width.

Technical Approach: Bureau and other organizations have built site specific labyrinth spillways. All parameters pertaining to labyrinth weir performance, primarily the length of magnification, vertical aspect ratio, sidewall angle, and discharge coefficient will be analyzed for dimensionless use in design curves.

General Progress in Last Two Years: Much data have been analyzed and compared to a design method presented in a technical paper. Several discrepancies have surfaced that will require further in-depth analysis.

Plans for Next Twelve Months (FY88): Complete preparation of design curves and report.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: X Technology Transfer None  
X Safety of Dams X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number 8-7c

Subject Area Hydraulics

Project Title Stilling Basin Damage Due to Erosion

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1531 (FIS) 776-6155  
 Investigator Eugene R. Zeigler Denver CO 80225 (303) 236-6155  
 (Name) (Address) (Telephone)

Starting Year FY82 Estimated Completion Year FY87

Technical Objectives: To improve stilling basin design by developing recommendations and criteria towards prevention of erosion damage to stilling basin.

Technical Approach: Use hydraulic model to investigate add-ons and changes in design criteria to avoid hydraulic action which draws abrasive materials into stilling basin.

General Progress in Last Two Years:

1. Investigated area of downstream channel susceptible to rock movement.
2. Made single bay tests and compared to field tests.
3. Tested rock trap at end of stilling basin.
4. Tested modified end still.
5. Tested flushing rocks from basin.

Plans for Next Twelve Months (FY88): Final report (in progress).

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: X Safety of Dams Technology Transfer  
X Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number H-7d  
 Subject Area Hydraulics  
 Project Title Scout Downstream from Stilling Basins  
 Performing Organization USARMS, Hydraulics Laboratory  
 Principal (FIS) 542-7402  
 Investigator John E. Hite, Jr., P.O. Box 831, Vicksburg, MS (601) 634-7402  
 Name (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives:

To develop and provide better guidance for repair and rehabilitation of scoured areas downstream from stilling basins.

Technical Approach:

Evaluate feasibility of protective materials, specifically riprap, large stone, grout-filled fabric bags, and grouted rock and stone based on previous hydraulic model tests. Physical hydraulic model studies will be utilized to develop rehabilitation criteria for sizing protective materials and preventing future scour.

General Progress in Last Two Years:

(1) Technical note submitted for RDMR Notebook on "Use of Grout-Filled Fabric Bags as a Substitute for Riprap;" (2) Published article on "Current Methods for Repairing Scoured Areas Downstream from Stilling Basins;" (3) Technical note submitted for RDMR Notebook on "Guidance for Repairing Scoured Areas Below Navigation Dam Stilling Basins and Spillway Aprons;" (4) Draft Technical Note in preparation on "Scour Downstream from Uncontrolled Fixed-Crest Dams."

Plans for Next Twelve Months (FY 88):

Provide information for revision of EM 1110-2-1605, "Hydraulic Design of Navigation Dams. Publish technical report on research results. Provide final input to RDMR notebooks.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interest  
 to be Addressed at this Conference: X Safety of Dams X Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H-7e  
 Subject Area Hydraulics  
 Project Title Combined Hydraulic Jump-Flip Bucket Energy Dissipator  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1531 (FIS) 776-6164  
 Investigator Thomas J. Rhone Denver CO 80225 (303) 236-6164  
 Name (Address) (Telephone)

Starting Year FY-New Estimated Completion Year FY

Technical Objectives: A hydraulic jump basin is designed to dissipate energy at the maximum discharge. In the range between 50 percent and 100 percent, it is highly efficient; below this range the basin is not efficient and has a tendency to draw rock and debris into the basin, resulting in severe erosion. The energy is dissipated in a plunge pool. The purpose of this study is to develop design criteria for a combination bucket that will utilize the high efficiency of the hydraulic jump for a predetermined percentage of the design discharge and act as a flip bucket for larger flows. This type of bucket will be smaller and less expensive than a standard stilling basin.

Technical Approach: The Bureau has built a limited number of combined basins; these will be compared and evaluated. A literature search will also be performed. Parameters to be compared include incoming flow velocity (Froude number), bucket geometry, tail-water effect, and operating history. Based on these data, a model will be constructed to obtain additional data to develop generalized design criteria. A research report will be written for future editions of Monograph No. 25.

General Progress in Last Two Years: New.

Plans for Next Twelve Months (FY88): Depends on funding.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interest  
 to be Addressed at this Conference: None Safety of Dams Technology Transfer  
Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H-2E

Subject Area Hydraulics

Project Title Damage to Spillway Plunge Pools

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1532 (FIS) 776-6156  
 Investigator K. Warren Frizell Denver, CO 80225 (303) 236-6156  
 (Name) (Address) (Telephone)

Starting Year FY82 Estimated Completion Year FY90

Technical Objectives: To evaluate free falling water jets and the possible damage which may be experienced in the plunge pool. The influences of dynamic pressure fluctuations and air entrainment are of particular interest.

Technical Approach: The past approach of looking at scale models of a jet has been abandoned in favor of looking at high velocity jets. This will enable the large turbulence and air entrainment effects to be included.

General Progress in Last Two Years: The effects of air entrainment on a high velocity free jet were studied by a visiting professor. He determined the spreading angles and looked at several parameters as a function of turbulent intensity.

Plans for Next Twelve Months (FY88): Redesign a test facility to allow for impingement into a plunge basin so that pressure measurements can be made in the plunge pool. This facility will utilize a high head pump to produce high velocity jets.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-7E

Subject Area Hydraulics

Project Title Model Study of Unsteady Supercritical Flow Conditions in Open Channel Distribution Systems

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1532 (FIS) 776-6146  
 Investigator Hilaire Peck Denver, CO 80225 (303) 236-6146  
 (Name) (Address) (Telephone)

Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: (1) With energy dissipation blocks placed in a trapezoidal channel, identify the range of flowrates where surge waves occur for various combinations of block spacing and channel slope. (2) Identify a method to control the surge waves. (3) Identify an experimental procedure as an aid to further study the phenomenon of surge waves in supercritical open channel flow.

Technical Approach: A model was constructed of a prototype canal which had experienced problems with surging flow. The model was constructed in a 60-foot-long tilting flume.

General Progress in Last Two Years: Technical objective No. 1 above was accomplished by visual means through systematically changing block spacing and flume slope. Objective No. 2 was accomplished with raft type wave suppressors. Objective No. 3 was addressed by noting that surge waves occur only when hydraulic jumps were present between blocks.

Plans for Next Twelve Months (FY88): Perform a field study to test raft type wave suppressors in the prototype canal. Obtain funding for a more in-depth general study of surging flow in canals with energy dissipation blocks, as recommended in the initial study.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency TVA Priority        1987 Session Number H-8a  
 Subject Area Hydraulics  
 Project Title Analyses of Hydroturbine Vibrations  
 Performing Organization TVA  
 Principal Investigator Patrick A. March EMG LAB-N (FTS) 632-1944  
 (Name) (Address) (Telephone)  
 Starting Year FY82 Estimated Completion Year Continuing

Technical Objectives:

To develop vibration signature analysis methods for crack detection and monitoring in hydroturbines.

Technical Approach:

Instrumented impact hammers, fixed accelerometers, and a dynamic signal analyzer are used to perform modal analyses on fixed-blade and Francis-type hydroturbines and other types of rotating machinery. Modal frequencies, shapes, and damping values are used in interpreting vibration data taken during operation of the turbines. Finite element codes have been applied to vibration problems in rotating machinery to analyze problems and to compare results to experimental data.

General Progress:

Reports characterizing the modes of vibrations at TVA hydro plants have been prepared. Modal analyses of a prototype induced draft scrubber fan at a TVA power plant, modal analyses of a physical model of the scrubber fan, and finite element analyses of the fan have been compared. The effects of a crack in the physical model have been examined experimentally and with finite element models. Rotational stiffening and fluid loading effects on modal analyses conducted in air have been analyzed.

Plans for Next Twelve Months:

Experience gained in research studies will be applied to the analyses of routine vibration measurement conducted in TVA power plants. Finite element studies and prototype modal analyses will be conducted on vibration problems as they arise.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority        1987 Session Number H-8b  
 Subject Area Hydraulics  
 Project Title Cavitation Studies  
 Performing Organization TVA  
 Principal Investigator Patrick A. March EMG LAB-N (FTS) 632-1944  
 and Stein Vislander EMG LAB-N (615) 632-1946  
 (Name) (Address) (Telephone)  
 Starting Year FY85 Estimated Completion Year Continuing

Technical Objectives:

To solve or ameliorate specific cavitation problems at TVA hydro plants, navigation locks, nuclear plants and coal-fired power plants.

Technical Approach:

Compare the cavitation resistance of different metals and overlays in a laboratory test facility. Develop monitoring methods to detect cavitation in operating hydroturbines. Determine the causes of specific cavitation problems at TVA facilities and develop solutions. Develop pipewall thickness monitor to detect cavitation in closed conduits and determine remaining pipe wall thickness.

General Progress:

Conducted laboratory tests of cavitation resistance of exhaustive list of metals, weld overlays, and coatings. Began development of monitoring methods for detecting cavitation in hydroturbines and for pipe wall thickness.

Plans for Next Twelve Months:

Analyses of specific cavitation problems as they are identified. Development of monitoring methods to continue in laboratory studies and prototype tests at TVA hydro plant.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number H-8c  
 Subject Area Hydraulics  
 Project Title Evaluation of Turbine Operation  
 Performing Organization USBR/Colorado State University  
 Principal Colorado State University, Dept. of  
 Investigator Morris M. Skinner Civil Engrg., Ft. Collins CO 80523 (FIS) 491-5291  
PO Box 25007, MC D-1532 (FIS) 776-6157  
Brent W. Mefford Denver CO 80225 (FIS) 236-6157  
 (Name) (Address) (Telephone)  
 Starting Year FY86 Estimated Completion Year FY88

Technical Objectives: Develop instrumentation techniques for implementation on prototype types to identify when cavitation is occurring on the turbine runner and to identify maintenance needs on turbines.

Technical Approach: (1) Investigate technique, including signature analysis, acoustic emissions, magnetostrictive films and shaft torque transducers. (2) Develop baseline data for existing Bureau of Reclamation powerplants for identifying maintenance needs.

General Progress in Last Two Years: A database for signature analysis data has been started. A testing sequence has been identified for existing powerplants. Study of possible techniques for identifying cavitation has been initiated.

Plans for Next Twelve Months (FY88): Install a model turbine test facility to study the techniques identified. Continue to identify signature analysis for existing turbines to help plan maintenance and identify acceptable noise and vibration levels.

Coordination or Cooperation with Another Agency: Will coordinate this research with TVA (Tennessee Valley Authority) on increased efficiency and air injection turbine testing program proposed by TVA.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number 8-8d  
 Subject Area Hydraulics  
 Project Title Online Hydroturbine Efficiency Monitoring and Optimization  
 Performing Organization TVA  
 Principal Patrick A. March (FIS)  
 Investigator ENG LAB-M (615) 632-1944  
 (Name) (Address) (Telephone)  
 Starting Year FY87 Estimated Completion Year FY89

Technical Objectives:

Development of an online hydroturbine efficiency monitor incorporating accurate electronic measurement of pertinent quantities and computer-based data acquisition, analyses, and reporting. Mathematical optimization of unit loading at multiunit plant.

Technical Approach:

Development and field testing at a hydro plant. Incorporation of optimization techniques, cavitation monitoring, vibration monitoring to expand the scope of the efficiency monitor.

General Progress:

Efficiency monitor installed on Chickamauga Unit 1. Multiunit optimization program installed for use by Douglas hydro plant operators.

Plans for Next Twelve Months:

Operation of prototype system to continue. Alternative techniques for cavitation, vibration monitoring to be tested. Operator interaction to be studied to maximize utility of monitor to plant staff.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number H-8e  
Subject Area Hydraulics  
Project Title Hydroturbine Flow Measurement Using the Pressure-Time Method  
Performing Organization TVA  
Principal Investigator Charlie Almqvist ENG LAB-N (FTS)  
(Name) (615) 632-1941 (Address) (Telephones)  
Starting Year FY85 Estimated Completion Year Continuing

Technical Objectives:

Evaluate a computer-based pressure time flow measurement technique for applicability to TVA hydroturbine flow measurements.

Technical Approach:

Prototype tests during which two or more methods are used simultaneously for comparative purposes.

General Progress:

Conducted pressure time flow measurements at Raccoon Mountain, Tims Ford, Great Falls, Cherokee and Douglas hydro plants. Compared simple versus differential method. Developed reliable hardware/software systems for conducting tests.

Plans for Next Twelve Months:

Error analysis to be conducted to determine reliable accuracy of the method. Additional tests to be conducted as opportunities arise.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

APPENDIX H  
AGENDA AND TOPIC STATEMENTS  
ROCK MECHANICS SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987

AGENDA

ROCK MECHANICS SESSION

Jerry S. Huie, Chairman  
Jim B. Warriner, Recorder

Time	Topic No.	Title	Agency	RM-#	INSITU TESTING AND EXPLORATION
Tuesday, Nov. 3			1330		
0900	RM-1	<b>COMPUTER APPLICATIONS</b>	USBM	RM-4	Stability of Existing Concrete Structures on Rock
	RM-1a	State-of-the-Art Subsidence Prediction Model	USBM	RM-4a	Critical Parameters Controlling Roof Stability
	RM-1b	Numerical Methods-Advancing Longwall/Packwall Interaction Study	USBM	RM-4b	Grouting Practices for Repair and Rehabilitation
	RM-1c	Artificial Support for Highwall Stability	USBM	RM-4c	Investigation of the Use of Acoustics to Determine Geophysical and Geomechanical Properties of Rock
	RM-1d	Computer Applications in Geotechnical Engineering (CAGE)	COE	RM-4d	Geophysical Methodology for Assessment of Existing Structures and Structural Foundations
	RM-1e	CAGE: Task Group on Laboratory Automation	COE	RM-4e	Acoustic Emissions for the Detection and Location of Tar Sand Production Front
	RM-1f	Theory and Mechanics of Mine Roof Presupport	USBM	RM-4f	Rock Mechanics Investigation of Longwall Gate Road
	RM-1g	Constitutive Laws for Bedded Hard Rock	USBM		
	RM-1h	Selection of Remedial Seepage Control Measures	COE	RM-4g	
	RM-2	<b>DRILLING AND BLASTING</b>			
	RM-2a	Application of Water Jet Technology for Selective Mining	USBM	RM-5	<b>GROUND STABILIZATION</b>
	RM-2b	Enhanced Drilling Concepts	USBM	RM-5a	Mechanics of a Roof Compression System
	RM-2c	Designing Blasts to Produce Inherently Safer Pitwalls	USBM	RM-5b	Roof Bolt Torque and Load
				RM-5c	Uniformly Tensioned Roof Bolts
				RM-5d	Short Rock Bolt Feasibility Study
				RM-5e	Performance Evaluation of Polyester Resin Grouted Rock Bolts
	RM-3	<b>ROCK PROPERTY DETERMINATION</b>		RM-5f	The Fundamental Drill/Bolt Parameters Affecting Roof Integrity
	RM-3a	Rock Erosion in Emergency Spillway Channels	COE	RM-5g	Support/Rock Interaction Mechanics for Full-Column Bolting
	RM-3b	Dredgeability of Rock	COE	RM-5h	Evaluation of Flexible-Tendon Ground Stabilization
	RM-3c	Rock Drains	COE	RM-5i	Support Mechanics for Rib Stability
1230	LUNCH			RM-5j	Ground Support Research in Mine Roof Simulator
			1700	ADJOURN	
			Wednesday, November 4		
			0815		
				RM-6	<b>MINING AND TUNNELING</b>
				RM-6a	Mining with Backfill
				RM-6b	Advanced Concepts for Mining Deep Ore Bodies
				RM-6c	Flexible Distributed-Load Support Concepts
				RM-6d	Structure Characteristics of Deep Mine Accessways
				RM-6e	Ground Control Planning for Deep Vein Mining

RM-6f	The Mechanics and Controls of Time-Dependent Deformation Around Deep Mine Openings	USBM
RM-6g	The Interaction of Super and Subjacent Mine Workings	USBM
RM-6h	Investigation of Geologic and Engineering Factors Associated with Cutter Roof Failure	USBM
RM-6i	Fundamental Studies of Coal Mine Bumps	USBM
RM-6j	Improved Ground Control in Outcrop Barrier Zones	USBM
RM-6k	Geologic Anomalies and How They Effect the Regional Stress in Illinois	USBM
RM-6l	Undercut Mining on Steeply Pitched Coal	USBM
RM-6m	Retreat Mining Geomechanics	USBM
	LUNCH	

1230

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBM Priority          1987 Session Number RR-1a  
 Subject Area Rock Mechanics  
 Project Title A State-of-the Art Subsidence Prediction Model  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Vladimir Adamek Cochrans Mill Road, P.O. Box (FIS) 723-4323  
 (Name) (Address) (412) 892-4323 (telephones)  
 Starting Year FY 82 Estimated Completion Year FY 90

Technical Objectives: The specific objective of this research is to construct a subsidence prediction model that is specifically tailored to the mining and geological conditions in the United States.

Technical Approach: The European subsidence prediction methods have been quickly adopted since the capabilities were not available in the US. The basic problem is that these models were developed for European geological and mining conditions. Consequently, the resultant predictions do not match the observations made in the field. The concept of this approach is to define a parameter which describes the mine overburden material in such a way as to allow for the heterogeneity of the rock mass. Once this task is completed, the parameter is inserted into a prediction equation.

General Progress in Last Two Years: The response of the overburden rock mass has been described in terms of a variable subsidence coefficient. This variable was developed as a result of collecting field data at 16 longwall panels. The variable has been inserted into an equation developed by Bals. The equation was then incorporated into a computer program for use on personal computers. The resulting model predictions closely match field observations in the Northern Appalachian Coal Region.

Plans for the Next Twelve Months (FY 88): The predictive capabilities of the model will be expanded to include prediction of inclination, curvature and horizontal strain. These values are important indicators of damage to structures. The model will also be tested against field observations from the Southern Appalachian Coal Region and the Warrior Basin.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority          1987 Session Number RM-1b  
 Subject Area Rock Mechanics  
 Project Title Mathematical Methods-Advancing Longwall/Packwall Interaction Study  
 Performing Organization Spokane Research Center  
 Principal Investigator Kenneth E. Hay (FIS) 439-6880  
 (Name) (Address) (WA 99207-009) 484-1610 (telephones)  
 Starting Year FY 84 Estimated Completion Year FY 87

Technical Objectives: To gain a fundamental understanding of the packwall/support rock interaction mechanics in advancing longwalls in difficult geologic environments.

Technical Approach: To model the advancing longwall in highly stressed rock and locate the zones where the shear and normal stress concentrations cause structural failure or weakening. Once these zones are located, the behavior of the weakened material is modeled and its deformation simulated. The packwall support requirements of the opening will be optimized by matching the strength of the supports to the requirements of the ground. Methods of analyzing openings in different ground conditions and packwall support requirements will then be developed.

General Progress in Last Two Years:

The initial field testing was completed to obtain data for modeling work. The finite element modeling work has been completed. The initial analysis showed a considerable amount of failure in the coal below the mined out area. Other areas showing failure were in the packwalls and adjacent coal pillar. A final report is being prepared.

Plans for Next Twelve Months (FY 88):

Project will be completed at the end of FY87.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer          None  
Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number RM-1c  
 Subject Area Rock Mechanics  
 Project Title Artificial Support for Highwall Stability  
 Performing Organization USBM--Mining Research, Spokane Research Center  
 Principal (FTS) 439-6880  
 Investigator Earl M. Frizzell, E-315 Montgomery, Spokane, WA 99207 (509) 484-1610  
 (Name) (Address) (Telephone)  
 Starting Year FY85 Estimated Completion Year FY91

Technical Objectives: To document methods of determining physical properties and behavior of pit walls in open-pit mining; assess the capabilities of artificial stabilization systems to support pit walls; provide criteria to the industry for evaluating the potential for application of these support systems; and provide a realistic model of these systems so that individual mine parameters can be used as input and good estimates for system evaluation can be retrieved as model output.

Technical Approach: Evaluate methods used in obtaining properties of rock and the behavior of rock masses; the analysis of actual slope failures in the field; the assessment of current slope stabilization techniques, and development of improved techniques if necessary, and the evaluation of the risk and cost benefit of steeper slopes.

General Progress in Last Two Years: An analysis has been completed on in-situ stress measurements methods. Back analysis of slope failures at the Maciniento and Berkeley copper mines have been made using finite-element (Maciniento only) and limiting equilibrium techniques. A computer program (BACKPACK) has been developed that determines discontinuity strength parameters, rock anchor tensions, installation angles, and idealized rock anchor installation patterns for stabilization of coherent rock masses.

Plans for Next Twelve Months (FY88): Case studies and engineering analyses of mine slope failures to test theoretical concepts and modeling techniques will continue. The use of artificial support systems to successfully support potential slope failures will be assessed. An expert system will be developed utilizing BACKPACK to give advice to the industry on slope stability utilizing artificial supports.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-1d  
 Subject Area Rock Mechanics  
 Project Title Computer Applications on Geotechnical Engineering  
 Performing Organization CEVES  
 Principal W. E. Strohm CEVES-CE-R (FTS) 342-2604  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 534-2604  
 (Name) (Address) (Telephone)  
 Starting Year FY 78 Estimated Completion Year Continuing

Technical Objectives: To develop a comprehensive library of geotechnically oriented computer based programming in support of critical Corps of Engineers needs.

Technical Approach: Software and hardware will be configured for the key areas of instrumentation, grouting, slope stability, quality assurance, and boring and subsurface data.

General Progress in Last Two Years: Several instrumentation data packages have been converted for use on microcomputers. Boring data packages have been modified for military use; graphics programs were converted to the microcomputer. A grouting data base program was developed.

Plans for Next Twelve Months (FY88): Develop graphics display for use with CAD/CAE workstations; update 1978 survey of Corps of Engineers needs and report on current technology. Address new developments in rock mechanics.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number RM-1e  
 Subject Area Soil Mechanics (Concrete and Structures) (Rock Mechanics)  
 Project Title Computer Applications in Geotechnical Engineering: Task Group on Laboratory Automation  
 Performing Organization CEWES  
 Principal W. E. Strohm, Jr., CEWES-GR (FTS) 542-2604  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 631-2604  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89  
 Technical Objectives: To improve the efficiency and capabilities of CE materials testing laboratories through the use of computers.

Technical Approach: A prioritized list of possible computer applications in the laboratory will be formulated. Existing programs will be surveyed to ascertain their usefulness and technical experts hired to perform modifications or create new programs as needed to meet established goals. Task group will formulate goals for data acquisition and test control and draw on in-house and outside experts as necessary to complete guidance documents for use by all CE laboratories.

General Progress in Last Two Years: New start in Summer 1987: Initial meeting prioritized task group goals. Existing microcomputer based programs for data reduction have been surveyed and selected programs have been distributed for review by participating laboratories.

Plans for Next Twelve Months (FY 88): (1) Refine existing data reduction programs; (2) complete development of interim laboratory management program; (3) begin development of criteria for data acquisition systems.

Coordination or Cooperation with Another Agency: None to date - Anticipate contacting other agencies regarding experience with data acquisition systems.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Agency U.S. Bureau of Mines Priority 1987 Session Number RM-1f  
 Subject Area Rock Mechanics  
 Project Title Theory and Mechanics of Mine Roof Presupport  
 Performing Organization Spokane Research Center  
 Principal Investigator J. D. Dixon E. 315 Montgomery, Spokane, WA 99207 (FTS) 9-6880  
 (Name) (Address) (509) 444-1610 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 92  
 Technical Objectives:  
 Evaluate the potential effectiveness of mine roof presupport and perform initial steps toward development of presupporting as an effective roof reinforcement technique for U.S. room-and-pillar coal mines.

Technical Approach:

Develop and test hypothesis using structural models to evaluate presupport concepts and conduct underground tests to evaluate the suitability of various mine roof conditions for presupport installation.

General Progress in Last Two Years: Structural models, based on application of the finite element method for evaluating beam suspension and beam building concepts have been developed. Computer codes for running these problems are under evaluation. A method for evaluating the loose rock suspension concept, based on the distinct element method is under consideration and computer hardware and software are being procured. A search is underway to locate a coal mine to initiate underground air injection tests to determine the feasibility of injecting resinous liquids under pressure into joints and fissures.  
Plans for Next Twelve Months (FY 88):  
 Continue evaluation of coal mine roof presupport concepts by analytical methods and conduct underground tests to determine the feasibility of injecting resinous liquids under pressure into joints and fissures in the mine roof.

Coordination or Cooperation with Another Agency:  
 Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBM Priority 1987 Session Number RM-1g  
 Subject Area Rock Mechanics  
 Project Title Constitutive Laws for Bedded Hard Rock  
 Performing Organization Spokane Research Center  
 Principal Investigator Whyatt/McWilliams FTS 439-6880  
E. 315 Montgomery Spokane, WA 99207 (509) 484-1610  
 Name Address Phone Number  
 Starting Year FY87 Estimated Completion Year FY95

Technical Objective:

Define anisotropic strength and deformation properties of bedded hard rock, and develop constitutive equations for inclusion of these properties in numerical models.

Technical Approach:

Definition of the influence of bedding on hard rock behavior will be achieved through laboratory testing and analysis of in situ deformation measurements from deep mines. Size effects, test time effects, and failure mode changes will be evaluated. Interbed, fracture, and joint surfaces common in bedded rock masses will be examined, with special attention given to geostatistical methods for characterizing discontinuity surface roughness and its relation to mechanical properties. As sufficient data is collected, work will be undertaken to develop constitutive laws that more accurately reflects the behavior of a bedded rock mass.

General Progress:

Comparison of field and laboratory test results for a bedded rock mass have demonstrated the importance of test loading rate on rock fracturing. In addition, the field test has shown large differences in rock strength and post-fracture dilatancy around underground openings. Laboratory work on the influence of bedding direction on rock strength has been hampered by surprisingly large variations in in situ microcrack density over small distances at the source mine. An increased number of tests will be required to filter out this influence. Photogrammetry has been chosen to characterize discontinuity surfaces and the equipment procured. Results of a trial test are encouraging.

Plans for Next Twelve Months:

The photogrammetry equipment will be used to develop a number of data sets which will be used to investigate statistical methods for describing surface roughness. Laboratory testing on bedded rock samples will continue. As laboratory data becomes available, it will be compared to existing constitutive laws and compared, through numerical modeling, to field measurements. Deficiencies in these constitutive laws will be identified for later work.

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
 TOPIC STATEMENT

Agency CE Priority 1987 Session Number RM-1b  
 Subject Area Rock Mechanics  
 Project Title Selection of Remedial Seepage Control Measures  
 Performing Organization CEMRES  
 Principal Investigator W. O. Miller FTS 542-3147  
P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3147  
 Name Address Telephone  
 Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives: The development of a data base and an expert system for evaluating and recommending remedial seepage control measures, which will be periodically updated with current experience, as well as new development.

Technical Approach: A data base on seepage control experience will be developed and used to identify the driving parameters, develop correlations and relationships, and relate urgency, site characteristics, and results to the various options available for remedial seepage control. Subsequently, an expert system will be developed providing a systematic process for selection of a seepage control measure based on experience, site characteristics, risk evaluations, flow mechanics, available options, research, and other considerations such as cost, materials, policy, etc.

General Progress in Last Two Years: A comprehensive compilation of data on remedial seepage control experience within the Corps was completed with contractual assistance. Selected a tentative case history for documentation and calibration of the expert system using dBASE III.

Plans for Next Twelve Months (FY88): Work scheduled for completion in FY87.

Coordination or Cooperation with Another Agency: Coordination with USBR through meetings.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- None
- Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency Bureau of Mines Priority 1987 Session Number RM-2a  
 Subject Area Rock Mechanics  
 Project Title Application of Water Jet Technology for Selective Mining  
 Performing Organization Bureau of Mines Mining Research  
 Principal Min. Cities Research Center (FTS) 725-4543  
 Investigator G. A. Savanick 3639 Minnehaha Ave. So. / 1725-4543  
 (Address) Minneapolis, MN 55417 (Telephone)  
 Starting Year FY 82 Estimated Completion Year FY 89

Technical Objectives:  
 Develop a water jet cutting device to cut deep slots along ore-waste contact in hard rock to enable the ore to be selectively removed.

Technical Approach:

The aim is to develop a kerf cutter for hard rock that uses a high velocity abrasive water jet. This device differs from other abrasive jet cutters in its ability to follow into the cut and thereby cut deep (6 ft) kerfs in hard rock. Other abrasive jet cutters are limited to cutting in a single plane. Abrasive jet kerfing permits cutting the hardest rocks at moderate pressure (10,000 psi), for which hoses, fittings, and reliable pumps are readily available for in-mine use.

General Progress in Last Two Years:

This work has resulted in the invention of a novel abrasive water jet cutting method for hard rock. Patent 4,663,893 "End Deflector for Abrasive Water Jet Slot Cutter" was obtained. Patent application 899,266 "Rotatable End Deflector for An Abrasive Water Jet Drill" was filed. The abrasive water jet rock cutter has been successfully tested in the laboratory and in a mine. It has been shown to be capable of drilling small holes, collaring holes at any angle, drilling through rubble, drilling over-lapping holes, chambering holes, in addition to cutting kerfs.  
 Plans for Next Twelve Months (FY 83):  
 Perform tests in an underground nickel mine in Canada.

Coordination or Cooperation with Another Agency:

Memorandum of Agreement signed with CANMET for cooperative research with HDRK, a Canadian research organization. HDRK has offered funds for this work.

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 None

Fifteenth Interagency Research Coordination Conference,  
 3-5 November 1987

Agency USBM Priority 1 1987 Session Number RM-2b  
 Subject Area Rock Mechanics  
 Project Title Enhanced Drilling Concepts  
 Performing Organization USM-Mining Research-Twin Cities Research Center  
 Principal 5629 Minnehaha Ave. So. (FTS) -725-4829  
 Investigator John F. Pahlman Minneapolis, Mn 55417 (612) -725-4829  
 (Name) (Address) (Telephone)  
 Starting Year FY 1981 Estimated Completion Year FY 1990

Technical Objectives:  
 Determine the underlying mechanisms of chemical and electrochemical effects on drilling rate enhancement and bit wear reduction. Apply chemical and electrochemical methods to enhance drilling rates and to reduce bit wear in mining operations.

Technical Approach:

Laboratory investigations will be conducted to delineate the boundary conditions and possible mechanism(s) that give rise to chemically and electrochemically enhanced drilling performance. A theory or model which predicts such enhanced drilling behavior will be established. The theory or model will be tested to determine its applicability to drilling of rock types commonly encountered in mining operations, using typical drilling fluids and drill bits.

General Progress in Last Two Years:

Laboratory-scale drilling investigations have been conducted with either diamond-impregnated coring bits on hard rocks using cationic surfactants or inorganic salts as drilling fluid additives. Results of these drilling tests showed maximum penetration improvements ranging from 60 to 105 pct with simultaneous maximum bit life extensions of 60 to 140 pct were obtained when drilling these rocks with the singular concentration of cationic additive solution that resulted in neutralization of the rock surface charge, i.e., produced a zero surface charge (ZSC) condition. It was demonstrated that achieving the ZSC condition is responsible for the enhanced drilling performance and not the type of surface charge modifier. Recent drilling results on these same rocks using a nonionic polymer as the drilling fluid additive showed unexpectedly that the ZSC condition and thus resulting enhanced drilling performance (penetration improvements of over 350 pct and extended bit life of over 235 pct) could be obtained over a wide range of polymer concentrations (3 to 125 ppm). Field testing the nonionic polymer in granite cutting with a 28-inch-diameter diamond saw resulted in cutting penetration improvements of over 230 pct compared to water alone.

Plans for Next Twelve Months (FY 88):

Drilling Experiments will be conducted with nulling out or reversing the naturally occurring drilling current between drill bit and rock during drilling to determine what effect this has on drilling performance and bit life. Field drilling and cutting tests are planned to validate laboratory-scale drilling results in large-scale rock drilling and cutting operations.

Coordination or Cooperation with Another Agency:

Coordination and cooperation is sought with any government agencies that do rock or concrete drilling or cutting in carrying out their charter activities. Cooperative chemically enhanced drilling efforts with CANMET, the Canadian counterpart to the U.S. Bureau of Mines are underway.

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 None

Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number RM-2c  
 Subject Area Rock Mechanics  
 Project Title Designing Blasts to Produce Inherently Safer Pitwalls  
 Performing Organization Twan Cities Research Center  
 Principal Investigator Virgil J. Stachura 5629 Minnehaha Ave SO. (FTS) 725-4252  
 (Name) Minneapolis, MN 55417 (Address) (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives: To reduce rockfall fatalities and injuries through blasting practices which reduce overbreak in highwalls at surface mines.

Technical Approach: Blasting tests will initially be conducted in limestone quarries. Blast design changes that reduce overbreak and produce smoother, more stable pitwalls will be evaluated. Pitwall irregularity will be measured using stereophotography. Seismic refracting methods will be used to determine overbreak. Blast designs to be evaluated will include use of airspace columns, improved accuracy initiators, and lighter powder loads.

General Progress in Last Two Years: The first series of blasting tests began in July, 1987. Tests will be run at two limestone quarries, one massive and the other fractured. Preliminary work with seismic refraction looks promising.

Plans for Next Twelve Months (FY 88): Tests will continue at limestone quarries to evaluate blast designs and overbreak measurement techniques. A second series of tests will be initiated in a surface coal mine.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-3a  
 Subject Area Rock Mechanics  
 Project Title Rock Erosion in Emergency Spillway Channels  
 Performing Organization CEVES  
 Principal Investigator J. B. Noy CEVES-CR-OS (FTS) 542-3395  
 (Name) P.O. Box 631, Vicksburg, MS 39180-0631 (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: To predict geological conditions which initiate and increase rate of erosion in unlined emergency spillways to determine preventive and remedial measures.

Technical Approach: Numerous complex factors influence rate of erosion in spillways. Both hydraulic and geologic factors must be identified and given proper weighting. From the geotechnical standpoint, the erosion problem can best be viewed as a continuum from grain-to-grain tractive force scour on one end to massive block failure on the other end. The mechanisms that govern the rate of block failure are being studied in the laboratory and the results compared to prototypes in the field.

General Progress in Last Two Years: Numerous sites which have experienced severe erosion have been visited and documented. Research efforts are underway to determine the effect of stratigraphic variability on the rate of erosion, to devise a ranking system for erosion potential and to devise state-of-the-art preventive and remedial techniques.

Plans for Next Twelve Months (FY88): To continue limited laboratory and field research and to conduct a workshop on spillway erosion.

Coordination or Cooperation with Another Agency: Technical liaison has been established with personnel of the US Soil Conservation Service and the US Bureau of Reclamation. Liaison has also been established with the Hydraulics Lab at HES, University of Southern Mississippi, University of Missouri-Rolla, and Corps Districts and Divisions.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority Rock Mechanics 1987 Session Number RM-3b  
 Subject Area Rock Mechanics  
 Project Title Dredgeability of Rock  
 Performing Organization CEMES  
 Principal H. J. Smith CEMES-CR-M (FTS) 542-2431  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2431  
 (Name) (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: To determine and define geotechnical descriptors for rock and rock masses as applicable to underwater excavation, and to develop method(s) for estimating the dredgeability of rock with respect to equipment type and methods used, given a geotechnical description of the rock mass.

Technical Approach: A determination will be made as to which rock mass parameters influence dredgeability, and relationships will be developed to estimate performance for dredging operations with respect to rock mass parameters such as unconfined compressive strength, abrasiveness, rock structure, geophysical properties, etc. Case history data may be supplemented by peripheral site data or laboratory testing as required.

General Progress in Last Two Years: This research both contributed to the Corps Working Group (WG) No. 5, "Corps Specifications Excavating Hard Materials," and benefited from the output. Reports of the WG, were presented to WRSC-D and field personnel 25 June and 9 Dec 1986. Surface excavation techniques, such as ripping, with possible dredging applications, have been investigated; resulting papers published in the US Symposium on Rock Mechanics, Jun 86, 87. Misc. Paper on Future Research Needs for the Dredgeability of Rock was published. Contributed input to the development of the Corps Dredging Research Program; resulting TR was published Sep 86.

Plans for Next Twelve Months (FY88):

1. Draft ETL on Rock Mass Parameters for Dredgeability.
2. Wet/dry comparison UCS tests on dredged rock material.
3. Initial field testing of drilling parameter recorder.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Rock Mechanics 1987 Session Number RM-3c  
 Subject Area Rock Mechanics  
 Project Title Rock Drains  
 Performing Organization CEMES  
 Principal A. Schaffer CEMES-CR-M (FTS) 542-2632  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2632  
 (Name) (Address) (Telephone)  
 Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: The objective of this study is the development of procedure and methodology to minimize potential increases in uplift pressures beneath structures caused by degradation of rock drains.

Technical Approach: Standard procedures will be developed for the evaluation of rock drain performance and efficiency. Criteria interrelating drain efficiency, uplift pressures, and stability will be selected for establishing a required level of maintenance or rehabilitation efforts. Existing as well as new and innovative rehabilitation methods which are potentially applicable to rock drains will be evaluated and tested. Recommendations will be developed, correlating drain performance, foundation characteristics, and stability requirements to various remedial methods.

General Progress in Last Two Years: A rock drain workshop was held in Denver, Colorado, as a working group meeting with Corps and Bureau of Reclamation personnel. The process of selecting a site for a drilling investigation was initiated. Information concerning Corps and Bureau experience in drain rehabilitation is being compiled. Laboratory development/evaluation of a mechanical borehole jacking device is underway.

Plans for Next Twelve Months (FY88): Three dams have been chosen to evaluate effectiveness of drain rehabilitation techniques. Drains at a fourth dam will be overcored and examined.

Coordination or Cooperation with Another Agency: Close coordination between CEMES and the US Bureau of Reclamation.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE Priority Rock Mechanics 1987 Session Number RM-68  
Subject Area Rock Mechanics  
Project Title Stability of Existing Concrete Structures on Rock  
Performing Organization Waterways Experiment Station, RMAC  
Principal R. D. Bennett, A. F. Kimbrell CENES-CR-H 542-3974  
Investigator P. O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3083/634-3974 (FTS) 542-3083  
(Name) (Address) (Telephones)  
Starting Year FY 86 Estimated Completion Year FY 89

**Technical Objectives:** The objectives of this work unit are: (a) expand existing shear strength selection concepts used for design to the selection of shear strength used for re-evaluation of existing structures, (b) specify the limitations of the criteria and determine those specific situations where the criteria cannot be applied, and develop procedures for (c) assessing forces acting on an existing structure, improved analysis of structures and selection of systems to improve structural stability.

**Technical Approach:** A multidisciplinary approach is being used to cover all aspects of the stability of existing concrete structures. A review of completed and ongoing stability investigations is combined with instrumentation of two navigation locks to assess current sliding stability criteria. Instrumentation as well as analytical techniques will be evaluated and recommendations made as to their suitability for predicting stability.

**General Progress in Last Two Years:** Reviews have been completed of ongoing stability investigations. Reports on new technology are in preparation for publication. Districts and Divisions have been interviewed and selected case histories studied. Field sites for research instrumentation have been selected and site preparation initiated. Instrumentation has been installed at one site.

**Plans for Next Twelve Months (FY88):** Plans for next twelve months include completion of site preparation and instrumentation at two selected field sites; monitoring of stability at those structures over a period of active navigation; recovery and laboratory testing of foundation and backfill samples; and preliminary stability analysis performed with material parameters derived from site investigations.

**Coordination or Cooperation with Another Agency:** One field site is being developed with the cooperation of the St. Lawrence Seaway Development Corp.

**General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:**  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority Rock Mechanics 1987 Session Number RM-4b  
Subject Area Rock Mechanics  
Project Title Critical Parameters Controlling Roof Stability  
Performing Organization Spoikane Research Center  
Principal (FTS) 439-6880  
Investigator Maynard Serbousek E. 315 Montgomery, Spokane, WA 99207 (509) 482-1610  
(Name) (Address) (Telephones)  
Starting Year FY 85 Estimated Completion Year FY 87

**Technical Objectives:**  
To develop the means to detect hazardous ground conditions, roof movements, and other ground control problems in time to take corrective action to avoid roof falls, bumps, outbursts, or premature caving. The specific objective is to determine critical ground control criteria for different mining and geological conditions through underground tests.

**Technical Approach:**

A ground evaluation instrumentation package is developed that allows the user to select small but effective systems of state-of-the-art technology with onsite processing capabilities. The system allows the measurements of loads, roof sag, and closure rates, and convert the data for a more reliable roof control decision-making process. Efforts will be made to correlate these measurements with bumps, outbursts of pillar and face.

**General Progress in Last Two Years:**

A report for all of the collected data was completed in May 1987. Several mines have adopted this system of ground monitoring.

**Plans for Next Twelve Months (FY 88):**

To determine the effectiveness of critical closure rates for roof caving prediction in various geographical areas of the United States.

**Coordination or Cooperation with Another Agency:**

Coordination with Mine Safety and Health Administration.

**General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:**  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-4c  
 Subject Area Rock Mechanics  
 Project Title Grouting Practices for Repair and Rehabilitation  
 Performing Organization CEVES  
 Principal P. A. Taylor CEVES-GR-M (FTS) 542-2117  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2117  
 (Name) (Address) (Telephone)  
 Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: Methods will be developed to evaluate rock mass properties prior to and subsequent to grout injection. State-of-the-art methods to plan, monitor, and control grout procedures and parameters will be evaluated or developed. A system will be developed to determine the grout distribution in situ beneath foundations.

Technical Approach: Past applications of consolidation grouting for structural foundation improvement will be studied. The interaction of grouting parameters such as injection pressure, hole spacings, and depth will be investigated. Microcomputer applications for control and monitoring of grout operations will be pursued through a cooperative effort with the USBR. Current grout body exploration methods will be assessed. Acoustic emission/microseismic techniques will be examined for feasibility of monitoring grout location during or after placement.

General Progress in Last Two Years: A field experiment on the distribution of grout pressures in a fractured rock mass completed (Joint USBR/WES Study). A computer program for the manual entry of data for reporting grouting operations was submitted by contractor (Geomen) for review. The contract with LBL was renewed for AE monitoring of grout. Hardware and software specifications were developed and scheduled for August field trials.

Plans for Next Twelve Months (FY88): Conduct field investigations using the grout monitoring systems in order to develop a grouting system for the districts that will be a useful grouting tool.

Coordination or Cooperation with Another Agency: The work has been coordinated with CEVES, USBR, and DOE (LBL).

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority \_\_\_\_\_ 1987 Session Number RM-4d  
 Subject Area Rock Mechanics  
 Project Title Investigation of the Use of Acoustics to Determine Geophysical and Geomechanical Properties of Rock  
 Performing Organization USBM - Mining Research - Twin Cities Research Center  
 Principal Karen S. Radcliffe 5629 Minnehaha Av S (FTS) 725-4261  
 Investigator Minneapolis, MN 55417 (612) \_\_\_\_\_ (Telephone)  
 (Name) (Address)  
 Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: To develop in situ stress measurement and monitoring technology using acoustic properties of rock.

Technical Approach: Theoretical relationships are developed for predicting change in in situ stress as a function of change in P-wave velocities in rock. Experimental verification of prediction is conducted in laboratory and large-scale experiments in which P-wave velocities are measured in the  $\sigma_1$  and  $\sigma_3$  directions in rock under uniaxial and triaxial compression, both in dry and saturated rock.

General Progress in Last Two Years: Theoretical models based on wave propagation in cracked media have been developed. Further refinement of modeling using concepts from continuum damage mechanics is underway. Experimental laboratory studies involving P-wave velocity change in the  $\sigma_1$  and  $\sigma_3$  direction in dry and saturated rock have been completed. Correlations between velocity and stress have been made by regression analyses.

Plans for Next Twelve Months (FY 88): Complete laboratory testing and analyses for the triaxial states of stress, and for large-scale testing on rock blocks up to 2 ft square by 4 ft long for size effect analyses.

Coordination or Cooperation with Another Agency: Coordination is done internally through the USBR Rock Mechanics Steering Committee and through a Memorandum of Understanding with CAWIET and MCL in Canada.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_



TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-4e  
 Subject Area Rock Mechanics (Geophysics, Engineering Geology, Soil Mechanics)  
 Project Title Geophysical Methodology for Assessment of Existing Structures and Structural Foundations  
 Performing Organization CEWES  
 Principal Dwain K. Bucelar/Jose L. Llopis, CEWES-GH-R/-1 (FTS) 542-2127/542-3164  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2127/634-3164  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89

**Technical Objectives:** Develop new and adapt existing engineering geophysical methods for geotechnical investigations of existing structures and structural foundations.

**Technical Approach:** Identify characteristics of existing structure sites which defeat or complicate the application of standard engineering geophysical methods. Assess the state of the art of engineering geophysics and identify adaptations which could make geophysical methods more applicable to existing structure sites. Identify new geophysical methods or techniques applicable to the investigation of existing structure sites. Select field test sites for evaluation of new and adapted geophysical methods.

**General Progress in Last Two Years:** Geophysical methods investigated include electrical and electromagnetic techniques, high-resolution seismic reflection surveying, ground-penetrating radar, self potential (SP) surveying, and microgravimetry. Two field test sites were selected: Lockport Approach Dike, Illinois, and Beaver Dam Dike 1, Arkansas. Field work at Lockport Dike was limited to ground-penetrating radar; while the work at Beaver Dam was extensive and included all of the geophysical techniques mentioned above plus other standard geophysical methods. The investigations at Beaver Dam are fully integrated with other geotechnical investigations conducted by the US Army Engineer District, Little Rock. Results of the work at Beaver Dam have been helpful in defining the geotechnical investigations and assessing remedial measures alternatives. Three draft reports have been completed, and four contractor studies are on-going.

**Plans for Next Twelve Months (FY 88):** Complete four draft contractor reports and one in-house draft report. Participate in and help organize international symposium of SP applications to existing structure evaluation. Finalize data analyses for work at Beaver Dam.

**Coordination of Cooperation with Another Agency:** Workshop on geotechnical applications of SP with CE, TVA, and USBR held at WES. USGS is also participating in the research.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-4f  
 Subject Area Rock Mechanics  
 Project Title Acoustic Emissions for the Detection and Delineation of Tar Sand Sand Production Front Location  
 Performing Organization CEWES  
 Principal J.B. Warriner CEWES-OR-M (FTS) 542-3610  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3610  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 88

**Technical Objectives:** Adapt the technology of acoustic emissions monitoring to observation of the extraction of petroleum from tar sand formations injected with high-pressure, high-temperature steam. Make this technology available to the Department of Energy.

**Technical Approach:** A laboratory investigation of acoustic phenomena in heated, stressed tar sand samples was initiated. A multi-channel, microcomputer-controlled AE recording system was assembled. Software was developed for the data computer that controls the acquisition of the AE and also performs waveform analyses and AE source location calculations. The final task was to deploy the AE monitoring system at a real-world commercial production site extracting petroleum from the tar sand formations by steam injection.

**General Progress in Last Two Years:** A prototype computerized data acquisition system has been designed, assembled, and tested in the laboratory. The acquisition software is adapted from a WES product that uses a MASSCOMP as an active seismic survey recorder/analyser. The laboratory testing consisted of relatively simple rock mechanics compression, tensile, and shear testing while monitoring and analyzing the generated AE. Additionally, the tested specimens were monitored for AE characteristics under elevated (300-400 deg C) temperatures.

**Plans for Next Twelve Months (FY88):** The laboratory investigation results will be reported. Final laboratory-based proof-testing of the data acquisition system will be performed. The Canadian-recorded AE data from Gregoire Lake will be analyzed by the resident software.

**Coordination of Cooperation with Another Agency:** Amoco-Canada Geophysics Division, University of Alberta Geophysics Department, the Canadian government research agencies, U.S. Bureau of Mines, Lawrence Berkeley Laboratory, and Pennsylvania State University.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency USBM Priority 1987 Session Number RM-48  
 Subject Area Rock Mechanics  
 Project Title Rock Mechanics Investigation of Longwall Gate Road Systems  
 Performing Organization Pittsburgh Research Center, USBM

Principal Investigator Jeffrey M. Listak Cochrans Mill Road, P.O. Box (FTS) 723-4306  
Christopher Mark 18070, Pgh., PA 15236 (412) 892-4306  
 (Address) (Telephones)  
 Starting Year FY 83 Estimated Completion Year FY 89

Technical Objectives: To develop a basic understanding of how longwall mining effects gate road entry stability and the loading behavior of the roof support elements.

Technical Approach: The installation of rock mechanics instrumentation in and around the components that comprise the longwall system will allow for the determination of location and magnitude of abutment loads, whether there exists cumulative effects from mining multiple adjacent panels, and how pillar configuration affects the mechanism of load transfer.

General Progress in Last Two Years: The recent completion of a study that compared various longwall gate road pillar configurations in a single 3-panel longwall system. Data reveal that gate road designs utilizing an abutment pillar and a companion yield pillar performed superior (i.e., provided better entry stability) to more commonly used conventional pillar designs. An experimental equipment recovery roof was instrumented to determine stress concentrations and load transfer of supplemental support units. Mining into the area and recovery operations were highly successful.

Plans for Next Twelve Months (FY 88): A broadening of the study areas is currently underway. At present, a site in eastern Kentucky is being instrumented with stressmeters, convergence stations, and differential strata separation instruments. Information from this site will add to the existing gate road pillar data base. In addition, longwall equipment recovery room sites will be sought to continue research for better recovery methods.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Agency U.S. Bureau of Mines Priority 1987 Session Number RM-5a  
 Subject Area Rock Mechanics  
 Project Title Mechanics of Roof Compression Systems  
 Performing Organization Spokane Research Center  
 Principal Investigator John P. Dunford E. 315 Montgomery, Spokane, WA 99207 (FTS) 439-6880  
 (Address) (Telephones)  
 Starting Year FY 82 Estimated Completion Year FY 90

Technical Objectives: Develop increased understanding of the behavior of roof compression systems and their interaction with the roof strata. Also to develop a device to determine the effectiveness of various roof compression systems.

Technical Approach:

Combine laboratory testing, field tests and theoretical analysis to increase understanding of roof supports that create active pressure in the roof strata. Develop a device that will monitor the stress in the support as a function of time and mining cycle.

General Progress in Last Two Years:

Developed the laboratory test procedures and equipment necessary to analyze how a roof truss system produces stress fields as a function of truss design and installation. Developed the first prototype truss tension monitor.

Plans for Next Twelve Months (FY 88):

Evaluate all of the currently commercial truss designs in the laboratory. Set up a field test that will evaluate various truss systems in actual mining situations. Develop the design criteria that is needed to design the second generation truss tension monitoring device.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: USBM Priority: Rock Mechanics 1987 Session Number: RM-5b  
Subject Area: Rock Mechanics  
Project Title: Roof Bolt Torque and Load  
Performing Organization: USBM, Denver Research Center  
Principal Investigator: Stephen C. Tadolini, Denver Federal Center, Bldg. 20  
(FTS) 776-0751 or (303) 236-0751  
Starting Year: Fy 1982 Estimated Completion Year: FY 1989

Technical Objectives: The specific objectives of the research are to:

1. Dynamically measure roof bolt loads, developing a full understanding of what factors influence them, and determine how they relate to mine stability.
2. Continue the development of pulse echo instrumentation technology.

Technical Approach: The Bureau-modified Raymond Engineering instrument and the multi-reflector Bolt-Mike S-1 are presently being used to accumulate data on mechanical, resin, and combination roof bolts. This information is being analyzed to determine the repeatability of the ultrasonic instrumentation and provide valuable insight into bolt performance and total roof support evaluation.

General Progress: Laboratory testing of the ultrasonic roof bolt load instrumentation has been completed. The laboratory testing included an in-depth analysis on the transfer mechanics of full-column resin grouted bolts. The information has provided contrary results to those published in the past. Field evaluations, to date, indicate that this measurement system is extremely reliable and relatively simple to use. The system is providing valuable information in the areas of transfer mechanics and roof bolt behavior.

Plans for the Next Twelve Months: Testing will continue on several types of roof bolts used in underground mining applications. Additionally, roof bolt trusses, used commonly today in coal mining applications, will be evaluated. A number of unique and new bolting systems will be evaluated in the laboratory to determine overall stress transfer mechanics and support capabilities. The ultrasonic measurement system, with the Bureau's modifications, has demonstrated the ability to be used in several applications in the mining, construction, and aerospace field.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety to Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: U. S. Bureau of Mines Priority: Rock Mechanics 1987 Session Number: RM-5c  
Subject Area: Rock Mechanics  
Project Title: Uniformly Tensioned Roof Bolts  
Performing Organization: Spokane Research Center  
Principal Investigator: Robert R. Thompson E. 315 Montgomery, Spokane, WA  
(FTS) 439-6880  
(509) ARM-1610  
(Address) 99207 (Telephones)  
Starting Year: FY81 Estimated Completion Year: FY89

Technical Objectives:

1. Determine if mechanical roof bolts can be installed with uniform tension.
2. If so, does this improve ground control.

Technical Approach:

Large numbers of roof bolts are being installed underground to verify, on a sound statistical basis, that uniformly tensioned roof bolts improve roof stability. Two field tests are being conducted in a western coal mine to accomplish this using the BuMines roof bolter equipped with a "Full Control Bolting System."

General Progress in Last Two Years:

The data from the first test showed that bolts can be installed uniformly. The test indicated that when properly installed they improve ground control. A second field test has been started to gather additional data.

Plans for Next Twelve Months (FY 88):

Complete the second field test. Analyze the data and publish results.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-5d  
 Subject Area Rock Mechanics  
 Project Title Short Rockbolt Feasibility Study  
 Performing Organization CEMES  
 Principal W. O. Miller, CEMES-CR-M (FTS) 342-3147  
 Investigator P. O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3147  
 (Name) (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 88

Technical Objectives: Evaluate the performance of rockbolted tunnel sections to determine the influence of rockbolt length, through a series of scale model tests.

Technical Approach: Scale model rockbolted tunnel sections with different length rockbolts are being carried to failure (51 closure) under plane strain conditions. Tests are being conducted in a large loading frame with the tunnels being cast in a low strength rock simulant. A history of the deformations within the rock mass and tunnel are recorded and related to the applied stresses and rockbolt length.

General Progress in Last Two Years: A large scale polyaxial loading frame was designed and fabricated. The frame is capable of loading a 9' X 9' X 3', 30,000 lbs sample, with a maximum of 8,000,000 lbs on each face. A total of five tests have been conducted (as of 1 Oct 87) in the frame. Data analysis currently supports the proposal that short rockbolts (< tunnel radius) provide at least comparable, possibly superior performance.

Plans for Next Twelve Months (FY88): Final analysis and completion of the report is scheduled for 31 Dec 87. No further testing is currently scheduled.

Coordination or Cooperation with Another Agency: Technical liaison has been maintained with personnel of the US Bureau of Mines regarding the testing. Additionally, liaison has also been established with other researchers which are, or have been, involved in large scale modeling studies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number RM-5e  
 Subject Area Rock Mechanics  
 Project Title Performance Evaluation of Polyester Resin Grouted Rock Bolts  
 Performing Organization CEMES  
 Principal T. S. Avery CEMES-CR-M (FTS) 542-4141  
 Investigator P. O. Box 631, Vicksburg, MS 39180-0631 (601) 634-4141  
 (Name) (Address) (Telephone)  
 Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives: Assess common installation procedures for their impact on the long-term performance of polyester resin grouted rockbolts. Specific attention will be placed on wet installation conditions.

Technical Approach: Installation procedures that affect the stability of polyester resin grouted rockbolts were identified to be hole diameter vs. bar diameter, spin time, installation procedure, and water conditioning. Bolts are installed under these various conditions and then pull tested to determine the impact of that installation method on the bolt's strength. Long-term creep tests will be conducted to determine the effects on the long-term stability of polyester resin grouted rockbolts.

General Progress in Last Two Years: A literature review was conducted to determine results of previous investigations. This background narrowed down and more clearly defined the objectives of this investigation. Efforts this FY were directed at evaluating the effects water has on the strength of a resin grouted anchor. Specific tests were conducted on bolts installed in submerged, water filled, and damp boreholes. Additional tests were conducted in boreholes that intercepted a water filled joint.

Plans for Next Twelve Months (FY88):

1. Continue long-term creep tests and evaluate the data.
2. Conduct pull tests at the Bonneville Lock site on bolts installed under wet and dry conditions.
3. Instrument bolts at Bonneville to determine long-term load retaining performance of polyester resin grouted bolts.

Coordination or Cooperation with Another Agency: The Bureau of Mines, Denver Research Center is conducting pull tests on bolts installed under varying water conditions.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority 1987 Session Number RM-5f  
Subject Area Rock Mechanics  
Project Title The Fundamental Drill/Bolt Parameters Affecting Roof Integrity  
Performing Organization Spokane Research Center  
Principal Investigator Robert Thompson (FTS) 439-6880  
E. 315 Montgomery, Spokane, WA 99207 (509) 484-1610  
(Address) (Telephone)  
Starting Year FY 84 Estimated Completion Year FY 88

Technical Objectives:

To design, assemble and install an instrumentation system which will both measure and display the specific energy of drilling and demonstrating its capability to determine various roof conditions from roof bolting machine parameters.

Technical Approach:

Specific energy of drilling is a prime indicator of roof rock integrity. The specific energy of drilling is the work required to drill through a unit volume of rock. Using inputs of thrust/torque, rotation rate, penetration rate and hole area, a small microprocessor based system will calculate, display and store values relating specific energy and drill bit position. This real time data will be used to determine the relationship between the specific energy of drilling and the geological structure of the mine roof rock.

General Progress in Last Two Years:

The major components of the instrumented bolter have been designed, prototyped and tested. These tests were used to make addition modifications of both hardware and software in the final design. A field test site has been selected and a contract was written to make available a roof bolting machine for final lab and field test.

Plans for Next Twelve Months (FY 88):

The instrument components will be mounted on the roof bolter. This installed system will then be laboratory tested and calibrated. Documentation will be completed to attain MSHA experimental approval for the total system. When the approval is received, field testing will be conducted and resulting field data analyzed for draft manuscript.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Table that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority 1987 Session Number RM-5g  
Subject Area Rock Mechanics  
Project Title Support/Rock Interaction Mechanics for Full-Column Bolting  
Performing Organization Spokane Research Center  
Principal Investigator Steve Signer (FTS) 439-6880  
E. 315 Montgomery, Spokane, WA 99207 (509) 484-1610  
(Address) (Telephone)  
Starting Year FY 83 Estimated Completion Year FY 89

Technical Objectives:

To develop fundamental knowledge and understanding of the behavior of full-column roof bolting in underground mines. The specific objectives of the program are:  
(1) Develop performance criteria for grouted rock bolts in coal roofs, and  
(2) Determine the load transfer mechanics of different grouts used for grouted full-column rock bolts.

Technical Approach:

To determine the mechanics by which load is transferred between the bolt and mine rock. This includes both linear and nonlinear (post yield and time-dependent) characteristics of the bolting system. This information will be established through laboratory testing, field testing, and numerical models of grouted bolts. The final results will be used to improve design practices and evaluations of fully grouted bolts used for support in mine rock.

General Progress in Last Two Years:

Elastic evaluations were performed in the laboratory and field on 4-foot, 2-foot and 1-foot instrumented bolts. These results were compared with numerical models. Correlation between these methods is good and a report has been written on the results. Testing on the nonlinear characteristics of grouted bolts has started. Testing for the time-dependent properties of gypsum bolts is complete and the evaluations of the plastic work is nearly complete.

Plans for Next Twelve Months (FY 88):

The nonlinear work will be completed and a report will be written. Criteria will be established necessary to develop a global numerical model of a grouted roof bolt.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Table that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority I 1987 Session Number RM-5b  
 Subject Area Rock Mechanics  
 Project Title Evaluation of Flexible-Tendon Ground Stabilization  
 Performing Organization USBH--Mining Research Spokane Research Center  
 Principal T. W. Smelser (FTS) 439-6880  
 Investigator John M. Goris, E. 315 Montgomery, Spokane, WA 99207 509 484-1610  
 (Name) (Address) (Telephones)  
 Starting Year FY 82 Estimated Completion Year FY 90

Technical Objectives: To assess the materials and support strengths of grouted hardware in boreholes, and provide design criteria for improving support as a viable roof control system for slope mining.

Technical Approach: Research includes laboratory evaluation of the behavior of grouted cables under loaded conditions, development of a mathematical model to analyze rock mass behavior where supported with cable bolts, and verification of the model through one or more field tests in a mine site.

General Progress in Last Two Years: Laboratory pull tests evaluated support capability of "birdcage" strands and strands with steel buttons attached. Computer modeling of lab tests was begun. Arrangements for in-mine test to verify laboratory test results were made.

Plans for Next Twelve Months (FY 88):

- o Install "birdcage" and conventional strands in underground mine site
- o Monitor behavior of cable bolts during mining
- o Continue computer modeling of laboratory and field test data

Coordination or Cooperation with Another Agency: Cooperative efforts are underway with Canada's Ministry of Labour and CANMET organization with visits and exchanges of technical data.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency U.S. Bureau of Mines Priority \_\_\_\_\_ 1987 Session Number RM-51  
 Subject Area Rock Mechanics  
 Project Title Support Mechanics for Rib Stability  
 Performing Organization Spokane Research Center  
 Principal T. W. Smelser (FTS) 439-6880  
 Investigator M. K. Larson E. 315 Montgomery, Spokane, WA 99207 509 484-1610  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives: To increase knowledge and understanding of the mechanics of coal mine rib falls so that the mining industry can decrease accidents and downtime associated with them.

Technical Approach:

Research will be conducted in the following areas: (1) Roof/floor/rib interaction mechanics, (2) Detection/warning/prediction of rib failure, (3) Support of the ribs, and (4) Modeling rib behavior.

General Progress in Last Two Years:

Site visits to four underground coal mines were made to observe rib problems. Rib fall accident data and reports were analyzed. It appears from fatality reports and the literature that precursors to rib failure are inconsistent for use as warning devices. Using a generic mesh, rib behavior under limiting assumptions has been modeled with a finite element code. An underground test has been conducted to determine the extent of the failure zone in the rib at a site with poor rib conditions.

Plans for Next Twelve Months (FY 88):

Another field test will be conducted that will focus on rib, roof and floor interaction. Support concepts will continue to be developed and ways to model these concepts will be explored. Various support methods will be tested in the field and the laboratory.

Coordination or Cooperation with Another Agency:

Coordination with Mine Safety and Health Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBM Priority            1987 Session Number RM-51  
 Subject Area Rock Mechanics  
 Project Title Ground Support Research in the Mine Roof Simulator  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Thomas M. Barczak (Name) Cochrans Mill Road, P.O. Box (FIS) 723-6557  
18070, Pgh., PA 15236 (Address) (412) 892-6557 (Telephone)  
 Starting Year FY 84 Estimated Completion Year FY 90

Technical Objectives: This program is investigating the interactions of mine roof supports with the surrounding strata during underground coal mining applications in an effort to improve support design and utilization.

Technical Approach: Laboratory evaluations of mine roof support systems are conducted by full scale testing of supports in the Bureau's Mine Roof Simulator. Field studies are conducted and correlated to observed laboratory behavior. Mathematical models are also developed to describe support behavior.

General Progress in Last Two Years: Critical load studies of longwall shield supports have indicated potential areas for optimization of longwall supports. Models have been developed to utilize longwall supports as monitors of strata activity to assess interaction of the support with the strata. Load displacement characteristics of passive supports have also been defined from tests in the simulator.

Plans for Next Twelve Months (FY 88): Evaluate load transfer among shield components in preparation for support optimization studies. Investigate methods to improve post failure behavior of concrete cribbing.

Coordination or Cooperation with Another Agency: Continued coordination is planned with MSHA to evaluate new support systems and investigate causes of support failures by controlled testing of support systems in the Mine Roof Simulator.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Technology Transfer None  
Safety of Dams  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority            1987 Session Number RM-6a  
 Subject Area Soil/Rock Mechanics  
 Project Title Mining With Backfill  
 Performing Organization Spokane Research Center  
 Principal Investigator Ronald R. Backer (Name) SRC Address FTS 439-6880  
 Starting Year FY82 Estimated Completion Year FY95

Technical Objectives: Conduct basic and applied research on mine backfill materials and placement procedures to provide the technologies needed to obtain maximum resource recovery from underground mines. Emphasis of this research will be to close the technology gap between soil mechanics and rock mechanics in order to provide a basis for use of backfill to support underground openings and to allow mining of mineral values currently left as support.

Technical Approach: Work will be focused on correctly defining the deformation properties of the backfill and rock pillars, placement of backfill as a slurry "paste," and determining the mechanics of gravity loading of the backfill-pillar support systems. The stability will be assessed by mathematical and physical models and comparisons made with actual mine pillar extraction data. Lean mix backfill utilizing mill total tailings placed in higher than 80% slurry density for support has been identified as a promising technique to effectively increase ore recovery. Engineering properties of various dewatered mine tailings will be defined for prediction of fill behavior as well as transportation and placement.

General Progress: To date (last 2 years), work has involved overcore drilling to determine state-of-stress, fault mapping, mathematical modeling of a known mine to evaluate fill requirements, and experimental fill test cylinders. The drilling equipment and drilling techniques have been improved. Mathematical modeling and physical laboratory testing is continuing. Various backfill mix designs have been developed for three cooperating mines. The designs have been developed through a test matrix system, whereby gradation, water, and cement amounts were varied to obtain backfill mixes that provide adequate strengths while optimizing the materials.

Plans for Next Twelve Months: Rock mechanics studies will continue for the evaluation and prediction of rock behavior. The interaction between pillars, slopes, and fills will be studied through mathematical and physical models. Methods to test in situ state-of-stress and models will be improved. Fills will be instrumented to evaluate the stress and deformation resulting from overburden loading of the Cannon Mine. A large scale compression test frame is being constructed to test larger-sized backfill models (4- by 4- by 8 feet).

Test cylinders using different grain size total tailings will be made and compared to previous data. By developing a range of engineering properties, it may be possible to predict fill behavior for any mine. Pumping tests on high slurry density total tailings will be performed on three different samples using the paste pumping loop.

Coordination and Cooperations with Other Agencies: Contact was initiated with CANMET, under the guidance of the cooperative agreement between the Bureau of Mines, CANMET, and Ontario MOL.

TOPIC STATEMENT

Agency USBM Priority 1987 Session Number RM-6b  
 Subject Area Rock Mechanics  
 Project Title Advanced Concepts for Mining Deep Ore Bodies  
 Performing Organization Spokane Research Center E. 315 Montgomery FTS 439-6880  
 Spokane, WA 99207 (509) 484-1610  
 Principal Investigator M. E. Poad Name Address Phone Number  
 Starting Year FY85 Estimated Completion Year FY94

Technical Objective:

This project seeks to develop improved deep slope designs based on increased understanding of the basic geomechanical principles of rock mass behavior.

Technical Approach:

The main effort is currently in field measurement of rock mass behavior around deep slopes, especially those that incorporate innovative stoping methods. These field observations are used to fine tune existing methods, evaluate and improve experimental methods, and identify key geomechanical factors for detailed study. These detailed studies in turn form the basis for the development of practical design tools and innovative mining methods. Special attention is currently being paid to the long-term deviatoric stress capacity of rock and rock mass classification.

General Progress:

Task I:

Data from an overcoring stress measurement site at the Lucky Friday Mine is being analyzed for spatial and geologic dependence of stresses measured by individual gauges. Rock samples have been collected from the major rock groups at the Lucky Friday Mine and are being tested along with the recovered overcores for modulus and possible anisotropy.

Task II:

The Rock Structure Rating (RSR) for prediction of ground support requirements (developed under Bureau contract) is being used as a basis for development of a rock mass characterization for use in deep hard rock mines -- the emphasis being on slope and accessway design.

Task III:

Two, 2-dimensional finite element models, a horizontal section, and a vertical section have been completed for the Goss pillar study at the Homestake Mine. The models are being used to simulate stope size and mining sequence for the pillar, and the subsequent effects on shaft stability.

A preliminary model using data from the Lucky Friday Underhand Longwall stope has been made using the FLAC explicit finite difference code and a newly-developed strain-softening constitutive law. Initial results show shear fractures developing near the stope which are typical of conditions observed in the field.

Plans for Next Twelve Months:

Task I:

Laboratory results will be used to assess the anisotropy and inhomogeneity of the rock both locally at the stress measurement site and globally throughout the mine. In combination with geologic information, the rock properties will provide an estimate of stress field inhomogeneity throughout the mine which can be checked by the local stress field inhomogeneity detected between stress gauges at the test site. This analysis will be extended to the Homestake Mine stress field as well.

Task II:

Work will continue on statistical and geotechnical index analysis of physical properties utilizing rock fractures, core analysis, drill penetration, and rock hardness for use in rock mass classification schemes.

Task III:

Rock mechanics instrumentation plans to evaluate pillar stability and mining methods will be developed and initial instrumentation will be installed in the Ross pillar.

FLAC will be used for conducting parametric studies of the LFUL. Variables to be studied include rock strength, modulus, in situ stress, and geologic structures.



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBM Priority          1987 Session Number RM-6c  
Subject Area Rock Mechanics (Ground Support)  
Project Title Flexible Distributed-Load Support Concepts  
Performing Organization Spokane Research Center  
Principle Investigator Bill F. Noble, E. 315 Montgomery, Spokane, WA 99207 (509) 484-1610  
(Name) (Address) (Telephone)  
Starting Year FY85 Estimated Completion Year FY89

Technical Objectives: Flexible liner systems backpacked with various materials such as sand or mill tailings provide a continuous bearing surface and distribute the load equally around the underground opening. The objective is to develop and confirm a "Flexible Distributed-Load" design theory to enable the mining industry to design and construct safe, effective support systems as they recover minerals from increasingly deeper mines.

Technical Approach: To study the geomechanics involved, a restraining frame to test full-scale underground supports, 5 feet in length, in a 10- by 10-foot simulated mine opening with loads in one axis approaching 1,000 psi was constructed. The data obtained from these tests will be used to establish and confirm a design theory which will be verified in the mines.

General Progress in Last Two Years: The test frame was constructed, and seven tests were conducted of 48-inch diameter, 1/4-inch thick steel liners. A finite-element mesh has also been devised to simulate the soil loading which occurs during these tests. Recorded soil pressure values are being compared to numerical values and an analysis made to explain the soil's behavior.

Plans for Next Twelve Months (FY 88): Various size liners will be tested in the simulator and compared to the finite-element analysis and theoretical equations. A field test of drift or raise liners will be begun. Instruments will be installed to measure liner deformation, opening wall closure, and total soil pressure at a selected site. The installation will be monitored, and measurements taken.

Coordination or Cooperation with Another Agency: Exchange of data, progress reports, and visits with Waterways Experiment Station, Corps of Engineers.

General Research or Problem Areas in this Topic that are of Current Special Interest to be Addressed at this Conference: \_\_\_\_\_  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ x None  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBM Priority          1987 Session Number RM-6d  
Subject Area Rock Mechanics (Deep Mine Design)  
Project Title Structural Characteristics of Deep Mine Accessways  
Performing Organization Spokane Research Center  
Principal Investigator H. J. Beus, E. 315 Montgomery, Spokane, WA 99207 (509) 484-1610  
(Name) (Address) (Telephone)  
Starting Year FY82 Estimated Completion Year FY88

Technical Objectives:

Determine structural response characteristics and develop a design methodology for deep mine accessways.

Technical Approach:

In situ and large-scale laboratory measurements will form the data base for evaluating rectangular, timber-supported, and circular, concrete-lined deep mine accessways. Evaluation of the results of in situ testing around deep shafts will be continued. Test frames will simulate the true stress state in a deep mine environment.

Shapes, supported systems, and station intersections with representative rock and support materials will be configured to the proper geometry to model as closely as possible the actual in situ conditions.

General Progress:

Evaluation of circular and rectangular shapes for deep mine accessways is underway in the polyaxial test frames. Failure patterns around these test shapes are being studied using strain gauges and LVDT measuring devices. Comparison of the data is being made with computer models.

Plans for Next Twelve Months:

Continue laboratory testing and analysis to develop design guidelines. Verify pressure capabilities of new polyaxial test frame to study dynamic behavior of openings in hard rocks under high stress.

TOPIC STATEMENT

Agency USBM Priority 1987 Session Number RM-6e  
 Subject Area Rock Mechanics  
 Project Title Ground Control Planning for Deep Vein Mining  
 Performing Organization Spokane Research Center  
 Principal Investigator F. M. Jenkins FTS 439-6680  
 Name Spokane, WA 99207 (509) 484-1610  
 Address Phone Number  
 Starting Year FY85 Estimated Completion Year FY88

Technical Objectives:

Establish the relationships needed to forecast underground stability problems using advanced computer techniques and remote rock characterization methods.

Technical Approach:

The integration of existing rock characterization methods in exploration boreholes and advanced computer modelling techniques will provide a stability forecasting method. Verification of this concept requires that the calculated predictions of stress and closure be compared to the observed stress and closure in the field. Correlation of the calculated and actual data will allow refinement of the prediction method.

General Progress:

Work has centered on gathering field data characterizing two available mine sites, one located in northern Idaho and the other in South Dakota. Overcoming measurements needed to determine the in situ stresses were completed at both mines and analysis of this data is underway to calculate the respective stress ellipsoids. Characterization of the stress state at a site will provide basic information necessary for advanced numerical modeling techniques to be applied. In addition to the stress determination work, detailed studies were made to delineate the structural geology at the two sites. Mine level maps, borehole logs, and other existing geological data were compiled to serve as the starting point for building a detailed numerical model of the structure and the surrounding geologic setting at the respective sites. Additional mapping of fracture patterns and minor faults was carried out to give greater detail to the numerical model and to provide information for selecting a representative material model for the numerical analysis.

Plans for Next Twelve Months:

Model the geology of the field sites and analyze the effects of different mining and support methods on the numerical model. Compare the predicted results with the data observed in the field. Reformulation of the model and the material characteristics may be necessary to achieve a reasonable correlation. Design mining and support strategies to optimize stability keeping in mind the options available at the respective sites.

TOPIC STATEMENT

Agency USBM Priority 1987 Session Number RM-6f  
 Subject Area Rock Mechanics  
 Project Title The Mechanics and Control of Time-Dependent Deformation Around Deep Mine Openings  
 Performing Organization Spokane Research Center  
 Principal Investigator J. K. Whyatt FTS 439-6880  
 Name Spokane, WA 99207 (509) 484-1610  
 Address Phone Number  
 Starting Year FY85 Estimated Completion Year FY90

Technical Objectives:

1. Define factors that influence the stability of rock fracturing.
2. Develop design criteria for inducing stable, time dependent fracturing in place of rock bursts, and catastrophic failures in deep mines.

Technical Approach:

The working hypothesis is that microfracture mechanics control the stability of rock failure and understanding these small scale phenomenon will shed light on larger scale instability mechanisms whether in massive rock or along discontinuities (asperity failure). Emphasis is being placed on laboratory and theoretical development. Laboratory work centers on acoustically monitoring microfracturing during compression tests and looking for microseismic "signatures" associated with instability. Theoretical work on instability theory is concentrating on bifurcation and strain softening localization.

General Progress:

Microfracture mechanics, experimental techniques, and the history of rock bursting in the Coeur d'Alene Mining District have been reviewed. This work formed the basis for on-going laboratory acoustic emissions testing. Energy release rate methods currently in use for evaluating the relative rock burst hazard of mine geometries have been expanded to include non-linear dissipative mechanisms (in 2-D). Development of bifurcation theory to date by Dr. Vardoulakis shows promise for explaining surface instability rock bursts and is being evaluated against field data. A strain softening constitutive model implemented in a 2-D finite difference code (which greatly reduces the numerical problems commonly experienced with strain softening in finite element codes) is showing considerable promise for analyzing shear mechanisms and is being used to compare overhand and underhand sloping methods at the Lucky Friday Mine. Comparison of model results with microseismic data and recorded rock bursts is on-going and should further define the validity of this approach.

Plans for Next Twelve Months:

Laboratory testing with acoustic emission monitoring of quartzite samples in uniaxial compression will continue. Special attention will be paid to initial microcrack density and the characteristics of the microseism waveforms. Theoretical work will concentrate on validation through parametric studies and comparison to field data. Extension of bifurcation theory to anisotropic materials is being considered.

TOPIC STATEMENT

Agency USBM Priority Rock Mechanics 1987 Session Number RM-68  
 Subject Area Rock Mechanics  
 Project Title The Interaction of Super and Subjacent Mine Workings  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Gregory J. Chekan Cochrans Mill Road, P.O. Box (FIS) 723-6749  
 (Name) 18070, Pgh., PA 15236 (Address) (412) 892-6749 (Telephones)  
 Starting Year FY 83 Estimated Completion Year FY 90

Technical Objectives: The specific objectives of this research are to:

1. To identify pillar load transfer mechanisms and entry convergence rates near face operations using in-mine instrumentation.
2. To determine how geology affects multi-seam interaction.
3. To establish baseline data that can be eventually factored into mine design procedures for reducing ground problems associated with multi-seam mining.

Technical Approach: Previous research in multiple seam mining only documented the existence of mining problems and then attempted to correlate them to such factors as: stratigraphy, nature of the mine roof and floor material, overburden, innerburden, method of mining, time between mining of each seam, and percent recovery in each mine. Unfortunately, the prior research did not evaluate the state of stress in each mine opening or in the innerburden material. This effort is designed to produce such data so a complete understanding of the interaction mechanism can be understood. During the conduct of this effort underground coal mines operating in a multiple seam situations will be investigated. This work will include studies of the geology of the area and the installation of instruments to observe the pillar load transfer mechanism. The data collected as a result of these studies will be correlated with known variables affecting seam characteristics.

General Progress in Last Two Years: Several mine sections have been instrumented and observed as mining progressed in the area. Various instruments installed in the roof and floor material and coal pillars have shown stress concentrations do indeed occur. Work is underway to correlate the stress concentrations to the mining and geologic variables.

Plans for Next Twelve Months (FY 88): Field studies of various combinations of overburden and innerburden thicknesses, mining geometries and stress conditions will be studied. In addition, a various mine models will be studied and modified to accommodate the multi-seam scenario.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority Rock Mechanics 1987 Session Number RM-6h  
 Subject Area Rock Mechanics  
 Project Title Investigation of Geologic and Engineering Factors Associated with Cutter Roof Failure  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Eric R. Bauer Cochrans Mill Road, P.O. Box (FIS) 723-6518  
 (Name) 18070, Pgh., PA 15236 (Address) (412) 892-6518 (Telephones)  
 Starting Year FY 83 Estimated Completion Year FY 88

Technical Objectives: Develop a greater knowledge of the mechanism(s) contributing to cutter roof development through geologic and engineering studies, to analyze methods of controlling cutter roof, hazardous geologic anomalies, and rib spalling, and to analyze changes in mine design and mining direction which may reduce the hazards associated with these problems.

Technical Approach: Geologic investigations of problem areas will be conducted. Problem areas and methods of control will be monitored using coal cells and u-cells to determine the pressure changes, and bolt loadings associated with mining advance and cutter development. Lithology above an below the coal will be evaluated to determine if it is contributing to stresses which are causing the cutter type roof. Core samples will be subjected to various mechanical property type testing.

General Progress in Last Two Years: Two (2) investigations in underground coal mines in Pennsylvania were completed. In both cases it was determined that the cutter roof problems were the result of localized geologic structures. Changes in mining sequences and the use of novel support techniques were shown to be effective in controlling the problem. A Regional investigation is underway; it has increased the knowledge and understanding of the extent of the cutter roof problem throughout the U.S. coalfields.

Plans for Next Twelve Months (FY 88): The Regional investigation will be continued. The data obtained will be analyzed to delineate the common factors responsible for cutter failures. Additional field sites will be located and underground investigations conducted. As emphasis will be placed on disseminating to the mining industry the information gained on predicting and controlling cutter roof problems.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority Rock Mechanics 1987 Session Number RM-61  
 Subject Area Rock Mechanics  
 Project Title Fundamental Studies of Coal Mine Bumps  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Alan A. Campoli Cochrans Mill Road, P.O. Box (FIS) 723-6558  
 18070, Pgh., PA 15236 (412) 892-6558 (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: Development of design criteria for controlling coal mine bumps on pillar and longwall retreat mining sections, in the eastern United States.

Technical Approach: Geology and rock mechanics evaluations will be performed in working coal mines with bump problems. Geologic mapping, rock properties testing, pillar pressure monitoring, roof-to-floor convergence studies, and pillar dilation evaluations contribute to a better understanding of the causes of bumps and to the development of anti-bump mining procedures.

General Progress in Last Two Years: The performance of a novel room-and-pillar extraction technique for controlling bumps was evaluated at the Olga Mine, McDowell, Co., WV. The pillar splitting mining method successfully transferred dangerous abutment zone pressures away from the pillar line, to outby pillars. The novel mining method assisted by shot firing and auger drilling for localized stress relief, demonstrated that proper pillar sizing and timing of stress relief techniques are critical to anti-bump mining methods.

Plans for Next Twelve Months (FY 88): A comparison of two anti-bump longwall gateroad designs will be performed in VP#3 Mine, Vansant, VA. Bumps occur on the tail side of longwalls under over 2,000 ft of overburden. Large barrier pillars are located in the center of four entry gateroads, flanked by narrow yield pillars. The success of this system and possible modifications are critical to designing anti-bump longwall mining methods.

Coordination or Cooperation with Another Agency: The Army Corps of Engineers have provided valuable assistance in refining drilling methods used in the instrumentation of associated strata during both the room-and-pillar and longwall studies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority Rock Mechanics 1987 Session Number RM-61  
 Subject Area Rock Mechanics  
 Project Title Improved Ground Control in Outcrop Barrier Zones  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator Gary P. Sames Cochrans Mill Road, P.O. Box (FIS) 723-4347  
 18070, Pgh., PA 15236 (412) 892-4347 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: The specific objectives of this research are to:  
 1. Characterize the outcrop barrier zone in hilltop mining through geotechnical descriptions, rock mass characterization, and rock mechanics monitoring.  
 2. Provide criteria for improved mine planning and scientifically based roof support recommendations in outcrop barrier zones.

Technical Approach: The geotechnical character of the outcrop barrier zone is being characterized in the Central Appalachian coal region, an area of predominantly above drainage mining that is affected by steep topography and unstable roof near outcrop. Several rock engineering classification systems, such as Rock Structure Rating, Rock Mass Rating, and the Q-System, are being applied to in situ conditions. Deformation monitoring equipment is being installed near critical roof conditions characteristic of outcrop mining.

General Progress in Last Two Years: Project funding began in FY 87. Progress to date includes geologic descriptions and mapping of outcrop barrier conditions and installation of convergence station arrays in areas affected by heavily weather jointing (hillsseams).

Plans for Next Twelve Months (FY 88): Continue deformation monitoring and geologic assessments. Develop drilling program for rock mass characterization studies and rock mechanics testing. Develop the necessary data for computer modelling studies of jointing and weathering of steep valley walls in Central Appalachia.

Coordination or Cooperation with Another Agency: Mine Health and Safety Administration.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams Technology Transfer X None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number RH-6k  
 Subject Area Rock Mechanics  
 Project Title Geologic Anomalies and how they Effect the Regional Stress In Illinois  
 Performing Organization Pittsburgh Research Center, USBM  
 Principal Investigator David K. Ingram (Name) Cochrans Mill Road, P.O. Box (FIS) 723-6647  
18070, Pgh., PA 15236 (Address) (412) 892-6547  
(Te lephones)  
 Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives: Identify possible stress field alteration surrounding major geologic anomalies. Awareness of these possible alterations allows coal mine operators to safely mine potential hazardous areas.

Technical Approach: Compare measured in situ horizontal stresses in the roof adjacent to large geologic structures with undisturbed areas free of any of these structures and evaluate the degree to which the local stress distribution has been distorted.

General Progress in Last Two Years: Thirty one in situ horizontal stress measurements and detailed underground geologic mapping were completed at the Wabash Mine and Galatia Mine in Southern Illinois. Measurements and geologic mapping were concentrated around a normal fault that has a displacement of 121 ft, and a in seam discontinuity that voids the total thickness of the coalbed.

Plans for Next Twelve Months (FY 88): Analysis the stress magnitudes and directions surrounding these geologic anomalies. This will be accomplished by combining the geologic information with the stress measurements to determine the extent of influence of the geologic features on stress distribution.

Coordination or Cooperation with Another Agency: None.

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams, Technology Transfer, Project Maintenance, Rehabilitation and Life Extension X None

TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number RH-6l  
 Subject Area Ground Control  
 Project Title Undercut Mining on Steeply Pitched Coal  
 Performing Organization Spokane Research Center  
 Principal Investigator Jim D. Vickery SRC FTS 439-6880  
Address Phone Number  
 Starting Year FY87 Estimated Completion Year FY89

Technical Objectives: Conduct basic and applied research to determine the technical requirements of extracting steeply pitched coal seams by an undercut and fill mining method adapted from current technology used in metal/non-metal mining. The major objectives of this research project are to gain a better understanding of the backfill behavior (the interaction between the backfill and the wallrock, the failure modes of the backfill, etc.) and the development of suitable backfill design criteria for use in softrock environments.

Technical Approach: Previous contract work by the Bureau has shown that an undercut and fill mining method may be economically feasible, if the technological means of successfully implementing this mining method can be developed. A field demonstration will provide researchers and the mining industry with practical information to assist in determining the feasibility of full-scale mining systems using backfill to recover steep coal seams.

General Progress in Last Two Years: Another contract reported that a backfill could be made of materials available at an open pit coal mine operating on an anticline with steeply dipping limbs in western Washington. The characteristics of the site have been determined by core drilling and laboratory testing of that core. These values were used as inputs to a numerical model used as an aid in determining the backfill requirements. A matrix of likely backfill materials was made and tested for strength. Plans for a field demonstration have been discussed with the mining company. A suitable location within the pit and means of access to the seams have also been investigated.

Plans for Next Twelve Months (FY 88): A analysis must be made to determine if the site has characteristics which are compatible for the proposed field demonstration. Requirements for the backfill and possible auxiliary support must be developed and matched to a suitable backfill mixture. Detailed planning for the field demonstration may then begin. A site plan outlining the means to complete and evaluate the demonstration will be completed.

Coordination or Cooperation with Another Agency: The Mine Safety and Health Administration will be consulted on safety issues which pertain to the design of the field demonstration.

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number RM-6a  
Subject Area Rock Mechanics  
Project Title Retreat Mining Geomechanics  
Performing Organization USBM--Spokane Research Center  
Principal Investigator John K. Owens, E. 315 Montgomery, Spokane, WA 99207 (FTS) 439-6880  
(Address) (509) 484-1610 (Telephones)

Starting Year FY 81 Estimated Completion Year FY 90

Technical Objectives: To develop guidelines for room-and-pillar retreat mining operations by correlating numerical results with field data collected from retreat mining panels, and to postulate theories to explain the mechanism and dynamics of ground behavior during pillar extraction.

Technical Approach: Field data will be collected at retreat mining operations that will characterize the response of the panel to mining. The data will be used to validate and calibrate computer models of room-and-pillar retreat operations. The models will be used as design tools for considering alternative and more effective layouts and to develop design criteria for retreat mining.

General Progress in Last Two Years: A retreat mining panel in southern Utah was instrumented and monitored. Material properties of the roof and floor strata were determined from laboratory rock property tests on NX core recovered from the test site. The panel was analyzed using numerical modeling codes that can run on microcomputer (PC's) and large mainframe computers.

Plans for Next Twelve Months (FY 88): Analytical modeling will continue with further refinements in closed-form solutions, finite difference, finite element, boundary element, and distinct element modeling techniques. The analytical investigation will focus on programs that can be run on small, desk-top computers to enable the operator to perform a structural evaluation on-site using geologic data obtained during the development of the panel.

Coordination or Cooperation with Another Agency: Information will be exchanged with Denver Research Center and the Technical Support Group of MSHA on project progress and results.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:  
Safety of Dams and Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

APPENDIX I  
AGENDA AND TOPIC STATEMENTS  
SOIL MECHANICS SESSION

FIFTEENTH INTERAGENCY RESEARCH COORDINATION CONFERENCE  
 U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION  
 VICKSBURG, MISSISSIPPI  
 3-5 NOVEMBER 1987

AGENDA

SOIL MECHANICS SESSION

Gene F. Hale - Chairman  
 Daniel A. Leavell - Recorder

<u>DATE/TIME</u>	<u>TOPIC NO.</u>	<u>TOPIC STATEMENT</u>	<u>AGENCY</u>	<u>DATE/TIME</u>	<u>TOPIC NO.</u>	<u>TOPIC STATEMENT</u>	<u>AGENCY</u>
TUESDAY NOV 3						<u>ANALYTICAL/DESIGN STUDIES (CONTINUED)</u>	
0900-1130	S-1	<u>LABORATORY TESTING</u>			S-3	Evaluation of Dynamic Soil Stiffness Based on Correlation	CE
	S-1-a	Large-Scale Soils Laboratory Stress Cell	CE		S-3-e		CE
	S-1-b	Testing Large-Particled Soils	CE				
	S-1-c	Laboratory Permeability and Consolidation Investigation	USBR	1430-1600	S-4	<u>SPECIAL STUDIES AND CORRELATION</u>	
	S-1-d	Centrifuge for Soil Property Determination	CE		S-4-a	Special Studies for Civil Works Soils Problems	CE
	S-1-e	Rapid Water Content Determination Using a Microwave Oven	CE		S-4-b	Mining With Back Fill	USBR
	S-1-f	Identification of Potentially Erosive Soil	USBR		S-4-c	Round Robin Testing Program of Standard Soil Samples	CE
	S-1-g	Characterization of Shear Strengths of Unsaturated Soils by Soil Suction	CE		S-4-d	Computer Applications in Geotechnical Engineering; Task Group on Laboratory Automation	CE
	S-1-h	Measurement of Vertical and Horizontal Swell Pressures	CE		S-4-e	Technology Transfer	CE
	S-1-i	Vibratory Table Motion Research	USBR				
1130-1230	S-2	<u>IN SITU INVESTIGATION TECHNOLOGY</u>		1600-1700	S-5	<u>FIELD PERFORMANCE</u>	
	S-2-a	Improved Soil Exploration, Sampling, and In Situ Testing Methods	USBR		S-5-a	Rehabilitation, Evaluation, Maintenance, and Repair (REMR), Geotechnical - Soils	CE
	S-2-b	In Situ Investigation Technology	CE		S-5-b	Evaluate Canal Performance in Loessial Soil	USBR
	S-2-c	Geophysical Methodology for Assessment of Existing Structures and Structural Foundations	CE		S-5-c	Acoustic Emission Monitoring of Cofferdam Performance, Lock and Dam No. 26	CE
	S-2-d	Deep Foundations	CE		S-5-d	Soil Cement Research	USBR
1230-1330	LUNCH						
1330-1430	S-3	<u>ANALYTICAL/DESIGN STUDIES</u>		0815-1015	S-6	<u>EARTHQUAKE ENGINEERING</u>	
	S-3-a	Soil Behavior Under Generalized Stress Paths	CE		S-6-a	In Situ Testing for Evaluating Soil Liquefaction	USBR
	S-3-b	Probabilistic Methods in Soil Mechanics	CE		S-6-b	Liquefaction of Fine-Grained Soils	CE
	S-3-c	Development of New Design Procedures for Sheetpile Walls	CE		S-6-c	Improvement of Foundation Soils Susceptible to Liquefaction	CE
	S-3-d	Centrifuge Model Study to Investigate Earth Dam Cracking	USBR		S-6-d	Seismically-Induced Settlements in Soils	CE
					S-6-e	Earthquake Hazard Evaluations for Engineering Sites	CE
					S-6-f	Reevaluation of the Lower San Fernando Dam	CE
				1015-1230	DISCUSSION:	SPECIAL ISSUES AND RESEARCH NEEDS	CE
							USBR
							TVA
							BPA
				1230-1330	LUNCH		



TOPIC STATEMENT

Agency CE Priority            1987 Session Number S-1-a  
 Subject Area Soil Mechanics

Project Title Large-Scale Soils Laboratory Stress Cell  
 Performing Organization CEWES  
 Principal R. W. Peterson, CEWES-GE-SR (FTS) 542-3737  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3737  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives: To develop a concept for, design, and construct a large-scale stress cell and its complement of auxiliary equipment to simulate in situ stress conditions in the soils laboratory environment. The apparatus will be of sufficient size to permit near full-scale or prototype in situ tests. The stress cell will be used for developing interpretative guidelines for in situ soils tests and improving soil sampling and testing techniques.

Technical Approach: Phase I of the study will include the development of conceptual schemes for a versatile large-scale laboratory stress cell and the assessment of the economic feasibility of using the stress cell for simulating in situ stress conditions. Phase II will consist of the design and construction of the stress cell and its complement of auxiliary equipment.

General Progress in Last Two Years: Technical liaison was established with approximately 15 world renowned researchers using the large-scale laboratory stress cell. A draft report describing the conceptual scheme for a large-scale stress cell has been prepared. Two contracts to assess the feasibility of the large-scale stress cell have been awarded.

Plans for Next Twelve Months (FY 88): Phase I of the feasibility studies will be completed and the results will be evaluated. Phase II, which includes design and construction of said apparatus, will be awarded to the contractor who provides the more innovative design for a versatile system, while maintaining a perspective of the overall cost of the system, the cost per test, as well as future needs for conducting unspecified geotechnical investigations in a cost effective, timely manner.

Coordination or Cooperation with Another Agency: Technical liaison was established with personnel of the US Bureau of Reclamation.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams Technology Transfer            None  
 X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number S-1-b  
 Subject Area Soil Mechanics

Project Title Testing Large-Particle Soils  
 Performing Organization CEWES  
 Principal V. H. Torrey III, CEWES-GE-R (FTS) 542-2619  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2619  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 91

Technical Objectives: Provide technology for determining the engineering properties of widely-graded soils containing particles larger than 1-in.; reduce or eliminate deficiencies in currently accepted practices for laboratory compaction, laboratory triaxial testing, and field compaction control.

Technical Approach: The research will: (1) determine the influence on compaction and shear strength parameters of large particles content, fines content, and plasticity of fines; (2) resolve procedural problems with determining these parameters and translate results into guidelines for proper fill compaction control; (3) resolve the effects of membrane compliance on results of undrained triaxial shear tests; and (4) develop satisfactory test methods for determining the maximum and minimum densities of cohesionless earth-rock mixtures.

General Progress in Last Two Years: A compaction test has been developed and verified using a mechanical compactor for material with up to 2-in. maximum particle size (12-in. mold) containing either silt or clay fines. The procedure is being checked for the 18-in. mold, 3-in. maximum particle size. A contract study was completed which developed a method for determining membrane compliance in undrained triaxial tests. Maximum/minimum density tests for cohesionless earth-rock mixtures with up to 6-in. maximum particle size was developed and verified. A fill compaction control methodology based on the minus No. 4 fraction looks very promising.

Plans for Next Twelve Months (FY 88): (1) Continue work to verify 18-in. mold compaction test; (2) write report on compaction testing and fill control methodology; (3) publish contract report on membrane compliance; and (4) initiate triaxial testing program to study effects of large particles, percent fines, and plasticity of fines.

Coordination or Cooperation with Another Agency: No associated current major efforts by another agency known. Available information has been obtained relative to past work from US Bureau of Reclamation, and California Department of Water Resources.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

X Safety of Dams Technology Transfer            None  
 X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 4 1987 Session Number S-1-c  
 Subject Area Soil Mechanics

Project Title Laboratory Permeability and Consolidation Investigation

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007 MC D-1541 (FIS) 776-4324  
 Investigator Robert Scavuzzo Denver CO 80225 (303) 236-4324  
 (Name) (Address) (Telephone)

Starting Year FY84 Estimated Completion Year FY89

Technical Objectives:

- a. Evaluate the effect of specimen size (height) with the value of permeability coefficient obtained using the flow pump permeability testing technique.
- b. Compare traditional Skempton's B-value criteria for indicating specimen saturation with flow pump "steady-state" criteria and evaluate its effect on laboratory permeability test results.

Technical Approach:

- a. Perform flow pump permeability test on specimens of a variety of soil types. Perform companion tests using specimens approximately 2.5 and 5.0 inches and compare the value of permeability coefficient obtained.
- b. Perform flow pump permeability test on specimens of a variety of soil types. Perform companion tests using Skempton's B-value criteria and flow pump "steady-state" criteria for indicating specimen saturation and compare the value of permeability coefficient obtained.

General Progress in Last Two Years:

Flow pump was designed, fabricated, and delivered to the Bureau of Reclamation geotechnical laboratory. Joint Research Project No. DR-461 with the University of Colorado completed.

Plans for Next Twelve Months (FY88):

- a. Finish testing as discussed in technical approach section.
- b. Test peat samples using flow pump for the USGS.

Coordination or Cooperation with Another Agency:

Cooperative efforts with USGS are underway with meetings to discuss testing and sampling techniques to be used for peat permeability testing.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-1-d  
 Subject Area Soil Mechanics

Project Title Centrifuge for Soil Property Determination

Performing Organization CEWES  
 Principal J. F. Peters, CEWES-GE-SR (FIS) 512-2590  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2590  
 (Name) (Address) (Telephone)

Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives: Use a laboratory centrifuge to consolidate soil specimens. Two principal objectives are: (1) determine soil properties when limited laboratory facilities are available; and (2) simplify the determination of consolidation properties of soft soils.

Technical Approach: Saturated soil specimens can be consolidated in a small laboratory centrifuge to determine conventional consolidation properties. The stress acting on the soil can be computed from the centrifuge arm speed; void ratio can be computed from water content. A centrifuge consolidation test is faster than a conventional test because consolidation rate is proportional to the square of the arm speed. The test is ideal for evaluating dredge fill properties because the actual field loading is simulated. Other properties can be determined using empirical relationships that are related to the consolidation curve. The test can be performed with minimal laboratory facilities by technicians with limited soil testing experience.

General Progress in Last Two Years: A test series was completed on over 20 soils. A classification scheme for soil plasticity was developed using the slope of the void ratio-consolidation stress curve and void ratio at 1 tsf in a manner similar to the liquid and plastic limits. Empirical relationships for determining undrained shear strength from the centrifuge consolidation properties have been investigated. Soft materials similar to dredge spoil have been tested to determine both void ratio-stress and void ratio-permeability properties.

Plans for Next Twelve Months (FY 88): Publish report.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-1-e  
 Subject Area Soil Mechanics

Project Title Rapid Water Content Determination Using a Microwave Oven  
 Performing Organization CEWES  
 Principal P. A. Gilbert, CEWES-GE-SR (FIS) 542-2797  
 Investigator P. O. Box 631, Vicksburg, MS 39180-0631 (601) 631-2797  
 (Name) (Address) (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 89

Technical Objectives: To develop equipment and procedures to automate the microwave oven drying of soil so that soil water content equivalent to the conventional oven water content may be determined rapidly and reliably using a microwave oven.

Technical Approach: As water is vaporized from a soil-water mixture from exposure to microwave energy, the temperature of the dry soil increases abruptly and the measured water content converges to a terminal value. One, or a combination of these effects will be used to trigger an automated system to terminate microwave drying.

General Progress in Last Two Years: New start in late FY88.

Plans for Next Twelve Months (FY 88): To construct the required system and fine tune/calibrate it for optimum correlation of microwave oven water content with conventional oven water content for normal (non-problem) soils and prepare a report describing the equipment and investigation.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special

Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 5 1987 Session Number S-1-f  
 Subject Area Soil Mechanics

Project Title Identification of Potentially Erosive Soil  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1541 (FIS) 776-4322  
 Investigator Robert Baumgarten Denver CO 80225 (303) 236-4322  
 (Name) (Address) (Telephone)  
 Starting Year FY83 Estimated Completion Year FY89

Technical Objectives:

To identify erosion resistant soils for use as canal lining by determining the critical tractive force at which erosion commences.

Technical Approach:

A hydraulic flume is used to compare the relative erodibility of various soils and to determine the magnitude of the boundary shear stresses at which erosion commences.

General Progress in Last Two Years:

Soil samples covering a range of soil types and plasticity characteristics have been tested in the laboratory flume. During these tests, the flow could not be maintained for the duration of a test with sufficient accuracy to permit measuring boundary shear stresses.

Plans for Next Twelve Months (FY88):

Re-evaluate the initial procedure for obtaining boundary shear stresses. Develop an acceptable procedure for eroding soils and obtaining accurate critical tractive forces. Soil samples will be obtained from existing canals that have experienced erosion problems and flume tests will be performed to determine critical shear stresses required to initiate erosion. After analysis of the data, a final report will be written.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-1-g  
 Subject Area Soil Mechanics

Project Title Characterization of Shear Strengths of Unsaturated Soils by Soil Suction

Performing Organization CEWES  
 Principal R. W. Peterson, CEWES-GE-SR (FTS) 542-3737  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3737  
 (Name) (Address) (Telephones)

Starting Year FY 80 Estimated Completion Year FY 88

Technical Objectives: Characterize the influence of soil suction on the shear strengths of unsaturated soils.

Technical Approach: A comprehensive review of the literature indicated that the shear strengths of unsaturated soils were dependent upon specimen density and water content as well as the type and concentration of cations in the pore fluid and the applied stress conditions. Furthermore, there was inconclusive evidence that shear strengths were also dependent upon test conditions and method of specimen preparation. Guided by the results of these studies, a laboratory investigation was formulated and conducted to assess the influence of density, water content, and cations in the pore fluid on the shear strengths of unsaturated soils.

General Progress in Last Two Years: The laboratory investigation and the subsequent analysis of test data has been completed. A modified Mohr-Coulomb failure model to predict the shear strengths of unsaturated soils has been proposed. The effect of suction is to increase the value of the cohesion intercept in the strength model, although the actual measurement of soil suction is not required to apply the model.

Plans for Next Twelve Months (FY 88): A summary report will be published.

Coordination or Cooperation with Another Agency: Technical liaison was established with personnel of the US Bureau of Reclamation.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-1-h  
 Subject Area Soil Mechanics

Project Title Measurement of Vertical and Horizontal Swell Pressures

Performing Organization CEWES  
 Principal L. D. Johnson, CEWES-GE-R (FTS) 542-3840  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3840  
 (Name) (Address) (Telephones)

Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives: To determine the feasibility of evaluating vertical and horizontal swell pressures as part of a triaxial strength test.

Technical Approach: Horizontal and vertical swell pressures of undisturbed cohesive soil will be measured by inundating the specimen with distilled water while maintaining no vertical and lateral deformation. The specimen may then be consolidated and/or sheared to determine soil strength. Companion specimens will be tested by standard methods for comparison with test results using the developed apparatus and methodology.

General Progress in Last Two Years: Double chamber triaxial test equipment was assembled and calibrated. Calibration tests indicated minimal and reproducible fluid level changes of up to 1 ml in the chamber and specimen buretts. Calibration fluid level changes are minimal because of the use of a double chamber. Tests performed on two different soils indicated that swell pressures are isotropic if volume change is not permitted in the specimen; i.e., swell pressure at a particular water content and dry density in any orientation will not exceed the applied isotropic pressure required to prevent volume change after exposure of the specimen to free water. Petrographic examination of one specimen indicated that particle orientation of at least some of the soil is highly anisotropic. Shear strength measured in the apparatus is similar to that measured using other methods. Stiffness of the tested soil is in the upper range of values by other methods, which is attributed to friction between an O-ring of the inner chamber and loading ram required for a seal and the solid filter fabric cage used to assure sufficient water to the specimen. The adopted test procedure shows that the methodology is practical.

Plans for Next Twelve Months (FY 88): This feasibility study is completed.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 6 1987 Session Number S-1-1  
 Subject Area Soil Mechanics

Project Title Vibratory Table Motion Research

Performing Organization Bureau of Reclamation (FIS) 776-4316  
 Principal PO Box 25007, MC D-1541  
 Investigator I. E. Metcalf Denver CO 80225 (303) 236-4316  
 (Name) (Address) (Telephone)

Starting Year FY87 Estimated Completion Year FY88

Technical Objectives:

- a. Determine feasibility of using accelerometers to calibrate vibratory tables used to determine the maximum index unit weight of cohesionless soils.
- b. Investigate improving, modifying, or replacing the vibratory table.

Technical Approach:

Evaluate and compare vibratory table amplitude and acceleration for several types of tables to develop correlation between acceptable levels of amplitude and acceleration, and calibrate tables using accelerometers.

General Progress in Last Two Years:

Vibratory table amplitude and acceleration data recorded and correlation response comparisons performed.

Plans for Next Twelve Months (FY88):

Prepare and publish conclusions.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ None

\_\_\_\_\_ Safety of Dams  Technology Transfer \_\_\_\_\_

\_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1 1987 Session Number S-2-a  
 Subject Area Soil Mechanics

Project Title Improved Soil Exploration, Sampling, and In Situ Testing Methods

Performing Organization Bureau of Reclamation (FIS) 776-6070  
 Principal PO Box 25007, MC D-1542  
 Investigator Michael Szygueliski Denver CO 80225 (303) 236-6070  
 (Name) (Address) (Telephone)

Starting Year FY78 Estimated Completion Year FY Ongoing

Technical Objectives:

Establish and improve Bureau-wide capability and compatibility for rapid methods of determining stratification and engineering properties of soil deposits using penetration resistance testing and other in situ testing methods. Improve Bureau-wide capability in sampling of loose, weak, or difficult soils by evaluating current techniques and improving and modifying existing sampling equipment or developing new equipment.

Technical Approach:

Evaluate, modify, standardize, and document use of current drilling and sampling equipment and procedures. Obtain, evaluate, develop, and standardize new and improved drilling and sampling equipment and techniques. Evaluate in situ soil test procedures.

General Progress in Last Two Years:

A 20-ton electric cone penetration testing system has been utilized in investigations related to safety of dams studies to reduce conventional drilling resulting in cost savings on exploration programs. Operational guidelines and field training was developed to allow regional forces to perform testing. Studies of standard penetration test equipment to develop safe and efficient hammer systems.

Plans for Next Twelve Months (FY88):

To establish procedures for SPT (standard penetration test) hammer energy testing. To further develop the use of DMT (dilatometer) testing for Bureau project site investigations.

Coordination or Cooperation with Another Agency:

Cooperative efforts are underway with Corps of Engineers with exchanges of progress and data collection for SPT hammer energy testing.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ None

\_\_\_\_\_ Safety of Dams  Technology Transfer \_\_\_\_\_

\_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number S-2-b  
 Subject Area Soil Mechanics  
 Project Title In Situ Investigation Technology  
 Performing Organization CEMES  
 Principal R. W. Peterson, CEMES-GE-SR (FTS) 542-3737  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3737  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 93  
 Technical Objectives: Assess the influence of fines on the penetration resistance of silty sands.

Technical Approach: Because of the uncertainty of the interpretation of penetration test results in silty sands, a laboratory investigation to assess the influence of fines on the penetration resistance of cohesionless soils was initiated. Two questions regarding the laboratory investigation were identified: (a) could the effects of fines be isolated and studied in the laboratory environment; and (2) if the answer to (a) was affirmative, what would be the feasibility of extending this research to in situ conditions using full-scale penetrometers in the laboratory and/or field?

General Progress in Last Two Years: Guided by the principles of dimensional analysis and similitude, a laboratory investigation was formulated to address the influence of specimen density, particle size, penetration rate, the influence of pore fluid, and penetrometer diameter on penetration resistance. A small-scale penetration apparatus and two scaled probes were constructed. Four uniform gradations of artificial materials have been used to obtain the majority of penetration resistance data. Two contracts have been awarded to assess the feasibility of obtaining a large-scale stress cell or calibration chamber to simulate in situ tests at or near full-scale conditions. A compendium of selected references on the use and interpretation of in situ tests has been prepared in draft form.

Plans for Next Twelve Months (FY 88): The laboratory investigation will continue. A contract will be awarded to develop a methodology to build large-scale samples of silty sands.

Coordination or Cooperation with Another Agency: Technical liaison has been established with personnel of the US Bureau of Reclamation regarding in situ testing. Technical liaison has also been established with approximately 15 world renowned researchers currently using the large-scale stress cell to evaluate in situ test results.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number S-2-c  
 Subject Area Rock Mechanics (Geophysics, Engineering Geology, Soil Mechanics)  
 Project Title Geophysical Methodology for Assessment of Existing Structures and Structural Foundations  
 Performing Organization CEVES  
 Principal Dwain K. Butler/Jose L. Llopis, CEVES-OH-R/-I (FTS) 542-2127/542-3164  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2127/634-3164  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 89  
 Technical Objectives: Develop new and adapt existing engineering geophysical methods for geotechnical investigations of existing structures and structural foundations.

Technical Approach: Identify characteristics of existing structure sites which defend or complicate the application of standard engineering geophysical methods. Assess the state of the art of engineering geophysics and identify adaptations which could make geophysical methods more applicable to existing structure sites. Identify new geophysical methods or techniques applicable to the investigation of existing structure sites. Select field test sites for evaluation of new and adapted geophysical methods.

General Progress in Last Two Years: Geophysical methods investigated include electrical and electromagnetic techniques, high-resolution seismic reflection surveying, ground-penetrating radar, self potential (SP) surveying, and microgravimetry. Two field test sites were selected. Lockport Approach Dike, Illinois, and Beaver Dam Dike 1, Arkansas. Field work at Lockport Dike was limited to ground-penetrating radar; while the work at Beaver Dam was extensive and included all of the geophysical techniques mentioned above plus other standard geophysical methods. The investigations at Beaver Dam are fully integrated with other geotechnical investigations conducted by the US Army Engineer District, Little Rock. Results of the work at Beaver Dam have been helpful in defining the geotechnical investigations and assessing remedial measures alternatives. Three draft reports have been completed, and four contractor studies are on-going.

Plans for Next Twelve Months (FY 88): Complete four draft contractor reports and one in-house draft report. Participate in and help organize international symposium of SP applications to existing structure evaluation. Finalize data analyses for work at Beaver Dam.

Coordination or Cooperation with Another Agency: Workshop on geotechnical applications of SP with CE, TVA, and USBR held at WES. USGS is also participating in the research.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-2-d  
 Subject Area Soil Mechanics

Project Title Deep Foundations  
 Performing Organization CEWES  
 Principal G. B. Mitchell, CEWES-GE-E (FTS) 542-2640  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2640  
 (Name) (Address) (Telephones)  
 Starting Year Not Applicable Estimated Completion Year Continuing

Technical Objectives: Determine the behavior of deep foundations - particularly driven piles - under various installation and loading conditions.

Technical Approach: Conduct field load tests on full-scale piles and laboratory tests on model piles, perform field and laboratory soils tests, and make appropriate analyses.

General Progress in Last Two Years: (1) Completed field and laboratory study of lateral loads on vertical piles in cohesive soils; (2) completed laboratory study of scour potential of soils around piles in a subaqueous environment; (3) completed a comparison of pressuremeter and cone penetrometer capacity predictions with actual field tests with lateral and axial loads on piles in sands and gravels; (4) completed a study of cyclic lateral loads on a 9-pile group in cohesive soils; (5) completed a study of cyclic lateral loads on a 9-pile group in sands; (6) completed a study of lateral single-pile interaction within a 9-pile group in sands; (7) completed the field testing of 3 large 100-ft long piles under cyclic lateral loads; (8) completed the field testing of axially loaded, H-piles in sands driven with an impact hammer, driven with a vibratory hammer, and driven with a vibratory hammer and restruck with an impact hammer; (9) completed a new Technical Manual, "Design of Deep Foundations;" and (10) held a Corps-wide "Geotechnical Research on Deep Foundations" workshop.

Plans for Next Twelve Months (FY 88): (1) Complete the field testing of "drilled and grouted" tension piles; (2) complete a summary report of the pressuremeter and cone penetrometer prediction/comparison study; (3) complete a summary report of the 9-pile group studies; (4) complete a report of the 3-pile cyclic lateral load study; (5) complete a report of the vibratory/impact hammer capacity comparison study; and (6) begin a study of a comparison of drivability of piles in a subaqueous versus dewatered environment.

Coordination of Cooperation with Another Agency: Minerals Management Service, Federal Highway Administration, US Navy.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-3-a  
 Subject Area Soil Mechanics

Project Title Soil Behavior Under Generalized Stress Paths  
 Performing Organization CEWES  
 Principal J. F. Peters, CEWES-GE-SR (FTS) 542-2590  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2590  
 (Name) (Address) (Telephones)  
 Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives: Develop experimental and analytical procedures to predict the response of soil to generalized loadings.

Technical Approach: The experimental methods will be developed to replicate the actual loading applied in the field with respect to orientation of principal stresses under drained and undrained conditions. Analytical procedures will be developed with emphasis placed on implementing realistic and reliable constitutive equations into practical computer codes for geotechnical analysis. Special emphasis will be given to instability related to strain softening, formation of shear bands, and liquefaction.

General Progress in Last Two Years: Experiments were performed in cubical and directional shear cells at the University of Colorado, Boulder. A directional shear cell developed for WES by the University College London, London, England, was delivered and preliminary experiments are in progress. A combined theoretical and experimental study on formation of shear bands in sands was completed. A constitutive model for soils was developed based on the theory of internal variables which predicts shear-dilatancy coupling and volume changes caused by cyclic loading.

Plans for Next Twelve Months (FY 88): Perform experiments using WES directional shear cell on influence of principal stress axes orientation on undrained shear strength of sedimented clays. Implement internal variable model into a computer code. Perform analysis of capability of model to predict behavior of sand in UCB experiments. Complete analysis of stability characteristics of model under drained and undrained conditions for monotonic and cyclic loading. Extend experimental investigation of shear banding to clays.

Coordination of Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-3-b  
 Subject Area Soil Mechanics  
 Project Title Probabilistic Methods in Soil Mechanics  
 Performing Organization CEWES  
 Principal M. E. Hynes-Griffin, CEWES-GH-R (FTS) 542-2280  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2280  
 (Name) (Address) (Telephones)  
 Starting Year FY 83 Estimated Completion Year FY 87  
 Technical Objectives: Identify Corps soil mechanics activities for which probabilistic methods are appropriate. Develop practical probabilistic methods for areas that are most adaptable to and offer the greatest potential benefits from the use of these methods.

Technical Approach: Examine a case history application of a wide range of existing probabilistic and statistical techniques and develop a long-range research plan for development of risk analysis tools. The topics covered in reports are (1) the general case history study, (2) basic statistical techniques for geotechnical data, (3) error analysis for geotechnical design, (4) statistical quality control for engineered fills, and (5) reliability of levees.

General Progress in Last Two Years: Development of user-friendly micro-computer software for field compaction quality assurance applications and publication of final reports.

Plans for Next Twelve Months (FY 88): None. Project completed.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-3-c  
 Subject Area Soil Mechanics  
 Project Title Development of New Design Procedures for Sheetpile Walls  
 Performing Organization CEWES  
 Principal D. A. Leavell, CEWES-GE-SR (FTS) 542-2496  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2496  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88  
 Technical Objectives: Evaluate current sheetpile design procedures and develop new design procedures based on finite element model results.

Technical Approach: A sheetpile test section is modeled using the finite element method. The test section field results are used to calibrate the finite element model. A parametric analysis is made of a generalized field section to develop new sheetpile design procedures.

General Progress in Last Two Years: Modeling of the sheetpile test section and calibration of the finite element model were completed.

Plans for Next Twelve Months (FY 88): The parametric analysis of the generalized field section will be completed. A new design procedure based on the finite element method will be developed and a final report will be published.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None



TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number S-3-d  
 Subject Area Soil Mechanics  
 Project Title Centrifuge Model Study to Investigate Earth Dam Cracking  
 Performing Organization Bureau of Reclamation  
 Principal Investigator Mark Gemperline (Name) Denver CO 80225 (Address) (303) 236-4319 (Telephone)  
 Starting Year FY87 Estimated Completion Year FY89

Technical Objectives:

Investigate causes of cracking in earth dams and usefulness of centrifugal modeling as analytical tool in study of crack formation and soil-structure interaction of composite dam models.

Technical Approach:

Evaluate existing state-of-the-art of embankment dam cracking and soil-structure interaction problems, methods of analysis, and design methods. Perform centrifugal modeling to investigate effects and suitability of using centrifuge as design tool.

General Progress in Last Two Years:

Literature review underway, model test materials, instrumentation selected.

Plans for Next Twelve Months (FY88):

Perform centrifuge modeling and numerical analysis of problem. Compile results.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number S-3-e  
 Subject Area Soil Mechanics  
 Project Title Evaluation of Dynamic Soil Stiffness Based on Correlations  
 Performing Organization CEVES  
 Principal Investigator David W. Sykora, CEVES-OH-R (Name) P.O. Box 631, Vicksburg, MS 39180 (Address) (601) 634-3551 (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 87

Technical Objectives: Compile a sizeable database of seismic velocities measured in situ with high-quality crosshole methods to determine the most accurate means of estimating dynamic soil shear modulus and shear wave velocity for any soil given any number of known parameters typically obtained in geotechnical investigations. This database will be useful in a number of Army applications including: prediction of ground motions from nuclear explosives, deployment of passive seismic systems, employment of active seismic systems, and evaluation of dynamic response of facilities.

Technical Approach: A very large data base will be generated, incorporating as much available data as possible from Corps of Engineers projects, other governmental agencies, foreign sources, and private consulting firms. Data will be acquired from personal contacts and reports of field studies at sites where dynamic soil properties were measured in addition to other geotechnical data such as SPT N-values, soil type, plasticity, geologic age, gradation, and ground water conditions. A computer will be used for data base management.

General Progress in Last Two Years: A report summarizing a literature review of existing correlations to estimate shear wave velocity or shear modulus, including comparisons among studies and recommendations to Corps personnel is being published as a VES report. Data has been collected from numerous sources throughout the United States. Database software has been implemented and customized for this study. Tasks defined in a purchase order to the University of Texas have been completed. Over 2000 data points from 40 project sites have been prepared from available geotechnical and geophysical reports and input into the data base. A preliminary analysis was performed. A report summarizing this aspect of the study is being published.

Plans for Next Twelve Months (FY 88): No work to be performed. PI is assigned to Long Term Training.

Coordination or Cooperation with Another Agency: Data collected from CE Districts, NRC, FERC, and DOE files.

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-4-a  
 Subject Area Soil Mechanics

Project Title Special Studies for Civil Works Soils Problems

Performing Organization CEWES  
 Principal Investigator C. L. McNear, CEWES-GE (FTS) 542-2228  
P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2228  
 (Name) (Address) (Telephones)

Starting Year FY 74 Estimated Completion Year Continuing  
 Technical Objectives: Study special problems arising in design and construction of embankment dams and foundations of other structures. Provide expertise and counsel on Civil Works soils problems, investigational and research programs, and related CE activities. The research products have immediate user application responsive to specific issues/problems.

Technical Approach: Expedient solutions are suggested or independent work units proposed. Experts well qualified in various aspects of soil mechanics are consulted for advice and guidance. Engineers with specialized capability are used to accomplish each study.

General Progress in Last Two Years: Published "The Large Strain, Controlled Rate of Strain (LSCRS) Device for Consolidation Testing of Soft Fine-Grained Soils;" completed contract on "Monograph on Atterberg Limits;" supported NAS Committee on Earthquake Engineering and EERI; coordinated cooperative inter-agency R&D on pile foundations and co-sponsored CE workshop "Geotechnical Research Activities on Deep Foundations;" completed contract concerning earth pressures on retaining walls in expansive soil excavations.

Plans for Next Twelve Months (FY 88): Publish research results concerning granular filters, embankment overtopping, consolidation of clay shales, Atterberg limits, retaining walls, and probability analyses of levee underseepage and stability; support NAS earthquake activities; issue progress reports on cooperative pile research; and address ad hoc issues.

Coordination or Cooperation with Another Agency: None other than informal liaison and exchange of information among principal investigators and program managers.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number S-4-b  
 Subject Area Soil/Rock Mechanics  
 Project Title Mining With Backfill

Performing Organization Spokane Research Center  
 Principal Investigator Ronald R. Backer SRC Address FTS 439-6680  
 (Name) (Address) (Phone Number)  
 Starting Year FY82 Estimated Completion Year FY95

Technical Objectives: Conduct basic and applied research on mine backfill materials and placement procedures to provide the technologies needed to obtain maximum resource recovery from underground mines. Emphasis of this research will be to close the technology gap between soil mechanics and rock mechanics in order to provide a basis for use of backfill to support underground openings and to allow mining of mineral values currently left as support.

Technical Approach: Work will be focused on correctly defining the deformation properties of the backfill and rock pillars, placement of backfill as a slurry "paste," and determining the mechanics of gravity loading of the backfill-pillar support systems. The stability will be assessed by mathematical and physical models and comparisons made with actual mine pillar extraction data. Lean mix backfill utilizing mill total tailings placed in higher than 80% slurry density for support has been identified as a promising technique to effectively increase ore recovery. Engineering properties of various dewatered mine tailings will be defined for prediction of fill behavior as well as transportation and placement.

General Progress: To date (last 2 years), work has involved overcore drilling to determine state-of-stress, fault mapping, mathematical modeling of a known mine to evaluate fill requirements, and experimental fill test cylinders. The drilling equipment and drilling techniques have been improved. Mathematical modeling and physical laboratory testing is continuing. Various backfill mix designs have been developed for three cooperating mines. The designs have been developed through a test matrix system, whereby gradation, water, and cement amounts were varied to obtain backfill mixes that provide adequate strengths while optimizing the materials.

Plans for Next Twelve Months: Rock mechanics studies will continue for the evaluation and prediction of rock behavior. The interaction between pillars, stopes, and fills will be studied through mathematical and physical models. Methods to test in situ state-of-stress and models will be improved. Fills will be instrumented to evaluate the stress and deformation resulting from overburden loading of the Cannon Mine. A large scale compression test frame is being constructed to test larger-sized backfill models (4- by 4- by 8 feet).

Test cylinders using different grain size total tailings will be made and compared to previous data. By developing a range of engineering properties, it may be possible to predict fill behavior for any mine. Pumping tests on high slurry density total tailings will be performed on three different samples using the paste pumping loop.

Coordination and Cooperation with Other Agencies: Contact was initiated with CANMET, under the guidance of the cooperative agreement between the Bureau of Mines, CANMET, and Ontario MOL.

TOPIC STATEMENT

Agency CE Priority Soil Mechanics 1987 Session Number S-4-c  
 Subject Area Soil Mechanics

Project Title Round Robin Testing Program of Standard Soil Samples

Performing Organization CEWES

Principal J. C. Oldham, CEWES-GE-ST (FTS) 542-2122  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2122  
 (Name) (Address) (Telephones)

Starting Year FY 88 Estimated Completion Year FY 89

Technical Objectives: To perform quality assurance of CE in-house soils testing.

Technical Approach: Standard soil samples representing a variety of soil types will be sent to each CE laboratory. Designated index property and physical property tests will be performed according to standard CE procedures and the results analyzed statistically. Possible sources of testing errors will be investigated to ascertain the need for improved testing procedures.

General Progress in Last Two Years: New start in FY 88.

Plans for Next Twelve Months (FY 88): (1) Prepare and ship soil samples to participating laboratories; (2) complete tests by laboratories.

Coordination or Cooperation with Another Agency: None to date: Invitation to other agencies for participation on a cost sharing basis will be initiated.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority Soil Mechanics 1987 Session Number S-4-d  
 Subject Area Soil Mechanics (Concrete and Structures) (Rock Mechanics)

Project Title Computer Applications in Geotechnical Engineering: Task Group on Laboratory Automation

Performing Organization CEWES

Principal W. E. Strohm, Jr., CEWES-GR (FTS) 542-2604  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2604  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 89

Technical Objectives: To improve the efficiency and capabilities of CE materials testing laboratories through the use of computers.

Technical Approach: A prioritized list of possible computer applications in the laboratory will be formulated. Existing programs will be surveyed to ascertain their usefulness and technical experts hired to perform modifications or create new programs as needed to meet established goals. Task group will formulate goals for data acquisition and test control and draw on in-house and outside experts as necessary to complete guidance documents for use by all CE laboratories.

General Progress in Last Two Years: New start in Summer 1987: Initial meeting prioritized task group goals. Existing microcomputer based programs for data reduction have been surveyed and selected programs have been distributed for review by participating laboratories.

Plans for Next Twelve Months (FY 88): (1) Refine existing data reduction programs; (2) complete development of interim laboratory management program; (3) begin development of criteria for data acquisition systems.

Coordination or Cooperation with Another Agency: None to date - Anticipate contacting other agencies regarding experience with data acquisition systems.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-4-e  
 Subject Area Soil Mechanics

Project Title Technology Transfer  
 Performing Organization CEWES

Principal C. L. McAnear, CEWES-GE (FTS) 542-2228  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2228  
 (Name) (Address) (Telephone)

Starting Year Not Applicable Estimated Completion Year Continuing

Technical Objectives: Implement research results into engineering practice.  
Technical Approach: Prepare manuals, regulations, specifications, and ad hoc technical information documents. Conduct training courses, symposia, seminars, workshops, conferences, and working group meetings.

General Progress in Last Two Years: Published or In-Publication:  
 EM 1110-2-1901 Seepage Analysis and Control for Dams  
 TM 5-809-7 Design of Deep Foundations  
 Workshop Geotechnical Research on Deep Foundations  
 Training Courses Soil Mechanics (11)  
 (Inspection, Expansive Soils, Seepage, Erosion, Strength)

Workshops, et al. Addressed under relevant Topic Statement  
 EM 1110-2-AREV (Combines -2501 and -2502) Retaining Floodwalls  
 (by others) (Includes earth pressures and geotechnical aspects)

Plans for Next Twelve Months (FY 88): Continue In-Progress Tasks:  
 EM 1110-1-1902 Stability of Earth and Rockfill Dams  
 EM 1110-2-1904 Settlement Analysis  
 EM 1110-2-1906 Laboratory Soils Testing  
 EM 1110-2-XNEW Design, Construction, and Maintenance of Relief Wells  
 EM 1110-2-XNEW Shear Strength of Soils  
 EM 1110-2-2300 Earth Embankments (Instrumentation Automation)  
 EM 1110-2-1907 Soil Sampling and Insitu Testing  
 EM 1110-2-1912 Stability of Excavated/Natural Slopes in Soils/Clay Shales

Training Courses:  
 Earthwork Construction Inspection  
 Shear Strength of Soils  
 Earth and Rockfill Dams

Workshops, et al. Addressed under relevant Topic Statement

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-5-a  
 Subject Area Soil Mechanics

Project Title Rehabilitation, Evaluation, Maintenance, and Repair (REMR), Geotechnical - Soils

Performing Organization CEWES  
 Principal G. B. Mitchell, CEWES-GE-E (FTS) 542-2640  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2640  
 (Name) (Address) (Telephone)

Starting Year FY 84 Estimated Completion Year FY 89

Technical Objectives: Accomplish research with respect to soils features of existing Civil Works projects and provide a sound basis for decisions when significant REMR action becomes necessary in the future.

Technical Approach: Separate the research into three tasks: (A) Remedial Improvements; (B) Evaluation of Soil Conditions and/or Performance; and (C) Maintenance of Soil Features. Task A research provides operating forces that will restore the functional capability of the project. Task B research addresses problems associated with the present functional condition, performance analyses for the past and present, and the predicted performance for anticipated events. Task C research results in alternatives to alleviate numerous recurring problems.

General Progress in Last Two Years: Work Units, "Rehabilitation Alternatives to Control Levee Underseepage" and "Improvement of Foundation Soils Susceptible to Liquefaction," were completed. Several reports are being published.

Plans for Next Twelve Months (FY 88): Complete Work Units, "Restoration of Drainage Systems and Relief Wells" and "Methods for Maintaining Wells and Seepage Control in Cold Regions." Two Work Units, "Geotechnical Applications for Soil Erosion Control and Slope Stabilization" and "Erosion Control in Cold Regions," will be replaced by two new Work Units, "Remedial Seepage Control in Internally Unstable Widely-Graded Soils" and "Mitigation of Distress in Clay Shale Foundations."

Coordination or Cooperation with Another Agency: Bureau of Reclamation, Tennessee Valley Authority, Federal Energy Resources Commission, and Environmental Protection Agency.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 8 1987 Session Number S-5-b  
 Subject Area Soil Mechanics

Project Title Evaluate Canal Performance in Loessial Soil

Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1542 (FTS) 776-6090  
 Investigator Theresa J. Casias Denver CO 80225 (303) 236-6090  
 (Name) (Address) (Telephone)

Starting Year FY83 Estimated Completion Year FY89

Technical Objectives:

To document performance of canals, canal structures, canal lining, and cut slopes for canals in loessial soil. By documenting past performance, this study will provide information for a more rational approach to the design of new canals in this material. Better design criteria will be established.

Technical Approach:

Inspect existing canals and evaluate performance in terms of collapse-settlement of linings and structures, slope stability, and erosion. Review and document design and construction practices and past performance of canals in loessial soil. Photograph and evaluate existing canals and canal structures constructed in loessial soil. Monitor current construction and inspect and document performance at selected events or time intervals. Determine cost effective, realistic, and efficient subsurface treatment for structures built on loessial soil. Determine the most effective method of sampling loessial soils for obtaining samples for in-place unit weight determinations and laboratory testing.

General Progress in Last Two Years:

1. Completed REC report and ASCE paper on unit weight determinations in loessial soil.
2. Published a paper titled "USBR Case History of Loess Cut Slopes in Nebraska" for ASCE conference.
3. Continued monitoring the progress of current construction of canals and related canal structures.

Plans for Next Twelve Months (FY88):

1. Prepare report on state-of-the-art review on loessial soil.
2. Document canal and canal structure settlement problems which have occurred in the North Loup Division in Nebraska.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number S-5-c  
 Subject Area Soil Mechanics

Project Title Acoustic Emission Monitoring of Cofferdam Performance, Look and Dam No. 26

Performing Organization CEMES  
 Principal G. B. Mitchell, CEVES-GE-E (FTS) 542-2640  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-2640  
 (Name) (Address) (Telephones)

Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives: Use acoustic emissions to measure stress levels at various points within selected cofferdam cells as loading conditions change (equipment operations, river stage fluctuations, construction progress.)

Technical Approach: Using triaxial apparatus in the laboratory, establish correlations between acoustic emission, strain, and stress of cofferdam backfill sands. In the field, install 16 acoustic emission sensors in certain arrays in the sands in selected cells and 10 sensors on the sheetpiles. Obtain continuous readings on all sensors, simultaneously but independently, so that all loading change events can be detected. Using the laboratory correlations, evaluate the cofferdam response to load changes.

General Progress in Last Two Years: (1) Laboratory correlations initiated; (2) all sensors and wave guides installed and calibrated; and (3) monitoring initiated and some background noises preliminarily identified.

Plans for Next Twelve Months (FY 88): (1) Complete sensor monitoring; and (2) initiate data analysis.

Coordination or Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 7 1987 Session Number S-5-d  
 Subject Area Soil Mechanics  
 Project Title Soil-Cement Research  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1542 (FIS) 776-6030  
 Investigator Theresa J. Casias Denver CO 80225 (303) 236-6030  
 (Name) (Address) (Telephone)  
 Starting Year FY76 Estimated Completion Year FY Ongoing

Technical Objectives:  
 I. To improve the quality of soil-cement and extend its range of applicability in hydraulic structures.  
 II. To determine the geotechnical applications for RCC (roller-compacted concrete) and to develop testing and mix design procedures for geotechnical applications of RCC.

Technical Approach:

- I.
    - a. Inspect and evaluate existing earth dam embankment facings of soil-cement.
    - b. Investigate bonding between soil-cement layers using test sections.
    - c. Evaluate soil-cement compaction methods.
    - d. Evaluate fines content and fly-ash content for soil-cement pipe bedding.
    - e. Evaluate various methods for determining cement content of soil-cement and RCC.
  - II.
    - a. Develop testing procedures for RCC when used in geotechnical applications.
    - b. Develop mix design procedures for RCC when used in geotechnical applications.
- General Progress in Last Two Years:
- I.
    - a. Continued evaluation of the vibratory roller and other soil-cement compaction methods.
    - b. Continued report on Bureau practice in soil-cement mix designs.
    - c. Initiated program to evaluate various methods for determining cement content of soil-cement and RCC.
  - II.
    - a. Performed testing program to investigate the use of soil compaction techniques with RCC.
    - b. Prepared draft of report on results of compaction study.
- Plans for Next Twelve Months (FY88):
- I.
    - a. Complete program to determine the maximum fines content and fly-ash content that can successfully be used for soil-cement pipe bedding.
    - b. Complete program to evaluate methods for determining cement content of soil-cement and RCC and prepare USBR Standard(s).
  - II.
    - a. Perform program to compare results of compressive strength tests on specimens prepared using geotechnical methods and those prepared using concrete methods.
    - b. Develop suitable durability test for testing RCC used in geotechnical applications.

Coordination or Cooperation with Another Agency:

Technology transfers through ASTM and ACI.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 3 1987 Session Number S-6-a  
 Subject Area Soil Mechanics (Earthquakes)  
 Project Title In Situ Testing for Evaluating Soil Liquefaction  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1542 (FIS) 776-6081  
 Investigator Jeffrey A. Farrar Denver CO 80225 (303) 236-6081  
 (Name) (Address) (Telephone)  
 Starting Year FY87 Estimated Completion Year FY89

Technical Objectives:

To perform field verification of new in situ testing instruments at earthquake liquefaction sites. To evaluate the ability of different in situ testing methods to accurately measure ground improvement on programs where liquefaction is to be prevented.

Technical Approach:

In cooperation with the government of Japan, field sites with known ground damage during earthquakes have been tested with several instruments in 1983 and 1986. Perform testing before and after improvement at ground densification sites.

General Progress in Last Two Years:

Cone penetration and flat plate dilatometer tests have been evaluated at field sites in Japan and reports have been issued. Assisted with funding of several in situ testing methods at a dynamic compaction ground improvement site.

Plans for Next Twelve Months (FY88):

Finalize reports of completed work in both areas. Develop a new work statement for evaluating in situ tests in silty sands under laboratory conditions.

Coordination or Cooperation with Another Agency:

Cooperative efforts will get underway with Corps of Engineers concerning possible extension of the program to laboratory chamber studies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number 5-6-b  
 Subject Area Soil Mechanics (Earthquakes)  
 Project Title Liquefaction of Fine-Grained Soils  
 Performing Organization CEVES  
 Principal Joseph P. Koester, CEVES-GH-R (FTS) 542-2202  
 Investigator P.O. Box 631, Vicksburg, MS 39180 (601) 534-2202  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 90

**Technical Objectives:** To assess the liquefaction susceptibility of soils finer than sand. A number of Corps of Engineers dams in seismically active areas are founded on alluvial deposits of fine-grained or plastic soils that would be judged liquefiable by current standards derived for and applied to non-plastic soils.

**Technical Approach:** (1) To evaluate field occurrences of liquefaction in fine-grained or plastic soils. (2) To develop and conduct a laboratory test program to assess the dynamic strength and liquefaction susceptibility of soils finer than sand on the basis of plasticity, grain-size distribution and density. (3) To establish criteria for the evaluation of resistance to liquefaction based on results from (1) and (2) above. (4) To compare procedures from (3) above with procedures for sand and well-graded soils to assure completeness and coherency in the approach.

**General Progress in Last Two Years:** Completion and publication of a preliminary study report documenting the findings and recommendations resulting from a research visit to the Peoples Republic of China (PRC), and pursuit of technical liaison with PRC and Japanese earthquake soil engineering researchers. Other progress interrupted due to funding constraints.

**Plans for Next Twelve Months (FY 88):** (1) To initiate, pending acquisition of suitable fine-grained and mixture soils either from liquefied and non-liquefied field sites, or reconstituted to replicate deposits of known response, or both, laboratory testing program of cyclic triaxial and hollow cylinder torsional cyclic tests on subject soils toward the technical approaches (2) and (3) above. (2) completion and publication of a technical report evaluating the dynamic behavior of well-graded soils.

Coordination of Cooperation with Another Agency: None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number 5-6-c  
 Subject Area Soil Mechanics (Earthquakes)  
 Project Title Improvement of Foundation Soils Susceptible to Liquefaction  
 Performing Organization CEVES  
 Principal Richard H. Ledbetter, CEVES-GH-R (FTS) 542-3380  
 Investigator P.O. Box 631, Vicksburg, MS 39180 (601) 534-3380  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year FY 88

**Technical Objectives:** Determine the feasibility and effectiveness of remedial improvements to assure earthquake safety of liquefiable foundations.

**Technical Approach:** (1) Examine feasibility of eliminating liquefaction potential of foundation soils under existing structures. (2) Evaluate relevant experience. (3) Analyze economic and technical feasibility of methods having high potential effectiveness. (4) Develop guidelines for laboratory experiments and field test demonstrations on CE projects. (5) Monitor performance of selected CE projects. (6) Sponsor symposiums.

**General Progress in Last Two Years:** The final full year of work is FY87; therefore, effort is being directed toward finalizing the study and the completion of reports and products. Main accomplishments in FY86 and FY87 include: (1) Published interim user guidelines in the RMR Technical Notes. (2) Identified and prepared recommendations for needed research areas where technology is lacking to prevent. (3) Co-sponsored with Cambridge University, England, an international symposium on geotechnical centrifuge dynamic model test data and earthquake hazard mitigation. (4) Results of this study made a major contribution to the National Research Council Workshop on Liquefaction. (5) Reports prepared for publication: (a) symposium proceedings, (b) report on sand compaction piles, (c) report on stone columns.

(6) Conducted two demonstrative centrifuge prototype earthquake liquefaction failure behavior tests. (7) Conferred with the Venezuelan Oil Company, INTEVEP, on their remedial treatment problems for a coastal dyke.

**Plans for Next Twelve Months (FY 88):** Complete publications and final report.

Coordination of Cooperation with Another Agency: No specific coordination.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Project Maintenance, Rehabilitation and Life Extension  
 Technology Transfer  
 None

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number S-6-d  
 Subject Area Soil Mechanics (Earthquakes)  
 Project Title Seismically-Induced Settlements in Soils  
 Performing Organization CEMES  
 Principal Richard H. Ledbetter, CEMES-GH-R (FTS) 542-3380  
 Investigator P.O. Box 631, Vicksburg, MS 39180 (601) 634-3380  
 (Name) (Address) (Telephones)  
 Starting Year FY 80 Estimated Completion Year Continuing

**Technical Objectives:** (1) To study existing technology. (2) Develop/identify procedures and technology using laboratory and analytical techniques to predict earthquake-induced settlements in soils. (3) Verify settlement analysis and prediction procedure.

**Technical Approach:** (1) Review the literature and determine the current state of knowledge. (2) Develop/modify analysis methodology for predicting and analysis of seismically induced settlements/deformations. (3) Verify settlement analysis and prediction procedures by centrifuge tests with earthquake loading simulation.

**General Progress in Last Two Years:** Two more instrumented centrifuge test series were conducted at Cambridge University, England, for obtaining equivalent prototype response data making a total of eleven series with 118 earthquakes and about 2,000 response histories from various locations within the models and on structures in both dry and saturated soil conditions. The last two test series were plane strain conditions with a massive embedded structure for both dry and saturated soil conditions. Analysis of the eleven test series has been completed. Reports are being prepared on this project which has resulted in a unique earthquake response data base and a verified non-linear, two-dimensional (2-D) and soil structure interactive dynamic effective stress analysis methodology by W. D. Liam Finn, University of British Columbia, Canada, which computes settlement and pore water pressure response histories in addition to motions.

**Plans for Next Twelve Months (FY 88):** (1) Publish reports on the project. (2) Start development of the 2-D model into a three-dimensional (3-D) one for the purpose of analysis of 3-D interactive effects and differential responses of sites containing structure complexes involving various geometries, loading, and interconnections under earthquake excitation.

**Coordination or Cooperation with Another Agency:** This research effort is a cooperative one with the Nuclear Regulatory Commission.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number S-6-e  
 Subject Area Rock Mechanics  
 Project Title Earthquake Hazard Evaluations for Engineering Sites  
 Performing Organization CEMES  
 Principal E. L. Krinitzsky CEMES-GR-R (FTS) 542-3329  
 Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-3329  
 (Name) (Address) (Telephones)  
 Starting Year FY 84 Estimated Completion Year Continuing

**Technical Objectives:** To provide methods for geological-seismological evaluations of earthquake hazards at engineering sites, provide earthquake ground motions for design, assess induced earthquakes, appraise geological factors affecting soil liquefaction from earthquake shaking.

**Technical Approach:** Field and office studies with worldwide data.

**General Progress in Last Two Years:** Two "State-of-the-Art" papers completed. Numerous special studies.

**Plans for Next Twelve Months (FY88):** New charts for intensity-related earthquake ground motions; magnitude-distance charts for motions from shallow earthquakes; magnitude-distance charts for motions from deep (subduction zone) earthquakes. Numerous other studies.

**Coordination or Cooperation with Another Agency:** Coordination with Bureau of Reclamation and US Geological Survey through reviews of reports, meetings, etc.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number 5-6-f  
Subject Area Soil Mechanics  
Project Title Reevaluation of the Lower San Fernando Dam  
Performing Organization CEWES  
Principal A. G. Franklin, CEWES-GH (FTS) 542-1658  
Investigator P.O. Box 631, Vicksburg, MS 39180-0631 (601) 634-1658  
(Name) (Address) (Telephones)  
Starting Year FY 85 Estimated Completion Year FY 88  
Technical Objectives: To validate a method, or methods, to determine post-liquefaction strength of soil.

Technical Approach: A program of field investigations in the remaining (downstream) shell of the dam, included SPT and CPT tests, undisturbed sampling with thin-wall tube samplers in boreholes, and finally, excavation of a 6-ft diameter shaft for direct access and undisturbed sampling. A laboratory testing program involving WES and three contractors, Geotechnical Engineers, Inc., H. B. Seed, and R. Dobry, was accomplished to determine the steady state or residual undrained strength of the soils for comparison with strengths determined by analysis of the slide that occurred in the upstream shell as a result of the 1971 earthquake.

General Progress in Last Two Years: Field investigations and laboratory testing programs have been completed, and participants have exchanged test and analysis results.

Plans for Next Twelve Months (FY 88): A final report will be prepared.

Coordination or Cooperation with Another Agency: No other Federal agency involved.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  
 Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension  
 None

APPENDIX J  
AGENDA AND TOPIC STATEMENTS  
WATER QUALITY AND ECOLOGY SESSION

Time      Topic No.      Topic Statement      Agency

Fifteenth Interagency  
Research Coordination Conference

November 3-5, 1987

Vicksburg, Mississippi

AGENDA

Water Quality and Ecology Session

Location: EL Conference Room

J.L. Mahloch, Chairman  
W.R. Rushing, Recorder

Time      Topic No.      Topic Statement      Agency

WQE-2h      Lake Sediment and Disposal of Coal Ash      TVA

WQE-2i      Toxics in Ashpond Discharges      TVA

WQE-2j      Effects of pH and Aluminum on Early Life Stages of Smallmouth Bass & Rainbow Trout      TVA

WQE-2k      Emergency Preparedness for Non-Nuclear Toxic Spills in TVA Waterways      TVA

WQE-2l      Effect of Agricultural Chemicals on Water Quality and Watershed Ecology      USDA-ARS

WQE-3      Groundwater

10:30 am      WQE-3a      Water Balance Method for Solid and Hazardous Waste Disposal      CE

WQE-3b      Macrodispersion Experiment (of ground water)      TVA

WQE-3c      Geohydrologic Study to Enhance Bio-reclamation Processes      TVA

10:45 am      BREAK

WQE-4      Reservoir Limnology

11:00 am      WQE-4a      Lake Havasu Limnology Study      USBR

WQE-4b      Plankton Dynamics in Bureau Reservoirs      USBR

WQE-4c      Historic Analysis of Algal Blooms in Pyramid Lake Using Landsat Imagery      USBR

WQE-4d      Algal Control Demonstration Program      CE

WQE-4e      Reservoir Eutrophication, U.S./Spain Cooperative Program      USBR

WQE-5      Water Quality Modeling

11:30 am      WQE-5a      Environmental Modeling      USBR

WQE-5b      Two-Dimensional Reservoir Modeling for Reservoir Management (Cherokee and Chickamauga Reservoirs)      TVA

WQE-5c      Verification of Water Quality Models      USBR

Time      Topic No.      Topic Statement      Agency

Tuesday, 3 November:

WQE-1      Water Quality Management

9:00 am      WQE-1a      Water Quality Management for Reservoirs and Tailwaters      CE

WQE-1b      Reservoir Water Quality Management      TVA

WQE-1c      Limnology for the Ecological Management of Reclamation Projects      USBR

WQE-1d      Surface Water Monitoring Strategy      TVA

WQE-1e      Field Tests of Garton Pumps      TVA

WQE-2      Sedimentation

9:45 am      WQE-2a      Review of Contaminant Fate Models for Dredging-Related Projects      CE

WQE-2b      Chemical Methods to Evaluate Trace Metal Bioavailability      USBR

WQE-2c      Short Term Chronic Bioassays to Assess Effluents, Surface Waters, Sediments, and Leachates      TVA

WQE-2d      Toxic Element Determinations      USBR

WQE-2e      Selenium and Toxic Metal Removal      USBR

WQE-2f      Selenium removal from Water      USBR

WQE-2g      Investigation of Environmental Conse-

Time	Topic No.	Topic Statement	Agency	Time	Topic No.	Topic Statement	Agency
	WQE-5d	Predicting Concentrations and Temperatures in Surface Waters	USBR		WQE-7e	Coordination of Control Tactics with Phenological Events of Aquatic Plants	CE
12:30 pm		LUNCH			WQE-7f	Factors Influencing Eurasian Water-milfoil Establishment	USBR
	<b>WQE-5 Reservoir Tailwaters</b>				WQE-7g	Aquatic Plant Control - Laboratory Studies	USBR
1:30 pm	WQE-6a	Assessing Effects of Reservoir Operations on Downstream Aquatic Resources	CE		WQE-7h	Biological Management of Aquatic Plants by Manipulation of the Microflora	CE
	WQE-6b	Techniques for Evaluating and Managing Water Quality of Reservoir Tailwaters	CE		WQE-7i	Biological Management of Submersed Plants by Manipulation of Phytophagous insects	CE
	WQE-6c	Tailwater Flow, Temperature, and DO Modeling for Environmental Management	TVA		WQE-7j	Management of Submersed Aquatic Plants with Genetically Engineered Microorganisms	CE
	WQE-6d	Flow Regulation in Tailwaters	TVA		WQE-7k	Biological Management of Aquatic Plants with Allelopathic and Competitive Species	CE
	WQE-6e	Richard B. Russell Fish Entrainment Study	CE		WQE-7l	Biological Control of Hydrilla Using Insects	CE
	WQE-6f	Ecological and Limnological Impact of Pumped-Storage Power Plants	USBR		WQE-7m	Biological Control of Hydrilla Using Plant Pathogens	CE
	WQE-6g	Lake Mead Limnology and Fishery Study, Spring Canyon Assessment	USBR		WQE-7n	Biological Control of Eurasian Water-milfoil Using Plant Pathogens	CE
	WQE-6h	Norris Tailwater Investigations	TVA		WQE-7o	Biological Control of Waterleaff with Insects	CE
	WQE-6i	Tailwater Ecology	USBR		WQE-7p	Aquatic Plant Control and Canal Environmental Field Studies	USBR
	WQE-6j	Downstream Drift in Lower Colorado River	USBR		WQE-7q	Grass Carp Barrier	USBR
	WQE-6k	Effects of Dissolved Oxygen on Fish and Other Aquatic Life	TVA		WQE-7r	Radio Telemetry Studies with White Amur on Guntersville Reservoir	TVA
	WQE-6l	Effects of Supersaturation of Dissolved Gas on the Big Horn River Montana	USBR		WQE-7s	Field Evaluation of Selected Herbicides for New Aquatic Uses	CE
	<b>WQE-7 Aquatic Plant Control</b>				WQE-7t	Investigations of Herbicide Residues in Water, Soil, Crops, and Fish	USBR
2:30 pm	WQE-7a	Aquatic Plant Ecology: Competitive/Environment Manipulation	CE		WQE-7u	Development of Controlled Release Herbicide for Aquatic Weed Control	USBR
	WQE-7b	Aquatic Plant Ecology: Submersed Vegetation on Habitat	CE				
	WQE-7c	Aquatic Plant Ecology: Effects of Water Chemistry	CE				
	WQE-7d	Aquatic Plant Ecology: Environmental Interactions	CE				

Time	Topic No.	Topic Statement	Agency	Time	Topic No.	Topic Statement	Agency
	WOE-7v	Herbicide/Adjuvant Evaluation in Flowing Water	CE		WOE-8h	Green River Backwater Habitat Mapping Study	USBR
	WOE-7w	Herbicide Concentration/Exposure Time Required to Control Aquatic Plants	CE		WOE-8i	Lower Colorado River, Parker Division Fishery Studies	USBR
	WOE-7x	Herbicide Application Technique Development for Flowing Water	CE		WOE-8j	Fish Refuge Projects	TVA
	WOE-7y	Herbicide Delivery Systems	CE		WOE-8k	Fish Refuge Projects	TVA
	WOE-7z	Plant Growth Regulators for Aquatic Plant Management	CE		WOE-8m	Colorado River Backwater Mapping Study	USBR
	WOE-7aa	Biocontrol Simulation	CE		WOE-8n	Water Quality and Hydrology Characteristics of a Bottomland Hardwood Wetland	CE
	WOE-7bb	Chemical Control Simulation	CE		<u>WOE-9 Vegetation/Habitat Management</u>		
	WOE-7cc	Plant Growth Model	CE	9:00 am	WOE-9a	Allowable Vegetation on Flood Control Levees	CE
	WOE-7dd	Aquatic Plant Data Base Development	CE		WOE-9b	Yazoo Basin Erosion Control Research Project (Water Quality)	USDA-ARS
	WOE-7ee	Management of Waterhyacinth Using Insects and Herbicides	CE		WOE-9c	Erosion Potential of Inland Shorelines and Embankments Subject to Freezing and Thawing	CE
	WOE-7ff	Fisheries Enhancement Using Aquatic Weed Control Techniques	TVA		WOE-9d	Aquatic Plant Soil Stabilization	USBR
3:30 pm		BREAK			WOE-9e	Demonstration and Cost Evaluation of Plant Growth Regulators at Military Installations	CE
3:45 pm		Joint Hydraulic/Water Quality Session			WOE-9f	Evaluation of Riparian Vegetation Trends in Grand Canyon Using Multi-temporal Remote Sensing Techniques	USBR
5:00 pm		ADJOURN			WOE-9g	Engineering Aspects of Habitat Management Along Large Rivers	CE
					WOE-9h	Creation of Aquatic Habitats in Navigable Waterways	CE
					<u>WOE-10 Acid Rain/Acid Mine Drainage</u>		
				9:30 am	WOE-10a	Acid Precipitation	TVA
					WOE-10b	Acid Precipitation Effects on Drinking Water Sources	TVA
					WOE-10c	Acid Precipitation Effects on Bureau Watersheds	USBR
					WOE-10d	Acid Mine Drainage and Heavy Metals	USBR

<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u> from Waste	<u>Agency</u>	<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u> Channel Alteration Projects	<u>Agency</u>
	WOE-10e	Treatment of Acid Mine Drainage Using Man-made Wetlands	TVA		WOE-13c	Control of Nonpoint Source Pollutants	TVA
	<u>WOE-11</u>	<u>Hydrological Impacts/Water Supply</u>			WOE-13d	Limnological Application of Landsat Thematic Mapper Imagery	USBR
9:45 am	WOE-11a	Effects of Global Climate Change on Water Resources	TVA		WOE-13e	Las Vegas Wash Effluent Study	USBR
	WOE-11b	Drought-related Water Supply Studies	TVA		WOE-13f	Animal Damage to Hydraulic Structures and its Control	USBR
	WOE-11c	Effective Precipitation	USBR		WOE-13g	Environmental Impacts of Modifying Estuarine Circulation	CE
	WOE-11d	Changing Water Requirements	USBR	11:45 AM		Session Wrapup/Conclusions	
	WOE-11e	Water Demand Forecast and Conservation Evaluation	CE	12:30 pm		LUNCH	
	WOE-11f	Evaluation of Saline Water Sources for Aquaculture	USBR				
10:15 am		BREAK					
	<u>WOE-12</u>	<u>Waste Processing</u>					
10:30 am	WOE-12a	Regional Hazardous Waste & Materials Management	TVA				
	WOE-12b	Environmental Partitioning of Hazardous Wastes/Materials Releases	TVA				
	WOE-12c	Waste Minimization Through Improved Separations Technology	TVA				
	WOE-12d	Hazardous Waste Gasification/Incineration	TVA				
	WOE-12e	Low-Tech Municipal Waste Incinerator	TVA				
	WOE-12f	Integrated Balesfill Demonstration	TVA				
	WOE-12g	ANFLOW	TVA				
	WOE-12h	Wastewater Operator Training Computer Managed Interactive Video Instruction	TVA				
	<u>WOE-13</u>	<u>Environmental Aspects - General</u>					
11:00 am	WOE-13a	Evaluation of Environmental Impacts of REMR Activities at CE Reservoirs	CE				
	WOE-13b	Development of an Expert System for Environmental Aspects of Stream	CE				

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-1a  
 Subject Area Water Quality & Ecology  
 Project Title Water Quality Management for Reservoirs and Tailwaters  
 Performing Organization WES/CE  
 Principal Investigator Dr. Robert Kennedy WES  
 (Name) (Address) (FTS) 542-3659  
 (601) 634-3659  
 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives:

To develop a comprehensive procedure for evaluation and management of water quality for CE reservoirs and tailwaters.

Technical Approach: To accomplish the technical objectives the following interrelated tasks will be conducted:  
 - CE-wide assessment of water quality enhancement needs  
 - Compilation of an inventory of water quality enhancement technology  
 - Development of a protocol for assessing water quality and establishing management approaches.

General Progress in Last Two Years:

Work was initiated in July 1987

Plans for Next Twelve Months (FY 88): Update and evaluate CE-wide water quality data base and survey FOAs for water quality enhancement needs. Survey FOA and other water quality agencies for past experiences, and CE research results for information concerning a wide variety of existing technologies for enhancement of reservoir and tailwater quality. Initiate development of the protocol.

Coordination or Cooperation with Another Agency:

Initial discussions with BOR and TVA concerning past and ongoing research efforts in the area of water quality problems and mitigation. Discussed potential involvement of TVA in development of protocol.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-1b  
 Subject Area Water Quality  
 Project Title Reservoir Water Quality Management  
 Performing Organization Water Quality Branch  
 Principal Investigator Donald Anderson, 248 401 Building, Chattanooga, TN 37401 FTS 958-7329  
 Starting Year 1978 Estimated Completion Year Continuous

Technical Objectives: Protect the long-term usefulness of TVA reservoirs by (1) providing an assessment of current conditions with emphasis on use impairments; (2) by identifying cause/effect relationships; (3) by developing recommendations for correcting use impairments, maintaining adequate water quality, and for effective management of the reservoirs water quality; and by (4) initiating implementation of these recommendations in cooperation with other agencies.

Technical Approach: For selected TVA reservoirs, water quality issues are defined and prioritized. Data collection programs are designed to document conditions and to support further analysis, generally the application of two dimension water quality models. Using this base of information, management plans are developed. The entire process utilizes a multi-disciplinary approach, making extensive use of mathematical modeling skills, and applying new techniques such as in-site SOD measurements, and the use of remote sensing for identifying non-point sources and categorizing land uses.

General Progress: Management plans have been completed for two reservoirs, Cherokee and Tellico. Draft plans have been completed for Fort Loudoun, Pickwick, and Boone Reservoirs. Projects at Guntersville and Kentucky are underway. Implementation of the Cherokee plan began in FY 1985, and included a demonstration of in-reservoir aeration to improve fisheries.

Plans for Next Twelve Months: The Cherokee implementation project will continue with operation and evaluation of the in-reservoir aeration demonstration. Implementation of Fort Loudoun, Tellico, and Boone management plans will begin in FY 1986. A management plan for Guntersville will be completed. Projects at Kentucky and Pickwick will be deferred due to funding constraints.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-1c  
 Subject Area Water Quality and Ecology  
 Project Title Limnology for the Ecological Management of Reclamation Projects  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator James J. Sartoris, D-1522 (Address)             
PO Box 25007 (Telephone) (303) 236-6004  
Denver CO 80225  
 Starting Year FY77 Estimated Completion Year FY90

**Technical Objectives:** To evaluate and develop basic limnological tools and techniques to aid in managing Reclamation reservoirs in an environmentally acceptable way. To research limnological problems that have wide applicability throughout the Bureau's area of operation and develop appropriate management tools for dealing with them. To compile available limnological data on existing projects to be used in managing existing resources, predicting environmental impacts of future developments, and identifying further research needs.

**Technical Approach:** The project will use field and laboratory investigations to develop, evaluate, and adapt appropriate limnological techniques, equipment, and indexes for use in the ecological management of Reclamation projects. Five stages are to be accomplished under this project. Stage one investigated the limnological effects of the operation of a series of reservoirs on the North Platte River in Wyoming; Stage two investigated the effects of aeration upon Lake Cachuma, California; Stage three was to investigate the effects of a variable outlet on the limnology of Lake Cachuma but was postponed due to construction delays; Stage four studied the process of reservoir maturation at Blue Mesa Reservoir, Colorado; Stage five will address processes contributing to the bloom of nuisance algae in reservoirs.

**General Progress in Last 2 Years:** Stage two (aeration at Lake Cachuma, California) was completed with the preparation of report REC-ERC-87-10 (in PRESS). Stage four (maturation of Blue Mesa Reservoir, Colorado) was completed under contract to Bio-Environ, Inc., and a final report (REC-ERC-87-3) was published.

**Plans for Next 12 Months (FY88):** Stage three, investigation of the reservoir effect of the floating outlet at Lake Cachuma, California, will be undertaken.

**Coordination or Cooperation with Another Agency:** Santa Ynez River Water Conservation District.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 Safety of Dams            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension           

TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-1d  
 Subject Area Water Quality  
 Project Title Surface Water Monitoring Strategy  
 Performing Organization Division of Air and Water Resources  
270 Haney Building  
 Principal Investigator Neil E. Carraker Chatka, TN 37401 615/751-7330  
 Starting Year FY 1986 Estimated Completion Year continuing activity

**Technical Objectives:** Implement a program for systematically identifying water resources issues and problems, collecting and analyzing ambient water quality data, and disseminating results to water resource managers and the public, without duplicating efforts of other agencies.

**Technical Approach:** A five component strategy including: (1) issues analysis; (2) ambient monitoring; (3) special surveys; (4) monitoring technique improvement; and (5) information management and dissemination is being implemented in stages over a four-year period. Components 1 and 2 will be performed for three parts of the Tennessee Valley each year, repeating a cycle every four years.

**General Progress:** A conceptual plan and a detailed proposal for this monitoring strategy was prepared in FY 1985. Implementation is proceeding in phases in FY 1986 through FY 1989. Addition of targeted, intensive monitoring in three watersheds in FY 1989 will complete implementation.

**Plans For Next Twelve Months:** Continue ambient monitoring, issues analyses, technique improvement, and information dissemination activities implemented in FY 1986 and 87, and develop plans for FY 1989 targeted monitoring in three watersheds.

**Coordination or Cooperation with Another Agency:** This activity is coordinated with Valley State agencies' monitoring programs in annual meetings with staff responsible for those programs.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 Safety of Dams            X            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-1e  
 Subject Area Water Quality and Ecology  
 Project Title Field Tests of Carton Pumps  
 Performing Organization TVA  
 Principal Investigator Dean Harshbarger (FTS) (615) 632-1947  
 (Name) (Address) (Telephones)  
 Starting Year FY86 Estimated Completion Year FY88

Technical Objectives

Evaluate Carton pumps as a technique for forcing warm, oxygenated, epilimnetic water into the withdrawal zone of a hydroturbine to increase the dissolved oxygen content of hydroturbine releases from stratified reservoir in the late summer and fall months

Technical Approach

A Carton pump consists of a relatively small motor connected by a shaft to a relatively large diameter propeller (N15 feet). The motor is supported by a float or raft on the surface the propeller is positioned beneath the float about 10 feet below the surface. Three pumps were purchased from a utility and are being field tested at Douglas Dam

General Progress

Carton pumps were installed at Douglas and have been operated during the FY87 summer season. Tests of the performance utilizing velocity, dye and oxygen measurements have been conducted. A mathematical model to predict pump performance has been prepared and is being calibrated using field data.

Plans for Next Twelve Months (FY88)

Continue tests to resolve appropriate configuration and operation.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-2a  
 Subject Area Water Quality and Ecology  
 Project Title Review of Contaminant Fate Models for Dredging-Related Projects  
 Performing Organization USAE Waterways Experiment Station  
 Principal Investigator CEWES-ES-Q (FTS) 542-3783  
PO Box 611 (601) 634-3783  
Vicksburg, MS 39180-0631 (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 88  
 Technical Objectives:

Review existing contaminant fate models for surface water that have applicability to dredging related issues. Following review, make recommendations.

Technical Approach:

Literature review, software review, and CE survey.

General Progress in Last Two Years:

Conducting review and preparing interim results for a DOTS information exchange bulletin.

Plans for Next Twelve Months (FY 88):

Prepare recommendations report.

Coordination or Cooperation with Another Agency:

EPA

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-2b

Subject Area Water Quality and Ecology

Project Title Chemical Methods to Evaluate Trace Metal Bioavailability  
Applied Sciences Branch

Performing Organization Division of Research and Laboratory Services  
 Principal Investigator Joug Craft, D-1523A (Name)  
PO Box 25007 (FTS) 776-4294  
Denver CO 80225 (303) 236-4294  
 (Address) (Telephone)

Starting Year FY85 Estimated Completion Year FY89

Technical Objectives: To develop and evaluate chemical methods to identify the bioavailable fraction of trace metals in natural waters. These methods will provide a more precise tool for evaluating the potential biological effects of trace metals.

Technical Approach: Methods under consideration include ion exchange column separations (using Chelex 100), electroanalytical methods, and equilibrium computer models. Once viable methods have been identified, cooperative experiments that pair analytical measurements with indicators of biological response (uptake, stress, mortality) are planned.

General Progress in Last 2 Years: Chelex resin methods for evaluating lability of trace metal complexes have been very successful. Paper has been submitted to Environmental Science and Technology. Principal investigator has organized and chaired a symposium, "Bioavailability of Trace Metals," given at the 194th American Chemical Society National meeting.

Plans for Next 12 Months (FY88): Explore cooperative studies with toxicologists and physiologists to evaluate whether the Chelex 100 lability is related to biological response.

Coordination or Cooperation with Another Agency: Coordination is accomplished through participation in professional society activities and technology transfer via talks and journal publications.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
 TOPIC STATEMENT

Agency IWA Priority            1987 Session Number WQE-2c

Subject Area Water Quality and Ecology

Project Title Short term Chronic Bioassays to Assess Effluents, Surface Waters, Sediments, and Leachates  
Performing Organization Fisheries & Aquatic Ecology Branch, Division of Air and Water Resources

Principal Investigator Dr. James R. Wright, Jr. (Name)  
125 Summer Place Building (FTS) N/A  
Knoxville, TN 37901 (615) 632-4017  
 (Address) (Telephones)

Starting Year FY 1986 Estimated Completion Year Indefinite

Technical Objectives: To utilize short-term chronic bioassays to assess toxicity of surface waters, wastewaters, sediments, and leachates.

Technical Approach: The Ceriodaphnia sp. 7-day survival and reproduction test and the 7-day P. promelas larval survival growth test are being utilized to assess potential toxicity of surface waters, wastewaters, elutriates of sediments, and leachates from landfills.

General Progress in Last Two Years: Twenty wastewater effluents, six surface waters, twenty six elutriates, and one landfill leachate have been tested.

Plans for Next Twelve Months (FY88): Continue the above, with potential increase in the number of samples tested.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams X Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-2d

Subject Area Trace Metal Analysis

Project Title Toxic Element Determinations  
Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services

Principal Investigator Thomas J. Leiker, D-1523 (Name)  
P0 Box 25007 (Address) Denver CO 80225 (Telephone)  
(303) 776-4290  
(303) 236-4290

Starting Year FY87 Estimated Completion Year FY87

Technical Objectives: The purpose of this investigation is to develop the analytical methodology that will allow the Bureau to determine trace levels of toxic elements that may be present in soils from lands that are subject to irrigation. The development of this methodology will allow the Bureau to comply with land use classification legislation that has been mandated by Congress.

Technical Approach: This investigation will involve checking out established methodology, modification of current methodology or development of new methodology that will allow aqueous extracts of soil samples to be analyzed by ICP/MS (Inductively Coupled Plasma/Mass Spectrometry) and various AA (atomic absorption) techniques. Current analytical methodology has presented limitations in conducting trace element analysis of soil extracts by ICP/MS. In some instances, the methods that have been used for AA analysis of soil extracts have not generated satisfactory data.

General Progress in Last 2 Years: Project started FY87, approximately 75 percent of project is complete.

Plans for Next 12 Months (FY88): Project completed

Coordination or Cooperation with Another Agency: Informal contacts with EPA (Environmental Protection Agency)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer X None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-2a

Subject Area Water Quality

Project Title Selenium and Toxic Metal Removal  
Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services

Principal Investigator Dr. Ed Lee (Name)  
P0 Box 25007 (Address) Denver CO 80225 (Telephone)  
(916) 978-4948

Starting Year Approximate FY84 Estimated Completion Year FY88

Technical Objectives: To develop suitable, low cost selenium and toxic metal water treatment processes for treating agricultural drainage waters. Other projects to look at various biological aspects of toxic metals in agricultural drainage are funded under this program.

Technical Approach: This office is funding, through an interagency committee, a number of research projects looking at various approaches to disposing of or upgrading agricultural drainage waters. Universities, private firms, and other Government agencies are the contractors.

General Progress in Last 2 Years: A number of selenium removal processes are well along in evaluation and a number of biological studies are in progress or completed.

Plans for Next 12 Months (FY88): Complete the major studies.

Coordination or Cooperation with Another Agency: The Bureau of Reclamation, the Fish and Wildlife Service, EPA, the Geological Survey, and several California county, state, water district, and private agencies and groups are cooperating.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-2E

Subject Area Water Quality and Ecology

Project Title Selenium Removal From Water  
Applied Sciences Branch

Performing Organization Division of Research and Laboratory Services

Principal Investigator Andrew P. Murphy, D-1523 (Address) PO Box 25007 (FTS) 776-4293  
Denver CO 80225 (303) 236-4293 (Telephone)

Starting Year FY86 Estimated Completion Year FY87

Technical Objectives: The develop a selective chemical reduction process for selenate-selenium relative to sulfate ion. Such selectivity would make possible the removal of toxic selenium from drainage water without the cost of desalting.

Technical Approach: Using information available from literature searchers on selenium, a detailed series of screening tests was developed to identify possible reductants for selenate-selenium.

General Progress in Last 2 Years: A successful method has been discovered to selectively remove selenium in high sulfate drainage water. This has resulted in a \$192,000 pilot study of the process. A patent application and outside journal article have been initiated.

Plans for Next 12 Months (FY88): Job completed.

Coordination or Cooperation with Another Agency: Funding for the pilot study has been made available through the San Joaquin Valley Drainage Program

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams        Technology Transfer        None

       Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-2G

Subject Area Water Quality and Ecology

Project Title Investigation of Environmental Consequences of Non-Point Source Discharges of PCBs

Performing Organization Fisheries & Aquatic Ecology Branch, Division of Air and Water Resources

Principal Investigator D. L. Dycus, J. R. Wright, Knoxville, TN 37901 (Address) (615) 632-4017  
(615) 632-3722 (Telephones)

Starting Year FY 1988 Estimated Completion Year FY 1989

Technical Objectives: To assess the potential for low-level non-point source discharges of PCB contaminated soil to adversely impact freshwater aquatic life.

Technical Approach: Surface water runoff and elutriates of sediment from the contaminated site will be tested for toxicity using short-term (7-day) chronic bioassays; and bioaccumulation potential will be evaluated by placing sediments in aquaria and utilizing essentially the assay techniques of Mac et al. (1984).

General Progress in Last Two Years: Project workplan produced

Plans for Next Twelve Months (FY88): Design structure to trap sediments and initiate ecological studies.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams         Technology Transfer        None

       Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-2h

Subject Area Water Quality and Ecology

Project Title Lake Sediment and Disposal of Coal Ash

Performing Organization Fisheries and Aquatic Ecology Branch

Principal Investigator Dr. W. L. Poppy, Chattanooga, TN 37401  
(Name) (Address) (FTS) None  
(615) 751-7333 (Telephones)

Starting Year FY 1988 Estimated Completion Year FY 1989  
Technical Objectives: Demonstrate the utility of coal ash for sealing off contaminated lake bottom sediments.

Technical Approach: microcosm and mesocosm (channel) experiments

General Progress in Last Two Years: New Project

Plans for Next Twelve Months (FY88): Microcosms will be established with eutrophic sediments and biota (macrophytes and animals). Their progress will be monitored and then a layer of smothering ash added with ecosystem reactions measured.

Coordination or Cooperation with Another Agency:           

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:           

           Safety of Dams            X            Technology Transfer            None

           Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-21

Subject Area Water Quality and Ecology

Project Title Toxics in Ashpond Discharges

Performing Organization Fisheries and Aquatic Ecology Branch

Principal Investigator Dr. P. A. Hackney, Knoxville, TN 37902  
(Name) (Address) (FTS) None  
(615) 632-3798 (Telephones)

Starting Year FY 1985 Estimated Completion Year FY 1991  
Technical Objectives: To investigate bioaccumulation of selected metals as causal factors for stress noted in resident ashpond communities, and to determine harmful body burden concentrations of these metals.

Technical Approach: The project began with a literature search, in situ ashpond studies, and in vitro bioassays, and now involves isotope tracer uptake experiments.

General Progress in Last Two Years: Found that while habit and food availability did not appear limiting, and effluent was not toxic in short term chronic bioassays, certain resident ashpond communities were stressed. Bioaccumulation was suspected, based on the above and the fact that elevated levels of Se, Cu and Cd were found in fish flesh.

Plans for Next Twelve Months (FY88): Isotope tracer experiments with two forms of selenium, as well as experiments to address significant body burden levels.

Coordination or Cooperation with Another Agency: This project is being coordinated with EPRI studies and those of several other electric power companies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:           

           Safety of Dams            X            Technology Transfer            None

           Project Maintenance, Rehabilitation and Life Extension

Agency TVA Priority 1987 Session Number WQE-21

Subject Area Water Quality and Ecology

Project Title Effects of pH and Aluminum on Early Life Stages of Smallmouth Bass & Rainbow Trout

Performing Organization Division of Air & Water Resources, Fisheries & Aquatic Ecology Branch

Principal Investigator Ross L. Schweinfurth, Aquatic Research Lab - (FTS) N/A  
Browns Ferry, P. O. Box 2000, Decatur, AL 35602 (205) 729-3249  
(Name) (Address) (Telephone)

Starting Year FY 1986 Estimated Completion Year FY 1988

Technical Objectives: To define the relationship between the water quality parameters H<sup>+</sup>, aluminum, and calcium and the survival and growth of early life stages of smallmouth bass and rainbow trout.

Technical Approach: Eggs fertilized under treatment conditions and swim up fry are exposed to continuous and pulsed regimes, respectively, of H<sup>+</sup> and Al+++ at three different calcium concentrations, to simulate constant and episodic acidic precipitation events.

General Progress in Last Two Years: A constant exposure experiment with rainbow trout, and a pulsed exposure experiment with both species have been completed.

Plans for Next Twelve Months (FY88): Conduct constant exposure experiments with smallmouth bass, repeat the constant exposure experiment with rainbow trout, and produce a final report.

Coordination or Cooperation with Another Agency: Project is coordinated with and cofounded by EPA-Corvallis, and is coordinated with EPRI's Lake Acidification and Fisheries Project.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Agency TVA Priority 1987 Session Number WQE-2k

Subject Area Water Quality and Ecology

Project Title Emergency Preparedness for Non-Nuclear Toxic Spills in TVA Waterways

Performing Organization TVA

Principal Investigator Gary E. Hauser EWG L08-M (FTS)  
(Name) (Address) (619) 632-1888  
(Telephone)

Starting Year FY86 Estimated Completion Year FY88

Technical Objectives:

Provide emergency response capability using mathematical models to predict transport and dispersion of accidental spills of toxic materials along portions of the Holston, South Holston, and Watauga Rivers in the Holston River Basin; along the Ocoee River downstream from Blue Ridge Dam; and along the Clinch River downstream from Melton Hill Dam. Models will provide expected travel times and exposure concentrations in highly unsteady flow regimes to guide early warning for water intakes, field monitoring, and mitigative reservoir operations.

Technical Approach:

Unsteady flow models are being calibrated for the three river systems for use in predicting travel times when only spill time and location are known. If spill volume and duration are also known, contaminants are routed as dissolved, neutrally buoyant, conservative substances using a two-dimensional (lateral-longitudinal) numerical dispersion model linked to flow models. The two-dimensional reservoir model BETTER is being considered for contaminant transport in stratified reservoirs.

General Progress in Last Two Years:

General flow routing model has been improved to better accommodate flow transients in shallow flow regimes, dynamic tributary junctions, and complicated internal boundary conditions. Model calibrations have been developed or improved for all important reaches of the Holston River basin, and calibration of the Ocoee and Clinch River flow models is ongoing. A numerical dispersion (streamtube) model has been developed and is being linked to flow models for testing against dye dispersion measurements.

Plans for Next Twelve Months (FY88):

Status report on Holston basin spill modeling; Development of contaminant transport capability for all important Holston River reaches;

Completion of Ocoee River calibration and development of operational on-line response capability;

Operational on-line emergency response capability for Clinch River; Generic testing and verification of the numerical dispersion model; Develop spill capability for the Tennessee River below Kentucky Dam.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USDA-ARS Priority 3 1987 Session Number H09-21  
 Subject Area Water Quality  
 Project Title Effect of Agricultural Chemicals or Water Quality and Watershed Ecology  
 Performing Organization USDA National Sedimentation Laboratory  
 Principal L. L. McDowell, Research Leader, (FTS) None  
 Investigator USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601)232-2900  
 (Name) (Address) (Telephone)

Starting Year FY1986 Estimated Completion Year FY1991  
 Technical Objectives: Evaluate pesticide and nutrient washoff from crops and residues to soil and runoff. Improve prediction of pesticide disappearance and washoff from foliage. Determine biological-suspended-sediment-nutrient interaction in farm pond ecosystems to improve control and management of small impoundments.

Technical Approach: Use experiments with natural and simulated rainfall to measure leaching and washoff rates of pesticides and nutrients. Define disappearance rates as functions of time after application, pesticide type, and rainfall. Use farm ponds in single-cover watersheds and controlled experiments to analyze and quantify pond chemical and sediment trapping efficiency.

General Progress in Last Two Years: Sediment and nutrient retention by small ponds has been described. The mechanisms and principal factors affecting leaching from agricultural and forest floor residues to runoff and soil profiles have been partially understood and described.

Plans for Next Twelve Months (FY 88): Continue program.

Coordination or Cooperation with Another Agency: Collaboration with USFS and SCS in research projects.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
X Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CZ Priority 1 1987 Session Number H09-3a  
 Subject Area Water Quality and Ecology  
 Project Title Water Balance Method for Solid and Hazardous Waste Disposal  
 Performing Organization USAE Watskva Experiment Station, Environmental Laboratory  
 Principal Dr. Paul R. Schroeder, CEVES-EE-R, P. O. Box 631 (FTS) 542-3709  
 Investigator (601) 634-3709  
 (Name) (Address) (Telephone)

Starting Year FY 82 Estimated Completion Year FY 88  
 Technical Objectives: Develop a computer model to estimate water balance components (runoff, evapotranspiration, lateral drainage to collection systems, and vertical percolation through the disposal sites) for designing land disposal sites and evaluating permit applications. Verify the computer model called Hydrologic Evaluation of Landfill Performance (HELP) model.

Technical Approach: Develop a daily simulation model using parts of existing models for agricultural systems (CREAMS and SWRRB) to estimate runoff and evapotranspiration and fundamental relationships for flow through porous media. Simplify the relationships to permit rapid determinations. Verify the lateral drainage equation using large scale laboratory tests. Verify the general approach used in the model by comparing the model predictions with field results.

General Progress in Last Two Years: Verified the lateral drainage equation using laboratory data. Verified the general model predictions using field data found in the literature. Revisions have been made to the first version of the HELP model to incorporate public comments and verification results.

Plans for Next Twelve Months (FY 88): Verify the second version of the HELP model using existing field data. Prepare documentation and user's guide for Version 2.

Coordination or Cooperation with Another Agency: Model has been developed using products of the Agricultural Research Service of the U.S. Department of Agriculture under a cooperative agreement with the U.S. Environmental Protection Agency.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams None Technology Transfer X  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-3b  
 Subject Area Water Quality and Ecology  
 Project Title Macrodispersion Experiment (of Ground Water)  
 Performing Organization TVA  
 Principal Investigator Mark Boggs ENG LAB-N (FTS)  
 (Name) (Address) (615) 632-1894 (Telephones)  
 Starting Year FY84 Estimated Completion Year FY90

Technical Objectives:

To quantify the transport and dispersion processes of chemicals transported in the saturated zone.

Technical Approach:

Injecting tracers into the ground water and tracking the tracers for two to three years by sampling several hundred wells at up to 30 depths per well.

General Progress in Last Two Years:

Three years of site characterization were completed, and tracers were injected in November 1986. Complete snapshots of influenced wells are performed every three months.

Plans for Next Twelve Months (FY88):

Sampling and data analysis will continue.

Coordination or Cooperation With Another Agency:

Supported by Electric Power Research Institute.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-3c  
 Subject Area Water Quality and Ecology  
 Project Title Geohydrologic Study to Enhance Bioreclamation Processes  
 Performing Organization TVA  
 Principal Investigator Steve Young ENG LAB-N (FTS)  
 (Name) (Address) (615) 632-1893 (Telephones)  
 Starting Year FY88 Estimated Completion Year FY89

Technical Objectives:

To develop geohydrologic procedures which will enhance in situ bioreclamation activity for remediating localized areas of ground-water contamination.

Technical Approach:

Field experiments will be conducted at Columbus AFB, Mississippi. Patterns of ground-water wells and infiltration techniques will be evaluated to facilitate the interaction of the necessary combination of microbes, nutrients, oxygen, and other physical parameters required for successful bioreclamation of contaminated ground water.

General Progress in Last Two Years:

New project.

Plans for Next Twelve Months (FY88):

Several exploratory wells will be drilled for site characterization. Computer models will be used to plan the field experiments.

Coordination or Cooperation With Another Agency:

Supported by USAF.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-4a  
 Subject Area Water Quality and Ecology  
 Project Title Lake Havasu Limnology Study  
 Performing Organization Applied Sciences Branch  
 Division of Research and Laboratory Services  
 Principal Investigator Richard Roline, D-1522 (FTS) 776-6005  
Denver CO 80225 (303) 236-6005  
 (Name) (Address) (Telephone)  
 Starting Year FY84 Estimated Completion Year FY89

Technical Objectives: Phase one, identify the baseline limnology of lower Lake Havasu to determine the effects that operations; Phase two, of the Central Arizona Project will have on the aquatic ecology of the lower lake due to pumping by the Havasu Pumping Plant.

Technical Approach: Phase one, monthly limnological field surveys, were performed at six stations on lower Lake Havasu from January 1984 through June 1985. Mathematical modeling was done to determine the source of water to be pumped and remote sensing (Landsat-5) study was performed to map temperature and productivity of the study area in relation to the entire lake. Phase two, monthly limnological field surveys, will be again performed at original six stations from January 1988 through June 1989 to identify changes in the aquatic ecology in the lower lake due to pumping plant operation.

General Progress in Last 2 Years: Phase one has been completed and pumping plant is now in operation. Final report on Phase one was also completed.

Plans for Next 12 Months (FY88): Phase two will be initiated if funds are available.

Coordination or Cooperation with Another Agency:           

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:           

Safety of Dams            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension           

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-4b  
 Subject Area Water Quality and Ecology  
 Project Title Plankton Dynamics in Bureau Reservoirs  
 Performing Organization Applied Sciences Branch  
 Division of Research and Laboratory Services  
 Principal Investigator Sharon Campbell, D-1522 (FTS) 776-6011  
Denver CO 80225 (303) 236-6011  
 (Name) (Address) (Telephone)  
 Starting Year FY86 Estimated Completion Year FY90

Technical Objectives: Nuisance algae blooms in Bureau reservoirs can cause severe water quality problems such as reduced dissolved oxygen concentrations and a resulting release of heavy metals from bottom sediments. Fish populations can be adversely affected by low dissolved oxygen concentrations, increased heavy metal concentrations, and toxic effects of the algae itself. Most of our knowledge of the mechanics of an algae bloom is derived from field studies which measure the onset, magnitude, decline, and composition of the bloom. Laboratory investigations of the nutrient, temperature, light, pH, and other environmental requirements of these algae would supplement the field studies. Information resulting from both field and laboratory studies would allow managers and planners to deal more effectively with water quality problems and the maintenance and development of reservoir fishery benefits.

Technical Approach: This study will be performed in the Environmental Sciences Section laboratories, utilizing existing equipment and facilities. Laboratory studies will coincide with field studies whenever possible, to enlarge the scope of those studies, and fit the results into a complete limnological context. Initially, algae and water samples from Bureau reservoirs which are currently being evaluated would be acquired. The algae would be cultured under controlled conditions to determine their response to such biotic and abiotic factors such as light and temperature fluctuations, nutrient concentrations, and species competition. Results of these studies would be integrated with field data and mathematical models developed in other research projects. Empirical relationships that are generally applicable to Bureau reservoirs for managers and planners concerned with water quality and fishery benefits would be the end product of the combined field and laboratory studies.

General Progress in Last 2 Years: a. Evaluation of a proposed modification to the standard AGP (algal growth potential) test was completed. b. In-house maintenance of blue green algae stock cultures began.

Plans for Next 12 Months (FY88): a. In-house maintenance of blue green algae stock cultures will continue. b. A literature search on culture techniques for blue green algae will be performed.

Coordination or Cooperation with Another Agency:           

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:           

Safety of Dams            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-4c  
 Subject Area Water Quality and Ecology  
 Project Title Historic Analysis of Algal Blooms in Pyramid Lake  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator James P. Verdin, D-1524 (Name)  
PO Box 25007 (FTS) 776-4302  
Denver CO 80225 (303) 236-4302  
 (Address) (Telephone)  
 Starting Year FY86 Estimated Completion Year FY87

Technical Objectives: To process 1972 through 1986 archival Landsat imagery to document the extent of Nodularia blooms in Pyramid Lake, Nevada, and interpret in conjunction with nutrient loading data to better understand possible changes in lake due to wastewater treatment and plant construction.

Technical Approach: Image negatives were scanned, digitally processed for registration and radiometric normalization, and mean lake radiance calculated for 84 dates in July - October of 1972-1986. Relations with chlorophyll content ratio were developed, and seasonal periodicity and annual variation of blooms documented.

General Progress in Last 2 Years: Project begun and completed.

Plans for Next 12 Months (FY88): None

Coordination or Cooperation with Another Agency: Study carried out with Arizona State University Department of Zoology (P.I. - Dr. David Galat). Source of funding was EPA.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension           

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-4d  
 Subject Area Water Quality and Ecology  
 Project Title Algal Control Demonstration Program  
 Performing Organization WES/CE  
 Principal Investigator Dr. John Barko (Name)  
WES (Address)  
(601) 634-3654 (FTS) 542-3654  
 (Telephone)  
 Starting Year FY 86 Estimated Completion Year FY 89

Technical Objectives: To evaluate the use of aluminum sulfate (alum) as a means to inactivate phosphorus generated from sediments during anoxic conditions for control of nuisance algal blooms in CE reservoirs. Results of this research will provide information for managing other lakes and reservoirs.

Technical Approach:

The research involved the addition of liquid alum to the hypolimnion of a Corps reservoir (Eau Claire Reservoir, WI) following the establishment of stable thermal stratification. The alum was added to the lake using barges equipped with tanks, pumps and perforated manifolds suspended at a depth of approximately 3 m. Phosphorus released from the sediments during anoxic conditions is adsorbed and retained in an insoluble form on the floor formed from the alum. Chemical and biological monitoring will be completed during the four-year study to determine the effectiveness of the General Program in Last Two Years.

Alum treatment was successfully completed in late May 1986. Initial chemical and biological monitoring results indicate a reduction of phosphorus concentration in the hypolimnion and a significant reduction in blue-green algae and total biomass during the summer of 1986.

Plans for Next Twelve Months (FY 88):

Continue the chemical and biological monitoring.

Coordination or Cooperation with Another Agency:

Research has been coordinated with the State of Wisconsin, Department of Natural Resources.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams            Technology Transfer            None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WEQ-4e  
 Subject Area Water Quality and Ecology  
 Project Title Reservoir Eutrophication, U.S./Spain Cooperative Program  
 Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator James F. LaBounty, D-1522 (Name) PO Box 25007 (FTS) 776-6002  
Denver CO 80225 (303) 236-6002  
 (Address) (Telephone)  
 Starting Year FY85 Estimated Completion Year FY90

Technical Objectives: Perform cooperative investigations in the United States and Spain on developing new technology to measure reservoir eutrophication. Exchange of visits annually to discuss progress and technology transfer.

Technical Approach: Utilize remote sensing technology to measure selected limnological parameters (temperature, chlorophyll a, and water clarity) of the reservoir surface. Compare results statistically within each reservoir, then between reservoirs.

General Progress in Last 2 Years: Collection of field data from seven reservoirs in Spain, three in the United States. Development of statistically reliable within reservoir comparisons. Exchange of three visits for technical interaction. Participation in workshop in Spain.

Plans for Next 12 Months (FY88): Completion of data comparison from different reservoirs. Statistical summarization of remote sensing and limnological data. Collection of field data continues. Exchange of visits.

Coordination or Cooperation with Another Agency: Visits to numerous field locations and visits to water districts. Participation in workshop in Madrid with numerous agencies of the Spanish government. Participation at American Water Works Association Annual Meeting

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ X Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WEQ-5a  
 Subject Area Water Quality and Ecology  
 Project Title Environmental Modeling  
 Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services  
 Principal Investigator James Sartoris, D-1522 (Name) PO Box 25007 (FTS) 776-6004  
Denver CO 80225 (303) 236-6004  
 (Address) (Telephone)  
 Starting Year FY71 Estimated Completion Year FY95

Technical Objectives: To provide the Bureau with computerized mathematical models of aquatic environments. Such models are needed to assist in quantifying impacts when assessing the environmental effects of water resource development projects and of modifications to existing projects. Main objective is to develop simple, reliable, predictive tools for making management and planning decisions on the basis of environmental field data.

Technical Approach: Limnological data generated by other section research projects and project work are mathematically and statistically analyzed to develop generally applicable mathematical models for predicting impacts and simulating the effects of various development alternatives. The mathematical relationships developed are also used to calibrate and adapt larger, more complex ecological computer models developed by other agencies to general Bureau use.

General Progress in Last 2 Years: Two years of attempting to develop empirical light-chlorophyll primary productivity models, using data from Twin Lakes, Colorado, resulted in the conclusion that such models could not be made predictive. Work was therefore shifted to reservoir and stream water quality and ecology models that can be used on PC's.

Plans for Next 12 Months (FY88): TVA's "BETTER" model will be applied to Twin Lakes, Colorado. EPA's "QUALZE" model will be applied to Las Vegas Wash, Nevada.

Coordination or Cooperation with Another Agency: TVA (contract for assistance with "BETTER")

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

## TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-5b  
 Subject Area Water Quality and Ecology  
 Project Title Two-Dimensional Reservoir Modeling for Reservoir Management  
(Cherokee and Chickamauga Reservoirs)  
 Performing Organization TVA  
 Principal Investigator Gary E. Hauser ENG LAB-N (FTS)  
(Name) (Address) (615) 632-1688  
(Telephones)  
 Starting Year FY86 Estimated Completion Year FY89

Technical Objectives:

Cherokee - evaluate management strategies for improved water quality, (reductions in sediment oxygen demand, inflowing nutrients, organics, and combinations)  
 - evaluate effects of John Sevier thermal loading on reservoir water quality

Chickamauga - evaluate impacts of effects of thermal loadings of Sequoyah (SQN) and Watts Bar (WBN) Nuclear plants on reservoir water quality. Investigate extent and frequency of plant-induced DO redistribution in the water column downstream from SQN.

Technical Approach:

The two-dimensional reservoir water quality model (BETTER) will be calibrated, validated, and used to simulate management alternatives.

General Progress in Last Two Years:

Cherokee modeling report has been published documenting the effects of various management alternatives and the thermal loading on reservoir water quality. The first of two years of planned data collection on Chickamauga reservoir is completed and model calibration has begun.

Plans for Next Twelve Months (FY88):

Complete model calibration for Chickamauga and upgrade and prepare draft of report documenting plant effects based on model results.

Coordination or Cooperation With Another Agency:

Complete model calibration for Chickamauga and upgrade and prepare draft of report documenting plant effects based on model results.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension  
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## TOPIC STATEMENT

Agency Reclamation Priority            1987 Session Number WQE-5c  
 Subject Area Water Quality  
 Project Title Verification of Water Quality Models  
 Performing Organization Division of Planning Technical Services  
 Principal Investigator J. W. Yahnke, Bureau of Reclamation, Mail Code D-755 (FTS) 776-3778  
P.O. Box 25007, Denver, CO 80225-0007 (303) 236-3778  
(Name) (Address) (Telephones)  
 Starting Year FY 1980 Estimated Completion Year FY 1993

Technical Objectives:

Develop and apply procedures for systematic verification of variety of water quality models. Results are intended to provide a basis for selection of the best techniques for analysis of planned projects, development of necessary data collection programs, and to evaluate the uncertainty in results.

Technical Approach:

Survey literature on model verification and uncertainty analyses. Conduct verification studies on specific water quality models; to date these include irrigation return flow models, phosphorus loading models, streamflow and chemical equilibrium models. Continue to evaluate uncertainty of results.

General Progress in Last Two Years:

Published journal article on the verification of chemical equilibrium models applied to salinity in the Colorado River Basin. The principal investigator was replaced. Obtained additional models on irrigation related fertilizer and pesticide use and effects and another chemical equilibrium model and began applying them to Reclamation data.

Plans for Next Twelve Months (FY 88):

Obtain additional data to further test the models and evaluate the results. Continue to develop and conduct uncertainty analyses.

Coordination or Cooperation with Another Agency:

Coordination with Department of Agriculture and Environmental Protection Agency.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ X None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency Reclamation Priority 1987 Session Number WQE-5d  
 Subject Area Water Quality and Ecology  
 Project Title Predicting Concentrations and Temperatures in Surface Waters  
 Performing Organization Bureau of Reclamation  
 Principal Robert L. George, Bureau of Reclamation, Mail Code D-754 (FTS) 776-3777  
 Investigator P.O. Box 25007, Denver, 80225-0007 (303) 236-3777  
 (Name) (Address) (Telephones)  
 Starting Year FY 1974 Estimated Completion Year FY 1989 (Current Phase)

Technical Objectives:

Develop techniques and simulation models to estimate change in water quality in reservoirs and streams as a result of planned Reclamation projects. Also, these models assist regional offices in operation of existing projects. Models will estimate water quality changes due to changes in selective withdrawal or reservoir operations. Develop coefficients and parameters that reflect the hydrology and meteorology unique to Reclamation projects.

Technical Approach:

1. Literature searches and personal contacts will be used to keep current with developments of models and model parameters.
2. Use models developed by others and modify them to meet Reclamation needs.
3. Obtain data and model parameters from cooperating agencies and the open literature to test their applicability to Reclamation sites.
4. Collect data when needed to develop model coefficients and/or techniques.

General Progress in Last Two Years:

1. QUAL 2E has been obtained and tested using Reclamation data.
2. Two-dimensional models have been applied to data collected at Flaming Gorge Reservoir. Models from the Corps of Engineers and TVA (Tennessee Valley Authority) will both be used.

Plans for Next Twelve Months (FY 88):

1. Application of the models will continue using the Flaming Gorge data set.
2. TVA's model BETTER will be applied to the New Maddell Reservoir site.

Coordination or Cooperation with Another Agency:

Flaming Gorge Studies have been coordinated with TVA and Waterways Experiment Station.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams        Technology Transfer        X        None  
       Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-6a  
 Subject Area Water Quality and Ecology  
 Project Title Assessing Effects of Reservoir Operations on Downstream Aquatic Resources  
 Performing Organization USARMS Waterways Experiment Station  
 Principal CEWPS, FS-0 (FTS) 542-3870  
 Investigator Dr. John Nestler, Vicksburg, MS 39130-0631 (601) 634-3870  
 (Name) (Address) (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 90

Technical Objectives:

Development of a general method for predicting habitat availability downstream of Corps of Engineers peaking hydropower projects under different release schedules (uprates, upgrades, and reregulation).

Technical Approach:

- (1) Calibration of models and simulation of hydraulics of Caney Fork River under dynamic flows.
- (2) Assessment of response of target game and non-game fish and benthic invertebrates to various peaking releases.
- (3) Determine physical habitat requirements of aquatic biota.
- (4) Construct specific and generic predictive models of habitat change under peaking releases.

General Progress in Last Two Years:

- (1) Establishment and survey of sampling grids at 0, 6, 12 miles downstream of Center Hill Dam on Caney Fork River.
- (2) Monthly benthic sampling with specific habitat information for each sample.
- (3) Drift sampling of benthos during various peaking releases.
- (4) Telemetric tracking of trout during peaking releases.

Plans for Next Twelve Months (FY 88):

- (1) Continue field studies of benthic drift and fish movement during peaking releases.
- (2) Calibration of dynamic flow model.
- (3) Construct physical habitat criteria.
- (4) Initiate specific model development/alteration of existing IFIM models.

Coordination or Cooperation with Another Agency:

U.S. Fish and Wildlife Service:  
 Tennessee Cooperative Fisheries Research Unit (Tennessee Tech)  
 National Ecology Center (Instream Flow Group)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams        Technology Transfer        X        None  
       Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-6b  
 Subject Area Water Quality and Ecology  
 Project Title Techniques for Evaluating and Managing Water Quality of Reservoir Tailwaters  
 Performing Organization USAE Waterways Experiment Station  
 Principal CEWES-ES-Q (FTS) 542-3517  
 Investigator Mark S. Dortch PO Box 631 (601) 634-3517  
 (Name) Vicksburg, MS 39180-0631 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 90

Technical Objectives:

The work unit objectives will be to develop improved techniques for evaluating and managing the impacts of reservoir releases on the quality of receiving waters under varying design and/or operating conditions. In addition, a better understanding of the primary processes governing water quality conditions in tailwaters will be gained.

Technical Approach:

The work is separated into the following work areas:  
 (1) Technical literature and water quality data will be reviewed to assess primary processes governing water quality conditions, identify deficiencies in available data, and compile available data for site-specific studies.  
 (2) Conduct field studies and laboratory investigations based on results of (1).  
 (3) Develop a user-friendly model incorporating existing simulation modules (e.g. selective withdrawal, structural aeration, riverine modules) with improved process rates identified in (1) and (2).  
 (4) Publish and distribute documents incorporating user-friendly model, description of field verification, and guidance on sampling tailwaters.

General Progress in Last Two Years:

Review of technical literature has been completed. Water quality data for tailwaters have been examined and deficiencies have been identified. Field study was conducted at Lake Greeson, Ark. Considerations for future field studies were established. Laboratory procedures were improved with on site analysis capability. Preliminary user-friendly model was developed with additions in mind.  
 Plans for Next Twelve Months (FY 88):  
 For FY 88 user-friendly model will be updated to include new subroutines for water quality constituents such as Fe, Mn and Sulfide, as these processes are better understood. Additional changes will be made as they arise. Data from Lake Greeson field study will be analyzed. Second field study will be conducted, and modified or new field techniques will be implemented as a result of first field study.

Coordination or Cooperation with Another Agency:

None.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-6c  
 Subject Area Water Quality and Ecology  
 Project Title Tailwater Flow, Temperature, and DO Modeling for Environmental Management  
 Performing Organization TVA  
 Principal ENG LAB-W (FTS)  
 Investigator Gary E. Hauser (Address) (615) 632-1888  
 (Telephones)  
 Starting Year FY86 Estimated Completion Year FY89

Technical Objectives:

Assist environmental management efforts in tailwaters of hydropower projects by simulating dynamics of flow, temperature, and dissolved oxygen. Results of these modeling studies are used to 1) quantify exposure of the aquatic community to variations in physical habitat variables for fishery management; 2) quantify downstream changes in these variables due to release improvement alternatives over a range of environmental conditions not testable in prototype; 3) provide operational guidance for maximizing downstream improvements or maintaining minimum flow requirements; and 4) interpret limited, conflicting, or counterintuitive field data.

Technical Approach:

Mathematical models are developed, upgraded, calibrated, and applied to simulate effects of reservoir release improvements, tailwater management strategies, reservoir operations, and other facets of hydroelectric generation on hydrodynamics and water quality in tailwaters of its hydropower projects. The dynamics of flow, temperature, and dissolved oxygen are simulated at a level of detail that allows investigation of how extreme transients in these constituents due to man-made flow changes are superimposed on natural fluctuations.

General Progress in Last Two Years:

Ft Patrick Henry Tailwater  
 - developed pulsing alternative to alleviate low DO downstream from Kingsport, TN.  
 - developed real-time flow model for scheduling releases to provide minimum bypass flow at John Sevier Fossil plant to meet NPDES requirements.  
 - environmental assessment of request by local industry for increased flows to meet cooling water requirements.

(Continued)

Norris, Tims Ford Douglas Tailwaters  
assessed temporal and spatial variations in temperature and DO for fish exposure studies:  
- provided operational guidance for maximizing downstream improvements due to alterations at the dams (minimum flow maintenance, artificial aeration)

Apalachia Tailwater  
- feasibility study of using dam releases to cool tailwater for a trophy trout fishery.

Plans for Next Twelve Months (FY88):

Ft Patrick Henry Tailwater  
- complete DO modeling for environmental assessment of a request by local industry for increased minimum flows from dam.

Norris Tailwater  
- continued modeling to support fishery management  
- assessment of historical water quality conditions in tailwater to help explain significantly improved mayfly hatch in 1987.

Tims Ford Tailwater  
- quantify fish exposure levels and guidance for fishery management

Douglas Tailwater  
- characterization of physical habitat and assessment of instream flow requirements

Coordination or Cooperation With Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
- Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
- Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number WQE-6d  
Subject Area Water Quality and Ecology  
Project Title Flow Regulation in Tailwaters  
Performing Organization TVA  
Principal Morgan Goranflo ENG LAB-W (615) 632-1959  
Investigator and Charles E. Bohac (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_  
Starting Year FY84 Estimated Completion Year FY87

Technical Objectives:  
TVA has embarked on a major effort to maintain increased flow in tailwater streams during idle turbine periods. More aesthetically pleasing conditions for fishing and other forms of recreation are expected to result from the increased minimum flows along with improved conditions for fish.

Technical Approach:

A Flow Reregulation Weir was constructed in the Clinch River below Norris Dam in 1984. The special design of the weir used rock fill gabion construction coupled with float-actuated discharge pipe controls for efficient use of storage. A minimum flow of 200 cfs is maintained in the tailwater when the turbines are idle.

A small turbine was installed on an existing 3-foot diameter sluice at Tims Ford Dam to discharge 80 cfs when the main turbine is not operating.

General Progress:

Since completion of the weir in May 1984, fishing pressure has increased dramatically along with other forms of recreational activities. Because of problems of deterioration of the gabion baskets, the weir was capped with a thin layer of concrete in the spring of 1984. This capping resulted in a potentially dangerous overflow condition under certain discharges from Norris Dam. Plans are to eliminate this dangerous flow condition by lengthening the weir nine feet using a timber crib-design. This modification is scheduled for September, 1987.

Construction of the small unit at Tims Ford was completed in 1986. Flow and power generation performance have been good. A compressor is being added to aerate the discharges.

Plans for Next Twelve Months:

Project monitoring will continue with special emphasis on obtaining field data to document the impact of improved flow conditions on trout growth rates in the Norris Dam and Tims Ford Dam tailwaters.

Coordination or Cooperation With Another Agency:  
Frequent telephone conversations with WES personnel.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
- Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
- Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-6e  
 Subject Area Water Quality and Ecology  
 Project Title Richard B. Russell Fish Entrapment Study  
 Performing Organization Waterways Experiment Station, USFWS Georgia Coop Unit  
 Principal (FTS) 342-3870  
 Investigator J. Nestlet, PO Box 631, Vicksburg, MS 39180-0631  
 (Name) (601) 634-3870  
 (Address) (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:

- a. Assemble necessary data to assess the potential for turbine mortality at Richard B. Russell Dam during pumped-storage operation; and
- b. Provide sufficient fishery information to develop engineering or operational solutions, if necessary and feasible, to alleviate the effects of pumped-storage operation at Richard B. Russell Dam.

Technical Approach: Monitor the distribution of abundances of different species of fishes in Clarks Hill Lake (the downstream reservoir in the pumped-storage system) with particular emphasis placed on the arm of the lake associated with the pumped-storage project. Monitoring methods include gillnetting, electro-shocking, hydroacoustics, ichthyoplankton sampling, cove rotenone sampling, and age and growth studies. Hydraulic simulation (STREMR - a 2-D steady state model) provides information on hydraulic environment near the project.

General Progress in Last Two Years: Monitoring has preceded for two years with only minor problems. Preliminary results of monitoring were presented to the project sponsor (Savannah District), other CE representatives, and the resource agencies at a workshop at Hickory Knob State Park, South Carolina.

Plans for Next Twelve Months (FY 88): Continue monitoring effort with some modifications to reflect what has been learned in the first two years of the study. Modifications will be detailed in meetings between the WES and project sponsor in July.

Coordination or Cooperation with Another Agency: Coordination with the resource agencies is performed by project sponsor. Agencies include the Georgia Department of Natural Resources, the South Carolina Wildlife and Marine Resources Department, Charleston Office of the Ecological Services, USFWS. Additional coordination with the USBR and other offices of the USFWS has been conducted by telephone.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams  Technology Transfer  Project Maintenance, Rehabilitation and Life Extension  None

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-6f  
 Subject Area Water Quality and Ecology  
 Project Title Ecological and Limnological Impact of Pumped-Storage Powerplants  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal James F. Labounty, D-1522 PO Box 25007  
 Investigator James J. Sartoris, D-1522 Denver CO 80225  
 (Name) (Address) (FTS) 776-6002  
(Telephone) (303) 236-6002  
 Starting Year FY71 Estimated Completion Year FY88

Technical Objectives: To determine and evaluate the ecological effects on bodies of water caused by the construction and operation of pumped-storage hydroelectric facilities. The data gathered will be used in planning and construction to avoid or reduce environmental impacts on aquatic ecosystems.

Technical Approach: Preoperational data from Twin Lakes, Colorado, a montane aquatic ecosystem, are being used as baseline data for comparison with data being gathered during pumped-storage operations at the site. Physical, chemical, atmospheric, and biological parameters were monitored for an extended period of time to assist in identifying possible ecological effects of the operation and recommending actions to mitigate possible serious effects. A monograph summarizing results and conclusions of this long-term study will be prepared.

General Progress in Last 2 Years: Field studies by the Bureau were concluded at Twin Lakes in September 1985. Cooperator's field studies were completed in 1986. USBR, Colorado Division of Wildlife, and Colorado Cooperative Fishery and Wildlife Research Unit (USFWS, at CSU) investigators began preparation of the final monograph.

Plans for Next 12 Months (FY88): Final draft of Twin Lakes monograph to be completed and submitted to Department of the Interior for publication.

Coordination or Cooperation with Another Agency:  
Colorado Division of Wildlife  
Colorado Cooperative Fishery and Wildlife Research Unit (USFWS, at Colorado State University)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: Safety of Dams  Technology Transfer  Project Maintenance, Rehabilitation and Life Extension  None



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-6g  
Subject Area Water Quality and Ecology  
Project Title Lake Mead Limnology and Fishery Study, Spring Canyon Assessment Applied Sciences Branch  
Performing Organization Division of Research and Laboratory Services  
Principal Investigator Stephen Grabowski, D-1522 20 Box 25007 (FTS) 776-6006  
Denver CO 80225 (303) 236-6006  
(Name) (Address) (Telephone)  
Starting Year FY85 Estimated Completion Year FY87

Technical Objectives: Evaluate limnological conditions and fish populations in the area of the proposed Spring Canyon Pumped-Storage Powerplant on Lake Mead for inclusion in the environmental assessment.

Technical Approach: Fish populations to be estimated by hydroacoustic sampling done by a contractor (BioSonics, Inc.). Limnological data to be collected by UNLV (University of Nevada, Las Vegas,) under the Lower Colorado Region's Reservoir Monitoring Program. Dr. Grabowski, with the assistance of Dr. Liston (IPA), will compile and evaluate these data to make the assessment.

General Progress in Last 2 Years: Hydroacoustic study completed. UNLV data compiled and reformatted. Data evaluation and assessment in progress.

Plans for Next 12 Months (FY88): Complete assessment of limnological and fisheries effects of Spring Canyon Pumped-Storage Powerplant.

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-6h  
Subject Area Water Quality and Ecology  
Project Title Norris Tailwater Investigations  
Performing Organization TVA Division of Air and Water Resources

Principal Investigator Bill Seawell, TVA, 132 SPB, Knoxville, TN 37902 (FTS) 632-3243  
(Name) (Address) (Telephones)

Starting Year FY81 Estimated Completion Year FY88  
Technical Objectives: To measure the effects of seasonal aeration of the releases which began in 1981, increased minimum flow which started in 1984, and better management of the trout fishery on abundance of benthic invertebrates, fish growth, and fishing use and harvest in Norris tailwater.

Technical Approach: Abundance of benthic invertebrates and quantitative samples of fish are collected quarterly. A five-day per week creel census measures fishing effort and harvest.

General Progress in Last Two Years: Fishing use in the tailwater has reached record levels. Populations of benthic invertebrates have shown increases in the abundance of larger, less tolerant forms, particularly mayflies, in the last six months. Condition of trout continues to drop during low DO periods in the tailwater but not as drastically as before aeration began.

Plans for Next Twelve Months (FY88):

Continue monitoring changes.

Coordination or Cooperation with Another Agency:

Cooperative effort with Tennessee Wildlife Resources Agency. Findings shared with U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and others.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-61  
 Subject Area Water Quality and Ecology  
 Project Title Tailwater Ecology  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal            PO Box 25007 (FTS) 776-6011  
 Investigator Sharon Campbell, D-1522 Denver CO 80225 (303) 236-6011  
 (Name) (Address) (Telephone)  
 Starting Year FY83 Estimated Completion Year FY89

Technical Objectives: Aquatic environments below Bureau structures provide both valuable fisheries and sites for production of food for various fish species. An extensive body of literature on tailwater ecology in the 17 Western States associated with Bureau impoundments exists. Data from this literature base should be compiled in a comprehensive report for Bureau use in tailwater fishery and/or water quality management concerns below Bureau dams. Specific field and laboratory research needed to develop water release regimes and dam design or modifications which benefit the water user and maintain downstream environments must be identified.

Technical Approach: Approximately 1000 pieces of literature on tailwater ecology below USBR impoundments will be compiled into a comprehensive report for management and planning use by USBR personnel. Areas of research where information is lacking will be identified. Field research will be designed to gather information where a need for further research is found.

General Progress in Last 2 Years: Working draft of the literature compilation report was completed and distributed to the regional 700 and 150 offices. b. Sample site locations, logistics of river access, and sampling methodologies to be used on the Rio Chama, New Mexico, have been worked out. c. Three field trips to the Rio Chama, New Mexico, were performed to study effect of silt releases on brown trout spawning.

Plans for Next 12 Months (FY88): a. A comprehensive field research plan will be developed for the Rio Chama study which will utilize an incremental approach to allow for FY88 funding level uncertainties. b. A meeting with U.S. Fish and Wildlife representatives from Albuquerque, New Mexico, who have been evaluating brown trout populations in the Rio Chama will be held to coordinate activities during the field study beginning October 1987.

Coordination or Cooperation with Another Agency:  
 U.S. Fish and Wildlife Service  
 New Mexico Department of Game and Fish

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams            Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-61  
 Subject Area Water Quality and Ecology  
 Project Title Downstream Drift in Lower Colorado River  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal            PO Box 25007 (FTS) 776-6010  
 Investigator Davine Lieberman, D-1522 Denver CO 80225 (303) 236-6010  
 (Name) (Address) (Telephone)  
 Starting Year FY86 Estimated Completion Year FY88

Technical Objectives: To determine the type and quantity of seston in the Lower Colorado River system and to determine the fate of this organic matter as it passed from upstream to downstream along this reservoir/river continuum.

Technical Approach: Conduct appropriate biological, chemical, and physical sampling above and below selected dams on the Lower Colorado River to characterize the biological drift within the system. The tasks are as follows: (1) formulation of a Scope of Work in conjunction with LC-150 personnel; (2) literature search and review; (3) selection and evaluation of sampling gear and field techniques; (4) data collection at selected sites; and (5) data analysis.

General Progress in Last 2 Years: Pertinent literature was collected, reviewed, and compiled into an Applied Sciences Report. Sampling was conducted at eight stations on the Lower Colorado River. Samples were analyzed in the laboratory for inorganic and organic matter, chlorophyll, nutrients, and plankton composition.

Plans for Next 12 Months (FY88): Field data will be analyzed and evaluated to determine further research needs.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams            Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

Agency TVA Priority Water Quality and Ecology 1987 Session Number WQE-6k  
 Subject Area Water Quality and Ecology  
 Project Title Effects of Dissolved Oxygen on Fish and Other Aquatic Life  
 Performing Organization Division of Air and Water Resources  
 Principal Investigator Richard J. Ruane, Chattanooga, TN 37401 615/751-7323  
Bill Seawell, Knoxville, TN 615/632-2342  
 Starting Year 1984 Estimated Completion Year 1988

**Technical Objectives:** Determine the effects of various concentrations of dissolved oxygen on (1) reproduction, growth, and survival of warmwater fish and other aquatic life and (2) growth and survival of coldwater fish and other aquatic life.  
**Technical Approach:** Available information is based entirely on laboratory tests. Some scientist in EPA and the U.S. Fish and Wildlife Service believe that criteria which now exist can only be improved upon by field evaluations or studies such as TVA has conducted in large channels under simulated field conditions at the TVA Aquatic Research Laboratory (ARL), (formerly the Browns Ferry Biothermal Research Facility). It is believed that laboratory testing conditions add various physiological stresses to fish being tested and, therefore, these fish are more sensitive to lower water quality conditions such as low DO.

The approach is to conduct investigations in a simulated natural environment under conditions where variables can be controlled. ARL has proven its capability to develop information essential for important decisions in water quality management relating to thermal enrichment of reservoirs. The main attribute of the facility is its proven ability to simulate the natural environment while replicating desired test conditions and to provide scientifically defensible results. This \$6 million facility presents an unequalled capability to acquire fundamental information necessary for improved water quality management strategies.

The experimental design includes three to five concentrations of dissolved oxygen and two controls. Fish species being tested include rainbow trout, sauger, smallmouth bass, white crappie, bluegill, catfish, striped X white bass hybrids, fathead minnows, golden shiners, and gizzard shad. Macroinvertebrates and zooplankton are being monitored.

**General Progress:** Research was initiated in June 1984 and continued through March 1986. Results were obtained on rainbow trout, smallmouth bass, and bluegill.

**Plans for Next Twelve Months:** Subject to available funding, effects of cyclical DO concentrations that represent proposed operations patterns for DO in reservoir releases will be evaluated.

Coordination or Cooperation with Another Agency: EPA

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency USBR Priority Water Quality and Ecology 1987 Session Number WQE-61  
 Subject Area Water Quality and Ecology  
 Project Title Effects of Supersaturation of Dissolved Gas on the Big Horn River Montana  
 Performing Organization Division of Research and Laboratory Services Applied Sciences Branch  
 Principal Investigator James F. LaBounty, D-1522 (Name) PO Box 25007 (Address) (FTS) 776-6002 (Telephone) (303) 236-6002  
 Starting Year FY85 Estimated Completion Year FY89

**Technical Objectives:** To investigate causes and ecological consequences of N<sub>2</sub> supersaturation below Bureau structures, learn the effect on various levels of the food chain in a stream, and measure the effectiveness of various corrective measures.

**Technical Approach:** Use the Big Horn River as a field site. Install automated monitoring equipment. Monitor effects of gas bubble disease. Study the influence of various operational schemes on the intensity of gas bubble disease.

**General Progress in Last 2 Years:** Automated monitoring equipment installed and functioning. Fishery monitoring continues with two full-time researchers. Studies of the effects on lower food chain has begun. Preliminary identification of operational changes needed to improve situation. Completed laboratory physiology tests on N<sub>2</sub> effects on fish.

**Plans for Next 12 Months (FY88):** Continue monitoring programs. Continue research on the effects of N<sub>2</sub> supersaturation on invertebrates. Emphasize physical limnology and how it influences dissolved gas. Monitor the influence of changing operation on supersaturation.

Coordination or Cooperation with Another Agency:  
 Cooperation with Montana Department of Fish, Wildlife, and Parks.  
 Cooperation with U.S. Fish and Wildlife Service.  
 Cooperation with Montana State University.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams X Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-7a  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Ecology: Competitive/Environment Manipulation  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494 (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 93

**Technical Objectives:** Given time, the process of ecological succession may lead to more desirable plant communities comprised of native vegetation. However, disturbance, resulting from various means of aquatic plant control, maintains the environment in an ecologically immature state. Disturbance thus favors reestablishment of weedy species. Previous investigations have provided information on the environmental requirements of submersed aquatic plants. The proposed work will examine methods for manipulating the environment of submersed aquatic plant communities to minimize the growth of weedy species and encourage the growth of more desirable vegetation.

**Technical Approach:** Competitive abilities of introduced and native species will be examined under selected environmental conditions in a controlled environment facility. Results of laboratory investigations will be used to develop methodologies for manipulating the natural environment to promote the growth of desirable species. Field experiments will test the implementation of selected environmental manipulations. Artificial establishment of desirable species will be tested under manipulated and controlled conditions at field sites in Wisconsin and in the Southeast.

**General Progress in Last Two Years:** No progress, new start in FY 88.

**Plans for Next Twelve Months (FY 88):** Initiate preliminary laboratory experiments.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-7b  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Ecology: Submersed Vegetation on Habitat  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 91

**Technical Objectives:** The objective is to provide a better understanding of the influence of submersed aquatic vegetation on the quality of the aquatic environment, and provide guidelines for aquatic plant management, considering beneficial as well as detrimental effects.

**Technical Approach:** The influence of submersed aquatic vegetation on physical, chemical, and biological conditions is being assessed through a combination of laboratory and field studies. Primary emphasis in laboratory studies is on effects of vegetation on sediment redox conditions, nutrient flux between sediment and overlying water, and water chemistry. This information is intended to augment interpretation of results from field studies. Studies designed to address effects of aquatic plants on physical and chemical conditions, distribution and abundance of invertebrates and fish, and the trophic significance of vegetation are being conducted in both lacustrine and flowing water systems.

**General Progress in Last Two Years:** Conducted workshop to further develop methods, and plan a coordinated field research program based on a detailed scope of work prepared earlier. Initiated research on the Eau Claire reservoir, Wisconsin and on the Potomac River, Washington, DC to determine the effects of submersed aquatic vegetation on physical, chemical, and biological characteristics of the aquatic environment. Initiated laboratory studies to determine effects of aquatic vegetation on sediment and water chemistry.  
**Plans for Next Twelve Months (FY 88):** A report on the Physical and Chemical Phases of the study will be completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7c  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Ecology: Effects of Water Chemistry  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (Address) \_\_\_\_\_ (FTS) 542-3494  
 Starting Year FY 83 Estimated Completion Year FY 89 (601) 634-3494 (Telephones)

**Technical Objectives:** To provide information on the influence of various water chemistry parameters on the growth rates of submersed aquatic plants. The findings will be used in conjunction with the results of prior and ongoing work units to determine the factors potentially limiting the growth of submersed aquatic plants. Knowledge of actual and potential limiting factors is critical to the successful implementation of aquatic plant management methodologies.

**Technical Approach:** Investigations are being conducted in controlled environmental facilities under uniform conditions of light, temperature, and sediment type on water chemistry parameters (cation concentration and inorganic carbon availability) affecting the growth and photosynthesis of Eurasian watermilfoil (*Hydrphyllum spicatum*). These studies have included other species (*Egeria*, *Hydrilla*, and *Potamogeton*) to identify potential competitive relationships. Results of laboratory studies will be verified by examination of field populations.

**General Progress in Last Two Years:** Results of laboratory studies indicate that the growth of the aquatic plant species examined to date may be limited by the availability of inorganic carbon. Cation concentrations do not seem to be limiting except at very low levels of inorganic carbon. The growth response of submersed plants to increasing carbon availability is augmented under high sediment nutrient conditions, suggesting that sediment fertility and carbon supply may interactively limit submersed plant growth. Preliminary field results confirm the likelihood of carbon limitation in a eutrophic reservoir (Eau Galle). A report on the effects of water chemistry on *M. spicatum* was published.

Plans for Next Twelve Months (FY 88): Field studies will be completed.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7d  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Ecology: Environmental Interactions  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (Address) \_\_\_\_\_ (FTS) 542-3494  
 Starting Year FY 85 Estimated Completion Year FY 89 (601) 634-3494 (Telephones)

**Technical Objectives:** The objective is to provide quantitative information on the interactive influence of key environmental factors (light, temperature, sediment composition, and water chemistry), which collectively regulate plant growth rates, species distribution and community composition.

**Technical Approach:** Studies are being conducted both under controlled laboratory conditions and in the field on the interactive influence of light, water temperature, sediment composition, and water chemistry on submersed aquatic plant growth, distribution, and community composition. These studies include native as well as introduced species in efforts to examine mechanisms influencing competitive outcome in different types of aquatic systems over a successional continuum. Results from laboratory studies are being subjected to scrutiny in the field.

**General Progress in Last Two Years:** Laboratory investigations of the interactive influences of sediment composition, water temp., light, and salinity on the growth of monocious versus dioecious HYDRILLA, in combination with selected native plant species, were completed. Studies were continued in Lake Marion, S.C., cooperatively with the State of South Carolina, to examine relationships between sediment composition and the distribution of *Egeria*. A technical report was published on sediment-related mechanisms of growth regulations in submersed aquatic vegetation.

Plans for Next Twelve Months (FY 88): A technical report on the laboratory studies phase will be completed and submitted for publication.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7e

Subject Area Water Quality and Ecology

Project Title Coordination of Control Tactics with Phenological Events of Aquatic Plants

Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeGell (FTS) 542-3494  
 (Name) (Address) (601) 538-3494  
 Starting Year FY 86 Estimated Completion Year FY 91 (Telephones)

**Technical Objectives:** To determine and describe the phenology and energy allocation of the major weed species (waterhyacinth, alligatorweed, hydrilla, Eurasian watermilfoil) in aquatic ecosystems based on calendar and/or degree days to determine when various control measures achieve maximum immediate and/or long term control; to correlate control to the phenological stage at which maximum control was achieved; and, to delineate environmental factors inducing plant stress and consequent impacts on phenology and efficacy of control tactics.

**Technical Approach:** This work will involve (1) A literature review followed by laboratory testing to ascertain gross phenology and energy allocation of the weed species listed, (2) determining the effects of chemical, biological or mechanical treatments on biomass and stored energy reserves in controlled-environment chambers; (3) developing a computerized growth model describing the probable time of phenological events and the "windows" (time) during which the most effective control can be achieved; (4) conducting field experiments to calibrate and validate the model for operational use.

**General Progress in Last Two Years:** A literature review to ascertain the gross phenology and energy allocation of waterhyacinth, alligatorweed, hydrilla, and watermilfoil has been completed. Laboratory studies have been initiated to correlate carbohydrate partitioning with phenological events of waterhyacinth.

Plans for Next Twelve Months (FY 88): Laboratory studies on food reserves for Hydrilla and Waterhyacinth will be completed.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-7f

Subject Area Water Quality and Ecology

Project Title Factors Influencing Eurasian Watermilfoil Establishment

Performing Organization Applied Sciences Branch  
 Principal Investigator D. Sisneros, D-1522 (FTS) 776-6019  
 (Name) (Address) (303) 236-8019  
 Starting Year FY 83 Estimated Completion Year FY 87 (Telephone)

**Technical Objectives:** To determine factors which influence where Eurasian watermilfoil will establish and to utilize the resulting data to develop a final report useful for developing control strategies and for anticipating where milfoil might establish.

**Technical Approach:** Field collected samples of water, hydrosol, and plant material will be analyzed. Viability determinations on the plant material will be made in the greenhouse. The 2-year data collection will be the initial step in development of an integrated milfoil control strategy allowing prediction of where stands might develop and what environmental factors could be manipulated to discourage growth.

**General Progress in Last 2 Years:** All field data collection was completed. This included four lakes in the Columbia Basin Project which were observed for similarities in pattern of weed growth, nutrient availability, and environmental factors. A final report has been prepared.

Plans for Next 12 Months (FY 88): None - Complete

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-7g  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Control - Laboratory Studies  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator J. A. Thullen, D-1522 (FTS) 776-6018  
 (Address) PO Box 25007 (303) 236-6018  
Denver CO 80225 (Telephone)  
 Starting Year FY86 Estimated Completion Year Continuing

Technical Objectives: To develop more efficient and effective methods for managing aquatic weeds in Western irrigation systems through an understanding of their physiological responses to environmental conditions. Research efforts focus on the major goal of timely delivery of water and prevention of water losses.

Technical Approach: Laboratory investigations will study the growth and reproduction of noxious aquatic weeds with emphasis on physiological response (including vegetative growth, reproduction stimulation on inhibition, and changes in metabolism) to varying environments. Additional studies will focus on physiological responses of aquatic plants to mechanical harvesting and biological control organisms and IPM (Integrated Pest Management) strategies as they affect plant growth.

General Progress in Last 2 Years: Studies were conducted to determine the effects of photoperiods temperature, aeration, and addition of gasses including O<sub>2</sub> and CO<sub>2</sub> to the surrounding medium. Extensive hydrilla turion germination studies were conducted with a paper on turion production submitted to the Journal of Aquatic Botany.

Plans for Next 12 Months (FY88): Hydrilla tuberization studies will continue with emphasis on the differences in monoecious and dioecious forms and the definition of optimal environmental conditions for tuber production. Outdoor investigations will be conducted to determine whether turion production will occur naturally in Colorado.

Coordination or Cooperation with Another Agency:  
 Principal Investigator visited USDA/ARS (U.S. Department of Agriculture/Agricultural Research Service) research facilities in Davis, California, to learn more of their physiology studies and to coordinate research activities.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7h  
 Subject Area Water Quality and Ecology  
 Project Title Biological Management of Aquatic Plants by Manipulation of the Microflora  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494  
 Starting Year FY 86 Estimated Completion Year FY 91  
 (Telephones)

Technical Objectives: To determine the micro flora and plant processes involved in the seasonal decline of submersed aquatic plants for the development of biological management strategies.

Technical Approach: A thorough literature search will be conducted. Laboratory studies will be conducted to determine methods of inducing senescence of Eurasian watermilfoil. Plants in different stages of induced senescence will be evaluated for their susceptibility to plant pathogens. The involvement of the microflora in the senescence of watermilfoil will be determined by the identification of the dominant microbial species at different stages in its senescence.

General Progress in Last Two Years: A literature review was completed.

Plans for Next Twelve Months (FY 88): Report on induction of senescence and susceptibility will be completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7J  
Subject Area Water Quality and Ecology

Project Title Management of Submersed Aquatic Plants with Genetically Engineered Microorganisms

Performing Organization Waterways Experiment Station

Principal Investigator J. L. Decell (Name) (Address) (FTS) 542-3494  
(601) 633-3494 (Telephones)

Starting Year FY 86 Estimated Completion Year FY 91

Technical Objectives: To genetically engineer microorganisms for the management of submersed aquatic plants.

Technical Approach: The research will be conducted in the following phases: (1) The isolation of microorganisms specific to the target plants. (2) Determination of desired trait to engineer into the microorganisms. (3) The engineering of the specific trait by transferring the gene(s) that code for it into a microorganism specific to the target plant. (4) Conduct bioassays to determine the expression of the new gene(s) and their effects on the recipient. (5) Conduct efficacy studies. (6) Develop a formulation for large-scale field testing.

General Progress in Last Two Years: A feasibility study was conducted. A panel of experts concluded that the technology was available to achieve the objective of the project.

Plans for Next Twelve Months (FY 88): Identification of host-specific microorganisms will be completed and a report on the specificity of microflora will be published.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7I  
Subject Area Water Quality and Ecology

Project Title Biological Management of Submersed Plants by Manipulation of Phytoplanktonic Insects

Performing Organization Waterways Experiment Station

Principal Investigator J. L. Decell (Name) (Address) (FTS) 542-3494  
(601) 633-3494 (Telephones)

Starting Year FY 86 Estimated Completion Year FY 91

Technical Objectives: The purpose of this work unit is to manage submersed aquatic plants with the natural invertebrate community using behavior-modifying compounds (stimulants and attractants).

Technical Approach: Laboratory studies will be conducted to identify kairomones and/or pheromones that can be used to attract invertebrates to aquatic plants. The effectiveness of these attractants will be tested in greenhouse studies. A computer model will be developed and verified by field demonstrations.

General Progress in Last Two Years: Survey for insects impacting Eurasian watermilfoil (1980-1982) and hydrilla (1978-1980) in the US have been conducted. An extensive list of invertebrates impacting Eurasian and hydrilla, their location, and population levels is well documented.

Plans for Next Twelve Months (FY 88): Complete greenhouse study phase.

Coordination or Cooperation with Another Agency: \_\_\_\_\_

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_



TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7k  
 Subject Area Water Quality and Ecology  
 Project Title Biological Management of Aquatic Plants with Allelopathic and Competitive Species  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeGell (FTS) 542-3494  
 (601) 634-3494 (Address) (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 91

**Technical Objectives:** To develop methods to utilize allelopathic and competitive plant species for the management of problem aquatic plants.

**Technical Approach:** A thorough literature search will be conducted. Laboratory investigations will be conducted to identify, characterize, and elucidate the mechanism of allelopathy in aquatic plant species. Greenhouse studies will be conducted to demonstrate allelopathic capabilities and other competitive traits. Field studies will be conducted to develop management strategies.

**General Progress in Last Two Years:** The feasibility and literature search were completed. A decision was made to continue the work.

**Plans for Next Twelve Months (FY 88):** Complete laboratory and greenhouse studies.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7l  
 Subject Area Water Quality and Ecology  
 Project Title Biological Control of Hydrilla Using Insects  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeGell (FTS) 542-3494  
 (601) 634-3494 (Address) (Telephones)  
 Starting Year FY Estimated Completion Year FY

**Technical Objectives:** To introduce host specific insects into the U. S. for the management of Hydrilla.

**Technical Approach:** To achieve the objective of this work unit, it will be necessary to conduct overseas searches for insect species that have potential for controlling hydrilla, perform host specificity and efficacy studies on the most promising species in the country of origin, conduct quarantine studies in the United States, and obtain permission for their operational deployment.

**General Progress in Last Two Years:** Quarantine studies on a tuber feeding weevil (Bagous affinis) have been completed and its release into the U. S. has been requested. Another weevil, Bagous australasiae, has been approved for quarantine studies in the U. S.

**Plans for Next Twelve Months (FY 88):** The fly (Hydrilla) will be released from quarantine and the quarantine studies on Bagous Australasiae will be completed.

Coordination or Cooperation with Another Agency:  
 Tennessee Valley Authority  
 Bureau of Reclamation  
 U. S. Department of Agriculture

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-7m  
 Subject Area Water Quality and Ecology  
 Project Title Biological Control of Hydrilla Using Plant Pathogens  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494  
 (Telephones)  
 Starting Year FY 82 Estimated Completion Year FY 89

Technical Objectives: To develop an operational capability for the use of plant pathogens to control hydrilla.

Technical Approach: To conduct a field survey of microorganisms on hydrilla and screen them on defined media for lytic (digestive) enzyme production. Enzyme production of candidates will be enhanced and they will be tested for host specificity and efficacy. The host specific pathogens will be formulated for field testing.

General Progress in Last Two Years: Fungal isolate 224-F (Cladosporium sp.) destroyed hydrilla in an aquarium test within 2 weeks. Host specificity studies were initiated.

Plans for Next Twelve Months (FY 88): Host specificity studies will be completed and field efficacy studies will be initiated. An experimental formulation of the pathogens should be completed.

Coordination or Cooperation with Another Agency:

Tennessee Valley Authority  
 Bureau of Reclamation  
 U. S. Department of Agriculture

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-7n  
 Subject Area Water Quality and Ecology  
 Project Title Biological Control of Eurasian Watermilfoil Using Plant Pathogens  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494  
 (Telephones)  
 Starting Year FY 82 Estimated Completion Year FY 91

Technical Objectives: To develop an operational capability for the use of plant pathogens to manage Eurasian watermilfoil.

Technical Approach: A survey of the continental U.S. for pathogens on Eurasian watermilfoil will be conducted. Researchers at the University of Massachusetts have isolated a fungus (Mycoleptodiscus) and a bacterium (Pseudomonas) which produce lytic enzymes (break down the plant cell wall). Laboratory and field studies will be conducted to develop these microorganisms for the management of Eurasian watermilfoil.

General Progress in Last Two Years: Two small-scale field studies were successfully completed, demonstrating the effectiveness of the control agents. The treated plants received two applications 4 weeks apart. The plants were destroyed 2 weeks after the second treatment in both studies.

Plans for Next Twelve Months (FY 88): Laboratory studies on disease mechanisms will be completed and large-scale field demonstrations will be initiated.

Coordination or Cooperation with Another Agency:

Tennessee Valley Authority  
 Bureau of Reclamation

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7a  
 Subject Area Water Quality and Ecology  
 Project Title Biological Control of Waterlettuce with Insects  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeCell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 90

Technical Objectives: To develop an operational capability for the use of insects to control waterlettuce.

Technical Approach: Two insect species, Neohydronomus puicellus and Namangana pectinicornis (formerly Episamea pectinicornis) have been used successfully as biological agents for control of waterlettuce in Australia and Thailand. Laboratory and field studies will be conducted on the life cycle and feeding habits of these insects on waterlettuce. A computer model will be developed and verified with a field study.

General Progress in Last Two Years: The working group for Biological Control of Weeds has granted permission for the release of Neohydronomus in the United States as a biological control agent of Waterlettuce. Namangana is currently undergoing host specificity testing in the quarantine facility in Gainesville, Florida.

Plans for Next Twelve Months (FY 88): Quarantine studies on Namangana will be completed and with proper approval, field studies will be initiated.

Coordination or Cooperation with Another Agency: Tennessee Valley Authority, Bureau of Reclamation, U. S. Department of Agriculture

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: Safety of Dams, Technology Transfer, Project Maintenance, Rehabilitation and Life Extension None

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-7p  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Control and Canal Environmental - Field Studies  
 Performing Organization Applied Sciences Branch, Division of Research and Laboratory Services  
 Principal Investigator F. L. Nibling, D-1522 (FTS) 776-6017  
 (Name) (Address) Denver CO 80225 (303) 236-6017 (Telephone)  
 Starting Year FY86 Estimated Completion Year Continuing

Technical Objectives: To evaluate and develop at the field level new management techniques for controlling aquatic weed and algae problems in Western irrigation systems. Research efforts focus on techniques that permit timely water delivery, prevent associated water losses, and improve water quality.

Technical Approach: Field studies will be conducted to investigate chemical, mechanical, biological, and environmental methods for managing problem aquatic vegetation. Field management studies will investigate the feasibility of utilizing herbivorous fish as an integrated pest management tool for controlling aquatic weeds. The ecology of irrigation systems will be evaluated to identify contributing environmental factors associated with aquatic weed and algae problems.

General Progress in Last 2 Years: A 3-year efficacy evaluation of grass carp for aquatic weed control in a Colorado field site was completed. Stocking density, fish movement, food preference, and tolerance to cold, flowing water, were evaluated. The study has now entered an operational phase with the Irrigation District assuming much of the responsibility. Plans were finalized for an effort to acquire grass carp brood stock from Northern China.

Plans for Next 12 Months (FY88): The operational testing phase of the grass carp study will continue with emphasis on the practicability of using the fish for full-scale implementation. Grass carp brood stock will be brought in from Northern China in an effort to expand and improve the gene pool and improve cold water hardiness. Additional development work will be done in the area of using hydroacoustics and electronic position instrumentation in aquatic weed control studies.

Coordination or Cooperation with Another Agency: Many of the grass carp research activities were coordinated with the Imperial Irrigation District, Imperial, California

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference: Safety of Dams, Technology Transfer, Project Maintenance, Rehabilitation and Life Extension None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-Zq

Subject Area Water Quality and Ecology

Project Title Grass Carp Barrier  
Applied Sciences Branch

Performing Organization Division of Research and Laboratory Services

Principal Investigator F. L. Nibling, D-1522 (Name)  
PO Box 25007 (Address) (303) 776-6017 (Telephone)  
Denver, CO 80225 (Address) (303) 236-6017 (Telephone)

Starting Year FY85 Estimated Completion Year FY89

Technical Objectives: To develop barrier and guidance techniques to maintain fish density in weed problem areas and to prevent escape into streams and connecting waterways.

Technical Approach: The study is approached from three aspects: Physical barriers, behavioral barriers, and guidance strategies. In the area of physical barriers, physical capabilities of the fish are evaluated in conjunction with determination of hydraulic and physical characteristics of canal structures which affect fish movement. With behavioral barriers, behavioral features of grass carp are identified, standardized, and measured followed by evaluation of promising behavioral barriers. Effective behavioral barrier methods would be adapted to active guidance techniques to be field tested.

General Progress in Last 2 Years: Migratory behavior of grass carp was evaluated over a 2-year period using radiotelemetry. Water velocity and turbulence in drop tailraces were measured for potential as barriers to upstream movement. Electrical field characteristics of an electrical barrier were evaluated using various sized electrodes. Evaluation of a bubble curtain barrier was started.

Plans for Next 12 Months (FY88): A final report on the fish migration study will be completed. The grass carp bubble curtain study will continue while other fish barrier designs involving physical and electrical techniques will be evaluated.

Coordination or Cooperation with Another Agency: These studies are coordinated through an interagency agreement with the U.S. Fish and Wildlife and Colorado State University.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None

Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-7r

Subject Area Water Quality and Ecology

Project Title Radio Telemetry Studies with White Amur on Guntersville Reservoir

Performing Organization Auburn University

Principal Investigator David Webb, TVA, EDB, Muscle Shoals, AL 35660 (Name)  
(205) 386-2276 (Address) (205) 386-2276 (Telephone)

Starting Year FY87 Estimated Completion Year FY88  
Technical Objectives: Determine if white amur will remain in hydrilla colonies where initially stocked and their movement in a large reservoir. This information will be integrated with existing knowledge to evaluate the feasibility of using white amur at low stocking rates for hydrilla control in a large open system.

Technical Approach: Radio transmitters were surgically implanted in 25 white amur that were stocked at two locations in Guntersville Reservoir a 27,438 ha impoundment in northeastern Alabama. Initial stocking was in the vicinity of large colonies of hydrilla. Location and movement of the amur will be determined for a period of one year.

General Progress in Last Two Years: The amur were stocked in July 1987.

Plans for Next Twelve Months (FY88):

- (1) Monitor location and movement on a monthly basis for one year.
- (2) Prepare final report

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams X Technology Transfer None

Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7a  
 Subject Area Water Quality and Ecology  
 Project Title Field Evaluation of Selected Herbicides for New Aquatic Uses  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Dezell (FTS) 542-3494  
 (Address) (601) 636-3494 (Telephones)  
 Starting Year FY 86 Estimated Completion Year FY 91

**Technical Objectives:** To cooperatively field test under Experimental Use Permits new or existing herbicides with developers, for determining environmental fate, dispersion, and residue partitioning.

**Technical Approach:** Field testing requirements for registration of herbicides and supporting expansion of product registrations varies for each herbicide. As needed, field test plans will be developed and submitted to appropriate regulatory agencies for approval. Field tests will be conducted cooperatively with industry and other Federal and state agencies at selected projects around the country.

**General Progress in Last Two Years:** Developed EPA-approved test protocol for Garlon 3A for use by the CE and Bureau of Reclamation. Completed field testing of Garlon 3A (trichlopyr) at Lake Seminole, GA, in cooperation with DDM Chemical Co. The Bureau of Reclamation is cooperating in a similar test scheduled for FY 87 in the State of Washington. Completed test protocol for Carson 106 (currently under review by the EPA); this test will be conducted in FY 87.  
**Plans for Next Twelve Months (FY 88):** Carson 106 tests at Lake Seminole, GA will be completed.

**Coordination or Cooperation with Another Agency:**

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-7c  
 Subject Area Water Quality and Ecology  
 Project Title Investigations of Herbicide Residues in Water, Soil, Crops, and Fish  
 Performing Organization Applied Sciences Branch  
 Division of Research and Laboratory Services  
 Principal Investigator J. Pringle, D-1522 P O Box 25007 (FTS) 776-6022  
 (Address) Denver CO 80225 (303) 236-6022 (Telephone)

Starting Year FY 86 Estimated Completion Year Continuing  
**Technical Objectives:** To develop herbicide residue data on water, soil, crops, and fish following the application of herbicides for control of aquatic and ditchbank weeds on irrigation projects. The major objectives are to support pesticide registrations, provide guidelines for herbicide use, and evaluate environmental impacts resulting from pesticide use.

**Technical Approach:** Herbicide research is conducted cooperatively with manufacturers, other Federal agencies, and water user organizations. Candidate herbicides are applied on test areas of canals, drains, and reservoirs according to field protocols. Applications are evaluated to establish acceptable residue tolerances and effects on the environment based on analysis of water, hydrosol, fish, and invertebrate organisms in accordance with established EPA standards. In addition, algaeicides and soil-applied herbicides are evaluated.

**General Progress in Last 2 Years:** The 2,4-D label amendment effort remains a priority but no additional comment has been received from EPA. A soil sterilant and selective herbicide report was completed and a new study was started to simulate aggregate surfaces in switchyards. Evaluation of selective herbicides in drawdown areas in Montana continues. The Garlon 3A Experimental Use Permit was approved and plans finalized for FY87 applications.

**Plans for Next 12 Months (FY88):** The 2,4-D label amendment permitting aquatic uses will remain a priority until additional word from EPA. Studies of new formulations of antifouling coatings and algaeicides will continue. Samples of water, hydrosol, fish, crustaceans, and invertebrate organisms resulting from the Garlon 3A applications will be submitted to Dow for analysis.

**Coordination or Cooperation with Another Agency:**  
 Most studies are conducted cooperatively with manufacturers, other Federal agencies, and water user organizations.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-7u  
 Subject Area Water Quality and Ecology  
 Project Title Development of Controlled Release Herbicide for Aquatic Weed Control  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator J. Boutwell, D-1522 (FTS) 776-6016  
D. Sinneros, D-1522 (303) 236-8019  
 (Name) (Address) (Telephone)  
 Starting Year FY79 Estimated Completion Year FY88

**Technical Objectives:** To develop CR (controlled release) herbicides and antifouling coatings which can be applied to irrigation canals and reservoirs for control of aquatic site weeds. The primary objective is to identify discover and develop effective herbicides that have considerable longevity and produce a demonstrated reduction in adverse environmental impact on nontarget organisms.

**Technical Approach:** Experimental compounds obtained from various sources including those developed in-house will be screened in static flowing water under standardized environmental conditions. Following establishment of efficacy and release profiles, small field test plots will be established for those materials showing potential prior to full scale field tests. Innovative ways of using CR materials will be studied which take advantage of reservoir and canal drawdowns for maintenance. Soil incorporation as well as surface applications of compounds to dry soils will be studied.

**General Progress in Last 2 Years:** Several new in-house developed materials were evaluated and soil-applied pellets were monitored for pellet life as well as residue levels. The cooperative program between the Bureau and the Army Corps of Engineers Waterways Experiment Station continues, and several materials obtained through the program were tested in a greenhouse. Work was started on encapsulation of plant growth regulators.

**Plans for Next 12 Months (FY88):** Additional field evaluation of the soil-applied controlled release pellets will complete this study. Greenhouse evaluations of in-house developed and industry supplied materials will complete the current series of studies. A final report will be prepared.

**Coordination or Cooperation with Another Agency:** Cooperators include the Army Corps of Engineers and industry including DuPont Chemical, Union Carbide, and Lilly Research.

**General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:**  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-7v  
 Subject Area Water Quality and Ecology  
 Project Title Herbicide/Adjuvant Evaluation in Flowing Water  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Dezell (FTS) 542-3494  
 (Name) (Address) (Telephone)  
 Starting Year FY 83 Estimated Completion Year FY 90

**Technical Objectives:** To determine which adjuvants (additives which potentially enhance a herbicide's effectiveness) and conventional registered herbicides may be used effectively in flowing water; and, to evaluate the potential role of controlled-release herbicide formulations in flowing water.

**Technical Approach:** A hydraulic flume at WES and a larger scale canal-flume system at the TVA Aquatic Research Laboratory will be used in this study. Aquatic plants will be placed in the structures and treated with selected herbicide/adjuvant mixtures and/or controlled-release herbicides to simulate field use patterns. A range of present flow velocities will be used with each test condition to determine operational velocity range for each treatment condition. Effects of water velocity on transport of herbicides and/or herbicide contact time with the target plants will be determined.

**General Progress in Last Two Years:** Completed tests and published a report on 2,4-D/adjuvant mixtures. Completed tests and prepared reports on endothall/adjuvant mixtures and diquat/alginate mixtures. Initiated and completed tests with controlled-release fluridone formulations at TVA-ARL, the data are being analyzed.

**Plans for Next Twelve Months (FY 88):** Evaluations of additional herbicides, including controlled release formulations will be initiated.

**Coordination or Cooperation with Another Agency:**  
 Tennessee Valley Authority

**General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:**  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7v  
 Subject Area Water Quality and Ecology

Project Title Herbicide Concentration/Exposure Time Required to Control Aquatic Plants  
 Performing Organization Waterways Experiment Station

Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494  
 Starting Year FY 85 Estimated Completion Year FY 92 (Telephones)

Technical Objectives: Selected herbicide concentrations and exposure times will be tested to determine significant relationships that effect control of submersed aquatic plants; and, identify combinations of registered herbicides which will allow better target plant control at lower concentrations of each herbicide.

Technical Approach: A modified WES diluter system will be used to test various concentrations of registered herbicides at a variety of exposure times to selected submersed aquatic plants. Rooted plant cuttings and reproductive propagules will be evaluated over 8-12 weeks following herbicide exposure to monitor efficacy and germination control of reproductive propagules. Following these tests, combinations of contact and systemic herbicides will be evaluated in a similar manner. Guidance on the application of these results to operational activities will be provided.

General Progress in Last Two Years: Completed tests with 2,4-D and fluridone on Myriophyllum spicatum at the specified water temperature. Technical reports have been completed for initial testing with 2,4-D and fluridone. A contract report has been submitted for endothall and diquat tests on Hydrilla verticillata. Data from expanded tests with fluridone and 2,4-D are being analyzed.

Plans for Next Twelve Months (FY 88): A report on evaluations of Diquat and Endothall on Myriophyllum Spicatum will be completed. Evaluations of Dichlobemil will be initiated.

Coordination or Cooperation with Another Agency:  
Tennessee Valley Authority

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7x  
 Subject Area Water Quality and Ecology

Project Title Herbicide Application Technique Development for Flowing Water  
 Performing Organization Waterways Experiment Station

Principal Investigator J. L. Decell (FTS) 542-3494  
 (Name) (Address) (601) 634-3494  
 Starting Year FY 85 Estimated Completion Year FY 89 (Telephones)

Technical Objectives: To characterize flow velocities within submersed plant stands under field conditions, e.g. rivers, irrigation/drainage canals, and estuarine tidal areas, and to identify application techniques which will maximize herbicide contact time and efficacy against submersed plants in those flowing water environments.

Technical Approach: Flow velocities will be characterized within submersed plant stands of various sizes in the field. Field locations will be selected to represent the major types of flowing water environments experiencing aquatic plant problems within the Corps' jurisdiction, e.g. rivers and streams, and drainage canals. Application techniques will be identified and tested on hydraulic flumes and subsequently in the field to maximize herbicide contact time and efficacy.

General Progress in Last Two Years: Information to assess various application techniques has been obtained (via literature review and personal contact) on the effectiveness of application techniques used in studies conducted by universities and government agencies. Initial field data on flow velocities in several types of submersed plant beds has been collected in the Holston River in Tennessee. Studies using selected application techniques for granular herbicide formulations have been initiated in the WES hydraulic flume.

Plans for Next Twelve Months (FY 88): Evaluations of developed techniques will take place in field locations.

Coordination or Cooperation with Another Agency:  
Tennessee Valley Authority

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7y  
 Subject Area Water Quality and Ecology  
 Project Title Herbicide Delivery Systems  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeceU (FTS) 542-3494  
 (Name) (Address) (Telephone) (601) 634-3494  
 Starting Year FY 87 Estimated Completion Year FY 93

**Technical Objectives:** To reevaluate existing herbicide formulations that are currently approved for aquatic use for possible "repackaging" into safer formulations that will effect control of aquatic plants; to identify, develop, and evaluate natural and synthetic herbicide carrier systems which will deliver the herbicide to the plant vicinity at appropriate rates while minimizing dilution by surrounding water; and, to evaluate existing delivery systems for intended aquatic uses.

**Technical Approach:** Previously developed controlled-release herbicide delivery systems will be evaluated in flowing and static water systems to determine appropriate application rates for control. Conventional dry formulations will be tested for herbicide release rate, and exfoliation properties determined under static and turbulent mixing conditions. New conventional carrier systems will be identified and evaluated for their potential in releasing herbicides for maximum plant uptake. Following evaluation, formulations will be evaluated under limited field tests.

**General Progress in Last Two Years:** None in FY 86.

**Plans for Next Twelve Months (FY 88):** Determination of controlled-release carriers/application rates will be completed and a report will be completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7z  
 Subject Area Water Quality and Ecology  
 Project Title Plant Growth Regulators for Aquatic Plant Management  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeceU (FTS) 542-3494  
 (Name) (Address) (Telephone) (601) 634-3494  
 Starting Year FY 86 Estimated Completion Year FY 91

**Technical Objectives:** To evaluate plant growth regulator (PGR) activity on submersed aquatic plants; and to determine PGR effectiveness at reducing budding and daughter plant formation on floating aquatic species such as waterhyacinth.

**Technical Approach:** Develop bioassay system to determine growth and physiological effects of PGRs on aquatic plants. Evaluate PGRs against hydrilla, Eurasian watermilfoil and waterhyacinth. Concentration/exposure time relationships will be assessed, to identify adverse influence and identify minimum contact time required.

**General Progress in Last Two Years:** No progress in FY 86. A contract was initiated with Purdue University to develop bioassay system for assessing PGR effects against select submersed aquatic plants.

**Plans for Next Twelve Months (FY 88):** Tests will be completed and a report on the potential for PGR use in the aquatic environment will be completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7aa  
 Subject Area Water Quality and Ecology  
 Project Title Biocontrol Simulation  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (601) 634-3494  
 Starting Year FY 87 (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_  
 Estimated Completion Year FY 91

Technical Objectives: 1) To identify biocontrol technologies sufficiently advanced to justify the development of computer-aided evaluation systems to aid in technology transfer for operational users; 2) to develop computer-aided systems for use by aquatic plant managers to plan for optimum use of biological control techniques to achieve plant control.

Technical Approach: (1) An inventory of biocontrol techniques will be compiled; (2) factors significantly affecting the selected plant species and their biocontrol agents will be identified; (3) conceptual models of these interactions will be developed; (4) functional relationships between the plants and biocontrol methods will be determined from previous research results; (5) data gaps will be identified; (6) computer models will be developed and then validated with field data to determine needed improvements; (7) the utility of the models will be demonstrated.

General Progress in Last Two Years: A first generation model (INSECT) depicting the interaction among waterhyacinths, two species of host-specific weevils, and the environment has been developed, with output in both tabular and graphic forms. Field studies to provide data for validation of the waterhyacinth-insect model are underway.

Plans for Next Twelve Months (FY 88): Validation of other biocontrol models will be initiated and coding of these models will be completed.

Coordination or Cooperation with Another Agency:  
 Tennessee Valley Authority

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-7bb  
 Subject Area Water Quality and Ecology  
 Project Title Chemical Control Simulation  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. Decell (FTS) 542-3494  
 (601) 634-3494  
 Starting Year FY 87 (Address) \_\_\_\_\_ (Telephones) \_\_\_\_\_  
 Estimated Completion Year FY 91

Technical Objectives: 1) To identify chemical control technologies sufficiently advanced to justify the development of computer-aided evaluation systems to aid in technology transfer for operational users; and 2) to develop computer-aided systems for use by aquatic plant managers to plan for optimum use of chemical control techniques to achieve plant control.

Technical Approach: (1) An inventory of chemical control techniques will be compiled; (2) important factors affecting the selected plant species and their chemical control agents will be identified; (3) conceptual models of these interactions will be developed; (4) functional relationships between the plants and chemical control methods will be determined from previous research results; (5) data gaps will be identified; (6) computer models will be developed and then validated with field data to determine needed improvements; (7) the utility of the models will be demonstrated.

General Progress in Last Two Years: No progress in FY 86; new effort.

Plans for Next Twelve Months (FY 88): Complete first generation 2,4-D/Waterhyacinth model. Report on 2,4-D/Waterhyacinth model will be completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-7cc  
 Subject Area Water Quality and Ecology  
 Project Title Plant Growth Model  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeceU (Name) (Address) (FTS) 542-3494 (501) 634-3494 (Telephones)  
 Starting Year FY 87 Estimated Completion Year FY 91

**Technical Objectives:** 1) To apply the various control technologies to carefully controlled plant conditions to identify important aquatic plant growth factors, and 2) to aid in development of computer-aided evaluation systems with which to assess the efficacy of the various control means.

**Technical Approach:** (1) Growth characteristics of aquatic plants will be identified, through a literature review, (2) the factors and functions identified will be used to modify and enhance existing models of plant growth (such as currently used in HARVEST, STOCK, and INSECT); (3) the results of these changes will be compared to laboratory and field experimental results for corresponding phenomena; (4) those changes deemed worthy will be used to develop improved plant growth models.

**General Progress in Last Two Years:** No progress in FY 86; new effort.

**Plans for Next Twelve Months (FY 88):** Complete waterhyacinth growth model.

**Coordination or Cooperation with Another Agency:**

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-74d  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Data Base Development  
 Performing Organization Waterways Experiment Station  
 Principal Investigator J. L. DeceU (Name) (Address) (FTS) 542-3494 (501) 634-3494 (Telephones)  
 Starting Year FY 88 Estimated Completion Year FY 93

**Technical Objectives:** To construct data bases that existing computer programs can draw upon for site specific aquatic plant problems wherever they might exist. To design user friendly desk-top computer software to store the information needed so that it can be retrieved easily and in readily usable form.

**Technical Approach:** Consistent with current model input needs, information on aquatic plants, the environment in which they exist, and possible control measures will be stored in usable and retrievable form. These storage systems will be updated as new information becomes available. Lists of users will be kept updated and the information will be made available on a continuing basis.

**General Progress in Last Two Years:** This work will begin in FY 88.

**Plans for Next Twelve Months (FY 88):** Complete design of data base organization.

**Coordination or Cooperation with Another Agency:**

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 \_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
 \_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number MOE-7ee  
Subject Area Water Quality and Ecology  
Project Title Management of Waterhyacinth Using Insects and Herbicides  
Performing Organization Waterways Experiment Station  
Principal Investigator J. L. Decell (Name) (Address) (Telephone) (FIS) 542-3494 (601) 634-3494  
Starting Year FY 86 Estimated Completion Year FY 89

Technical Objectives: (1) To determine the acute and chronic effects of herbicides on all life stages of the insect biocontrol agents; (2) to determine the minimum concentration of herbicides required to control waterhyacinth stressed by insect biocontrol agents; and (3) to determine the minimum area and spatial configuration of a herbicide application necessary to control a waterhyacinth population containing moderate to high levels of insect biocontrol agents.

Technical Approach: This study will include laboratory and greenhouse tests to determine: (a) behavior of insect biocontrol agents on herbicide treated plants, (b) acute and chronic effects of 2,4-D and Diquat on the biocontrol agents, (c) concentrations of herbicides required to remove waterhyacinth stressed by biocontrol agents and, (d) effectiveness of biocontrol agents on plants stressed by low doses of herbicides. Field tests will be conducted to determine the spatial and temporal configuration of herbicide treatments for maximum utilization of the two methods to achieve an acceptable level of plant reduction for the long term.

General Progress in Last Two Years: A literature review was completed.

Plans for Next Twelve Months (FY 88): Field demonstrations will be initiated.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ Technology Transfer \_\_\_ None  
\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number MOE-7ff  
Subject Area Water Quality and Ecology  
Project Title Fisheries Enhancement Using Aquatic Weed Control Techniques  
Performing Organization Tennessee Valley Authority  
Principal Investigator Leon Bates, TVA, EDB, Muscle Shoals, AL 36660 (205) 386-2276  
Douglas Powell, TVA P. O. Box 746, Blairsville, GA (404) 745-5561 (Name) (Address) 30512 (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88  
Technical Objectives: (1) Determination of the extent and pattern of herbicide treatment that would yield maximum edge effect while providing for angler access. (2) Evaluation of boat lane treatments will be made relating to angler access and angler success.

Technical Approach: Select dense macrophyte colonies on two reservoirs where angler use is limited because of access. Treat boat lanes using aquatic herbicides within two to three vegetation types (milfoil, hydrilla, naiads) and at varying plant densities (low, moderate, heavy). Monitor fish in the vicinity of special treatment using various sampling techniques. Interview anglers concerning utility of boat lanes and angler success.

General Progress in Last Two Years: Selection of study sites has been completed for one reservoir and pretreatment fish sampling conducted.

Plans for Next Twelve Months (FY 88):

- (1) Evaluation of extended control effects within vegetation types where boat lanes were opened using aerial photography.
- (2) Prepare final report and develop recommendations for future implementation.

Coordination or Cooperation with Another Agency: Cooperative study involving U.S. Army Corps of Engineers, Waterways Experiment Station, to evaluate standing crop of fish in various vegetation types and densities. Also cooperative field evaluation made with Tennessee Wildlife Resources Agency and Alabama Game and Fish Division.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_ Safety of Dams \_\_\_ X Technology Transfer \_\_\_ None  
\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE Priority            1987 Session Number WQE-8a  
Subject Area Water Quality and Ecology  
Project Title Benthic Resource Assessment Technique  
Performing Organization Environmental Laboratory  
Principal USAF Waterways Experiment Station (FTS) 542-3303  
Investigator John D. Lunz P. O. Box 631, Vicksburg, MS 39180 ( )  
(Name) (Address) (Telephone)  
Starting Year FY 80 Estimated Completion Year Fy 84 (Completed)  
Technical Objectives:

Develop a set of procedures to determine the value of the bottom in aquatic habitat as a feeding area for commercially and recreationally important bottom-dwelling fishes.

Technical Approach:

The technique considers characteristics of a benthic invertebrate community that influences the availability and vulnerability of that community to different size classes and different species of bottom-feeding fishes. It expresses habitat value in units of potential food biomass for feeding strategy class or guild of fishes.

General Progress in Last Two Years:

The technique has been fully developed and is being used by Corps' Districts in decisions concerning dredged material disposal site selection and management.

Plans for Next Twelve Months (FY 88):

Continue to field test and apply in other geographic regions.

Coordination or Cooperation with Another Agency:

The procedure has been coordinated with USFWS and other agencies through workshops and technical reports.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-8b  
Subject Area Water Quality and Ecology  
Project Title Evaluation of a Benthic Index to Assess Water Quality in Southeastern Ecosystems  
Performing Organization Fisheries & Aquatic Ecology Branch, Division of Air and Water Resources  
Principal E & D Building (FTS) N/A  
Investigator Dr. Ken J. Tennessee, Muscle Shoals, AL 35660 (205) 386-2277  
(Name) (Address) (Telephone)

Starting Year FY 1987 Estimated Completion Year FY 1988

Technical Objectives: To evaluate the usefulness, efficiency, and practicality of Warwick's (1985) Benthic Index for Monitoring water quality in Southeastern streams and reservoirs

Technical Approach: Chironomus sp. are being collected from a number of sites around the Tennessee valley, from both "contaminated" and "clean" environments (as defined by other monitoring methods). Antennal deformations are being evaluated, as are other abnormalities.

General Progress in Last Two Years: Samples have been collected from approximately 10 sites

Plans for Next Twelve Months (FY88): Complete sampling and produce report.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer            None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority            1987 Session Number WQE-8c

Subject Area Water Quality and Ecology

Project Title Real Time Automated Biomonitoring

Performing Organization Fisheries and Aquatic Ecology Branch

Principal            125 Summer Place Bldg. (FIS) N/A

Investigator Dr. James R. Wright, Jr. Knoxville, TN 37902 (615) 632-4017

(Name)            (Address)            (Telephones)           

Starting Year FY 1981 Estimated Completion Year FY Indefinite

Technical Objectives: To demonstrate, utilize, and improve real-time, computerized, automated biomonitoring systems.

Technical Approach: To monitor, store, and analyze on a real-time basis electric impulses (associated with muscle movements) in a variety of aquatic organisms as a determination of water quality. Almost all organisms tested show response to stress, normally in the form of breathing rate changes.

General Progress in Last Two Years: Automated biomonitoring has been demonstrated both in a streamside mobile laboratory, and in a remote location—where signals are bounced back by satellite to central laboratory computer facilities.

Plans for Next Twelve Months (FY88): Investigate additional organisms, additional ways to analyze electronic pulse signals, and additional data analysis techniques.

Coordination or Cooperation with Another Agency: NASA (National Aeronautics and Space Administration) and Center for Excellence in Water Resources at Tennessee Technological University

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:            X None  
           Safety of Dams            Technology Transfer  
           Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-8d

Subject Area James River Studies, Ecology

Project Title National Wildlife Refuge Monitoring Program

Performing Organization Applied Sciences Branch

Principal            PO Box 25007 (FIS) 776-4300

Investigator Michael Pucherelli, D-1524 Denver CO 80225 (303) 236-4300

(Name)            (Address)            (Telephone)           

Starting Year FY83 Estimated Completion Year FY91

Technical Objectives: To use large-scale aerial photography for interpretation of submergent and emergent vegetation within the boundaries of three National Wildlife Refuges and one State Game Management area along the James River in North Dakota and South Dakota. This work will aid in gathering baseline information before any increase of flows occur due to the Garrison Diversion Project.

Technical Approach: Gather aerial photography in July coincident with the peak submergent vegetation conditions. Interpretate emergent and submergent vegetation and enter into a digital data base. Prepare acreage tables and map plots.

General Progress in Last 2 Years: Emergent vegetation appears to be constant and submergent vegetation seems to fluctuate. Additional fieldwork is ongoing to determine water quality parameters associated with vegetation peaks. The remote sensing work will continue with aerial photography each year and possibly multitemporal data sets through the growing season.

Plans for Next 12 Months (FY88): Interpret the 1987 July aerial photography and prepare plots and tabular summaries. Also acquire the 1988 photography and gather ground reference information.

Coordination or Cooperation with Another Agency: This work is in coordination with the USFWS (U.S. Fish and Wildlife Service) at the refuges, Sand Lake and Arrowwood) and also the ecological services group of the USFWS in Bism rck, North Dakota.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:            X None  
           Safety of Dams            Technology Transfer  
           Project Maintenance, Rehabilitation and Life Extension

Agency USACRREL Priority \_\_\_\_\_ 1987 Session Number WQE-8e  
Subject Area Water Quality and Ecology  
Project Title Winter Habitat of Atlantic Salmon  
Performing Organization USACRREL  
Principal Investigator Darryl J. Calkins 72 Lyme Road (FTS)  
Hanover, NH 03755-1290 (603) 646-4304  
(Name) (Address) (Telephone)  
Starting Year FY 87 Estimated Completion Year FY 91

Technical Objectives:  
1. To determine the winter habitat preferences of Atlantic salmon in ice-covered rivers.  
2. To identify the limiting factors affecting over-wintering of Atlantic salmon.

Technical Approach:

1. Determine the in-stream locations where the salmonids hide just prior to freeze-up at water temperature of 2 degrees C.
2. Measure the distribution and type of ice at selected index sites to determine the potential for crowding and frost penetration into the stream bed.

General Progress in Last Two Years:

New

Plans for Next Twelve Months (FY 88):

Map and determine spatial distribution of river ice types in small streams stocked with Atlantic salmon parr in Vermont and New Hampshire.

Coordination or Cooperation with Another Agency:

USFS, USFWS, States of Vermont and New Hampshire

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-8f  
Subject Area Water Quality and Ecology  
Project Title Green River Colorado Squawfish Nursery Habitat Study  
Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
Principal Investigator Stephen Grabowski, D-1522 PO Box 25007 (FTS) 776-6006  
Denver CO 80225 (303) 236-6004  
(Name) (Address) (Telephone)  
Starting Year FY87 Estimated Completion Year FY89

Technical Objectives: Identify important ecological variables that impact the survival of young Colorado Squawfish in backwater habitats in the Green River, between the confluence of the Yampa River and the confluence of the White and Duchesne Rivers, in order to aid in developing an operation plan for Flaming Gorge Dam that will optimize Colorado Squawfish nursery habitat.

Technical Approach: Field collection of limnological data on selected backwater habitats by USBR researchers.  
Fish population studies by U.S. Fish and Wildlife Service personnel.  
Statistical evaluation of limnological and fishery data to identify critical variables, by USBR with U.S. Fish and Wildlife Service cooperation.

General Progress in Last 2 Years: Began field studies in June 1987.

Plans for Next 12 Months (FY88): Continue field studies, with ongoing data examination to determine if any changes are appropriate.

Coordination or Cooperation with Another Agency: U.S. Fish and Wildlife Service

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-8g  
 Subject Area Flaming Gorge Endangered Fishes Study  
 Project Title Green River Channel Mapping Study  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator Michael Pucherelli, D-1524 Denver CO 80225 (FTS) 776-4300  
 (Name) (Address) (303)            (Telephone)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives: To use aerial photography from several dates to quantify channel morphology changes on the Green River below Flaming Gorge Dam.

Technical Approach: Gather aerial photography from 1952, 1963, 1974, and 1986. Interpret the photographs for high water embankment lines and vegetated islands. Develop trend information on channel change since the installation of Flaming Gorge Dam. Enter all information in a digital data base and plot final map products.

General Progress in Last 2 Years: A 70 mile stretch of river is complete in draft and current review indicates that additional work (a 1981 data set) should be evaluated as high water years of 1983, 1984 may have skewed the data.

Plans for Next 12 Months (FY88):

An additional data set (1981) will be added.  
 A new stretch of river, in Labryinth Canyon will be evaluated using the same technical approach

Coordination or Cooperation with Another Agency:  
USGS (United States Geological Survey)  
USFWS (U.S. Fish and Wildlife Service)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams            Technology Transfer         None  
       Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-8h  
 Subject Area Flaming Gorge Endangered Fishes Study  
 Project Title Green River Backwater Habitat Mapping Study  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator Michael Pucherelli, D-1524 Denver CO 80225 (FTS) 776-4300  
 (Name) (Address) (303)            (Telephone)  
 Starting Year FY85 Estimated Completion Year FY89

Technical Objectives: To quantify area and numbers of backwaters as they change with the operation of Flaming Gorge Dam. Maximizing backwaters are determined to be the key factor in preserving the endangered Colorado Squawfish, as they are primary habitat for young-of-the-year fish.

Technical Approach: Coordinate dam operations at seven different flows with aerial photography missions. Interpret and groundtruth photography and enter the information in a digital data base. Prepare flow/habitat tabular information along with map products.

General Progress in Last 2 Years: Completed a pilot study of three flows and began a larger study with seven flows also incorporating backwater depth information.

Plans for Next 12 Months (FY88): Complete the seven flow mapping scenario. Prepare a report and followup with a 1988 field season (repeating the work) to verify that the river is in quasi-equilibrium and habitat predictions are valid.

Coordination or Cooperation with Another Agency:  
USFWS (U.S. Fish and Wildlife Service)  
NPS (National Park Service)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

       Safety of Dams            Technology Transfer         None  
       Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-81  
 Subject Area Water Quality and Ecology  
 Project Title Lower Colorado River, Parker Division Fishery Studies  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal PO Box 25007 (FTS) 776-6009  
 Investigator Steve Hiebert, D-1522 Denver CO 80225 (303) 236-6009  
 (Name) (Address) (Telephone)  
 Starting Year FY83 Estimated Completion Year FY87

Technical Objectives: To identify major habitat types and fauna within the Parker I and II reaches on the Lower Colorado River so determination of the effects of proposed river modifications in Parker II on the aquatic fauna can be made. This information will be used by the Lower Colorado Region in addressing environmental concerns.

Technical Approach: The major task is bimonthly limnology and fishery surveys at sampling stations representing different habitat types within Parker II and Parker I sections of the Colorado River. Subtasks include summarizing, and reporting this information to the LC Regional Office and YUMA Projects Office.

General Progress in Last 2 Years: Final report on Parker II, the unmodified section, was completed. Field studies on the highly modified section, Parker I, were performed, and a data summary was prepared.

Plans for Next 12 Months (FY88): Studies completed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ None  
 Safety of Dams Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-8J  
 Subject Area Water Quality and Ecology  
 Project Title Fish Refuge Projects  
 Performing Organization TVA  
 Principal E. Dean Harshbarger ENG LAB-N (615) 632-1547  
 Investigator and Charles E. Bohac  
 (Name) (Address) (Telephone)  
 Starting Year FY85 Estimated Completion Year FY87

Technical Objectives:

Man-made refuge areas are being constructed for striped bass - a fish that in many years has great difficulty finding suitable combinations of temperature and dissolved oxygen levels in the late summer.

Technical Approach:

An underwater fabric barrier was installed during the spring of 1985 at the mouth of a small embayment in Cherokee Lake to trap cold water that would otherwise be discharged through the turbine during the summer. An oxygen diffuser system was placed behind the barrier to oxygenate the cool water.

A siphon was mounted on one of the spillway gates at Tellico Dam and used to draw cool water from the lake into the river below the dam. A free fall of over 20 feet oxygenates the water before it enters the tailwater below the dam. Construction of a small underwater barrier retains the cool water in the tailwater area.

General Progress:

The Cherokee Refuge was completed early in the summer, 1985. Testing continued with several modifications in the summer of 1986 and 1987.

The siphon system at Tellico was installed in late August 1985. The underwater barrier was completed in late spring of 1986.

Plans for Next Twelve Months:

Both refuge areas will be monitored for fishery impacts. Field studies will be conducted to optimize the operation of each refuge area.

Coordination or Cooperation with Another Agency:

Frequent telephone conversations with MES personnel.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams Technology Transfer  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_ None  
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TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-81  
 Subject Area Water Quality & Ecology  
 Project Title Fish Refuge Projects  
 Performing Organization Division of Air and Water Resources  
 Principal Investigator Charles L. Bohac, Water Quality Branch  
270 Haney Building, Chattanooga, TN 37401 615/751-7323  
 Starting Year 1985 Estimated Completion Year 1986

Technical Objectives: A dam-made area was constructed and is being evaluated for striped bass - a fish that in many years has great difficulty finding suitable combinations of temperature and dissolved oxygen levels in the late summer.

Technical Approach: An underwater fabric barrier was installed during the spring of 1985 at the mouth of a small embayment in Cherokee Lake to trap cold water that would otherwise be discharged through the turbine during the summer. An oxygen diffuser system was placed behind the barrier to oxygenate the cool water. Fishery evaluations were conducted.

General Progress: The Cherokee Refuge was completed early in the summer, 1985, and fishery studies were completed in FY87.

Plans for Next Twelve Months: Future evaluations are uncertain and operational funds are presently not available for FY 88.

Coordination or Cooperation with Another Agency: Corps of Engineers and Bureau of Reclamation

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-8m  
 Subject Area Glen Canyon Backwater Mapping Study  
 Project Title Colorado River Backwater Mapping Study  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator Michael Pucherelli, D-1524 Denver CO 80225  
PO Box 25007 (FTS) 776-4300  
(Address) (303) 236-4300  
(Telephone)  
 Starting Year FY87 Estimated Completion Year FY87

Technical Objectives: In conjunction with the Glen Canyon Environmental Studies, a quantitative backwater study was undertaken to support the opinion that backwater habitat for fishes in Grand Canyon is not affected by controlled releases from Glen Canyon Dam. Arizona Game and Fish Department is the lead agency involved in the fisheries research. At their request a backwater to flow relationship study has been performed.

Technical Approach: Existing aerial photography for four flows were interpreted for backwater habitat. All information was planimetered and presented in graphic form.

General Progress in Last 2 Years: Complete

Plans for Next 12 Months (FY88): None

Coordination or Cooperation with Another Agency: None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

- Safety of Dams
- Technology Transfer
- Project Maintenance, Rehabilitation and Life Extension
- None

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency WZ Priority \_\_\_\_\_ 1987 Session Number WQE-8n  
 Subject Area Water Quality and Ecology  
 Project Title Water Quality and Hydrology Characteristics of a Bottomland Hardwood Wetland  
 Performing Organization WES/CE  
 Principal Dr. John Barko FTS 542-3654/ (FTS) 542-3836  
 Investigator Ms. Barbara Kleiss WES (601) 634-3654/ (601) 634-3836  
 (Name) (Address) (Telephones)

Starting Year FY 86 Estimated Completion Year FY 92

**Technical Objectives:** To determine the influence of a bottomland hardwood wetland on water quality and hydrology of an associated river system. Information obtained will be used to improve the applicability of the Wetlands Evaluation Technique in bottomland hardwood systems.

**Technical Approach:** Surface water, groundwater, and precipitation will be monitored for the Rex Hancock/Black Swamp area which is on the Cache River in eastern Arkansas. This information will be used to determine hydrologic variables, such as flood water storage and flood desynchronization, and to generate a hydrologic budget for the area. Data from water chemistry monitoring will be related to the hydrologic budget, and chemical mass balances will be calculated. Rates of sedimentation within the wetland are being measured and relationships between sedimentation and water quality will be developed. **General Progress in Last Two Years:** A project site was chosen during the summer of 1986. Surface water gaging stations and an automated meteorological station have been installed. Study transects in the wetland have been established. Biweekly water chemistry monitoring started in June 1987. The description of soil horizons and characterization of the soils and sediments has been started.

**Plans for Next Twelve Months (FY 88):** The installation of groundwater wells and groundwater monitoring will be initiated. Surface water and water chemistry monitoring will continue. Projects to measure annual sedimentation rates and sediment core dating procedures will be started.

**Coordination or Cooperation with Another Agency:** Department of Interior, US Geological Service, Little Rock, AR. Department of Agriculture, Soil Conservation Service, Augusta, AR.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-9a  
 Subject Area Water Quality and Ecology  
 Project Title Allowable Vegetation on Flood Control Levees  
 Performing Organization USAE WES Environmental Laboratory  
 Principal ATTN: CEMES-EE-R, PO Box 631 (FTS) 542-3046  
 Investigator Anne Macdonald Vicksburg, MS 39180-0631 (601) 634-3096  
 (Name) (Address) (Telephones)

Starting Year FY 87 Estimated Completion Year FY 88

**Technical Objectives:** Obtain information regarding the effect of vegetation on the structured integrity of levees. Current standards for maintenance limit vegetation to sod-forming grass 2-12" high. Some have suggested that these standards may be more conservative than needed for safety and result in lost environmental values and higher maintenance costs.

**Technical Approach:** Determine the frequency and spatial distribution of roots of a variety of wood species growing on selected levees not in compliance with the aforementioned standards. Use analytical tools to assess effects of these roots on slope stability and seepage.

**General Progress in Last Two Years:** A site has been selected along the Sacramento River in California. Prospective sites in Washington State are being considered. A study approach has been devised.

**Plans for Next Twelve Months (FY 88):** Finalize field data acquisition. Analyze data and produce final report.

**Coordination or Cooperation with Another Agency:**  
 Coordination and cooperation with the State of California.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 X \_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USDA-ARS Priority I 1987 Session Number WQE-9b  
 Subject Area Water Quality  
 Project Title Yazoo Basin Erosion Control Research Project (Water Quality)  
 Performing Organization USDA National Sedimentation Laboratory  
 Principal C. M. Cooper, Ecologist, (PTS) None  
 Investigator USDA-ARS, P. O. Box 1157, Oxford, MS 38655 (601) 232-2900  
 (Name) (Address) (Telephone)  
 Starting Year FY1984 Estimated Completion Year FY1988

Technical Objectives: Evaluate the effects of agricultural management practices and channel modifications on stream and lake environments.

Technical Approach: Determine ecological conditions in selected bluffline streams in the DEC (Demonstration Erosion Control) watersheds and provide SCS and Corps of Engineers with pre-and post-treatment comparisons of ecological communities, habitat diversity, and water quality.

General Progress in Last Two Years: Baseline (pretreatment) data for all six watersheds has been provided. Some salient facts have been demonstrated; for example, grade control structure installation in upland streams improves game fish and wildfowl habitat.

Plans for Next Twelve Months (FY 88): Continue post treatment monitoring as SCS and Corps of Engineers work in the DEC watersheds continues.

Coordination or Cooperation with Another Agency: Total cooperation with Mississippi SCS and Vicksburg District, COE through participation in DEC Task Force operations. Collaboration documented through 3-way Interagency Memorandum of Understanding.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency COE-CW Priority \_\_\_\_\_ 1987 Session Number WQE-9c  
 Subject Area Water Quality and Ecology  
 Project Title Erosion Potential of Inland Shorelines and Embankments Subject to Freezing and Thawing  
 Performing Organization U.S. Army Cold Regions Research and Engineering Laboratory  
 Principal \_\_\_\_\_ (PTS) \_\_\_\_\_  
 Investigator L. Catto/D. Lawson Hanover, NH 03755 (603) 646-4276/4344  
 (Name) (Address) (Telephones)  
 Starting Year FY \_\_\_\_\_ Estimated Completion Year FY 91

Technical Objectives:  
 1. Analyze the causes and rates of, and factors contributing to, bank erosion along northern reservoirs.  
 2. Assess the environmental impacts from erosion in northern regions.

Technical Approach:  
 1. Field studies to measure rates of erosion and recession and evaluate erodibility of glacial sediment.  
 2. Relate measurements to active processes and to properties of bank materials.  
 3. Field sites are those of interest to Corps Districts.

General Progress in Last Two Years:  
 1. Results of field observations in New England and in Alaska are being summarized in reports.  
 2. Technical publications have been sent to FOA's.

Plans for Next Twelve Months (FY 88):  
 1. Continue field studies.  
 2. Complete report on freezing and thawing ground processes.

Coordination or Cooperation with Another Agency:  
 Continue exchange of information with ARS, SCS, Iowa Geological Survey, northern Corps Districts, especially MRD, Rock Island, NED and NPA.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-9d  
 Subject Area Water Quality and Ecology  
 Project Title Aquatic Plant Soil Stabilization  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator J.E. Boutwell, D-1522 (Name)  
PO Box 25007 (FTS) 776-6016  
Denver CO 80225 (303) 236-6016  
 (Address) (Telephone)  
 Starting Year FY87 Estimated Completion Year FY91

Technical Objectives: To develop several plant species as management tools in riparian areas including reservoir drawdowns. Soil stabilization as well as allelopathic (inhibitory) qualities resulting in exclusion of undesirable species are benefits.

Technical Approach: The project has three phases. Phase one consists of a literature search and a survey of spikerush and other plant species for use in erosion control and bank stabilization. Phase two consists of selection of the most suitable plant species followed by development of a cultivation and transplantation scheme using sod, seed, tubers, root stock, or combinations of several methods to establish plants in needed areas. Phase three consists of field studies in both emerged and submersed areas to determine efficacy and and practicability of using selected plant species.

General Progress in Last 2 Years: Several riparian plant species were evaluated to determine their tolerance to water inundation and desiccation. A large nursery plot of spikerush was developed for seed and vegetative stock. Three riparian plant species were planted at Buffalo Bill Reservoir, Cody, Wyoming, and were evaluated for survival in drawdown areas.

Plans for Next 12 Months (FY88): The study plot evaluation at Buffalo Bill Reservoir will continue with several additional riparian plant species added. Seed collection and germination studies will continue. A literature search on allelopathic agents will be performed.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-9e  
 Subject Area Water Quality and Ecology (Vegetation Management)  
 Project Title Demonstration and Cost Evaluation of Plant Growth Regulations at Military Installations  
 Performing Organization WES/CE  
 Principal Investigator Dr. H. E. Westerdahl (Name)  
WES (Address)  
 (FTS) 542-3860  
 (602) 634-3860  
 (Telephones)

Starting Year FY 87 Estimated Completion Year FY 92  
 Technical Objectives: To determine if plant growth regulators (PGRs) are effective on unique applications (utility turf, trees, and ornamentals) at military installations; compare the cost effectiveness of selected PGRs versus mechanical mowing/trimming operations; determine impact of repeated PGR use on cool- and warm-season vegetation, e.g., chemical persistence in soil, changes in species composition, tolerance of vegetation to environmental stress, disease susceptibility; and familiarize grounds maintenance personnel with application & use of Technical Approach:  
 At each installation, replicated plots (up to 0.1 acre) are treated with selected PGRs every spring (and possibly fall) for 3 consecutive years. PGRs and application rates are selected based on climate and target vegetation at each installation. Turf treatments are evaluated every 2 weeks posttreatment for a 3 month period. Assessment of species abundance (density, percent cover frequency) will be determined to identify shifts in species composition. Plots will be monitored for color, surface uniformity, thinning, insect & disease susceptibility and drought effects. PGR residues in soil and monitored prior to each application. General Progress in Last Two Years: Four test sites were selected (2 Army, 2 Navy and PGR testing was initiated. The test installations are: Ft. Leonard Wood, MO; Red River Army Depot, TX; Willow Grove Naval Air Station, PA; and, Charleston Naval Station, SC. PGRs were applied in the spring at all locations and posttreatment evaluations were conducted every 2 weeks for 3 months. Preparations are underway for fall applications.

Plans for Next Twelve Months (FY 88): PGR testing and evaluations will continue in the spring and fall at the installations listed above.

Coordination or Cooperation with Another Agency:

Funds for this study are being provided by the U.S. Army and the U.S. Naval Facilities Engineering Command. Personnel from installations selected as test sites are cooperating with posttreatment evaluations.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-9f  
 Subject Area Glen Canyon Environmental Studies, Ecology  
 Project Title Evaluation of Riparian Vegetation Trends in Grand Canyon Using Multitemporal Remote Sensing Techniques  
 Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services  
 Principal Investigator Michael Pucherelli, D-1524 (FTS)776-4300  
Denver CO 80225 (303)236-4300  
 (Name) (Address) (Telephone)  
 Starting Year FY83 Estimated Completion Year \_\_\_\_\_

Technical Objectives: To define riparian vegetation trends in terms of native and exotic vegetation in the Grand Canyon. This work is in response to the proposed upgrade of Glen Canyon Dam for additional peaking power. It has been theorized that since the installation of the dam in 1964, native vegetation has been decreasing and exotic vegetation is now on the increase.

Technical Approach: Gather existing 1965, 1973, and 1980 aerial photography and planned a mission for 1985 photography. Interpret all vegetation by association (native/exotic), and enter the information in a digital data base. Present trend information by vegetation/river mile.

General Progress in Last 2 Years: Complete

Plans for Next 12 Months (FY88): None

Coordination or Cooperation with Another Agency: The Glen Canyon Environmental Studies involve over 40 research projects encompassing, the USGS (U.S. Geological Survey), USFWS (U.S. Fish and Wildlife Service), NPS (National Park Service), USBR (U.S. Bureau of Reclamation), Arizona Game and Parks Commission, and several consulting firms. The studies are ongoing and are entirely funded by USBR.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ X \_\_\_\_\_ None  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number WQE-9g  
 Subject Area Water Quality and Ecology  
 Project Title Engineering Aspects of Habitat Management Along Large Rivers  
 Performing Organization USAE, WES Environmental Laboratory  
 Principal Investigator Dr. F. D. Shields, Jr. (FTS) 542-3707  
Vicksburg, MS 39180-0631 (601) 634-3707  
 (Name) (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY 89

Technical Objectives: Evaluate the effectiveness of various techniques for manipulating habitat along large rivers. Generate design criteria for studies techniques.

Technical Approach: Analyze sequential hydrographic surveys and aerial photographs of modified reaches. Two types of reach modification have been studied: cutoff bendways along the Tenn-Tom Waterway and notched spur dikes along the Missouri River. When possible, physical data are compiled and compared with concurrent biological and water quality studies.

General Progress in Last Two Years: A technique for predicting the rate of change in cutoff bendway volume has been developed that is based on regression of dimensionless variables. In addition, before and after studies of notched spur dikes on the Missouri River near Omaha have also been performed.

Plans for Next Twelve Months (FY 88): Long-term changes in morphology and environmental conditions in oxbow lakes will be investigated.

Coordination or Cooperation with Another Agency: \_\_\_\_\_  
 US Fish and Wildlife Service.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ X \_\_\_\_\_ None  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-9h  
 Subject Area Water Quality and Ecology  
 Project Title Creation of Aquatic Habitats in Navigable Waterways  
 Performing Organization Environmental Lab, WES  
 Principal Investigator Andrew C. Miller (Name) Waterways Experiment Station (Address) (FTS) 542-2141  
Vicksburg, MS 39180-0631 (Telephone)  
(601) 634-2141  
 Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives:

To develop techniques for creating habitat for fish and invertebrates in large rivers.

Technical Approach:

Created two habitats, using gravel, for aquatic organisms. One is in the Tombigbee River, the other is on the Lower Ohio River.

General Progress in Last Two Years:

The Tombigbee site has been monitored since 1985. The Ohio River site was finished in the fall of 1986 and will be studied this year.

Plans for Next Twelve Months (FY 88):

Continue physical and biological studies at both sites. Publish papers on the results of both studies.

Coordination or Cooperation with Another Agency:

TVA, USFWS, and state agencies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-10a  
 Subject Area Water Quality and Ecology  
 Project Title Acid Precipitation  
 Performing Organization TVA Water Quality Branch  
 Principal Investigator Harvey Olam (Name) 270 Hanev Building (Address) Chattna., TN 37401  
615/751-7322  
 Starting Year 1980 Estimated Completion Year 1990

Technical Objectives: Investigate the relationship between the acidic deposition phenomenon and its effects on the aquatic chemistry of Tennessee Valley reservoirs and streams.

Technical Approach: (1) Review previously collected water quality data to determine any long-term trends in streams and reservoirs; (2) investigate specific water quality problems which may be related to acid deposition to determine probable causes; (3) perform detailed assessments of the extent and magnitude of acidification in high-elevation reservoirs of the Tennessee Valley region; (4) design and operate a stream and reservoir monitoring program to investigate long-term trends in water quality; (5) investigate the relationship of storm water quality to deposition and soil-water characteristics, and (6) demonstrate the effects of liming a stream low in pH and acid neutralization capacity.

General Progress: (1) An in-depth analysis of historical water quality data has been completed and a report is available; (2) an investigation of fishkills in trout-rearing facilities in the Raven Fork watershed has been completed and a report is available; (3) initial studies for the design of a long-term reservoir monitoring program were completed in FY 1983 and a long-term monitoring program was initiated in FY 1984; (4) investigations of storm flow water chemistry in five watersheds were completed and a report is available; (5) a detailed study of the relationship between storm episodes and water quality was initiated, and (6) one year of baseline data was obtained at the future site of stream liming.

Plans for Next Twelve Months: (1) Revise the long-term monitoring program as recommended by EPA, (2) continue the study of storm episodes, and (3) initiate stream liming during periods of high flow and investigate its effects and effectiveness.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-10b  
 Subject Area Water Quality and Ecology  
 Project Title Acid Precipitation Effects on Drinking Water Sources  
 Performing Organization Division of Air and Water Resources  
 270 Hanev Building  
 Principal Investigator Harvey Olem Chatta., TN 37401 615/751-7322  
 Starting Year 1985 Estimated Completion Year 1989

**Technical Objectives:** To determine the role of acidic deposition in modifying the quality of non-community drinking water supplies such as cisterns, shallow wells, and springs.

**Technical Approach:** (1) Compare the water quality characteristics including trace contaminants of cistern supplies in an area receiving acidic deposition to cisterns in an area not receiving acidic deposition and (2) investigate the relationship between acidic deposition and quality of shallow wells are springs used for drinking water by sampling systems in areas of high and low acidic deposition.

**General Progress:** (1) The role of acid deposition in modifying the quality of cistern water supplies was investigated and a report is available and (2) a workplan is being developed for the study of shallow wells and springs.

**Plans For Next Twelve Months:** The workplan for the study of the relationship between acidic deposition and shallow wells and springs will be completed and the study will be initiated.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

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TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-10c  
 Subject Area Water Quality and Ecology  
 Project Title Acid Precipitation Effects on Bureau Watersheds  
 Performing Organization Applied Sciences Branch  
 Division of Research and Laboratory Services  
 Principal PO Box 25007 (FIS) 776-4294  
 Investigator Doug Craft, D-1523A Denver CO 80225 (303) 236-4294  
 (Name) (Address) (Telephone)  
 Starting Year FY84 Estimated Completion Year FY88

**Technical Objectives:** To identify Bureau projects and watersheds that may potentially be impacted by acid precipitation.

**Technical Approach:** Perform a geographical information overlay analysis to identify acid sensitive areas in the 17 Western States.

**General Progress in Last 2 Years:** Geographical information base collected and pertinent literature reviewed. We have supported long-term base-line ecological studies in Rocky Mountain National Park (National Park Service) and the Mount Zirkel/Flattops Wilderness areas (U.S. Geological Survey) in Colorado.

**Plans for Next 12 Months (FY88):** Review and completion of final report.

**Coordination or Cooperation with Another Agency:** Report will be reviewed by contacts in the National Acid Precipitation Assessment Program as well as researchers in the Park Service and Geological Survey.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBM Priority 1 1987 Session Number WQE-10d  
 Subject Area Water  
 Project Title Acid Mine Drainage and Heavy Metals from Waste  
 Performing Organization Spokane Research Center  
 Principal Investigator Eric G. Zahl SRC FTS 439-6880  
 Name Address Phone Number  
 Starting Year FY87 Estimated Completion Year FY92

**Technical Objectives:** Determine controlling dissolution mechanisms and reaction kinetics involved in water contamination (primarily heavy metal) from mining wastes associated with metal/nonmetal mining. Determine better approaches or methods for assessing the risk of contamination from metal/nonmetal mine wastes. From this, application and control research can be more appropriately addressed.

**Technical Approach:** Dissolution mechanisms and reaction kinetics which influence heavy metal contamination are being evaluated through controlled laboratory experiments, detailed field site evaluations, and reconnaissance of many mine sites. Assessment methods are also being evaluated which more realistically reflect actual environmental conditions when determining risk of contamination from metal/nonmetal mine tailings, waste rock, leach/dump wastes, and stockpiled materials.

**General Progress in Last Two Years:** Over 3000 laboratory leach column experiments have been performed, primarily on 5 types of tailings. Experiments have been designed to simulate field conditions including: (1) wet dry cycles, (2) aerobic/anaerobic states, (3) ionic strengths of leachants, (4) pH variation of leachates, and (5) laboratory/sample handling procedures, (6) geologic factors, and (7) biological activity. Heavy metal concentration analyses are performed to obtain data trends for interpretation of controlling mechanisms. A field site has been selected in Central Washington to evaluate heavy metal migration at depth on one site. Instrumentation is currently being installed and monitoring will soon commence. Eleven existing mine sites in the West were investigated to determine the extent and potential for problems or research related to the project. Existing evaluation techniques such as the Ep toxicity test and the EPA Hazard Ranking System are being studied for their applicability to the issues of contamination resulting from mining activity.

**Plans for Next Twelve Months (FY88):** Continue the initiated laboratory and field investigations and to prioritize research needs which the Bureau should address.

**Coordination or Cooperation with Another Agency:** Research in this area requires a working relationship with EPA, particularly in Superfund related issues and EPA's Resource Conservation and Recovery Act (RCRA) Mine Waste Regulatory Development Program. Coordination will also involve the Northwest Hazardous Waste Research Development and Demonstration Center (Battelle NW), the American Mining Congress, the University of Idaho, and others.

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
 TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number WQE-10e  
 Subject Area Water Quality and Ecology  
 Project Title Treatment of Acid Mine Drainage Using Man-made Wetlands  
 Performing Organization Office of Power/OMRED (FAEB)  
 Principal Investigator David A. Tomljanovich 142 Summer Place Building (FTS) None  
 Name Address Phone Number  
 (Address) (615) 751-7333  
 (Telephones)

Starting Year 1987 Estimated Completion Year 1990  
**Technical Objectives:** Develop design guidelines for constructing treatment of wetlands used to bring water quality of acid mine drainage into compliance with permit limitations.

**Technical Approach:**

1. An experimental facility has been constructed to evaluate the effect of wetland soil type and vegetation on treatment of acid mine drainage.
2. Eight full-size wetlands have been constructed to treat acidic drainage. These sites are being monitored for water quality.

**General Progress in Last Two Years:** Improvement, development of vegetation and effect on receiving stream biota. The experimental facility has been operating for nearly one year and the full-size wetlands have been in place for 1 to 3 years. Water quality and biota data are available from all sites. Treatment varies among wetlands, but results to date are encouraging.

**Plans for Next Twelve Months (FY88):** Continue to monitor water quality and biota at the experimental facility and the full-size wetlands. Initiate studies on limestone beds within the wetlands, dye studies to assess retention time, and investigations of manganese oxidizing bacteria.

**Coordination or Cooperation with Another Agency:**

Bureau of Mines - Information exchange  
 Alabama Department of Environmental Management - Permit compliance  
 Environmental Protection Agency - Co-sponsor International Symposium

**General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference:**

Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension



Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-11a  
 Subject Area Water Quality and Ecology/Energy  
 Project Title Effects of Global Climate Change on Water Resources  
 Performing Organization TVA  
 Principal Investigator Barbara Miller ENG LAB-N (FTS)  
 (Name) (Address) (Telephones)  
 Starting Year FY87 Estimated Completion Year FY88

Technical Objectives:  
 To predict how changes in global weather which are expected to occur as a result of increased concentrations of carbon dioxide in the atmosphere may affect the availability and utilization of water resources in the Tennessee Valley.

Technical Approach:

Climatologists of NOAA and NASA will use global weather models to provide TVA with changes in rainfall and temperatures expected throughout the next century. The ENG LAB will evaluate how these changes in weather might influence reservoir operations, hydropower generation, water quality, and industrial operations on the Upper Holston River Basin in northeastern Tennessee.

General Progress in Last Two Years:

New project.

Plans for Next Twelve Months (FY88):

Rainfall and temperature data generated by NOAA and NASA will be incorporated into existing computer models designed to plan water utilization and compute environmental effects. Three climate scenarios will be evaluated.

Coordination or Cooperation with Another Agency:

Supported by EPA.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-11b  
 Subject Area Water Quality and Ecology  
 Project Title Drought-Related Water Supply Studies  
 Performing Organization Water Quality Branch  
 Principal Invest. Robert A. Buckingham, 248 401 Bldg., Chatta., TN 37402  
 FTS 858-7307  
 Starting Year 1) FY84 2) FY85 Estimated Completion Year FY86

Technical Objectives (1) Assist Tennessee Valley portions of Kentucky and Alabama in dealing with water quantity/quality-related problems, identifying drought-related water supply needs, and implementing water shortage response programs. (2) Assist small rural water supply associations in northeast Mississippi in solving wellwater system problems related to source depletion, contamination, and equipment failures.

Technical Approach (1) Identify public and self-supplied commercial and industrial systems that are now (or have potential for) experiencing severe water quantity/quality-related problems; develop guidelines and criteria to assist water resource managers in predicting the advent and severity of drought; assist in developing framework water shortage response programs; and identify practical water conservation methods and techniques for use by commercial and industrial facilities. (2) Determine needs and problems by interviewing personnel of small water associations; determine water source capacities for wells where current data is insufficient; obtain water quality data (field and laboratory) on well supplies suspected of, or having a high potential for, contamination; and evaluate short- and long-range needs and solutions.

General Progress (1) The Alabama study initial phase is being published, and the first stage of the Kentucky report will be finalized in FY86. (2) The Mississippi initial phase report will be finalized in FY85.

Plans for Next Twelve Months (1) Identify alternative water supply sources for users experiencing major shortages; determine source capacity of supplies where such is unknown; develop public information/education programs to increase public awareness of problem areas; and assist communities that are experiencing serious water system losses in locating and repairing water main leaks. (2) Because financial instability is a common problem among small water systems, TVA will identify difficulties associated with rate structures and recommended corrective measures. The feasibility of consolidating certain of the smaller less efficient systems will be studied, as will the advisability of converting some of the larger systems to surface water supply sources.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency Reclamation Priority            1987 Session Number WQE-11c  
 Subject Area Water Requirements  
 Project Title Effective Precipitation  
 Performing Organization University of Minnesota  
 Principal Investigator John Nieber, Agricultural Engineering Bldg.  
1390 Excites Ave., St. Paul, MN 55108 (FIS) 625-6724  
 (Name) (Address) (Telephone)  
 Starting Year FY 1985 Estimated Completion Year FY 1988

Technical Objectives:

Conserve water supplies - More accurate sizing and engineering of water supply facilities.

Technical Approach:

Evaluate existing methods of predicting effective precipitation in view of key variables involved, including meteorological factors, crop factors, soil factors, and management factors. Accuracy, simplicity and data requirements would be considered. Recommend use of an existing method or develop a new method for use in Reclamation planning.

General Progress in Last Two Years:

Literature Search complete.  
 Soil water balance model developed and verified.

Plans for Next Twelve Months (FY 88):

Compare results from model with results using established Soil Conservation Service and Reclamation methods of estimating effective precipitation. Complete and furnish final report and computer model.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

   Safety of Dams     Technology Transfer    None  
   Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency Reclamation Priority            1987 Session Number WQE-11d  
 Subject Area Water Requirements  
 Project Title Changing Water Requirements  
 Performing Organization Bureau of Reclamation, Engineering & Research Center  
 Principal Investigator Eldon L. Johns, Bureau of Reclamation, Mail Code D-752,  
P.O. Box 25007, Denver, CO 80225-0007 (FIS) 776-3810  
 (Name) (Address) (Telephone)  
 Starting Year FY 1978 Estimated Completion Year FY Continuing

Technical Objectives:

Conserve water supplies - More accurate sizing and engineering of water supply facilities.

Technical Approach:

The initial effort was to focus on crop irrigation water requirements, since irrigation is the single largest use of water in the Western States. Information will continue to be gathered in this area with emphasis on production functions, methods of increasing irrigation efficiency and decreasing losses. However, principal emphasis has been shifted to the water requirements of natural vegetation. There has been a demonstrated need to evaluate available information so hydrologists have the latest and most accurate information in a readily usable form. The results of this effort will be published as an American Society of Civil Engineers report.

General Progress in Last Two Years:

Review of irrigation water requirement estimating procedures and criteria complete. Reports completed and distributed.

Literature search is complete on use of water by natural vegetation.

Plans for Next Twelve Months (FY 88):

Complete and publish final report on use of water by natural vegetation. Evaluate shortage criteria.

Coordination or Cooperation with Another Agency:

None

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

   Safety of Dams     Technology Transfer    None  
   Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE Priority 1987 Session Number WQE-11e  
Subject Area Water Quality and Ecology (Water Conservation)  
Project Title Water Demand Forecast and Conservation Evaluation  
Performing Organization USAE/WREC Planning and Management Consultants, Inc.  
USAE Waterways Experiment Station  
ATTN: CEMES-EE-R, PO Box 631,  
(FTS) 542-3047  
(601) 534-3047  
Principal Investigator Mark Howard  
(Name) Washington, DC  
(Address) 39180-0631  
(Telephones)

Starting Year FY 87 Estimated Completion Year FY 88  
Technical Objectives: This project will prepare a (1) detailed water demand forecast and (2) an evaluation of water conservation measures for the City of Binghamton, NY. The objective is to determine if water conservation is economically beneficial for a community with an excess water supply.

Technical Approach: The water use forecast will be prepared using the IWR-Main Water Use Forecasting System, a sectorally disaggregate model providing greater insight into patterns and trends of water use. The characteristics and effects of each potential water conservation measure are identified. Each conservation measure is analyzed to determine if the implementation conditions, effectiveness, etc. are technically feasible, socially acceptable, and economically beneficial.

General Progress in Last Two Years:  
Collection of the data required for the forecast model began in June 1987.

Plans for Next Twelve Months (FY 88):  
The computer analysis of the data will be completed in August and September 1987 and the final report will be completed immediately afterwards.

Coordination or Cooperation with Another Agency:  
The New York Department of Environmental Conservation requested the project from the Baltimore District of the CE which, in turn, contacted Waterways Experiment Station. Data for this study was provided by the City of Binghamton, NY.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency USBR Priority 1987 Session Number WQE-11f  
Subject Area Water Quality and Ecology  
Project Title Evaluation of Saline Water Sources for Aquaculture  
Performing Organization Applied Sciences Branch  
Division of Research and Laboratory Services

Principal Investigator S. J. Grabowski, D-1522 PO Box 25007 (FTS) 776-6006  
(Name) Denver CO 80225 (303) 236-6006  
(Address) (Telephone)  
Starting Year FY81 Estimated Completion Year FY90

Technical Objectives: To investigate the biologic and economic feasibility of using natural saline spring waters or saline waste waters of cultural origin flowing into the Colorado River drainage for raising marine and/or euryhaline finfish and shellfish, consistent with other Bureau activities related to salinity control of waterways, as legislated by Colorado River Salinity Control Act of 1974. Aquaculture using saline waters is a potential beneficial use of this water and supports salinity control activities of the Colorado River Water Quality Office.

Technical Approach: The initial phase will assess the scientific and economic feasibility of using saline waters in an integrated aquacultural operation by performing a literature review. A list of candidate finfish and shellfish species will be formulated, followed by survival and growth studies of selected species using saline source water. An economic evaluation of the present and projected market demand for fish and the type of fish desired in the Rocky Mountain region will be made to determine the extent to which culture of finfish and shellfish in saline waters would be practical and yield a beneficial use. A field demonstration facility will be established when saline water collection facilities are constructed. This facility should include interagency and/or State/Federal cooperation and involvement.

General Progress in Last 2 Years: Long-term growth studies of fish and shellfish species completed. Chemical analysis of selected tissues for some test organisms was performed to determine the potential for bioaccumulation of toxic and/or radioactive material. Performed economic analysis of present demand and projected demands for fish and shellfish in the Denver and Front Range area of Colorado as related to saline water for aquaculture.

Plans for Next 12 Months (FY88): Kokanee salmon and red drum will both be tested for short-term survival, and long-term survival and growth in saline water.

Coordination or Cooperation with Another Agency:  
Colorado Division of Wildlife  
General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: TVA Priority        1987 Session Number WQE-12a  
 Subject Area: Solid and Hazardous Waste  
 Project Title: Regional Hazardous Waste & Materials Management  
 Performing Organization: Waste Management Institute  
 Principal Investigator: Doye B. Cox, 270 Haney Building, Chatta., TN 37401, 615/751-3759  
 Starting Year: 1984 Estimated Completion Year 1985  
Continuation through 1988

**Technical Objectives:** Determine regional priorities for hazardous waste programs based on public opinion. Develop regional waste programs and projects consistent with TVA policies and priorities. Project has continued with formation of Region IV roundtable representing industry, governmental agencies, state governments and environmental groups

**Technical Approach:** (1) Hold a series of regional public workshops across the Tennessee Valley. Obtain public input as well as solicited input from industrial, environmental and regulatory groups. Analyze input, compare with TVA programs, and policies to develop regional waste management programs and projects, and (2) Took information from one and fed it into roundtable process. Roundtable is making input to Southern Governors Conference and Southern Legislators Conference.

**General progress:** Regional workshops completed, report completed, several projects developed including: instruction and assistance to volunteer fire departments in hazardous materials incidents, instituted industrial hazardous materials manager training course and a waste management curriculum for high schools using the roundtable process to further regional management of hazardous materials.

**Plans For Next Twelve Months:** Roundtable is presenting a series of recommendations to the Southern Governors Conference and working to regional solutions. This may lead to interstate compacts.

Coordination or Cooperation with Another Agency: EPA, DOD, DOE

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams        Technology Transfer X None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
 TOPIC STATEMENT

Agency: TVA Priority        1987 Session Number WQE-12b  
 Subject Area: Water Quality and Ecology  
 Project Title: Environmental Partitioning of Hazardous Wastes/Materials Released  
 Performing Organization: Waste Management Institute  
 Principal Investigator: Dr. James R. Wright, Jr., 125 Summer Place Building (FTS) N/A, Knoxville, TN 37901 (615) 632-4017 (Telephones)  
 Starting Year: FY 1988 Estimated Completion Year Unknown

**Technical Objectives:** To determine routes, fate, and effects of selected solids, liquid and gaseous hazardous substances

**Technical Approach:** Selected hazardous substances would be introduced into large experimental ecosystems at TVA's Aquatic Research Laboratory and the cycling of these materials and by-products between sediment, water, air and aquatic life monitored. Aquatic effects (dose/response) would be monitored.

General Progress in Last Two Years Project scoping/planning

Plans for Next Twelve Months (FY88): Implementation

Coordination or Cooperation with Another Agency: EPA

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams        X Technology Transfer        None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority            1985 Session Number HQE-12c  
 Subject Area Solid and Hazardous Waste  
 Project Title Waste Minimization Through Improved Separations Technology  
 Performing Organization Waste Management Institute, Technology Development Center  
 Principal Investigator Steve K. Seale, T237 MFDC-H  
 Starting Year 1987 Estimated Completion Year Ongoing

**Technical Objectives:** To identify better chemical, physical, or biological means of separating or concentrating specified components in solid and liquid industrial waste streams.

**Technical Approach:** Focusing initially on dilute acidic waste streams, develop innovative concentration/separation techniques to remove contaminating ions or recover metal cation ions to render the resultant acid usable in fertilizer or other production systems. Demonstrate promising new technologies by constructing and operating portable pilot-plants at specified generator or storage sites.

**General Progress:** Preliminary laboratory designs complete, initial lab furniture equipment specified.

**Plans for Next Twelve Months:** Obtain funding for subsequent construction of laboratory, 2 professional employees, and 1 technician; identify appropriate target acidic wastes and initiate lab work.

Coordination or Cooperation with Another Agency Many agencies

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference.            X            Technology Transfer            None  
           Safety of Dams            Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority            1985 Session Number HQE-12d  
 Subject Area Solid and Hazardous Waste  
 Project Title Hazardous Waste Gasification/Incineration  
 Performing Organization Waste Management Institute, Technology Development Center  
 Principal Investigator Ronald E. Addison, Muscle Shoals, AL 205-386-2743  
 Starting Year 1987 Estimated Completion Year 1991

**Technical Objectives:** Evaluate the technical, environmental, and economic viability of destruction of hazardous waste in a partial oxidation gasifier.

**Technical Approach:** Select potential wastes for gasification based on gasifier design and operational specifications and knowledge of the available waste streams including characteristics and generation rates. Test gasifier destruction efficiency and operations by conducting a 6-month pilot-plant study. If warranted, follow with a 30-month commercial scale operation for process demonstration and improvement and economic determinations.

**General Progress:** Wastes for gasification testing have been selected. Preliminary economic evaluations have been completed. Agreements have been reached with the University of Tennessee Space Institute (UTSI) to conduct the pilot-plant study to UTSI's pilot-plant coal gasifier.

**Plans for Next Twelve Months:** Obtain funding for gasification tests. Complete process modifications and environmental test plants. Conduct pilot-plant tests.

Coordination or Cooperation with Another Agency EPA

General Research or Problem Area(s) in this Topic that are of Current Special Interest to be Addressed at this Conference.            X            Technology Transfer            None  
           Safety of Dams            Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency: TVA Priority 1985 Session Number WQE-126  
 Subject Area: Waste Management  
 Project Title: Low-Tech Municipal Waste Incinerator  
 Performing Organization: Waste Management Institute, Waste Technology Development Center  
 Principal Investigator: R. W. Weatherington, Muscle Shoals, AL 205-386-2355  
 Starting Year: 1988 Estimated Completion Year 1992

**Technical Objectives:** Develop a low-cost process to incinerate municipal solid wastes using salvaged, high-temperature, rotary equipment adapted from other industries (cement manufacture, limestone calcining, etc.).

**Technical Approach:** Conduct a technical and economic feasibility study.

Determine the availability of high-temperature rotary equipment that may be adapted to process

Conduct an engineering design and cost study.

Install and test unit. Conduct environmental tests on all streams to and from unit

**General Progress:** Preliminary cost and process evaluation study indicates project feasibility. Potentially adaptable used equipment at a fraction of new equipment cost has been located

**Plans for Next Twelve Months:** Complete conceptual design and engineering study. Determine project site and secure commitment of local officials for test and demonstration project. Secure funds and begin engineering and procurement.

Coordination or Cooperation with Another Agency: Others

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams X Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency: TVA Priority \_\_\_\_\_ 1987 Session Number WQE-12f  
 Subject Area: Solid/Hazardous Waste Management  
 Project Title: Integrated Bafefill Demonstration  
 Performing Organization: Waste Management Institute  
 Principal Investigator: Brian Crutchfield, TVA, 20 45 Old City Hall Building, Knoxville, TN 37902 615/632-7421  
 Starting Year: FY 1988 Estimated Completion Year FY 1992

**Technical Objectives:** To integrate several different technological innovations in waste processing and disposal. The integrated concept will meet new RCRA subtitle D regulations and provide a cost-effective, environmental sound waste management system.

**Technical Approach:** A three phase project will be performed over five years. Existing research efforts will be completed in the first phase. A demonstration scale project will be implemented in phase two. The final phase will include monitoring and technology transfer. The overall thrust to integrate technologies that have potential for leachate reduction, methane reduction, volume reduction, and recycling enhancement.

**General Progress:** For the past two years, TVA staff have been examining state-of-the-art technologies associated with solid waste baling. This effort has been directed at medium and high density balers, foam spray for daily cover, leachate collection systems, liner applications, land stabilization techniques, recycling separation technologies, and improved transportation options

**Plans For Next Twelve Months:** Continue research and solicit funding from other potential cooperators.

Coordination or Cooperation with Another Agency: EPA

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_  
 Safety of Dams \_\_\_\_\_ X Technology Transfer \_\_\_\_\_ None \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-128  
 Subject Area Environment/Wastewater Treatment  
 Project Title ANFLOW  
 Performing Organization  
 Principal Investigator Charles L. McEntyre 270 Haney Building 615/751-7310  
 Name Address Phone Number  
 Starting Year 1985 Estimated Completion Year 1988

**Technical Objectives:** Oak Ridge National Laboratory developed and piloted ANFLOW during the 1970's and early 60s. ANFLOW is an anaerobic system for municipal and industrial wastewater treatment. This project will demonstrate ANFLOW at the 150,000 gpd level using municipal wastewater.

**Technical Approach:** Three 50,000 gpd units have been set up with different packings. They will be monitored for treatment efficiency and operational problems.

**General Progress:** The units have been installed and sewage was directed to the units in May 1987. The biological growth in the units should reach steady-state conditions by August 1987.

**Plans For Next Twelve Months:** Operational monitoring will begin in August 1987. Additional funding for long-term, additional monitoring is being sought.

**Coordination or Cooperation with Another Agency:** (1) City of Haleyville, (2) Appalachian Regional Commission, and (3) ANFLOW Inc.

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency TVA Priority 1987 Session Number WQE-12h  
 Subject Area Water Quality and Ecology  
 Project Title Wastewater Operator Training Computer Managed Interactive Video Instruction  
 Performing Organization TVA, Water Quality Branch  
 Principal Investigator Gerald R. Steiner 248 401 Building, Chattanooga, TN 615/751-  
 Name Address Phone Num  
 Starting Year 1984 Estimated Completion Year 1986

**Technical Objectives:** Develop an innovative wastewater operator training program which will result in improved training (i.e., greater information retention and presentation (practical information), increased numbers of operators being trained, and the resulting more effective and efficient operations of treatment systems).

**Technical Approach:** An innovative concept in education and training, called Computer Managed Interactive Video Instruction (CHIVI) is being used. A technical script is developed and professional video film is shot of wastewater treatment unit operations, maintenance, process control, trouble shooting and laboratory methods. Audio and video combined with computer graphics. A trainee uses a computer to interact with video and audio to see, hear, and write and answer questions.

**General Progress:** TVA developed an outline of the total script, about 20 percent of the audio and video footage, and two learning modules of the estimated total 30 were complete for CHIVI demonstration. The demonstration has been shown to EPA, several states and professional groups who have all stated that this new type of training would be very valuable and encouraged its completion. A request has been made to EPA for funds to complete the project and implement it in the Tennessee Valley region as a national demonstration.

**Plans For Next Twelve Months:** It is anticipated that EPA will provide the funds needed to complete the project. It is estimated that 11 months will be needed to complete, field test, revise and then implement use of the training program at state training centers, state regional offices, continuing education centers, and for onsite training.

**Coordination or Cooperation with Another Agency**

**General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:**  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE \_\_\_\_\_ Priority \_\_\_\_\_ 1987 Session Number WQE-13b  
Subject Area Water Quality and Ecology  
Project Title Stream Channel Alteration Projects  
Performing Organization USAE WES  
Principal Investigator Dr. F. D. Shields, Jr. PO Box 631, Vicksburg, MS 39180-0631 (FTS) 542-3707 (601) 634-3784 (Telephones)  
Starting Year FY 85 Estimated Completion Year FY 90

Technical Objectives: Develop a tool to concentrate a diffuse body of information in a form that is easily accessed and updated. Allow users of many different disciplines to tap expertise of related disciplines to facilitate planning and design of environmental aspects of streambank protection works and flood control projects involving levees and channels.

Technical Approach: A simple expert system for use on the PC is under development. The system is written in the PROLOG (Turbo Prolog) language, but requires no computer skills to use. The system will have modules for each major type of stream alteration within each module, users respond to a series of questions regarding project setting and goals. Program outline is a list of suggested design features for further study. Descriptive matter and sources of additional information are contained in help screens.

General Progress in Last Two Years: Draft versions of the system have been developed that contain modules for streambank protection and flood control channels. They are in review.

Plans for Next Twelve Months (FY 88): A module for streamside flood control levees will be added. Existing modules will be reviewed, refined, and released.

Coordination or Cooperation with Another Agency:  
Draft copies have been distributed to USFWS personnel and to several state agency personnel.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE \_\_\_\_\_ Priority \_\_\_\_\_ 1987 Session Number WQE-13a  
Subject Area Water Quality and Ecology  
Project Title Evaluation of Environmental Impacts of RMR Activities at CE Reservoirs  
Performing Organization USAE Waterways Experiment Station  
Principal Investigator M.J. Zimmerman PO Box 631 (FTS) 542-3784 (601) 634-3784 (Telephones)  
Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:  
Examine impacts of RMR reservoir activities on water quality; provide guidance aimed at minimizing impacts of RMR activities at reservoir projects.

Technical Approach:  
Field site visits to observe RMR activities and their impacts, record and obtain relevant data where possible.

General Progress in Last Two Years:  
One Technical Report (in press); one Technical Note (09/87); several site visits made.

Plans for Next Twelve Months (FY 88):  
Further site visits; update Technical Note as appropriate.

Coordination or Cooperation with Another Agency:  
Occasional interaction with state wildlife personnel.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer \_\_\_\_\_ None  
Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_



TOPIC STATEMENT

Agency TVA Priority \_\_\_\_\_ 1987 Session Number WQE-13c  
 Subject Area Water Quality and Ecology  
 Project Title Control of Nonpoint Source Pollutants (NPS)  
 Performing Organization Water Quality Branch  
 Principal Investigator John M. Higgins 270 Hany Building  
 Name Chatta, TN 37402 615/751-7299 Phone Number  
 Starting Year 1984 Estimated Completion Year Continuing program

Technical Objectives: To assist Land and Water 201 in defining NPS pollution problems and focusing existing implementation programs on those sources causing the greatest impact on water quality.

Technical Approach: Land and Water 201 was established in 1984 to promote cooperation among agencies involved in land and water conservation. One of the primary objectives of this effort is to improve water quality. The basic approach in meeting this objective involves: (1) identifying priority watersheds where NPS pollutants are having the greatest impact on water quality and stream uses; (2) identifying the site-specific land uses having the greatest impact within each priority watershed; and (3) focusing existing conservation and pollution control programs on demonstration projects in these watersheds.

General Progress: In FY 1984 and 1985 existing reports were summarized and a resource status report prepared. NPS issues and needs were identified and a conceptual approach developed. In 1986 a report was completed by an interagency task force which identified priority watersheds in the region. Demonstration projects have been initiated in Tennessee, Alabama, Virginia, Kentucky, and North Carolina.

Plans For Next Twelve Months: Efforts will be directed toward initiating watershed demonstration projects under Section 319 of the Water Quality Act of 1987.

Coordination or Cooperation with Another Agency: The Land and Water 201 project involves cooperative efforts among TVA, the Soil Conservation Service, EPA, and State agencies.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_\_ Safety of Dams \_\_\_\_\_ X \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency USBR Priority \_\_\_\_\_ 1987 Session Number WQE-13d  
 Subject Area Water Quality and Ecology  
 Project Title Limnological Application of Landsat Thematic Mapper Imagery  
 Performing Organization Applied Sciences Branch  
 Division of Research and Laboratory Services  
 Principal Investigator James P. Verdin D-1524 P O Box 25007 (FTS) 776-4302  
 Investigator James F. Labounty D-1522 Denver CO 80225 (303) 238-4302  
 (Name) (Address) (Telephone)  
 Starting Year FY84 Estimated Completion Year FY89

Technical Objectives: To fully determine the utility of TM satellite imagery for characterizing the spatial and temporal variability of reservoir surface temperature, chlorophyll concentration, and Secchi transparency.

Technical Approach: Collection of surface measurements of reservoir parameters on the same day as satellite image acquisition, development of empirical relationships between water quality measures and remote sensing data, and mapping water quality variability over the entire reservoir. Scene normalization for multirate application of the approach is being examined.

General Progress in Last 2 Years: In conjunction with U.S./Spain Reservoir Eutrophication study, extensive data collection has been carried out on Spanish reservoirs in 1985 and 1986. In the United States, concurrent surface sampling data and TM imagery of Lake Mead have been acquired in 1986 and 1987.

Plans for Next 12 Months (FY88): Data reduction, regression analysis, and image-map production are scheduled for both Lake Mead and Spanish reservoirs. Implementation of techniques on personal computers will be examined.

Coordination or Cooperation with Another Agency: Spanish Centro de Estudios Hidrograficos in Madrid.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

\_\_\_\_\_ Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_ None  
 \_\_\_\_\_ Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-13e

Subject Area Water Quality and Ecology

Project Title Las Vegas Wash Effluent Study  
Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services

Principal Investigator Richard Rolline, D-1522 (Name)  
PO Box 25007 (Address) (FTS) 776-6005  
Denver CO 80225 (303) 236-6005 (Telephone)

Starting Year FY86 Estimated Completion Year FY89

**Technical Objectives:** Las Vegas Wash containing a flow of approximately 120 ft<sup>3</sup>/s drains the Las Vegas Valley of Southern Nevada into Lake Mead. The objectives of this study are to: (1) document the existence, extent, and source areas for salt contributions within the wash in the context of the Las Vegas Wash Salinity Control Project; (2) document present salt loads contributed to the Colorado River (Lake Mead) by Las Vegas Wash; (3) document the existence, sources, and transformations of phosphorus and nitrogen compounds within the wash; and (4) compare present concentrations of nitrogen and phosphorus compounds within the wash to concentrations found before the recent channelization and marsh erosion that have occurred within the wash.

**Technical Approach:** Monthly surveys of 21 stations in Las Vegas Wash for physical and chemical (salinity and nutrient) water parameters for FY86 and FY87. In addition to annual progress reports, a final report will be prepared to: (1) summarize and evaluate the data collected; (2) present predictions of nutrient concentrations and loads, discuss how these predictions were made, and discuss the significance of the project impacts on the nutrients; and (3) present conclusions and recommendations.

**General Progress in Last 2 Years:** The 1986 surveys and report were completed. The 1987 program was expanded at the request of the Las Vegas Wash Salinity Control Project to include monthly, rather than quarterly, surveys.

**Plans for Next 12 Months (FY88):** Funds for the Las Vegas Wash Salinity Control Project have been "zeroed-out" for FY88 and FY89. Efforts at redirecting this study into a research project on wetland control of eutrophication in Las Vegas Bay of Lake Mead are under way.

**Coordination or Cooperation with Another Agency:** USGS and Clark County Sanitation District. (Would also welcome cooperation/coordination with NPS and the Army Corps of Engineers.)

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ None  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

TOPIC STATEMENT

Agency USBR Priority            1987 Session Number WQE-13f

Subject Area Water Quality and Ecology

Project Title Animal Damage to Hydraulic Structures and Its Control  
Applied Sciences Branch  
 Performing Organization Division of Research and Laboratory Services

Principal Investigator V. S. Miyahara, D-1522 (Name)  
PO Box 25007 (Address) (FTS) 776-6021  
Denver CO 80225 (303) 236-6021 (Telephone)

Starting Year FY85 Estimated Completion Year FY87

**Technical Objectives:** To determine the extent of the animal damage problem and to develop effective environmentally safe control methods. On completion of the project, the final report will serve as a guide for the identification and control of burrowing animals in and around hydraulic structures.

**Technical Approach:** The program is two phased. Phase one seeks to document animal damage, correlate extent of damage by animal species and soil composition, and survey vegetation conditions and their effects on burrowing activities. Phase two consists of an investigation of several methods of controlling burrowing animals including chemical, biological, environmental, and structural and design.

**General Progress in Last 2 Years:** An extensive literature search was developed. Site visits were made to Idaho, Oklahoma, and the Front Range in Northeastern Colorado, to identify burrowing animals and damage caused. Soil types and density characteristics were monitored in conjunction with field surveys and correlated with occurrence of burrowing animals.

**Plans for Next 12 Months (FY88):** A draft final report will be completed at the end of FY87 for distribution to Bureau regional personnel for comment before final printing. Draft brochures tailored to each region's animal damage problems will be completed in FY87 for FY88 distribution.

**Coordination or Cooperation with Another Agency:** Studies were coordinated with State agencies and Irrigation District personnel.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference: \_\_\_\_\_ None  
 Safety of Dams \_\_\_\_\_ Technology Transfer \_\_\_\_\_  
 Project Maintenance, Rehabilitation and Life Extension \_\_\_\_\_

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987

TOPIC STATEMENT

Agency CE Priority \_\_\_\_\_ 1987 Session Number MOE-13g  
Subject Area Water Quality and Ecology  
Project Title Environmental Impacts of Modifying Estuarine Circulation  
Performing Organization USAE Waterways Experiment Station  
Principal CEVES-ES-O  
Investigator Ross W. Hall PO Box 631 (FTS) 542-3714  
(Name) Vicksburg, MS 39180-0631 (601) 634-3714  
(Address) (Telephones)  
Starting Year FY 81 Estimated Completion Year FY 87

Technical Objectives:

The objective of the study is to develop methods to evaluate the impacts of changes in circulation on the water quality of estuarine systems.

Technical Approach:

Numerical water quality modeling is used to predict changes in transport of dissolved and suspended water quality constituents. Subjects addressed include solution techniques, marins and canals, mixing processes and their parameterization, formulation and simulation of water quality constituents, and coupling to hydro-dynamics. The study initially emphasizes two-dimensional laterally- and vertically-averaged water quality models. Consideration is then expanded to include the use of the multiple-box model to couple water quality to arbitrary hydrodynamic codes. General Progress in Last Two Years:

Accomplishments the past two years include: coupling the multiple-box model to arbitrary hydrodynamic codes and incorporation of QUICKEST into the multiple-box model and CE-QUAL-W2.

Plans for Next Twelve Months (FY 88):

The project terminates FY 87.

Coordination or Cooperation with Another Agency:

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer None  
Project Maintenance, Rehabilitation and Life Extension

APPENDIX K  
AGENDA AND TOPIC STATEMENTS  
JOINT HYDRAULICS/WATER QUALITY SESSION

FIFTEENTH INTERAGENCY  
RESEARCH COORDINATION CONFERENCE  
November 3-5, 1987

Vicksburg, Mississippi

AGENDA

Joint Hydraulics - Water Quality Session

Jerome L. Mahloch, Chairman  
Richard A. Sager, Co-Chairman

<u>Time</u>	<u>Topic No.</u>	<u>Topic Statement</u>	<u>Agency</u>
Tuesday Nov. 3		(10 minutes per topic)	
3:30 p.m.	H&WQ-A	Hydraulic Turbine Aeration Project	TVA
	H&WQ-B	Reaeration at Low-Head Projects	USACE
	H&WQ-C	Reaeration and Control of Dissolved Gases	USBR
	H&WQ-D	Improved Design and Operation of Selective Withdrawal Structures	USACE
	H&WQ-E	Evaluation of Blending Characteristics in Single Wet Well Structures	USACE
	H&WQ-F	Simulation of Oil Spills in Rivers and Lakes	USACE
	H&WQ-G	Ice-Affected Flooding Downstream of Oahe Dam	USACE
	H&WQ-H	Water Distribution System Analysis and Optimization (WADISO)	USACE

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency TVA Priority 1 1987 Session Number HMWQ-A  
Subject Area Water Quality and Ecology/Electric Power  
Project Title Hydraulic Turbine Aeration Project  
Performing Organization Turbine Designers and Model Testing Labs (to be determined later)  
Principal John E. Kirkland, Jr., TVA, W3 B105 (FTS) 632-2395  
Investigator 400 W. Summit Hill Dr., Knoxville, TN 37902 (Address) (615) 632-2395 (Telephones)  
Starting Year FY 88 Estimated Completion Year FY 93

Technical Objectives: To develop a procedure for designing hydraulic turbines which are capable of increasing dissolved oxygen levels in turbine releases by inducing atmospheric air and/or dispersing compressed air. The aim is to increase dissolved oxygen to satisfactory levels with minimum impact on turbine performance.

Technical Approach: Turbine runners of differing designs will be analyzed mathematically to determine designs which show promise of meeting program objectives. Model tests will be conducted on selected designs to confirm mathematical analyses. One or more prototype runners in the turbines of TVA's Norris Hydro Plant and tested to confirm model test results.

General Progress in Last Two Years:

None - Project will be initiated in FY 88.

Plans for Next Twelve Months (FY 88):

Complete mathematical analyses, analyze results and select designs for model testing.

Coordination or Cooperation with Another Agency:

TVA will solicit cooperation from other agencies interested in this solution to the problem of low dissolved oxygen in turbine releases.

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

Fifteenth Interagency Research Coordination Conference, 3-5 November 1987  
TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number HMWQ-B  
Subject Area Hydraulics - Water Quality  
Project Title Reaeration at Low-Head Projects  
Performing Organization USAMWS, Hydraulics Laboratory  
Principal Steven C. Wilhelms, 30 Box 531, Vicksburg, MS (FTS) 547-2475  
Investigator Steven C. Wilhelms, 30 Box 531, Vicksburg, MS (601) 634-2475 (Address) (Telephones)  
Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:

To characterize reaeration at low-head hydraulic projects and identify and develop effective methods for improving the DO content of releases from low-head gated spillways, fixed- and variable-crest weirs, navigation locks, and hydropower projects; and to subsequently provide predictive tools and guidance that can be used in evaluating the effectiveness of various alternatives for release improvement.

Technical Approach:

Conduct a literature survey and review of water quality problems and potential solutions related to low-head hydraulic structures particularly, hydropower facilities. Based on preliminary data from FOA's, theoretically analyze the reaeration process and develop a mathematical formulation or numerical description thereof. Conduct field investigations at selected sites to verify and validate the process description. Develop operational guidance to maximize DO uptake based on results of field investigations and the theoretical description.

General Progress in Last Two Years:

Completed FOA survey of low-head hydropower sites within the CE. Conducted literature and limited FOA survey and confirmed that release DO is most common concern. Loss of reaeration capability as a result of hydropower retrofit is another major concern of FOA's. Common problems associated with low-head hydraulic structures were identified. Five field studies were initiated and initial low-head data were gathered.

Plans for Next Twelve Months (FY 88):

Low-head project reaeration testing will continue. Analysis of FY 87 data will be completed. Initial guidance on reaeration characteristics of low-head gated structures will be distributed.

Coordination or Cooperation with Another Agency:

Previous coordination on hydropower reaeration for high-head projects was conducted with both TVA and USBR.

General Research or Problem Areas in this Topic that are of Current Special Interests to be Addressed at this Conference:  
Safety of Dams  Technology Transfer  None  
Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency USBR Priority 2 1987 Session Number H5HQ-C  
 Subject Area Hydraulics - water quality  
 Project Title Reaeration and Control of Dissolved Gases  
 Performing Organization Bureau of Reclamation  
 Principal PO Box 25007, MC D-1531 (FIS) 776-6160  
 Investigator Perry L. Johnson Denver CO 80225 (303) 236-6160  
 (Name) (Address) (Telephone)

Starting Year FY71 Estimated Completion Year FY91

Technical Objectives: Address hydraulics related dissolved gas problems (supersaturation, reaeration, dissolved oxygen depletion) that occur at USBR structures and develop analytical and design procedures to deal with these problems.

Technical Approach: Continue to wrap up and publish reports on completed work. Continue to maintain interagency coordination activities (both TVA and the Corps have active research efforts in this field). Survey design and region dissolved gas needs and use information gained to set future research direction. The present program phase is near completion. Future work (if appropriate) will be directed towards meeting current Bureau needs.

General Progress in Last Two Years: Work has been limited by availability of staff. A summary report on pneumatic diffuser aerator design has been prepared and published and a detailed design guide has been drafted.

Plans for Next Twelve Months (FY88): Conduct survey of USBR needs in the field. Redirect research program to reflect current concerns. Publish pneumatic diffuser design guide.

Coordination or Cooperation with Another Agency: An interagency (USBR, CE, TVA) coordination meeting was held in January 1987 and it is expected that a similar meeting will be held in FY88. Report, data, and information are exchanged as the need arises.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

Agency CE Priority 1 1987 Session Number H6HQ-D  
 Subject Area Hydraulics-Water Quality  
 Project Title Improved Design and Operation of Selective Withdrawal Structures  
 Performing Organization USAEWES, Hydraulics Laboratory  
 Principal F-544-2644  
 Investigator J. P. Holland, PO Box 631, Vicksburg, MS 601 634-2644  
 (Address) (Telephone)  
 Starting Year FY 85 Estimated Completion Year FY Ongoing  
 Technical Objectives:

To develop and apply numerical predictive techniques which will allow better design and operation of selective withdrawal intake structures for improved release quality maintenance.

Technical Approach:

Existing one-dimensional reservoir water quality (usually thermal) models will be coupled with optimization techniques. These products, when coupled, will allow evaluation of optimal selective withdrawal structure design and operation. The operational policy tools should consider either present or anticipated conditions.

General Progress in Last Two Years:

Three numerical tools, all coupling one-dimensional thermal modeling techniques with optimization or intake selection algorithms, were developed. The first, MESMIN, allows systematic selection of the optimal number and locations of intakes for structure design. The second, #ESDP allows evaluations of alternative operating policies which consider anticipated conditions. The third, SELCIDE, allows evaluation of daily selective withdrawal operating policy decisions.

Each of these tools is being used by MES, the field, or both, on site-specific projects. This will continue. No new research is planned.

Coordination or Cooperation with Another Agency:

Both TVA and USBR are aware of SELECT model, but not of additional models.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number H6M0-E  
 Subject Area Hydraulics - Water Quality  
 Project Title Evaluation of Blending Characteristics in Single Wet Well Structures  
 Performing Organization USAEMES, Hydraulics Laboratory  
 Principal Stacy E. Rowinston, PO Box 611, Vicksburg, MS  
 Investigator Stacy E. Rowinston, PO Box 611, Vicksburg, MS  
 (Name) 601-634-2939  
 Address 601-634-2939  
 Telephone  
 Starting Year 86 Estimated Completion Year FY 88

Technical Objectives:

Guidance will be provided for design and operation of single wet well reservoir intake structures that simultaneously release flows from multiple reservoir elevations for the maintenance of downstream or in-reservoir water quality. The parameters which affect the blending of waters of different densities within these structures will be investigated. An operational tool will be developed which will use the blending technology in a predictive mode for gate operation guidance based on desired release quality.

Technical Approach:

An analytic approach to the blending problem will be used to develop an initial theoretical description. The theoretical description will be tested against observed data and will be improved as necessary. Once the technology has been adequately verified for a number of diverse structures, it will be implemented as a predictive mathematical technique for development and evaluation of operational strategies.

General Progress in Last Two Years:

The theoretical description was developed and expanded to include first linear, then arbitrary, stratification patterns and describe flow distributions when many (3 or more) simultaneous withdrawal elevations are employed. Physical model results were again used to verify the theory. The assumptions inherent in the theoretical derivation were reevaluated. Field data have been collected from several sources. These data have to date compared favorably with the theoretical predictions. More complete comparison between the field data and the theory is ongoing.

Plans for Next Twelve Months FY 88:

The work unit will be completed. Documentation will be distributed. Present selective withdrawal methodologies will be updated to include single wet well algorithms.

Coordination or Cooperation with Another Agency:

Mentioned at last meeting; none otherwise.

General Research or Problem Area in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1 1987 Session Number H6M0-F  
 Subject Area Hydraulics (Water Quality)  
 Project Title Simulation of Oil Spills in Rivers and Lakes  
 Performing Organization Clarkson University, Potsdam, NY  
 Principal S. F. Daly, USACERL  
 Investigator 72 Lyme Road, Hanover, NH 03755-1290  
 (Name) (603) 646-6218  
 Address (Telephone)  
 Starting Year FY 83 Estimated Completion Year FY 87

Technical Objectives:

To develop a numerical model that is capable of modeling an oil spill in open water and ice covered conditions. The model includes advection, mechanical spreading, horizontal diffusion, shoreline deposition, evaporation and dissolution.

Technical Approach:

Use as basis a one dimensional unsteady flow model. Distribution of flow is determined using stream tube approach. A Lagrangian discrete-parcel algorithm is used to determine location and concentration distribution of the oil spill.

General Progress in Last Two Years:

The model was written and installed on mainframe and desktop P.C. computers. Desktop version produces high resolution color maps indicating location of spill. Maps include zoom feature, river landmarks, and user friendly menu driven format.

Plans for Next Twelve Months FY 87:

Distribution of software, update of under ice transport module of model.

Coordination or Cooperation with Another Agency:

Cooperative efforts have been made with U.S. Coast Guard, NOAA and EPA.

General Research or Problem Area in this Topic that are of Current Special Interests to be Addressed at this Conference:  
 Safety of Dams  Technology Transfer  None  
 Project Maintenance, Rehabilitation and Life Extension



TOPIC STATEMENT

Agency CE Priority 1987 Session Number H40Q-G  
 Subject Area Hydraulics (Water Quality)  
 Project Title Ice-Affected Flooding Downstream of OAKE Dam  
 Performing Organization CRREL  
 Principal Dr. George D. Ashton, USACRREL (FTS) None  
 Investigator 72 Lyme Road, Hanover, NH 03755-1290 (603) 866-6100  
 (Name) (Address) (Telephone)  
 Starting Year FY 86 Estimated Completion Year FY 88

Technical Objectives:

Determine feasibility of using warmer bottom water in Oake Reservoir to reduce ice production and accumulation downstream that causes flooding associated with ice jams.

Technical Approach:

Use bubbler system to raise warmer bottom water to outlet level. Feasibility determined by numerical simulation involving ice production, accumulation, and melting.

General Progress in Last Two Years:

Developed numerical simulation; obtained field data on water temperatures, heat transfer coefficients, and ice accumulations and retreat.

Plans for Next Twelve Months (FY 88):

Refine, calibrate, and validate simulation; obtain additional field data; examine variations in operational strategies.

Coordination or Cooperation with Another Agency:

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General Research or Problem Area in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

TOPIC STATEMENT

Agency CE Priority 1987 Session Number H40Q-H  
 Subject Area Hydraulics (Water Distribution System Analysis Environmental Engineering)  
 Project Title Water Distribution System Analysis and Optimization (MADISO)  
 Performing Organization Environmental Laboratory, Stevens Experiment Station  
 Principal Don Chase ATTN: CEVES-EE-R (FTS) 542-1931  
 Investigator PO Box 631, Uicksburg, MS 39180-0631 (601) 634-1931  
 (Name) (Address) (Telephone)  
 Starting Year FY 84 Estimated Completion Year FY 88

Technical Objectives:

The main objective of the project was to develop a computer model to assist engineers in designing least-cost improvements to water distribution systems to meet performance standards.

Technical Approach:

To determine least-cost improvements to a water distribution system, the program uses a bounded enumeration technique based on minimizing the sum of piping installation, pipe cleaning and lining, and present worth of pumping energy costs. To determine whether the performance standards of the system are met, the program uses a node method with sparse matrix techniques to reduce computations of the flows and pressures in a pipe network.

General Progress in Last Two Years:

The program structure has been modified by separating well defined tasks into individual sub-routines. The program code has been commented and a detailed documentation has been written to describe the internal workings of the program. An extended period simulation module has been added to the program and the User's Guide has been updated to describe the new module.

Plans for Next Twelve Months (FY 88):

The plans for the next twelve months include publication of the User's Guide and documentation of the program and applying the program to assist in the design and analysis of water distribution systems.

Coordination or Cooperation with Another Agency:

No coordination or cooperation with another agency is taking place.

General Research or Problem Area(s) in this Topic that are of Current Special Interests to be Addressed at this Conference:

Safety of Dams  Technology Transfer None  
 Project Maintenance, Rehabilitation and Life Extension

APPENDIX L

WORK GROUP REPORTS

1. Steering Committee on Water Quality and Ecology (12 Nov 1986).
2. Aquatic Plant Management Working Group (Jan 1987).



DEPARTMENT OF THE ARMY  
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS  
P.O. BOX 831  
VICKSBURG, MISSISSIPPI 39180-0631

REPLY TO  
ATTENTION OF

WESEP-W

12 November 1986

SUBJECT: Meeting of the Interagency R&D Steering Committee on Water Quality  
and Ecology

Dr. Bill Roper, RDC  
Mr. Dave Buelow, CWH-W  
Dr. Charles Bohac, TVA  
Mr. L. O. Timblin, Jr., BOR

1. The subject meeting was held in conjunction with the Water Operations Technical Support (WOTS) workshop on Reservoir Releases in Atlanta, Ga., on 28 Oct 86. This workshop also served as the off-year meeting for the steering committee hosted by the CE. Dr. Bohac attended the meeting in place of Mr. Ruane for TVA. The workshop included many presentations by both TVA and the Bureau of Reclamations and served as an excellent forum for the exchange of information between the three agencies. All committee members agreed that the workshop was an overwhelming success in terms of providing R&D coordination among the principle water resource agencies. During the meeting, members discussed plans for the out-years.

2. The next interagency R&D coordination conference will be held in the Fall of 1987 and be hosted by the CE at the Waterways Experiment Station in Vicksburg, Ms. As soon as plans for the meeting are finalized, steering committee members will be asked to coordinate topic statement input for this respective agencies in the Water Quality and Ecology area. Reports from the various working groups within the Water Quality and Ecology Area will be prepared in advance of this meeting. The Reaeration Working Group also met during the workshop. It was decided that the next off-year meeting of the Steering Committee would be hosted by the Bureau of Reclamation. Several topics were discussed, but a final decision will await our next meeting to be held in conjunction with the 1987 Coordination Conference.

FOR THE COMMANDER AND DIRECTOR:

JEROME L. MAHLOCH, PhD, PE  
Manager, Environmental and Water  
Quality Operational Studies

# INTERAGENCY RESEARCH COORDINATION CONFERENCE

## Aquatic Plant Management Working Group

### Report to Steering Committee

January 1987

The Aquatic Plant Management Working Group (APMWG) met two times in 1986. Once in conjunction with the Aquatic Plant Management Society (APMS) national meeting in July 1986, and again in conjunction with the Corps of Engineers (COE) national Aquatic Plant Control Research Program meeting in November 1986.

At the July meeting, discussions centered around three main topic areas:

The first was related to the continual coordination of research being conducted by not only the member agencies, but also by interested participating agencies such as the USDA, and the USDI F&WS. It was decided that a yearly document should be produced with an abstract/synopsis of each agencies research efforts, for distribution to those agencies and universities engaged in this area. Such a document would supplement the Bi-Annual topic statement report, and serve at the working level. It would be updated yearly as a result of the working groups semi-annual meetings and reviews.

The second area discussed was the inter-state transport of noxious aquatic plants. In spite of laws/regulations existing for prevention, the majority of new infestations reported can be traced backed to inter or intra-state transportation. The APHIS is tasked with the responsibility of enforcing the Noxious Weed Act of 1974 and the Plant Quarantine Act of 1912. Realistically, these are almost impossible to enforce at the Federal level. Like so many other regulations pertaining to aquatic plant control, both Federal and State existing agricultural laws have been amended and/or interpreted, after the fact, to include aquatics. The result is a lip service treatment at best. The Working Group decided to compile a document that brings together both the nature and status of existing State and Federal laws/regulations, and some information on methods of enforcement. Target date for completion is July 1987, and backed by this information the Working Group will formulate recommendations for a more consistent and enforceable system. To date, we have received responses from 24 States, including copies of regulations/laws and identification of responsible agency heads.

The third area discussed was the continuing need for a National survey that would reflect the scope and nature of the aquatic plant problems. This item has been considered before and a format and proposal was produced. At that time, it was estimated that \$1,000,000 would be needed to conduct the survey, and produce a report that would be useful at both the Federal and State levels. The working Group agreed to pick up the proposal, update and upgrade where necessary, and to pursue funding for the effort. Such a report would probably not need to be updated any more frequently than every 3-5 years. By virtue of this report, we are soliciting the assistance of the Steering Committee

members in coordinating with other Federal agencies, for a cooperatively funded effort. As APC is funded with Construction General Appropriation, consideration should be given to funding under P.L. 99-662. Many noted project in this P.L. are or will encounter aquatic plant problems, and the P.L. raised the ceiling on APC funding from \$10M to \$12M.

Respectfully,

J.L. Decell, COE  
Chairman

John Pringle, USDI-BR  
Co\_Chairman

cf: John Pringle

Leon Bates, TVA

Jerome Mahloch, WQ&E

APPENDIX M  
CONFERENCE ORGANIZATIONAL PERSONNEL DIRECTORY

CONFERENCE ORGANIZATION PERSONNEL DIRECTORY

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<b>Fifteenth Conference</b> 3-5 November 1987 US Army Corps of Engineers Vicksburg, Mississippi	<b>Sixteenth Conference</b> 17-19 October 1989 Bonneville Power Administration Portland, Oregon
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Steering Committee

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Mr. Jim Pachot, Research and  
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Concrete and Structures

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Vicksburg, Mississippi

Sixteenth Conference  
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Portland, Oregon

Session Chairmen (Continued)

Electric Power Session

Mr. James J. Ray  
Manager, Research Application  
EO  
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Energy Session

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Hydraulics Session

Mr. Richard A. Sager  
Assistant Chief, Hydraulics  
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CEWES-HV-A  
US Army Engineer Waterways  
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Mr. Philip H. Burgi  
Bureau of Reclamation  
(proposed)

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Rock Mechanics Session

Mr. Jerry S. Huie  
Chief, Rock Mechanics Application  
Group  
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Vicksburg, MS 39180-0631  
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Geotechnical Session

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CONFERENCE ORGANIZATION PERSONNEL DIRECTORY (Continued)

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Session Chairmen (Concluded)

Soil Mechanics Session

Mr. C. LeRoy McAnear  
Chief, Soil Mechanics Division  
CEWES-GE  
US Army Engineer Waterways  
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Water Quality and Ecology Session

Dr. Jerome L. Mahloch  
Program Manager, Environmental  
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Mr. Lloyd Timblin  
Bureau of Reclamation  
(proposed)

Work Group Chairmen  
(as of 15 January 1988)

Executive Session: No work groups.

Concrete and Structures Session: No work groups.

Electric Power Session: No work groups.

Energy Session: No work groups.

Hydraulics Session:

Reaeration Research Work Group:

Jeffery P. Holland  
Chief, Reservoir Water Quality Branch  
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(Continued)

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Work Group Chairmen (Continued)

Hydraulics Session (Continued):

Water Quality Modeling Work Group:

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Hydraulic Laboratory Techniques  
and Instrumentation Work Group:

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Geotechnical Session:

Interagency Standard Penetration  
Test (SPT) Procedure Work Group:

A. G. Franklin  
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Geophysics Division  
CEWES-GH  
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Water Quality and Ecology Session:

Water Quality and Ecology Steering Committee:

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Work Group Chairmen (Concluded)

Water Quality and Ecology Session (Continued):

Water Quality Modeling and  
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