FINAL

Human Health Baseline Risk Assessment
Hastings Second Street Subsite
Hastings, Nebraska

Volume 2 - Appendices

Prepared by:

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Bureau of Environmental Health
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Lincoln, NE 68509-5007

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Table of Contents

List of Appendices

Appendix 1

Demographic Information for Hastings, Nebraska

Prepared by the Nebraska Department of Econmonic Development

URBAN AND RURAL RESIDENCE	
Total population	22,837
Urban population	22,837
Percent of total population	100.0
Rural population	0
Percent of total population	0.0
Farm population	0
SCHOOL ENROLLMENT	
Persons 3 years and over enrolled in school	5,890
Preprimary school	468
Elementary or high school	3,537
Percent in private school	13.9
College	1,885
EDUCATIONAL ATTAINMENT	
Persons 25 years and over	14,688
Less than 9th grade	957
9th to 12th grade, no diploma	1,831
High school graduate	5,147
Some college, no degree	3,263
Associates degree	1,073
Bachelor's degree	1,673
Graduate or professional degree	744
Percent high school graduate or higher	81.0
Percent bachelor's degree or higher	16.5
RESIDENCE IN 1985	
Persons 5 years and over	21,211
Lived in same house	11,639
Lived in different house in U.S.	9,517
Same State	7,687
Same county	4,744
Different county	2,943
Different State	1,830
Lived abroad	55
DISABILITY OF CIVILIAN NONINSTITUTIONALIZED PERSONS	
Persons 16 to 64 years	13,452
With a mobility or self-care limitation	473
With a mobility limitation	140
With a self-care limitation	402
With a work disability	880
In labor force	498
Prevented from working	313
Persons 65 years and over	3,652
With a mobility or self-care limitation	610
With a mobility limitation	438
With a self-care limitation	383

CHILDREN EVER BORN PER 1,000 WOMEN	
Women 15 to 24 years	208
Women 25 to 34 years	1,481
Women 35 to 44 years	2,003
VETERAN STATUS	
Civilian veterans 16 years and over	2,446
65 years and over	769
NATIVITY AND PLACE OF BIRTH	
Native population	22,641
Percent born in state of residence	76.6
Foreign-born population	196
Entered the U.S. 1980 to 1990	33
LANGUAGE SPOKEN AT HOME	
Persons 5 years and over	21,211
Speak a language other than English	725
Do not speak English 'very well'	217
Speak Spanish	271
Do not speak English 'very well'	42
Speak Asian or Pacific Island language	74
Do not speak English 'very well'	50
ANCESTRY	
Total ancestries reported	29,337
Arab	21
Austrian	25
Belgian	6
Canadian	7
Czech	1,034
Danish	838
Dutch	591
English	3,076
Finnish	0
French (except Basque)	959
French Canadian	174
German	13,455
Greek	17
Hungarian	12
Irish	3,155
Italian	243
Lithuanian	13
Norwegian	424
Polish	441
Portuguese	21
Romanian	23
Russian	207
Scotch-Irish	545

Scottish	491
Slovak	116
Subsaharan African	0
Swedish	1,403
Swiss	123
Ukrainian	0
United States or American	526
Welsh	171
West Indian (excluding Hispanic origin groups)	0
Yugoslavian	0
Other ancestries	1,220

LABOR FORCE STATUS

Persons 16 years and over	17,941
In labor force	11,639
Percent in labor force	64.9
Civilian labor force	11,596
Employed	11,082
Unemployed	514
Percent unemployed	4.4
Armed Forces	43
Not in labor force	6,302
Males 16 years and over	8,319
In labor force	6,136
Percent in labor force	73.8
Civilian labor force	6,100
Employed	5,867
Unemployed	233
Percent unemployed	3.8
Armed Forces	36
Not in labor force	2,183
Females 16 years and over	9,622
In labor force	5,503
Percent in labor force	57.2
Civilian labor force	5,496
Employed	5,215
Unemployed	281
Percent unemployed	5.1
Armed Forces	7
Not in labor force	4,119
Females 16 years and over	9,622
With own children under 6 years	1,282
Percent in labor force	78.3
With own children 6 to 17 years only	1,476
Percent in labor force	85.4
Own children under 6 years in families and subfamilies	1,917
All parents present in household in labor force	1,450
Own children 6 to 17 years in families and subfamilies	3,493
All parents present in household in labor force	2,863
Persons 16 to 19 years	1,419
Not enrolled in school and not high school graduate	74
Employed or in Armed Forces	32
Unemployed	11
Not in labor force	31

COMMUTING TO WORK	
Workers 16 years and over	11,004
Percent drove alone	80.7
Percent in carpools	10.2
Percent using public transportation	0.0
Percent using other means	0.6
Percent walked or worked at home	8.0
Mean travel time to work (minutes)	12.1
OCCUPATION	
Employed persons 16 years and over	11,082
Executive, administrative, and managerial occupations	1,121
Professional specialty occupations	1,533
Technicians and related support occupations	273
Sales occupations	1,275
Administrative support occupations, including clerical	1,533
Private household occupations	37
Protective service occupations	136
Service occupations, except protective and household	1,909
Farming, forestry, and fishing occupations	291
Precision production, craft, and repair occupations	1,267
Machine operators, assemblers, and inspectors	910
Transportation and material moving occupations	393
Handlers, equipment cleaners, helpers, and laborers	404
INDUSTRY	
Employed person 16 years and over	11,082
Agriculture, forestry, and fisheries	413
Mining	36
Construction	465
Manufacturing, nondurable goods	797
Manufacturing, durable goods	1,139
Transportation	376
Communications and other public utilities	365
Wholesale trade	587
Retail trade	2,237
Finance, insurance, and real estate	334
Business and repair services	344
Personal services	302
Entertainment, and recreation services	82
Health services	1,229
Educational services	1,223
Other professional and related services	777
Public administration	376

CLASS OF WORKER	
Employed persons 16 years and over	11,082
Private wage and salary workers	8,390
Government workers	1,806
Local government workers	841
State government workers	682
Federal government workers	283
Self-employed workers	839
Unpaid family workers	47

Total housing units	**9,846**
YEAR STRUCTURE BUILT	
1989 to March 1990	26
1985 to 1988	188
1980 to 1984	280
1970 to 1979	1,851
1960 to 1969	1,050
1950 to 1959	1,543
1940 to 1949	1,726
1939 or earlier	3,182
BEDROOMS	
No bedroom	98
1 bedroom	1,513
2 bedrooms	3,495
3 bedrooms	3,354
4 bedrooms	1,162
5 or more bedrooms	224
SELECTED CHARACTERISTICS	
Lacking complete plumbing facilities	30
Lacking complete kitchen facilities	34
Condominium housing units	100
SOURCE OF WATER	
Public system or private company	9,718
Individual drilled well	128
Individual dug well	0
Some other source	0
SEWAGE DISPOSAL	
Public sewer	9,723
Septic tank or cesspool	109
Other means	14
Occupied housing units	**9,127**
HOUSE HEATING FUEL	
Utility gas	8,401
Bottled, tank, or LP gas	39
Electricity	547
Fuel oil, kerosene, etc	0
Coal or coke	0
Wood	76
Solar energy	0
Other fuel	64
No fuel used	0

YEAR HOUSEHOLDER MOVED INTO UNIT	
1989 to March 1990	1,768
1985 to 1988	2,224
1980 to 1984	1,331
1970 to 1979	1,982
1960 to 1969	853
1959 or earlier	969
TELEPHONE	
No telephone in unit	371
VEHICLES AVAILABLE	
Occupied housing units	9,127
None	780
1	3,223
2	3,449
3 or more	1,675
MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS	
Specified owner-occupied housing units	4,991
With a mortgage	2,609
Less than $300	163
$300 to $499	867
$500 to $699	969
$700 to $999	439
$1,000 to $1,499	142
$1,500 to $1,999	18
$2,000 or more	11
Median (dollars)	547
Not mortgaged	2,382
Less than $100	98
$100 to $199	980
$200 to $299	907
$300 to $399	251
$400 or more	146
Median (dollars)	210
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1989	
Specified owner-occupied housing units	4,991
Less than 20 percent	3,371
20 to 24 percent	633
25 to 29 percent	438
30 to 34 percent	176
35 percent or more	348
Not computed	25

GROSS RENT	
Specified renter-occupied housing units	3,612
Less than $200	631
$200 to $299	1,137
$300 to $499	1,499
$500 to $749	214
$750 to $999	12
$1,000 or more	0
No cash rent	119
Median (dollars)	298
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1989	
Specified renter-occupied housing units	3,612
Less than 20 percent	1,238
20 to 24 percent	534
25 to 29 percent	424
30 to 34 percent	297
35 percent or more	967
Not computed	152

INCOME IN 1989	
Households	9,115
Less than $5,000	544
$5,000 to $9,999	1,095
$10,000 to $14,999	1,142
$15,000 to $24,999	2,161
$25,000 to $34,999	1,651
$35,000 to $49,999	1,402
$50,000 to $74,999	853
$75,000 to $99,999	117
$100,000 to $149,999	80
$150,000 or more	70
Median household income (dollars)	23,317
Families	5,850
Less than $5,000	92
$5,000 to $9,999	307
$10,000 to $14,999	456
$15,000 to $24,999	1,354
$25,000 to $34,999	1,359
$35,000 to $49,999	1,280
$50,000 to $74,999	761
$75,000 to $99,999	112
$100,000 to $149,999	70
$150,000 or more	59
Median family income (dollars)	30,076
Nonfamily households	3,265
Less than $5,000	457
$5,000 to $9,999	816
$10,000 to $14,999	700
$15,000 to $24,999	792
$25,000 to $34,999	305
$35,000 to $49,999	104
$50,000 to $74,999	65
$75,000 to $99,999	5
$100,000 to $149,999	10
$150,000 or more	11
Median nonfamily household income (dollars)	11,945
Per capita income (dollars)	11,905

INCOME TYPE IN 1989	
Households	9,115
With wage and salary income	6,745
Mean wage and salary income (dollars)	27,562
With nonfarm self-employment income	1,265
Mean nonfarm self-employment income (dollars)	12,666
With farm self-employment income	242
Mean farm self-employment income (dollars)	5,262
With Social Security income	3,029
Mean Social Security income (dollars)	7,516
With public assistance income	418
Mean public assistance income (dollars)	3,181
With retirement income	1,229
Mean retirement income (dollars)	6,433
POVERTY STATUS IN 1989	
All persons for whom poverty status is determined	21,254
Below poverty level	2,217
Persons 18 years and over	15,817
Below poverty level	1,517
Persons 65 years and over	3,652
Below poverty level	485
Related children under 18 years	5,437
Below poverty level	700
Related children under 5 years	1,617
Below poverty level	253
Related children 5 to 17 years	3,820
Below poverty level	447
Unrelated individuals	3,913
Below poverty level	1,003
All families	5,850
Below poverty level	367
With related children under 18 years	2,985
Below poverty level	313
With related children under 5 years	1,282
Below poverty level	203
Female householder families	680
Below poverty level	238
With related children under 18 years	505
Below poverty level	225
With related children under 5 years	196
Below poverty level	140

Percent below poverty level:	
All persons	10.4
Persons 18 years and over	9.6
Persons 65 years and over	13.3
Related children under 18 years	12.9
Related children under 5 years	15.6
Related children 5 to 17 years	11.7
Unrelated individuals	25.6
All families	6.3
With related children under 18 years	10.5
With related children under 5 years	15.8
Female householder families	35.0
With related children under 18 years	44.6
With related children under 5 years	71.4

Appendix 2

Surface Soil Gas Sampling Results
Hastings Second Street Subsite
Hastings, Nebraska

Surface Soil Gas Data
SECOND STREET SUBSITE

(gchem9.frm, Sample.dbf, Analyses.dbf)

Location	Depth	Act & Typ	Sample Date	HNU Back Samp	Fld Mois (%)	Sample Tag Number	Lab	TCA (ppmv)	CT (ppmv)	TCE (ppmv)	EDB (ppmv)	PCE (ppmv)	BZ (ppmv)	VC (ppmv)	CF (ppmv)	DCE (ppmv)	Record Number
ZD15	2-3	S-C	12/08/87	0.6 0.2	NA	R09S2135	CSL	U	U	U	U	U	--	--	--	--	311
ZD16	0-3	S-C	12/07/87	4.9 5.4	NA	R09S2123	CSL	U	U	U	U	U	--	--	--	--	298
ZD17	0-3	S-C	12/07/87	4.7 5.2	NA	R09S2124	CSL	U	U	U	U	U	--	--	--	--	299
ZD18	0-2	S-C	12/08/87	0.6 0.1	NA	R09S2126	CSL	U	U	U	U	U	--	--	--	--	312
ZD19	0-3	S-C	12/08/87	0.8 0.3	NA	R09S2127	CSL	U	U	U	U	U	--	--	--	--	313
ZD19	FLD-BLK	S-C	12/08/87	0.8 0.8	NA	R09S2128	CSL	U	U	U	U	U	--	--	--	--	314
ZD20	2-3	S-C	12/14/87	0.9 5.2	NA	R09S2140	CSL	U	U	U	U	U	--	--	--	--	360
ZD26	2-3	S-C	12/14/87	0.9 7.6	NA	R09S2146	CSL	U	U	U	U	U	--	--	--	--	383
ZD28	1-2	S-C	12/15/87	1.0 27	NA	R09S2148	CSL	U	U	U	U	U	--	--	--	--	385

Appendix 3

Subsurface Soil Gas Sampling Results
Hastings Second Street Subsite
Hastings, Nebraska

Borehole Soil Gas Data
SECOND STREET SUBSITE

(gchem9.frm, Sample.dbf, Analyses.dbf)

Location	Depth	Act & Typ	Sample Date	HNU Back Samp	Fld Mois (%)	Sample Tag Number	Lab	TCA (ppmv)	CT (ppmv)	TCE (ppmv)	EDB (ppmv)	PCE (ppmv)	BZ (ppmv)	VC (ppmv)	CF (ppmv)	DCE (ppmv)	Record Number
BD17	12-16	B-G	12/22/87	0.8 4.8	NA	R09S2228	CSL	U	U	2.976	U	0.340	--	--	--	--	594
BD17	22-26	B-G	12/22/87	0.3 3.8	NA	R09S2230	CSL	0.183	U	3.162	U	0.340	--	--	--	--	596
BD17	28-32	B-G	12/22/87	0.3 1.7	NA	R09S2232	CSL	U	U	1.804	U	0.148	--	--	--	--	598
BD17	34-38	B-G	12/22/87	M 1.4	NA	R09S2235	CSL	U	U	1.562	U	U	--	--	--	--	599
BD17	40-44	B-G	12/22/87	0.2 1.5	NA	R09S2236	CSL	U	U	0.744	U	U	--	--	--	--	601
BD17	46-50	B-G	12/22/87	0.3 0.7	NA	R09S2241	CSL	U	U	0.372	U	U	--	--	--	--	603
BD17	52-56	B-G	12/22/87	0.3 3.3	NA	R09S2243	CSL	0.238	U	1.302	U	U	--	--	--	--	605
BD17	58-62	B-G	12/22/87	0.8 99	NA	R09S2245	CSL	--	--	--	--	--	--	--	--	--	607
BD17	65-69	B-G	12/23/87	0.7 200	NA	R09S2248	CSL	8.235	U	18.228	U	9.324	--	--	--	--	660
BD17	75-79	B-G	12/23/87	0.5 220	NA	R09S2252	CSL	30.378	U	71.610	U	3.552	--	--	--	--	664
BD17	85-89	B-G	12/23/87	0.7 192	NA	R09S2255	CSL	34.587	U	86.118	U	5.920	--	--	--	--	667
BD17	FLD-BLK	B-G	12/22/87	0.9 M	NA	R09S2224	CSL	0.348	U	5.394	U	0.755	--	--	--	--	592
BD17	FLD-BLK	B-G	12/23/87	0.7 M	NA	R09S2249	CSL	0.256	U	2.046	U	U	--	--	--	--	661
BD18	5-9	B-G	01/11/88	1.6 2.8	NA	R09S2258	CSL	U	U	0.465	U	U	--	--	--	--	635
BD18	11-15	B-G	01/11/88	0.8 1.8	NA	R09S2260	CSL	U	U	0.372	U	U	--	--	--	--	637
BD18	17-21	B-G	01/12/88	0.9 0.4	NA	R09S2263	CSL	U	U	0.186	U	U	--	--	--	--	651
BD18	23-27	B-G	01/12/88	0.6 1.1	NA	R09S2265	CSL	U	U	0.260	U	U	--	--	--	--	643
BD18	29-33	B-G	01/12/88	1.2 1.1	NA	R09S2267	CSL	U	U	U	U	U	--	--	--	--	645
BD18	35-39	B-G	01/12/88	0.9 1.3	NA	R09S2270	CSL	U	U	U	U	U	--	--	--	--	648
BD18	41-45	B-G	01/13/88	0.3 0.5	NA	R09S2273	CSL	U	U	U	U	U	--	--	--	--	637
BD18	47-51	B-G	01/13/88	0.5 0.8	NA	R09S2276	CSL	U	U	0.186	U	U	--	--	--	--	641
BD18	57-61	B-G	01/14/88	1.2 14.4	NA	R09S2282	CSL	0.293	0.318	0.372	U	U	--	--	--	--	621
BD18	65-69	B-G	01/14/88	2.3 153	NA	R09S2285	CSL	0.366	U	1.860	U	U	--	--	--	--	625
BD18	75-79	B-G	01/14/88	0.8 126	NA	R09S2288	CSL	0.366	U	2.046	U	U	--	--	--	--	629

Borehole Soil Gas Data
SECOND STREET SUBSITE

(gchem9.frm, Sample.dbf, Analyses.dbf)

Location	Depth	Act & Typ	Sample Date	HNU Back Samp	Fld Mois (%)	Sample Tag Number	Lab	TCA (ppmv)	CT (ppmv)	TCE (ppmv)	EDB (ppmv)	PCE (ppmv)	BZ (ppmv)	VC (ppmv)	CF (ppmv)	DCE (ppmv)	Record Number
B018	85-89	B-C	01/14/88	1.1 108	NA	R09S2291	CSL	0.549	U	2.976	U	U	--	--	--	--	668
B018	FLD-BLK	B-C	01/13/88	0.6 0.6	NA	R09S2272	CSL	U	U	U	U	U	--	--	--	--	636
B018	FLD-BLK	B-C	01/14/88	1.3 1.2	NA	R09S2281	CSL	0.659	0.731	3.906	0.143	0.207	--	--	--	--	638
B018	FLD-BLK	B-C	01/12/88	0.6 3.4	NA	R09S2262	CSL	U	U	0.372	U	U	--	--	--	--	650
B018	FLD-BLK	B-C	01/11/88	1.0 1.6	NA	R09S2257	CSL	U	U	1.525	U	U	--	--	--	--	654
B023	7-11	B-C	03/14/88	0.4 0.4	NA	R09S2804	CSL	U	2.544	U	U	U	U	--	--	--	1672
B023	23-27	B-C	03/15/88	0.2 420	NA	R09S2841	CSL	U	0.398	U	U	U	21.284	--	--	--	1681
B023	29-33	B-C	03/15/88	70 600	NA	R09S2843	CSL	U	0.175	U	U	U	55.714	--	--	--	1683
B023	35-39	B-C	03/16/88	0.5 480	NA	R09S2845	CSL	U	U	U	U	U	14.085	--	--	--	1688
B023	41-45	B-C	03/16/88	4.4 350	NA	R09S2848	CSL	U	U	U	U	U	3.130	--	--	--	1693
B023	47-51	B-C	03/16/88	3.6 390	NA	R09S2850	CSL	U	U	U	U	U	U	--	--	--	1691
B023	53-57	B-C	03/16/88	4.0 560	NA	R09S2764	CSL	U	U	U	U	U	--	--	--	--	1695
B023	59-63	B-C	03/16/88	7.0 500	NA	R09S2767	CSL	U	U	U	U	U	76.685	--	--	--	1698
B023	FLD-BLK	B-C	03/15/88	0.2 0.2	NA	R09S2840	CSL	U	0.509	U	U	U	U	--	--	--	1680
B023	FLD-BLK	B-C	03/16/88	0.4 4	NA	R09S2846	CSL	U	U	U	U	U	U	--	--	--	1689
B025	5-9	B-C	03/10/88	0.4 0.6	NA	R09S2689	CSL	U	U	U	U	U	U	--	--	--	1457
B025	11-15	B-C	03/10/88	0.2 0.4	NA	R09S2691	CSL	U	U	U	U	U	U	--	--	--	1459
B025	17-21	B-C	03/10/88	0.2 0.6	NA	R09S2693	CSL	U	U	U	U	U	U	--	--	--	1461
B025	23-27	B-C	03/10/88	1.0 0.9	NA	R09S2695	CSL	--	--	--	--	--	--	--	--	--	1463
B025	29-33	B-C	03/10/88	1.0 0.5	NA	R09S2697	CSL	U	U	U	U	U	U	--	--	--	1465
B025	35-39	B-C	03/10/88	0.5 0.5	NA	R09S2699	CSL	U	U	U	U	U	U	--	--	--	1468
B025	41-45	B-C	03/10/88	0.3 0.8	NA	R09S2701	CSL	U	U	U	U	U	U	--	--	--	1470
B025	47-51	B-C	03/10/88	0.8 1.0	NA	R09S2703	CSL	U	U	U	U	U	U	--	--	--	1472
B025	53-57	B-C	03/10/88	0.9 0.9	NA	R09S2705	CSL	U	U	U	U	U	U	--	--	--	1474

Borehole Soil Gas Data
SECOND STREET SUBSITE

(gchem9.frm, Sample.dbf, Analyses.dbf)

Location	Depth	Act & Typ	Sample Date	HNU Back Samp	Fld Mois (%)	Sample Tag Number	Lab	TCA (ppmv)	CT (ppmv)	TCE (ppmv)	EDB (ppmv)	PCE (ppmv)	BZ (ppmv)	VC (ppmv)	CF (ppmv)	DCE (ppmv)	Record Number
BD25	59-63	B-C	03/11/88	0.4 1.7	NA	R09S2707	CSL	U	U	U	U	U	U	--	--	--	1476
BD25	65-69	B-C	03/11/88	0.4 0.4	NA	R09S2729	CSL	U	U	U	U	U	U	--	--	--	1479
BD25	75-79	B-C	03/11/88	0.5 3.2	NA	R09S2732	CSL	U	U	U	U	U	U	--	--	--	1482
BD25	85-89	B-C	03/11/88	6.0 65	NA	R09S2735	CSL	U	U	U	U	U	1.565	--	--	--	1485
BD25	95-99	B-C	03/11/88	0.8 52	NA	R09S2752	CSL	U	U	U	U	U	U	--	--	--	1488
BD25	115-119	B-C	03/12/88	0.3 0.7	NA	R09S2757	CSL	U	U	U	U	U	U	--	--	--	1573
BD25	FLD-BLK	B-C	03/10/88	1.0 1.0	NA	R09S2727	CSL	U	U	U	U	U	--	--	--	--	1462
BD27	5-9	B-C	03/21/88	1.0 1.2	NA	R09S2769	CSL	U	U	U	U	U	U	--	--	--	1700
BD27	11-15	B-C	03/21/88	0.2 0.6	NA	R09S2772	CSL	U	U	U	U	U	--	--	--	--	1703
BD27	17-21	B-C	03/21/88	0.2 0.4	NA	R09S2774	CSL	U	U	U	U	U	--	--	--	--	1705
BD27	23-27	B-C	03/21/88	0.0 0.2	NA	R09S2776	CSL	U	U	U	U	U	--	--	--	--	1707
BD27	29-33	B-C	03/21/88	0.4 0.8	NA	R09S2778	CSL	U	U	U	U	U	U	--	--	--	1709
BD27	35-39	B-C	03/21/88	0.4 0.8	NA	R09S2780	CSL	U	U	U	U	U	U	--	--	--	1711
BD27	41-45	B-C	03/21/88	0.3 1.6	NA	R09S2852	CSL	U	U	U	U	U	U	--	--	--	1714
BD27	47-51	B-C	03/21/88	0.2 2.1	NA	R09S2854	CSL	U	U	U	U	U	U	--	--	--	1716
BD27	53-57	B-C	03/22/88	0.2 0.9	NA	R09S2857	CSL	U	U	U	U	U	U	--	--	--	1721
BD27	59-63	B-C	03/22/88	0.4 1.8	NA	R09S2859	CSL	U	U	0.428	U	U	U	--	--	--	1723
BD27	65-69	B-C	03/22/88	0.4 3.2	NA	R09S2862	CSL	0.421	U	2.976	U	0.178	--	--	--	--	1727
BD27	75-79	B-C	03/22/88	0.8 3.7	NA	R09S2865	CSL	0.512	U	4.278	U	0.281	U	--	--	--	1729
BD27	85-89	B-C	03/22/88	0.4 4.9	NA	R09S2868	CSL	0.439	U	3.348	U	0.192	U	--	--	--	1733
BD27	95-99	B-C	03/22/88	0.0 0.4	NA	R09S2871	CSL	U	U	U	U	U	U	--	--	--	1736
BD27	105-109	B-C	03/22/88	0.2 0.8	NA	R09S2874	CSL	U	U	U	U	U	U	--	--	--	1739
BD27	115-119	B-C	03/23/88	0.3 5.9	NA	R09S2878	CSL	U	U	U	U	U	--	--	--	--	1773
BD27	FLD-BLK	B-C	03/21/88	0.0 0.2	NA	R09S2771	CSL	--	--	--	--	--	--	--	--	--	1702

Appendix 4

Soil Sample Results
Hastings Second Street Subsite
Hastings, Nebraska

B23

ANALYSIS TYPE: SEMIVOLATILES--PAGE 1

TITLE: HASTINGS
LAB: EMSMO
SAMPLE PREP: _____ ANALYST/ENTRY: DJH REVIEWER: _____
REVIEW LEVEL: 2

MATRIX: SEDIMENT
METHOD: CSC288A
DATA FILE : A3Z

UNITS: UG/KG
CASE: 13081
DATE: 12/20/89

SAMPLES	5-7' CSXS2001	11-13' CSXS2002	51-53' CSXS2003	17-19' CSXS2004
PHENOL	1900 U	2400 U	37000 U	110000 U
BIS(2-CHLOROETHYL) ETHER	1900 U	2400 U	37000 U	110000 U
2-CHLOROPHENOL	1900 U	2400 U	37000 U	110000 U
1,3 DICHLOROBENZENE	1900 U	2400 U	37000 U	110000 U
1,4 DICHLOROBENZENE	1900 U	2400 U	37000 U	110000 U
BENZYL ALCOHOL	1900 U	2400 U	37000 U	110000 U
1,2 DICHLOROBENZENE	1900 U	2400 U	37000 U	110000 U
2-METHYLPHENOL	1900 U	2400 U	37000 U	110000 U
BIS(2-CHLOROISOPROPYL)ETHER	1900 U	2400 U	37000 U	110000 U
4-METHYLPHENOL	1900 U	2400 U	37000 U	110000 U
N-NITROSO-DIPROPYLAMINE	1900 U	2400 U	37000 U	110000 U
HEXACHLOROETHANE	1900 U	2400 U	37000 U	110000 U
NITROBENZENE	1900 U	2400 U	37000 U	110000 U
ISOPHORONE	1900 U	2400 U	37000 U	110000 U
2-NITROPHENOL	1900 U	2400 U	37000 U	110000 U
2,4-DIMETHYLPHENOL	1900 U	2400 U	37000 U	110000 U
BENZOIC ACID	I	I	180000 U	510000 U
BIS(2-CHLOROETHOXY) METHANE	1900 U	2400 U	37000 U	110000 U
2,4 DICHLOROPHENOL	1900 U	2400 U	37000 U	110000 U
1,2,4-TRICHLOROBENZENE	1900 U	2400 U	37000 U	110000 U
NAPHTHALENE	1900 U	5300	430000	1500000
4-CHLOROANILINE	1900 U	2400 U	37000 U	110000 U
HEXACHLOROBUTADIENE	1900 U	2400 U	37000 U	110000 U
4-CHLORO-3-METHYLPHENOL	1900 U	2400 U	37000 U	110000 U
2-METHYLNAPHTHALENE	1900 U	2900	550000	1700000
HEXACHLOROCYCLOPENTADIENE	1900 U	2400 U	37000 U	110000 U
2,4,6-TRICHLOROPHENOL	1900 U	2400 U	37000 U	110000 U
2,4,5-TRICHLOROPHENOL	9300 U	11000 U	180000 U	510000 U
2-CHLORONAPHTHALENE	1900 U	2400 U	37000 U	110000 U
2-NITROANILINE	9300 U	11000 U	180000 U	510000 U
DIMETHYLPHTHALATE	1900 U	2400 U	37000 U	110000 U
ACENAPHTHYLENE	1900 U	1100 J	77000	250000
3-NITROANILINE	I	I	I	I
ACENAPHTHENE	1900 U	530 J	21000	61000 J
2,4-DINITROPHENOL	9300 U	11000 U	180000 U	510000 U
4-NITROPHENOL	9300 U	11000 U	180000 U	510000 U
DIBENZOFURAN	1900 U	510 J	24000	67000 J
2,4-DINITROTOLUENE	1900 U	2400 U	37000 U	3900 J

B23

ANALYSIS TYPE: SEMIVOLATILES--PAGE 2

TITLE: HASTINGS
LAB: EMSMO
SAMPLE PREP: _____ ANALYST/ENTRY: DJH
REVIEW LEVEL: 2

MATRIX:
METHOD: CS0288A
REVIEWER: _____
DATA FILE : B3Z

UNITS: UG/KG
CASE: 13081
DATE: 12/21/89

SAMPLES	5-7 CSXS2001	11-13 CSXS2002	51-53 CSXS2003	17- CSXS2004
2,6-DINITROTOLUENE	1900 U	2400 U	37000 U	7500 J
DIETHYLPHTHALATE	1900 U	2400 U	37000 U	110000 U
4-CHLOROPHENYL PHENYL ETHER	1900 U	2400 U	37000 U	110000 U
FLUORENE	1900 U	3100	69000	160000
4-NITROANILINE	9300 U	11000 U	180000 U	510000 U
4,6-DINITRO-2-METHYLPHENOL	9300 U	11000 U	180000 U	510000 U
N-NITROSODIPHENYLAMINE	1900 U	2400 U	37000 U	17000 J
4-BROMOPHENYL PHENYL ETHER	1900 U	2400 U	37000 U	110000 U
HEXACHLOROBENZENE	1900 U	2400 U	37000 U	110000 U
PENTACHLOROPHENOL	9300 U	11000 U	180000 U	510000 U
PHENANTHRENE	260 J	18000	200000	490000
ANTHRACENE	1900 U	1200 J	26000 J	84000 J
DI-N-BUTYLPHTHALATE	1900 U	2400 U	37000 U	110000 U
FLUORANTHENE	240 J	11000	22000 J	53000 J
PYRENE	230 J	17000	35000 J	73000 J
BUTYL BENZYL PHTHALATE	1900 U	2400 U	37000 U	110000 U
3,3' DICHLOROBENZIDINE	3900 U	4700 U	74000 U	210000 U
BENZO(A)ANTHRACENE	1900 U	4600	13000 J	32000 J
BIS(2-ETHYLHEXYL)PHTHALATE	470 J	630 J	4500 J	110000 U
CHRYSENE	1900 U	6800	11000 J	26000 J
DI-N-OCTYL PHTHALATE	1900 U	2400 U	37000 U	110000 U
BENZO(B)FLUORANTHENE	1900 U	4000	3400 J	7100 J
BENZO(K)FLUORANTHENE	1900 U	3500	3400 J	9800 J
BENZO(A)PYRENE	1900 U	1700 J	5800 J	15000 J
INDENO(1,2,3-CD)PYRENE	1900 U	1600 J	1900 J	2600 J
DIBENZO(A,H)ANTHRACENE	1900 U	850 J	37000 U	110000 U
BENZO(G,H,I)PERYLENE	1900 U	1800 J	1700 J	3500 J

ANALYSIS REQUEST REPORT — VALIDATED DATA

FOR ACTIVITY: CS7S2

S P F D — 01/20/93 16:17:31 — ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 93 ACTIVITY: CS7S2 DESCRIPTION: HASTINGS-SECOND STREET SITE LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 2/ 5/93. REPORT DUE DATE IS 2/ 1/93.

INSPECTION DATE: 12/ 3/92 ALL SAMPLES RECEIVED DATE: 12/07/92

ALL DATA APPROVED BY LABO DATE: 01/13/93 FINAL REPORT TRANSMITTED DATE: 01/20/93

EXPECTED LABO TURNAROUND TIME IS 60 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 37 DAYS ACTUAL REPORT TURNAROUND TIME IS 48 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE STATUS	#	CITY	STATE	AIRS/ STORET LOC NO	LAY-SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		S	B2 7'		1	HASTINGS	NEBRASKA				12/02/92	11:20	/ /	:
002		S	B2 17'		1	HASTINGS	NEBRASKA				12/02/92	11:50	/ /	:
003		S	B2 27'		1	HASTINGS	NEBRASKA				12/02/92	12:25	/ /	:
004		S	B2 34'		1	HASTINGS	NEBRASKA				12/02/92	13:45	/ /	:
005		S	B2 47'		1	HASTINGS	NEBRASKA				12/02/92	14:20	/ /	:
006		S	B2 57'		1	HASTINGS	NEBRASKA				12/02/92	15:00	/ /	:
007		S	B2 67'		1	HASTINGS	NEBRASKA				12/02/92	15:40	/ /	:
008		S	B2 77'		1	HASTINGS	NEBRASKA				12/02/92	16:25	/ /	:
009		S	B2 87'		1	HASTINGS	NEBRASKA				12/03/92	09:50	/ /	:
010		S	B2 97'		1	HASTINGS	NEBRASKA				12/03/92	10:20	/ /	:
011		S	B2 107'		1	HASTINGS	NEBRASKA				12/03/92	11:10	/ /	:
012		S	B2 117'		1	HASTINGS	NEBRASKA				12/03/92	11:45	/ /	:
013		S	B2 127'		1	HASTINGS	NEBRASKA				12/03/92	12:50	/ /	:
014		S	B1 7'		1	HASTINGS	NEBRASKA				12/05/92	11:25	/ /	:
015		S	B1-20'		1	HASTINGS	NEBRASKA				12/05/92	12:00	/ /	:
016		S	B1-30'		1	HASTINGS	NEBRASKA				12/05/92	13:10	/ /	:
017		S	B1-40'		1	HASTINGS	NEBRASKA				12/05/92	13:40	/ /	:
018		S	B1-50'		1	HASTINGS	NEBRASKA				12/05/92	14:20	/ /	:
019		S	B1-60'		1	HASTINGS	NEBRASKA				12/05/92	14:55	/ /	:
020		S	B1-70'		1	HASTINGS	NEBRASKA				12/05/92	15:25	/ /	:
021		S	B1-80'		1	HASTINGS	NEBRASKA				12/05/92	09:30	/ /	:
022		S	B1-90'		1	HASTINGS	NEBRASKA				12/05/92	10:00	/ /	:
023		S	B1-100'		1	HASTINGS	NEBRASKA				12/06/92	10:30	/ /	:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE STATUS	#	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
024		S	B1-110'	1		HASTINGS	NEBRASKA				12/06/92	11:00	/ /	
025		S	B1-120'	1		HASTINGS	NEBRASKA				12/06/92	11:35	/ /	
026		S	B1-127'	1		HASTINGS	NEBRASKA				12/06/92	12:20	/ /	
027		S	B3-10'	1		HASTINGS	NEBRASKA				12/08/92	09:25	/ /	
028		S	B3-25'	1		HASTINGS	NEBRASKA				12/08/92	11:00	/ /	
029		S	B3-35'	1		HASTINGS	NEBRASKA				12/08/92	11:30	/ /	
030		S	B3-45'	1		HASTINGS	NEBRASKA				12/08/92	12:00	/ /	
031		S	B3-55'	1		HASTINGS	NEBRASKA				12/09/92	11:25	/ /	
032		S	B3-65'	1		HASTINGS	NEBRASKA				12/09/92	11:50	/ /	
032	D	S	B3-65' DUPLICATE	1		HASTINGS	NEBRASKA				12/09/92	11:50	/ /	
033		S	B3-75'	1		HASTINGS	NEBRASKA				12/09/92	12:20	/ /	
034		S	B3-85'	1		HASTINGS	NEBRASKA				12/07/92	13:00	/ /	
035		S	B3-95'	1		HASTINGS	NEBRASKA				12/09/92	13:15	/ /	
036		S	B3-105'	1		HASTINGS	NEBRASKA				12/09/92	13:50	/ /	
037		S	B2 87'	1		HASTINGS	NEBRASKA				12/03/92	09:50	/ /	
038		S	B1-20'	1		HASTINGS	NEBRASKA				12/05/92	12:00	/ /	
039		S	B3-10'	1		HASTINGS	NEBRASKA				12/08/92	09:25	/ /	
040	D	S	B2 87'	1		HASTINGS	NEBRASKA				12/08/92	09:50	/ /	
041	F	W		1			NEBRASKA				/ / :		/ /	
041	F	W	TRIP BLANK	1		HASTINGS	NEBRASKA				12/03/92	17:25	/ /	
042	F	W	EQUIPMENT RINSATE	1		HASTINGS	NEBRASKA				12/08/92	11:05	/ /	
043	F	W		1			NEBRASKA				/ / :		/ /	
043	F	W	EQUIPMENT RINSATE	1		HASTINGS	NEBRASKA				12/06/92	10:15	/ /	
044	D	S	B1-80'	1		HASTINGS	NEBRASKA				12/06/92	09:30	/ /	
045	F	S	TRIP BLANK	1		HASTINGS	NEBRASKA				12/08/92	16:30	/ /	
046	F	S	TRIP BLANK	1		HASTINGS	NEBRASKA				12/09/92	10:00	/ /	
047	F	W	EQUIPMENT RINSATE	1		HASTINGS	NEBRASKA				12/09/92	12:40	/ /	
047	F	W	EQUIPMENT BLANK	1		HASTINGS	NEBRASKA				12/09/92	12:40	/ /	
048		S	B3-115'	1		HASTINGS	NEBRASKA				12/09/92	14:00	/ /	
049		S	B3-125'	1		HASTINGS	NEBRASKA				12/09/92	14:30	/ /	

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- A = TRUE VALUE FOR CALIBRATION STANDARD
- B = CONCENTRATION RESULTING FROM DUPLICATE LAB SPIKE
- C = MEASURED VALUE FOR CALIBRATION STANDARD
- D = MEASURED VALUE FOR FILED DUPLICATE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CONCENTRATION RESULTING FROM DUPLICATE FIELD SPIKE
- L = MEASURED VALUE FOR LAB DUPLICATE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED VALUE FOR DUPLICATE FIELD SPIKE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED VALUE FOR LAB SPIKE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED VALUE FOR DUPLICATE LAB SPIKE
- Y = MEASURED VALUE FOR FIELD SPIKE
- Z = CONCENTRATION RESULTING FROM FIELD SPIKE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR
- H = OTHER (DOES NOT FIT ANY OTHER CATEGORY)
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION IDENTIFICATION NUMBER FOR EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES:
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPCIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS752 VALIDATED DATA

COMPOUND	UNITS	001		002		003		004		005	
SG07 SOLIDS, PERCENT	%	80.5		79.3		81.5		81.6		85.8	
SS01 PHENOL, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS02 CARBAZOLE	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS04 CHLOROPHENOL, 2-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS06 DICHLOROBENZENE,1,4-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS07 BENZYL ALCOHOL	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS12 N-NITROSODIPROPYLAMINE	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS13 HEXACHLOROETHANE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS14 NITROBENZENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS15 ISOPHORONE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS16 NITROPHENOL,2-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS18 BENZOIC ACID, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS20 DICHLOROPHENOL, 2,4-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS22 NAPHTHALENE, BY GC/MS	UG/KG	5400		66000		37000		910000		240000	
SS23 CHLOROANILINE,4-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS25 PHENOL,4-CHLORO-3-METHYL	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	001		002		003		004		005	
SS26 METHYLNAPHTHALENE, 2-	UG/KG	14000		78000		51000		500000		150000	
SS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS28 TRICHLOROPHENOL,2,4,6	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS29 TRICHLOROPHENOL,2,4,5	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS30 CHLORONAPHTHALENE, 2-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS31 NITROANILINE,2-	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS33 ACENAPHTHYLENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	200000		72000	
SS34 NITROANILINE,3-	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS35 ACENAPHTHENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS36 DINITROPHENOL,2,4, BY GC/MS	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS37 NITROPHENOL,4-	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS38 DIBENZOFURAN	UG/KG	2100	U	10000	U	8000	U	120000		37000	U
SS39 DINITROTOLUENE,2,4, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS40 DINITROTOLUENE,2,6-	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS41 PHTHALATE, DIETHYL, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS43 FLUORENE, GC/MS	UG/KG	2100	U	10000	U	8400		160000		51000	
SS44 NITROANILINE,4-	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS45 PHENOL,4,6-DINITRO-2-METHYL	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS47 ETHER, 4-BROMOPHENYL PHENYL	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS48 HEXACHLOROBENZENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS49 PENTACHLOROPHENOL, BY GC/MS	UG/KG	5100	U	25000	U	19000	U	180000	U	90000	U
SS50 PHENANTHRENE, BY GC/MS	UG/KG	4700		42000		19000		500000		150000	
SS51 ANTHRACENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	200000		51000	

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	001		002		003		004		005	
SS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS53 FLUORANTHENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	250000		54000	
SS54 PYRENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	220000		65000	
SS55 PHTHALATE, BUTYL BENZYL	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS56 DICHLOROBENZIDINE, 3,3'	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	92000		37000	U
SS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS59 CHRYSENE, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	93000		37000	U
SS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	96000		37000	U
SS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS63 PYRENE, BENZO(A), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS64 PYRENE, INDENO(1,2,3-CD)	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/KG	2100	U	10000	U	8000	U	75000	U	37000	U
SV03 CHLOROMETHANE, BY GC/MS	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV04 BROMOMETHANE, BY GC/MS	UG/KG	1130	U	1260	U	876	U	15300	U	777	U
SV05 VINYL CHLORIDE, BY GC/MS	UG/KG	847	U	946	U	657	U	11500	U	583	U
SV06 CHLOROETHANE, BY GC/MS	UG/KG	847	U	946	U	657	U	11500	U	583	U
SV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV08 DICHLOROETHYLENE,1,1, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV09 DICHLOROETHANE,1,1, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV10 DICHLOROETHYLENE,TRANS-1,2	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV11 CHLOROFORM, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV12 DICHLOROETHANE,1,2, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	001		002		003		004		005	
SV14 CARBON TETRACHLORIDE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV15 BROMODICHLOROMETHANE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV17 BENZENE, BY GC/MS	UG/KG	4690		2040		2480		91600		3240	
SV18 DICHLOROPROPYLENE,TRANS-1,3	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV19 TRICHLOROETHYLENE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV24 BROMOFORM, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV25 TETRACHLOROETHYLENE, BY GC/MS	UG/KG	282	U	315	U	401		11800		194	U
SV26 TOLUENE, BY GC/MS	UG/KG	3320		7340		4380		200000		4400	
SV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV28 CHLOROBENZENE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV29 ETHYL BENZENE, BY GC/MS	UG/KG	8460		6610		6240		21800		2990	
SV30 ACETONE, BY GC/MS	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV31 CARBON DISULFIDE, BY GC/MS	UG/KG	282	U	315	U	219	U	3820	U	194	U
SV32 METHYL ETHYL KETONE	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV34 HEXANONE, 2-	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV35 4-METHYL-2-PENTANONE	UG/KG	565	U	631	U	438	U	7640	U	389	U
SV36 STYRENE, BY GC/MS	UG/KG	644		315	U	219	U	43800		8200	
SV37 XYLENES, TOTAL, BY GC/MS	UG/KG	8600		10600		8180		299000		17900	
SV44 DICHLOROBENZENE,1,4-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV49 XYLENE, ORTHO	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV57 XYLENE, M AND/OR P	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV60 DICHLOROBENZENE, 1, 3-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	001	002	003	004	005
SV61 DICHLOROBENZENE, 1, 2-	UG/KG	NA O	NA O	NA O	NA O	NA O
ZZ01 SAMPLE NUMBER	NA	001	002	003	004	005
ZZ02 ACTIVITY CODE	NA	CS7S2	CS7S2	CS7S2	CS7S2	CS7S2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		03	03	03	03	03

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	011		012		013		014		015	
SG07 SOLIDS, PERCENT	%	88.0		94.6		77.0		82.6		81.7	
SS01 PHENOL, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS02 CARBAZOLE	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS04 CHLOROPHENOL, 2-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS06 DICHLOROBENZENE,1,4-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS07 BENZYL ALCOHOL	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS12 N-NITROSODIPROPYLAMINE	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS13 HEXACHLOROETHANE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS14 NITROBENZENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS15 ISOPHORONE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS16 NITROPHENOL,2-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS18 BENZOIC ACID, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS20 DICHLOROPHENOL, 2,4-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS22 NAPHTHALENE, BY GC/MS	UG/KG	1900000		2300000		560000		320000		2200000	
SS23 CHLOROANILINE,4-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS25 PHENOL,4-CHLORO-3-METHYL	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	011		012		013		014		015	
SS26 METHYLNAPHTHALENE, 2-	UG/KG	780000		1100000		350000		580000		2100000	
SS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS28 TRICHLOROPHENOL,2,4,6	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS29 TRICHLOROPHENOL,2,4,5	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS30 CHLORONAPHTHALENE, 2-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS31 NITROANILINE,2-	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS33 ACENAPHTHYLENE, BY GC/MS	UG/KG	570000		770000		260000		130000		230000	
SS34 NITROANILINE,3-	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS35 ACENAPHTHENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS36 DINITROPHENOL,2,4, BY GC/MS	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS37 NITROPHENOL,4-	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS38 DIBENZOFURAN	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS39 DINITROTOLUENE,2,4, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS40 DINITROTOLUENE,2,6-	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS41 PHTHALATE, DIETHYL, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS43 FLUORENE, GC/MS	UG/KG	270000		420000		150000		94000	U	270000	
SS44 NITROANILINE,4-	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS45 PHENOL,4,6-DINITRO-2-METHYL	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS47 ETHER, 4-BROMOPHENYL PHENYL	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS48 HEXACHLOROBENZENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS49 PENTACHLOROPHENOL, BY GC/MS	UG/KG	460000	U	450000	U	220000	U	230000	U	460000	U
SS50 PHENANTHRENE, BY GC/MS	UG/KG	750000		1100000		410000		270000		740000	
SS51 ANTHRACENE, BY GC/MS	UG/KG	260000		560000		130000		94000	U	190000	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	011		012		013		014		015	
SS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS53 FLUORANTHENE, BY GC/MS	UG/KG	220000		410000		150000		130000		190000	U
SS54 PYRENE, BY GC/MS	UG/KG	470000		540000		230000		380000		240000	
SS55 PHTHALATE, BUTYL BENZYL	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS56 DICHLOROBENZIDINE, 3,3'	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	100000		190000	U
SS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS59 CHRYSENE, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	140000		190000	U
SS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	310000		190000	U
SS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	300000		190000	U
SS63 PYRENE, BENZO(A), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS64 PYRENE, INDENO(1,2,3-CD)	UG/KG	190000	U	190000	U	91000	U	140000		190000	U
SS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	94000	U	190000	U
SS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/KG	190000	U	190000	U	91000	U	170000		190000	U
SV03 CHLOROMETHANE, BY GC/MS	UG/KG	5410	U	8320	U	309	U	36.7	U	13200	U
SV04 BROMOMETHANE, BY GC/MS	UG/KG	10800	U	16600	U	618	U	73.4	U	26300	U
SV05 VINYL CHLORIDE, BY GC/MS	UG/KG	8110	U	12500	U	464	U	55.0	U	19700	U
SV06 CHLOROETHANE, BY GC/MS	UG/KG	8110	U	12500	U	464	U	55.0	U	19700	U
SV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/KG	5410	U	8980	U	309	U	36.7	U	17300	U
SV08 DICHLOROETHYLENE,1,1, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV09 DICHLOROETHANE,1,1, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV10 DICHLOROETHYLENE,TRANS-1,2	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV11 CHLOROFORM, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV12 DICHLOROETHANE,1,2, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	011		012		013		014		015	
SV14 CARBON TETRACHLORIDE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV15 BROMODICHLOROMETHANE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV17 BENZENE, BY GC/MS	UG/KG	58600		227000		5830		39.4		90600	
SV18 DICHLOROPROPYLENE,TRANS-1,3	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV19 TRICHLOROETHYLENE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV24 BROMOFORM, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV25 TETRACHLOROETHYLENE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV26 TOLUENE, BY GC/MS	UG/KG	170000		511000		5490		165		761000	
SV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV28 CHLOROBENZENE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV29 ETHYL BENZENE, BY GC/MS	UG/KG	15800		34600		1250		43.6		75700	
SV30 ACETONE, BY GC/MS	UG/KG	5410	U	8320	U	1750		67.7		13200	U
SV31 CARBON DISULFIDE, BY GC/MS	UG/KG	2700	U	4160	U	155	U	18.3	U	6580	U
SV32 METHYL ETHYL KETONE	UG/KG	5410	U	8320	U	309	U	36.7	U	13200	U
SV34 HEXANONE, 2-	UG/KG	5410	U	8320	U	309	U	36.7	U	13200	U
SV35 4-METHYL-2-PENTANONE	UG/KG	5410	U	8320	U	309	U	36.7	U	13200	U
SV36 STYRENE, BY GC/MS	UG/KG	221000		457000		22900		187		406000	
SV37 XYLENES, TOTAL, BY GC/MS	UG/KG	183000		455000		32600		477		961000	
SV44 DICHLOROBENZENE,1,4-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV49 XYLENE, ORTHO	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV57 XYLENE, M AND/OR P	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV60 DICHLOROBENZENE, 1, 3-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	011	012	013	014	015
SV61 DICHLOROBENZENE, 1, 2-	UG/KG	NA O	NA O	NA O	NA O	NA O
ZZ01 SAMPLE NUMBER	NA	011	012	013	014	015
ZZ02 ACTIVITY CODE	NA	CS7S2	CS7S2	CS7S2	CS7S2	CS7S2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		03	03	03	03	03

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029		030	
SG07 SOLIDS, PERCENT	%	91.1		79.8		81.6		85.3		58.1	
SS01 PHENOL, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS02 CARBAZOLE	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS04 CHLOROPHENOL, 2-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS06 DICHLOROBENZENE,1,4-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS07 BENZYL ALCOHOL	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS12 N-NITROSODIPROPYLAMINE	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS13 HEXACHLOROETHANE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS14 NITROBENZENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS15 ISOPHORONE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS16 NITROPHENOL,2-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS18 BENZOIC ACID, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS20 DICHLOROPHENOL, 2,4-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS22 NAPHTHALENE, BY GC/MS	UG/KG	370	U	2200	U	5700		380	U	390	U
SS23 CHLOROANILINE,4-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS25 PHENOL,4-CHLORO-3-METHYL	UG/KG	370	U	2200	U	1900	U	380	U	390	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029		030	
SS26 METHYLNAPHTHALENE, 2-	UG/KG	370	U	2200	U	4800		380	U	390	U
SS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS28 TRICHLOROPHENOL,2,4,6	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS29 TRICHLOROPHENOL,2,4,5	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS30 CHLORONAPHTHALENE, 2-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS31 NITROANILINE,2-	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS33 ACENAPHTHYLENE, BY GC/MS	UG/KG	370	U	2200	U	2200		380	U	390	U
SS34 NITROANILINE,3-	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS35 ACENAPHTHENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS36 DINITROPHENOL,2,4, BY GC/MS	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS37 NITROPHENOL,4-	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS38 DIBENZOFURAN	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS39 DINITROTOLUENE,2,4, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS40 DINITROTOLUENE,2,6-	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS41 PHTHALATE, DIETHYL, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS43 FLUORENE, GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS44 NITROANILINE,4-	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS45 PHENOL,4,6-DINITRO-2-METHYL	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS47 ETHER, 4-BROMOPHENYL PHENYL	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS48 HEXACHLOROBENZENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS49 PENTACHLOROPHENOL, BY GC/MS	UG/KG	900	U	5400	U	4700	U	910	U	940	U
SS50 PHENANTHRENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS51 ANTHRACENE, BY GC/MS	UG/KG	370	U	2600		3600		380	U	390	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029		030	
SS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS53 FLUORANTHENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS54 PYRENE, BY GC/MS	UG/KG	370	U	3000		1900	U	380	U	390	U
SS55 PHTHALATE, BUTYL BENZYL	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS56 DICHLOROBENZIDINE, 3,3'	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS59 CHRYSENE, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS63 PYRENE, BENZO(A), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS64 PYRENE, INDENO(1,2,3-CD)	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/KG	370	U	2200	U	1900	U	380	U	390	U
SV03 CHLOROMETHANE, BY GC/MS	UG/KG	11.2	U	15.8	U	37.4	U	12.0	U	42.8	U
SV04 BROMOMETHANE, BY GC/MS	UG/KG	22.3	U	31.6	U	74.7	U	24.1	U	85.6	U
SV05 VINYL CHLORIDE, BY GC/MS	UG/KG	16.7	U	23.7	U	56.0	U	18.1	U	64.2	U
SV06 CHLOROETHANE, BY GC/MS	UG/KG	16.7	U	23.7	U	56.0	U	18.1	U	64.2	U
SV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/KG	11.4	U	15.8	U	37.4	U	12.0	U	42.8	U
SV08 DICHLOROETHYLENE,1,1, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV09 DICHLOROETHANE,1,1, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV10 DICHLOROETHYLENE,TRANS-1,2	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV11 CHLOROFORM, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV12 DICHLOROETHANE,1,2, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029		030	
SV14 CARBON TETRACHLORIDE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV15 BROMODICHLOROMETHANE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV17 BENZENE, BY GC/MS	UG/KG	5.6	U	7.9	U	148		20.2		226	
SV18 DICHLOROPROPYLENE,TRANS-1,3	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV19 TRICHLOROETHYLENE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV24 BROMOFORM, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV25 TETRACHLOROETHYLENE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	158	
SV26 TOLUENE, BY GC/MS	UG/KG	5.6	U	7.9	U	350		10.1		44.8	
SV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV28 CHLOROBENZENE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV29 ETHYL BENZENE, BY GC/MS	UG/KG	5.6	U	7.9	U	154		6.0	U	21.4	U
SV30 ACETONE, BY GC/MS	UG/KG	11.2	U	37.7		134	U	66.1		90.3	
SV31 CARBON DISULFIDE, BY GC/MS	UG/KG	5.6	U	7.9	U	18.7	U	6.0	U	21.4	U
SV32 METHYL ETHYL KETONE	UG/KG	11.2	U	15.8	U	37.4	U	12.0	U	42.8	U
SV34 HEXANONE, 2-	UG/KG	11.2	U	15.8	U	37.4	U	12.0	U	42.8	U
SV35 4-METHYL-2-PENTANONE	UG/KG	11.2	U	15.8	U	37.4	U	12.0	U	42.8	U
SV36 STYRENE, BY GC/MS	UG/KG	5.6	U	7.9	U	670		6.0	U	21.4	U
SV37 XYLENES, TOTAL, BY GC/MS	UG/KG	5.6	U	13.9		970		10.9		59.7	
SV44 DICHLOROBENZENE,1,4-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV49 XYLENE, ORTHO	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV57 XYLENE, M AND/OR P	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O
SV60 DICHLOROBENZENE, 1, 3-	UG/KG	NA	O	NA	O	NA	O	NA	O	NA	O

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS7S2 VALIDATED DATA

COMPOUND	UNITS	026	027	028	029	030
SV6J DICHLOROBENZENE, 1, 2-	UG/KG	NA 0	NA 0	NA 0	NA 0	NA 0
ZZ01 SAMPLE NUMBER	NA	026	027	028	029	030
ZZ02 ACTIVITY CODE	NA	CS7S2	CS7S2	CS7S2	CS7S2	CS7S2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		03	03	03	03	03

Appendix 5

Groundwater Sampling Results
Hastings Second Street Subsite
Hastings, Nebraska

Groundwater Results MW-9
PRC Environmental Management, Inc.

March 1988/May 1988/June 1988/September 1988/December 1988/March 1989

Hastings Second Street Subsite

VWL_r 05/11/90 09:42:41

HASTINGS GROUND WATER REPORT
VOLATILE ORGANIC SAMPLE RESULTS FOR WELL MW-9

Parameter	SAMPLE ID	R59S2012	N07S2049	N07S2052	N37S2022	N97S2007
	DATE SAMPLED	03/23/88	05/12/88	05/12/88	06/15/88	09/15/88
	SAMPLER	PRC	PRC	PRC	PRC	PRC
	SAMPLE DEPTH	135	130	140	135	135
Chloroform		340U	5.0U	4.0M	250.U	330U
1,2-Dichloroethane		340U	5.0U	5.0U	250.U	330U
Trichloroethene		340U	5.0U	1.0M	250.U	33U
Tetrachloroethene		340U	5.0U	5.0U	250.U	330U
Xylenes, total		2200	5600J	7600J	2200.	2800J
Styrene		4300	4400J	5800J	4600.	3200J
Benzene		9700	14000J	14000J	11000.	8700J
Ethyl Benzene		250M	660J	470J	500.	250M
2-Hexanone		670U	10U	10U	500.U	57M
Toluene		9300	13000J	15000J	11000J	9200J

HASTINGS GROUND WATER REPORT
VOLATILE ORGANIC SAMPLE RESULTS FOR WELL MW-9

Parameter	SAMPLE ID	NA7S2020	NA7S2021	NA7S2022	NM7S2016
	DATE SAMPLED	12/15/88	12/15/88	12/15/88	03/15/89
	SAMPLER	PRC	PRC	PRC	PRC
	SAMPLE DEPTH	140	135	130	135
Chloroform		5.0U	5.0U	5.0U	1000U
1,2-Dichloroethane		6.0	4.0M	3.0M	1000U
Trichloroethene		19	16	19	1000U
Tetrachloroethene		2.0M	2.0M	2.0M	1000U
Xylenes, total		710	1300	1500	1400
Styrene		1200	2100	2700	1000U
Benzene		2600	4100	5300	7400
Ethyl Benzene		160	240	290	3200
2-Hexanone		10U	10U	10U	2000U
Toluene		2900	5200	6200	8200

Groundwater Results MW-9
Environmental Protection Agency

June 1989

Hastings Second Street Subsite

Hasher

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

Site: Hastings
ID #:
Break: 3.3
Other: 1989
12-22-89

DEC 22 1989

Mr. Mike Sullivan, Esq.
City of Hastings
220 N. Hastings
Hastings, Nebraska 68901

Dear Mr. Sullivan:

Re: Transmittal of June 1989 Data for EPA Monitoring Wells, State Observation Wells and Production Wells, Hastings, Nebraska

Enclosed are copies of the ground water data for the Hastings Ground Water Contamination site. The Environmental Protection Agency (EPA) monitoring wells were installed to characterize the five subsites named in this letter, and are identified with the prefix "MW". Monitoring wells are located at the five subsites as reflected by the enclosed index. The enclosed maps show the locations of these wells. We are also enclosing a copy of Table A, which explains the regulatory status of certain chemicals for drinking water.

EPA Monitoring Well Data

As discussed above, these data were collected from wells installed solely for the purpose of gathering data for determining the extent of contamination of ground water in the area; therefore, they are not supplying water for any other purpose. However, since they do represent the quality of ground water which exists in the location of the well, you should be aware the concentration of the following volatile organic compounds exceed criteria the EPA has established for public drinking water or other criteria established to protect public health.

For the Colorado Avenue Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,1,1, trichloroethane (TCA)

For the Second Street Subsite (MW-9)
benzene
ethyl benzene
toluene
xylenes
naphthalene
2-methylnaphthalene
acenaphthalene
fluorene
phenanthrene

For the North Landfill Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,2 dichloroethene
1,1,1-trichloroethane

For the FAR-MAR-CO Area

ethylene dibromide (EDB)
carbontetrachloride

For the Well Number 3 Area
carbon tetrachloride

Analytical data from the June 1989 ground water sampling are consistent with historical data.

Other Data

In addition, we are providing copies of laboratory data sheets for all other samples collected in June 1989. The enclosed data represent samples from the observation wells, production wells, Hastings' municipal wells and the CMS, Inc., supply wells. The respective well/system identification and EPA sample numbers are provided on the enclosed index sheets.

Your cooperation with EPA during this investigation is appreciated. If you have further questions, please contact Diane Easley, Environmental Scientist, at (913) 236-2857.

Sincerely yours,

Robert L. Morby
Chief, Superfund Branch
Waste Management Division

Enclosures

cc: Richard Schlenker, NDEC w/enclosures
Jack Daniel, NDOH w/enclosures

DATA REPORTING / QUALIFICATION CODES

U - The material was analyzed for, but was not detected. The associated numerical value is the sample detection limit.

J - The associated numerical value is an estimated quantity (explanation attached).

I - The data are invalid (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

N - Sample not analyzed.

CODES FOR FLASH POINT DATA

L - The sample did not ignite or "flash". This is the highest temperature at which the sample was tested. It is possible that the material may be ignitable at higher temperatures.

K - The sample did ignite or "flash" at the lowest temperature tested. This is usually the ambient temperature at the time of the test. It is possible that the material may be ignitable at even lower temperatures.

Index
EPA Monitoring Wells
June 1989

EPA Number	Well I.D. *		Depth (feet)	Analyses VOA	EDB	BNA
		Colorado Avenue Subsite				
S2001	MW-2		120-140	X		
-2002	MW-3		120-140	X		
-2003	MW-4		120-140	X		X
-2008	MW-32	(MW-9)	125-140	X		X
-2009	MW-33	(MW-10)	135	X		
-2010	MW-34	(MW-11)	135	X		
-2011		(MW-12)	140	X		X
		North Landfill				
-2004	MW-5		120-140	X		
-2005	MW-6		120-140	X		
-2006	MW-7		120-140	X		
-2012	DW-1		120-140	X	X	
-2016	MW-50	(MW 19)	135	X		
-2017	MW-54	(MW-21)	135	X		
-2018	MW-52	(MW 25)	135-140	X	X	

* Numbers shown in parentheses are field log I.D. Numbers.

ANALYSIS TYPE: VOLATILES

TITLE: HASTINGS
LAB: SWOK
SAMPLE PREP: _____ ANALYST/ENTRY: PMN
REVIEW LEVEL: 1

MATRIX: WATER
METHOD: 9303M02
REVIEWER: PMN
DATA FILE : N12

UNITS: UG/L
CASE: 12175
DATE: 09/07/89

SAMPLES	HSXS2008	HSXS2009	HSXS2010
CHLOROMETHANE	500 U	500 U	10 U
BROMOMETHANE	500 U	500 U	10 U
VINYL CHLORIDE	500 U	500 U	10 U
CHLOROETHANE	500 U	500 U	10 U
METHYLENE CHLORIDE	250 U	250 U	5.0 U
ACETONE	500 U	500 U	10 U
CARBON DISULFIDE	250 U	250 U	5.0 U
1,1 DICHLOROETHENE	250 U	82 J	5.0 U
1,1 DICHLOROETHANE	250 U	250 U	5.0 U
1,2,-DICHLOROETHENE (TOTAL)	250 U	250 U	5.0 U
CHLOROFORM	250 U	250 U	5.0 U
1,2,DICHLOROETHANE	250 U	250 U	5.0 U
2-BUTANONE	500 U	500 U	10 U
1,1,1 TRICHLOROETHANE	250 U	660	5.0 U
CARBON TETRACHLORIDE	250 U	250 U	5.0 U
VINYL ACETATE	500 U	500 U	10 U
BROMODICHLOROMETHANE	250 U	250 U	5.0 U
1,1,2,2,-TETRACHLOROETHANE	250 U	250 U	5.0 U
1,2-DICHLOROPROPANE	250 U	250 U	5.0 U
TRANS-1,3-DICHLOROPROPENE	250 U	250 U	5.0 U
TRICHLOROETHENE	430	8300	5.0 U
DIBROMOCHLOROMETHANE	250 U	250 U	5.0 U
1,1,2-TRICHLOROETHANE	250 U	250 U	5.0 U
BENZENE	7700	250 U	5.0 U
CIS-1,3-DICHLOROPROPENE	250 U	250 U	5.0 U
BROMOFORM	250 U	250 U	5.0 U
2-HEXANONE	500 U	500 U	10 U
4-METHYL-2-PENTANONE	500 U	500 U	10 U
TETRACHLOROETHENE	250 U	190 J	5.0 U
TOLUENE	7800	250 U	5.0 U
CHLOROBENZENE	250 U	250 U	5.0 U
ETHYL BENZENE	290	250 U	5.0
STYRENE	1900	250 U	5.0
TOTAL XYLENES	3000	250 U	5.0

MODIFIED DATA

Groundwater Results MW-9
Environmental Protection Agency

September 1989

Hastings Second Street Subsite

Yellow

Site: Hastings GW
ID #: NED982520046
Break: 2.3
Other: DT - HS152
1989

MAY 21 1990

Mr. Mike Sullivan, Esq.
City of Hastings
220 N. Hastings
Hastings, Nebraska 68901

Dear Mr. Sullivan:

Re: Transmittal of September 1989 Data for EPA Monitoring Wells, State Observation Wells and Production Wells, Hastings, Nebraska

Enclosed are copies of the ground water data for the Hastings Ground Water Contamination site. The Environmental Protection Agency (EPA) monitoring wells were installed to characterize the five subsites named in this letter, and are identified with the prefix "MW". Monitoring wells are located at the five subsites as reflected by the enclosed index. The enclosed maps show the locations of these wells. We are also enclosing a copy of Table A, which explains the regulatory status of certain chemicals for drinking water.

EPA Monitoring Well Data

As discussed above, these data were collected from wells installed solely for the purpose of gathering data for determining the extent of contamination of ground water in the area; therefore, they are not supplying water for any other purpose. However, since they do represent the quality of ground water which exists in the location of the well, you should be aware the concentration of the following volatile organic compounds exceed criteria the EPA has established for public drinking water or other criteria established to protect public health.

For the Colorado Avenue Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,1,1, trichloroethane (TCA)

WSTM:SPFD:REMD:Easley:du Easley Disk - Sept 4/26/90

REMD	REMD	WATR	CGL	SPFD
Easley	Wright			Morby
5/15/90	Wright 5/15/90	5/16/90	5/17/90	5/18

For the Second Street Subsite (MW-9)
benzene
toluene

For the North Landfill Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,2 dichloroethene
vinyl chloride

For the FAR-MAR-CO Area

ethylene dibromide (EDB)
carbon tetrachloride

For the Well Number 3 Area

carbon tetrachloride
trichloroethene

Analytical data from the September 1989 ground water sampling are consistent with historical data.

Other Data

In addition, we are providing copies of laboratory data sheets for all other samples collected in September 1989. The enclosed data represent samples from the observation wells, production wells, Hastings' municipal wells and the CMS, Inc., supply wells. The respective well/system identification and EPA sample numbers are provided on the enclosed index sheets.

Your cooperation with EPA during this investigation is appreciated. If you have further questions, please contact Diane Easley, Environmental Scientist, at (913) 551-7797.

Sincerely yours,

Robert L. Morby
Chief, Superfund Branch
Waste Management Division

Enclosures

cc: Richard Schlenker, NDEC w/enclosures
Jack Daniel, NDOH w/enclosures

Index, (Continued)
September 1989
EPA Monitoring Wells

EPA Number	Well I.D. *		Depth (Feet)	Analysis VOA	Analysis EDB
Colorado Avenue Subsite					
MS1S2077	MW-1		140	X	
-2001	MW-2		120-140	X	
-2002	MW-3		127	X	
-2003	MW-4		120-140	X	
-2022	MW-34	(MW-11)	133	X	
-2072		(MW-24)	215-220	X	
-2073		(MW-24)	195-200	X	
-2074		(MW-24)	180-185	X	
-2075		(MW-24)	155-160	X	
-2076		(MW-24)	135-140	X	
Second Avenue Subsite					
MS1S2015	MW-32	(MW-9)	126	X	
North Landfill Subsite					
MS1S2049	DW-1		135	X	X
-2012	MW-6		120-140	X	
-2013	MW-7		120-140	X	
-2041	MW-50	(MW-19)	135	X	
-2043	MW-54	(MW-21)	135	X	
-2045	MW-52	(MW-25)	135	X	X
-2062		(MW-26)	215-220	X	X
-2063		(MW-26)	195-200	X	X
-2064		(MW-26)	175-180	X	X
-2066		(MW-26)	155-160	X	X
-2065		(MW-26)	135-140	X	X
FAR-MAR-CO Subsite					
MS1S2014	MW-8		120-140	X	X
-2024	MW-82	(MW-14)	135	X	X
-2025	MW-84	(MW-15)	135	X	X
-2040	MW-85	(MW-16)	135	X	X
-2004	MW-83	(MW-18)	160-165	X	X
-2005	MW-83	(MW-18)	150-155	X	X
-2016		(MW-28)	215-220	X	X
-2017		(MW-28)	195-200	X	X
-2018		(MW-28)	155-160	X	X
-2019		(MW-28)	145-150	X	X
-2020		(MW-28)	122-127	X	X

DATA REPORTING / QUALIFICATION CODES

U - The material was analyzed for, but was not detected. The associated numerical value is the sample detection limit.

J - The associated numerical value is an estimated quantity (explanation attached).

I - The data are invalid (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

N - Sample not analyzed.

CODES FOR FLASH POINT DATA

L - The sample did not ignite or "flash". This is the highest temperature at which the sample was tested. It is possible that the material may be ignitable at higher temperatures.

K - The sample did ignite or "flash" at the lowest temperature tested. This is usually the ambient temperature at the time of the test. It is possible that the material may be ignitable at even lower temperatures.

ANALYSIS TYPE: VOLATILES

[redacted]TLE: HASTINGS
AB: EMS
SAMPLE PREP: _____ ANALYST/ENTRY: AAI
REVIEW LEVEL: 1

MATRIX: WATER
METHOD: 9303M02
REVIEWER: _____
DATA FILE : DRS

UNITS: UG/L
CASE: 12757
DATE: 03/22/90

SAMPLES	MS1S2013	MS1S2014	MS1S2015
CHLOROMETHANE	10 U	10 U	500 U
BROMOMETHANE	10 U	10 U	500 U
VINYL CHLORIDE	14	10 U	500 U
CHLOROETHANE	10 U	10 U	500 U
METHYLENE CHLORIDE	8.0 U	8.0 U	250 U
ACETONE	10 U	10 U	500 U
CARBON DISULFIDE	5.0 U	5.0 U	250 U
1,1 DICHLOROETHENE	8.0	5.0 U	250 U
1,1 DICHLOROETHANE	5.0 U	5.0 U	250 U
1,2,-DICHLOROETHENE (TOTAL)	190	5.0 U	250 U
CHLOROFORM	5.0 U	12	250 U
1,2,DICHLOROETHANE	5.0 U	5.0 U	250 U
2-BUTANONE	10 U	10 U	500 U
1,1,1 TRICHLOROETHANE	13	3.0 J	250 U
CARBON TETRACHLORIDE	5.0 U	1400	250 U
[illegible]YL ACETATE	10 U	10 U	500 U
[illegible]DICHLOROMETHANE	5.0 U	5.0 U	250 U
[illegible],2,2,-TETRACHLOROETHANE	5.0 U	5.0 U	250 U
[illegible]2-DICHLOROPROPANE	1.0 J	5.0 U	250 U
[illegible]RANS-1,3-DICHLOROPROPENE	5.0 U	5.0 U	250 U
TRICHLOROETHENE	260	14 U	250 U
DIBROMOCHLOROMETHANE	5.0 U	5.0 U	250 U
1,1,2-TRICHLOROETHANE	5.0 U	5.0 U	250 U
BENZENE	1.0 J	5.0 U	8200 J
CIS-1,3-DICHLOROPROPENE	5.0 U	5.0 U	250 U
BROMOFORM	5.0 U	5.0 U	250 U
2-HEXANONE	10 U	10 U	500 U
4-METHYL-2-PENTANONE	10 U	10 U	500 U
TETRACHLOROETHENE	5.0	5.0 U	250 U
TOLUENE	5.0 U	5.0 U	8800 J
CHLOROBENZENE	5.0 U	5.0 U	250 U
ETHYL BENZENE	5.0 U	5.0 U	150 J
STYRENE	5.0 U	5.0 U	3600 J
TOTAL XYLENES	5.0 U	5.0 U	2500 J

MODIFIED DATA

Groundwater Results MW-9
Environmental Protection Agency

December 1989

Hastings Second Street Subsite

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

JUN 25 1990

Mike Sullivan, Esq.
City of Hastings
216 N. Denver
Hastings, Nebraska 68901

Dear Mr. Sullivan:

Re: Transmittal of December 1989 Data for
EPA Monitoring Wells, State Observation Wells
and Production Wells, Hastings, Nebraska

Enclosed are copies of the ground water data for the Hastings Ground Water Contamination site. The Environmental Protection Agency (EPA) monitoring wells were installed to characterize the five subsites named in this letter, and are identified with the prefix "MW". Monitoring wells are located at the five subsites as reflected by the enclosed index. The enclosed maps show the locations of these wells. We are also enclosing a copy of Table A, which explains the regulatory status of certain chemicals for drinking water.

EPA Monitoring Well Data

As discussed above, these data were collected from wells installed solely for the purpose of gathering data for determining the extent of contamination of ground water in the area; therefore, they are not supplying water for any other purpose. However, since they do represent the quality of ground water which exists in the location of the well, you should be aware the concentration of the following volatile organic compounds exceed criteria the EPA has established for public drinking water or other criteria established to protect public health.

For the Colorado Avenue Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,1,1, trichloroethane (TCA)

For the Second Street Subsite (MW-9)

benzene
styrene
toluene

For the North Landfill Subsite

1,1 dichloroethene
trichloroethene (TCE)
tetrachloroethene (PCE)
1,2 dichloroethene
vinyl chloride

For the FAR-MAR-CO Area

ethylene dibromide (EDB)
carbon tetrachloride

For the Well Number 3 Area

carbon tetrachloride

Analytical data from the December 1989 ground water sampling are consistent with historical data.

Other Data

In addition, we are providing copies of laboratory data sheets for all other samples collected in December 1989. The enclosed data represent samples from the observation wells, production wells, Hastings' municipal wells and the CMS, Inc., supply wells. The respective well/system identification and EPA sample numbers are provided on the enclosed index sheets.

Your cooperation with EPA during this investigation is appreciated. If you have further questions, please contact Diane Easley, Environmental Scientist, at (913) 551-7797.

Sincerely yours,

Robert L. Morby
Chief, Superfund Branch
Waste Management Division

Enclosures

cc: Richard Schlenker, NDEC w/enclosures
Jack Daniel, NDOH w/enclosures

Index, (Continued)
December 1989
EPA Monitoring Wells

EPA Number	Well I.D. *		Depth (feet)	Analyses VOA	Analyses EDB
		Well Number 3			
CS2S2012	CW-1		135	X	
-2029		MW-23	200-195	X	
-2081		MW-23	200-195		X
-2030		MW-23	180-175	X	
-2082		MW-23	180-175		X
-2031		MW-23	160-155	X	
-2083		MW-23	160-155		X
-2032		MW-23	140-135	X	
-2084		MW-23	140-135		X
		Colorado Avenue Subsite			
CS2S2014	MW-2		120-140	X	
-2015	MW-3		135	X	
-2016	MW-4		120-140	X	
-2019	MW-33	(MW 10)	133	X	
-2021	MW-34	(MW 11)	135	X	
-2022		MW-12	140	X	
-2023		MW-13	180-175	X	
-2024		MW-13	160-155	X	
-2025		MW-22	200-195	X	
-2026		MW-22	180-175	X	
-2027		MW-22	160-155	X	
-2028		MW-22	140-135	X	
-2033		(MW-24)	215-220	X	
-2034		(MW-24)	180-185	X	
-2035		(MW-24)	155-160	X	
-2036		(MW-24)	135-140	X	
		Second Street			
CS2S2017	MW-32	(MW-9)	126	X	
		North Landfill			
-2051	MW-6		120-140	X	
-2052	MW-7		120-140	X	
-2039	MW-50	(MW 19)	135	X	
-2050		DW-1	120-149	X	
-2063		DW-1	120-149		X
-2040	MW-53	(MW-17)	175-180	X	
-2064	MW-53	(MW-17)	175-180		X
-2041	MW-53	(MW-17)	160-165	X	
-2042	MW-53	(MW-17)	150-155	X	

ANALYSIS TYPE: VOLATILES

TITLE: HASTINGS
LAB: EMS LABS
SAMPLE PREP: _____ ANALYST/ENTRY:
REVIEW LEVEL: 1

MATRIX: WATER
METHOD: CS0288A
REVIEWER: AMP
DATA FILE : q55

UNITS: UG/L
CASE: 13351
DATE: 03/22/90

SAMPLES	CS2S2014	CS2S2017	CS2S2019
CHLOROMETHANE	1000 U	1000 U	10 U
BROMOMETHANE	1000 U	1000 U	10 U
VINYL CHLORIDE	1000 U	1000 U	10 U
CHLOROETHANE	1000 U	1000 U	10 U
METHYLENE CHLORIDE	500 U	500 U	2.0 J
ACETONE	1000 U	1500 J	10 U
CARBON DISULFIDE	500 U	500 U	5.0 U
1,1 DICHLOROETHENE	500 U	500 U	57
1,1 DICHLOROETHANE	500 U	500 U	14
1,2,-DICHLOROETHENE (TOTAL)	500 U	500 U	23
CHLOROFORM	500 U	500 U	5.0 U
1,2,DICHLOROETHANE	500 U	500 U	5.0 U
2-BUTANONE	I	I	I
1,1,1 TRICHLOROETHANE	690	500 U	240
CARBON TETRACHLORIDE	500 U	500 U	5.0 U
VINYL ACETATE	1000 U	1000 U	10 U
BROMODICHLOROMETHANE	500 U	500 U	0.70 J
1,1,2,2,-TETRACHLOROETHANE	500 U	500 U	5.0 U
1,2-DICHLOROPROPANE	500 U	500 U	5.0 U
TRANS-1,3-DICHLOROPROPENE	500 U	500 U	5.0 U
TRICHLOROETHENE	17000	500 U	3600
DIBROMOCHLOROMETHANE	500 U	500 U	5.0 U
1,1,2-TRICHLOROETHANE	500 U	500 U	5.0 U
BENZENE	500 U	7200 J	5.0 U
CIS-1,3-DICHLOROPROPENE	500 U	500 U	5.0 U
BROMOFORM	500 U	500 U	5.0 U
2-HEXANONE	1000 U	1000 U	10 U
4-METHYL-2-PENTANONE	1000 U	1000 U	10 U
TETRACHLOROETHENE	460 J	500 U	130
TOLUENE	92 J	9000 J	16 J
CHLOROBENZENE	500 U	500 U	5.0 U
ETHYL BENZENE	500 U	380 J	5.0 U
STYRENE	500 U	1700 J	5.0 U
TOTAL XYLENES	500 U	1900 J	5.0 U

MODIFIED DATA

DATA REPORTING / QUALIFICATION CODES

U - The material was analyzed for, but was not detected. The associated numerical value is the sample detection limit.

J - The associated numerical value is an estimated quantity (explanation attached).

I - The data are invalid (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

N - Sample not analyzed.

CODES FOR FLASH POINT DATA

L - The sample did not ignite or "flash". This is the highest temperature at which the sample was tested. It is possible that the material may be ignitable at higher temperatures.

K - The sample did ignite or "flash" at the lowest temperature tested. This is usually the ambient temperature at the time of the test. It is possible that the material may be ignitable at even lower temperatures.

Groundwater Results MW-9
Environmental Protection Agency

September 1990

Hastings Second Street Subsite

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

FEB 21 1991

Mike Sullivan, Esq.
City of Hastings
216 N. Denver
Hastings, Nebraska 68901

Dear Mr. Sullivan:

Re: Transmittal of September 1990 Data for EPA Monitoring Wells and One Decommissioned Municipal Well

Enclosed are copies of the ground water data for the Hastings Ground Water Contamination site. The Environmental Protection Agency (EPA) monitoring wells were installed to characterize the four subsites named in this letter, and are identified with the prefixes "MW-, DW-, BW- and CW-." The State of Nebraska installed observation wells which are identified with the prefix "OW-." These wells are located at the four subsites as reflected by the enclosed index. The enclosed maps show the locations of these wells. We are also enclosing a copy of Table A, which explains the regulatory status of certain chemicals for drinking water.

State Observation Well Data and EPA Monitoring Well Data

As discussed above, these samples were collected from wells installed solely for the purpose of gathering data for determining the extent of contamination of ground water in the area; therefore, they are not supplying water for any other purpose. However, since they do represent the quality of ground water which existed in the location of the well, you should be aware the concentration of the following volatile organic compounds exceed criteria the EPA has established for public drinking water or other criteria established to protect public health.

For the Colorado Avenue Subsite

trichloroethene (TCE)
1,1 dichloroethene
1,2 dichloroethene
1,1,1 trichloroethane
benzene
tetrachloroethene
1,2 dichloroethane

For the North Landfill Subsite

trichloroethene

For the Well #3 Area

carbon tetrachloride

2nd Street

benzene
toluene
styrene
fluorene
phenanthrene

City Decommissioned Well

Water samples were collected from decommissioned well M-18 by use of a bailer device. Therefore, the well casing was not purged. This well was sampled at three different depths, and no contamination was detected at the laboratory detection levels shown.

Analytical data from the June 1990 ground water sampling are consistent with historical data.

Your cooperation with EPA during this investigation is appreciated. If you have further questions, please contact Diane Easley, Environmental Scientist, at (913) 551-7797.

Sincerely yours,

Robert L. Morby
Chief, Superfund Branch
Waste Management Division

Enclosures

cc: Richard Schlenker, NDEC w/enclosures
Jack Daniel, NDOH w/enclosures

Index, (Continued)
September 1990
EPA Monitoring Wells

EPA Number	Well I.D. *		Depth (feet)	Analyses VOA	Analyses BNA
		2nd Street			
-2056	MW-32	(MW-9)	136	X	X

* Numbers shown in parentheses are PRC field log I.D. Numbers.

Notes:

- Wells MW-2, MW-3, MW-4 and MW-9 (MW-32) have dedicated bladder pumps installed within the 120-140 foot screened interval. Pumps are positioned at a depth of 126-127 feet.
- Wells MW-33(MW-10), -34(MW-11), -24, -22, -12, -13, BW-1, and DW-1 were purged with a bladder pump that was steam cleaned before each use and taken from well to well. The depth shown as greater than a 5-foot interval indicates the entire water column was purged. A 5-foot interval indicates the five-foot interval was packed off, purged and sampled using a bladder pump.
- Well MW-1 was purged and sampled with a stainless steel bailer
- Wells MW-19 (MW-50) and CW-1 were purged and sampled with a dedicated bladder pumps having flow rates of approximately 0.7 and 0.4 gallons/minute respectively.

DATA REPORTING / QUALIFICATION CODES

U - The material was analyzed for, but was not detected. The associated numerical value is the sample detection limit.

J - The associated numerical value is an estimated quantity (explanation attached).

I - The data are invalid (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

N - Sample not analyzed.

CODES FOR FLASH POINT DATA

L - The sample did not ignite or "flash". This is the highest temperature at which the sample was tested. It is possible that the material may be ignitable at higher temperatures.

K - The sample did ignite or "flash" at the lowest temperature tested. This is usually the ambient temperature at the time of the test. It is possible that the material may be ignitable at even lower temperatures.

ANALYSIS TYPE: VOLATILES

TITLE: HASTINGS
LAB: EPA REGION VII
SAMPLE PREP:_____ ANALYST/ENTRY: LAJ

MATRIX: WATER
METHOD: 5241D00
REVIEWER:
DATA FILE: AJ7

UNITS: UG/L
CASE:
DATE: 11/08/90

	CSBS2056
CHLOROMETHANE	100.U
BROMOMETHANE	200.U
VINYL CHLORIDE	150.U
CHLOROETHANE	150.U
METHYLENE CHLORIDE	100.U
ACETONE	150.U
CARBON DISULFIDE	50.U
1,1-DICHLOROETHENE	50.U
1,1-DICHLOROETHANE	50.U
1,2-DICHLOROETHENE	50.U
CHLOROFORM	50.U
1,2-DICHLOROETHANE	50.U
2-BUTANONE	100.U
1,1,1-TRICHLOROETHANE	50.U
CARBON TETRACHLORIDE	50.U
VINYL ACETATE	100.U
BROMODICHLOROMETHANE	50.U
1,2-DICHLOROPROPANE	50.U
CIS-1,3-DICHLOROPROPENE	50.U
TRICHLOROETHENE	50.U
BENZENE	15000.J
DIBROMOCHLOROMETHANE	50.U
1,1,2-TRICHLOROETHANE	50.U
TRANS-1,3-DICHLOROPROPENE	50.U
BROMOFORM	50.U
4-METHYL-2-PENTANONE	100.U
2-HEXANONE	100.U
1,1,2,2-TETRACHLOROETHANE	50.U
TETRACHLOROETHENE	50.U
TOLUENE	15000.J
CHLOROBENZENE	50.U
ETHYL BENZENE	600.J
STYRENE	4700.J
TOTAL XYLENES	5000.J

** NOTE: N MEANS NOT ANALYZED **
*** I MEANS ANALYZED BUT INVALID DATA ***

ANALYSIS TYPE: SEMIVOLATILES--PAGE 1

TITLE: HASTINGS GRNDWTR CONTAMINATION
LAB: EPA RGN VII ESAT
SAMPLE PREP: _____ ANALYST/ENTRY: MTW
REVIEW LEVEL:

MATRIX:WATER
METHOD: 625S
REVIEWER: BLS
DATA FILE : M30

UNITS: UG/L
CASE: CSBS2
DATE: 10/25/90

SAMPLES	CSBS2056
PHENOL	5.0 U
BIS(2-CHLOROETHYL) ETHER	5.0 U
2-CHLOROPHENOL	5.0 U
1,3 DICHLOROBENZENE	5.0 U
1,4 DICHLOROBENZENE	5.0 U
BENZYL ALCOHOL	50 U
1,2 DICHLOROBENZENE	50 U
2-METHYLPHENOL	50 U
BIS(2-CHLOROISOPROPYL)ETHER	50 U
4-METHYLPHENOL	5.0 U
N-NITROSO-DIPROPYLAMINE	5.0 U
HEXACHLOROETHANE	5.0 U
NITROBENZENE	5.0 U
ISOPHORONE	5.0 U
2-NITROPHENOL	10 U
2,4-DIMETHYLPHENOL	5.0 U
BENZOIC ACID	2000 U
BIS(2-CHLOROETHOXY) METHANE	5.0 U
2,4 DICHLOROPHENOL	50 U
1,2,4-TRICHLOROBENZENE	500 U
NAPHTHALENE	7500
4-CHLOROANILINE	5.0 U
HEXACHLOROBUTADIENE	5.0 U
4-CHLORO-3-METHYLPHENOL	10 U
2-METHYLNAPHTHALENE	2000
HEXACHLOROCYCLOPENTADIENE	5.0 U
2,4,6-TRICHLOROPHENOL	5.0 U
2,4,5-TRICHLOROPHENOL	5.0 U
2-CHLORONAPHTHALENE	5.0 U
2-NITROANILINE	10 U
DIMETHYLPHTHALATE	50 U
ACENAPHTHYLENE	340
3-NITROANILINE	10 U
ACENAPHTHENE	23
2,4-DINITROPHENOL	10 U
4-NITROPHENOL	10 U
DIBENZOFURAN	16
2,4-DINITROTOLUENE	10 U

ANALYSIS TYPE: SEMIVOLATILES--PAGE 2

TITLE: HASTINGS GRNDWTR CONTAMINATION MATRIX: WATER UNITS: UG/L
LAB: EPA RGN VII ESAT METHOD: 625S CASE: CSBS2
SAMPLE PREP: _____ ANALYST/ENTRY: MTW REVIEWER: BVS DATE: 10/17/90
REVIEW LEVEL: DATA FILE : M31

SAMPLES	CSBS2056
2,6-DINITROTOLUENE	10 U
DIETHYLPHTHALATE	5.0 U
4-CHLOROPHENYL PHENYL ETHER	5.0 U
FLUORENE	65
4-NITROANILINE	10 U
4,6-DINITRO-2-METHYLPHENOL	10 U
N-NITROSODIPHENYLAMINE	5.0 U
4-BROMOPHENYL PHENYL ETHER	5.0 U
HEXACHLOROBENZENE	5.0 U
PENTACHLOROPHENOL	10 U
PHENANTHRENE	68
ANTHRACENE	11
DI-N-BUTYLPHTHALATE	5.0 U
FLUORANTHENE	5.0 U
PYRENE	5.0 U
BUTYL BENZYL PHTHALATE	5.0 U
3,3' DICHLOROBENZIDINE	10 U
BENZO(A)ANTHRACENE	5.0 U
BIS(2-ETHYLHEXYL)PHTHALATE	8.0
CHRYSENE	5.0 U
DI-N-OCTYL PHTHALATE	5.0 U
BENZO(B)FLUORANTHENE	5.0 U
BENZO(K)FLUORANTHENE	5.0 U
BENZO(A)PYRENE	5.0 U
INDENO(1,2,3-CD)PYRENE	5.0 U
DIBENZO(A,H)ANTHRACENE	5.0 U
BENZO(G,H,I)PERYLENE	5.0 U

Groundwater Results MW-9
Environmental Protection Agency

March 1991

Hastings Second Street Subsite

SITE: HASTINGS COLORADO AVENUE

ACTIVITY: CSIS2 ANALYSIS TYPE: VOLATILES METHOD:
LAB: MATRIX: WATER DATA COMPLETED: 04/08/91

	EPA #	CSIS2036	CSIS2037	CSIS2038
	SAMPLED	03/23/91	03/22/91	03/22/
	ID #	MW-9	MW-13	MW-13
	SMO #			
PARAMETERS	UNITS			
CHLOROMETHANE	UG/L	10. U	10. U	1(
BROMOMETHANE	UG/L	20. U	20. U	2(
VINYL CHLORIDE	UG/L	15. U	15. U	1!
CHLOROETHANE	UG/L	15. U	15. U	1!
METHYLENE CHLORIDE	UG/L	10. U	10. U	1(
1,1-DICHLOROETHENE	UG/L	5.0 U	5.0 U	5.
1,1-DICHLOROETHANE	UG/L	5.0 U	5.0 U	5.
1,2-DICHLOROETHENE, TOTAL	UG/L	5.0 U	5.0 U	5. U
CHLOROFORM	UG/L	5.0 U	5.0 U	5.0 U
1,2-DICHLOROETHANE	UG/L	5.0 U	5.0 U	5.0 U
1,1,1-TRICHLOROETHANE	UG/L	5.0 U	5.0	7.9
CARBON TETRACHLORIDE	UG/L	5.0 U	5.0 U	5.0 U
BROMODICHLOROMETHANE	UG/L	5.0 U	5.0 U	5.0 U
1,2-DICHLOROPROPANE	UG/L	5.0 U	5.0 U	5.0 U
BENZENE	UG/L	3700.	5.0 U	5.0 U
TRICHLOROETHENE	UG/L	5.0 U	110.	180.
CIS-1,3-DICHLOROPROPENE	UG/L	5.0 U	5.0 U	5.0 U
DIBROMOCHLOROMETHANE	UG/L	5.0 U	5.0 U	5.0 U
1,1,2-TRICHLOROETHANE	UG/L	5.0 U	5.0 U	5.0 U
BROMOFORM	UG/L	5.0 U	5.0 U	5.0 U
TETRACHLOROETHENE	UG/L	5.0 U	5.0 U	5.0
TOLUENE	UG/L	3800.	5.0 U	5.0 U
1,1,2,2-TETRACHLOROETHANE	UG/L	5.0 U	5.0 U	5.0 U
CHLOROBENZENE	UG/L	5.0 U	5.0 U	5.0 U
ETHYL BENZENE	UG/L	250.	5.0 U	5.0 U
ACETONE	UG/L	4700. J	10. U	10. U
CARBON DISULFIDE	UG/L	5.0 U	5.0 U	5.0 U
2-BUTANONE	UG/L	10. U	10. U	10. U
VINYL ACETATE	UG/L	10. U	10. U	10. U
2-HEXANONE	UG/L	10. U	10. U	10. U
4-METHYL-2-PENTANONE	UG/L	10. U	10. U	10. U
STYRENE	UG/L	2100.	5.0 U	5.0 U
XYLENES, TOTAL	UG/L	1700.	5.0 U	5.0 U
TRANS-1,3-DICHLOROPROPENE	UG/L	5.0 U	5.0 U	5.0 U

* DATA QUALIFIER CODES *

U: LESS THAN DETECTION LIMIT
I: INVALID - NO VALUE REPORTED
J: DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
N: PARAMETER NOT ANALYZED
M: DETECTED BUT BELOW LEVEL FOR ACCURATE QUANTIFICATION

Groundwater Results MW-9
Environmental Protection Agency

April 1992

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT — VALIDATED DATA

FOR ACTIVITY: CSDS2

S P F D — 04/28/92 12:36:58 — ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 92 ACTIVITY: CSDS2 DESCRIPTION: HASTINGS-COLORADO AVENUE LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 5/ 2/92. REPORT DUE DATE IS 5/31/92.

INSPECTION DATE: 4/ 1/92 ALL SAMPLES RECEIVED DATE: 04/02/92

ALL DATA APPROVED BY LABO DATE: 04/27/92 FINAL REPORT TRANSMITTED DATE: 04/28/92

EXPECTED LABO TURNAROUND TIME IS 30 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 25 DAYS ACTUAL REPORT TURNAROUND TIME IS 27 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		W	MW-11 (128' - 133')	1	HASTINGS	NEBRASKA				03/24/92	11:45	03/24/92	:
002		W	MW-12	1	HASTINGS	NEBRASKA				03/22/92	17:00	/ /	:
003		W	MW-24 (135' - 140')	1	HASTINGS	NEBRASKA				03/23/92	16:15	03/23/92	:
004		W	MW-24 (140' - 145')	1	HASTINGS	NEBRASKA				03/23/92	15:40	03/23/92	:
005		W	MW-19	1	HASTINGS	NEBRASKA				03/19/92	13:50	03/19/92	:
005	D	W	MW-19/DUPLICATE	1	HASTINGS	NEBRASKA				03/19/92	13:50	03/19/92	:
006		W	MW-24 (160' - 165')	1	HASTINGS	NEBRASKA				03/23/92	15:00	03/23/92	:
007		W	MW-24 (165' - 170')	1	HASTINGS	NEBRASKA				03/23/92	14:00	03/23/92	:
008		W	MW-24 (195' - 200')	1	HASTINGS	NEBRASKA				03/23/92	11:15	03/23/92	:
009		W	MW-24 (215' - 220')	1	HASTINGS	NEBRASKA				03/23/92	12:30	03/23/92	:
011	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				03/20/92	14:00	/ /	:
012	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				03/21/92	08:00	/ /	:
018	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				03/24/92	12:00	/ /	:
101		W	WELL OW-3S	1	HASTINGS	NEBRASKA				03/16/92	14:20	/ /	:
102		W	WELL OW-3D	1	HASTINGS	NEBRASKA				03/16/92	15:30	/ /	:
103		W	WELL MW-2	1	HASTINGS	NEBRASKA				03/16/92	18:10	/ /	:
104		W	WELL OW-5S	1	HASTINGS	NEBRASKA				03/17/92	10:00	/ /	:
105		W	WELL OW-5D	1	HASTINGS	NEBRASKA				03/17/92	14:20	/ /	:
106		W	WELL MW-4	1	HASTINGS	NEBRASKA				03/17/92	12:30	/ /	:
107		W	WELL OW-1D	1	HASTINGS	NEBRASKA				03/17/92	15:19	/ /	:
108		W	WELL OW-1S	1	HASTINGS	NEBRASKA				03/17/92	16:40	/ /	:
109		W	WELL BW-1	1	HASTINGS	NEBRASKA				03/18/92	09:15	03/18/92	09:55
110		W	WELL BW-1	1	HASTINGS	NEBRASKA				03/18/92	10:40	03/18/92	11:30

VALIDATED DATA

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	LAY- SECT ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
111		W	WELL BW-1	1	HASTINGS	NEBRASKA			03/18/92	11:51	03/18/92	12:35
112		W	WELL BW-1	1	HASTINGS	NEBRASKA			03/18/92	12:50	03/18/92	13:30
113		W	WELL BW-1	1	HASTINGS	NEBRASKA			03/18/92	13:40	03/18/92	14:40
114		W	WELL BW-1	1	HASTINGS	NEBRASKA			03/18/92	15:00	03/18/92	15:40
115		W	WELL MW-3	1	HASTINGS	NEBRASKA			03/16/92	18:00	/ /	:
115	D	W	WELL MW-3-DUPLICATE	1	HASTINGS	NEBRASKA			03/16/92	18:00	/ /	:
116		W	WELL OW-4D	1	HASTINGS	NEBRASKA			03/18/92	17:20	/ /	:
116	D	W	WELL OW-4D DUPLICATE	1	HASTINGS	NEBRASKA			03/18/92	17:20	/ /	:
117		W	WELL OW-4S	1	HASTINGS	NEBRASKA			03/18/92	14:34	03/18/92	17:34
118		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	08:56	03/19/92	09:36
119		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	09:55	03/19/92	10:35
120		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	10:56	03/19/92	11:36
121		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	11:50	03/19/92	12:30
122		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	12:40	03/19/92	13:20
123		W	MW-22	1	HASTINGS	NEBRASKA			03/19/92	15:15	03/19/92	15:45
124		W	WELL MW-1	1	HASTINGS	NEBRASKA			03/19/92	15:36	03/19/92	:
125		W	MW-10	1	HASTINGS	NEBRASKA			03/20/92	09:50	/ /	:
126		W	MW-13	1	HASTINGS	NEBRASKA			03/20/92	12:15	/ /	:
127		W	MW-13	1	HASTINGS	NEBRASKA			03/20/92	13:10	/ /	:
128		W	MW-13	1	HASTINGS	NEBRASKA			03/20/92	13:25	03/20/92	14:10
129		W	MW-9	1	HASTINGS	NEBRASKA			03/20/92	12:45	03/20/92	:
134	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA			03/12/92	:	/ /	:
135	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA			03/12/92	:	/ /	:
136	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA			03/12/92	:	/ /	:
160		W	BW-3D	1	HASTINGS	NEBRASKA			03/31/92	:	/ /	:
161		W	BW-3D	1	HASTINGS	NEBRASKA			03/31/92	20:45	/ /	:
161	D	W	BW-3D/DUPLICATE	1	HASTINGS	NEBRASKA			03/31/92	20:45	/ /	:
162	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA			03/31/92	20:45	/ /	:

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- A = TRUE VALUE FOR CALIBRATION STANDARD
- B = CONCENTRATION RESULTING FROM DUPLICATE LAB SPIKE
- C = MEASURED VALUE FOR CALIBRATION STANDARD
- D = MEASURED VALUE FOR FILED DUPLICATE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CONCENTRATION RESULTING FROM DUPLICATE FIELD SPIKE
- L = MEASURED VALUE FOR LAB DUPLICATE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED VALUE FOR DUPLICATE FIELD SPIKE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED VALUE FOR LAB SPIKE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED VALUE FOR DUPLICATE LAB SPIKE
- Y = MEASURED VALUE FOR FIELD SPIKE
- Z = CONCENTRATION RESULTING FROM FIELD SPIKE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR
- H = OTHER (DOES NOT FIT ANY OTHER CATEGORY)
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION IDENTIFICATION NUMBER FOR EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES:
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPCIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSDS2 #01 VALIDATED DATA

COMPOUND	UNITS	126	127	128	129	134F
WV03 CHLOROMETHANE, BY GC/MS	UG/L	10U	10U	10U	10U	10U
WV04 BROMOMETHANE, BY GC/MS	UG/L	20U	20U	20U	20U	20U
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	15U	15U	15U	15U	15U
WV06 CHLOROETHANE, BY GC/MS	UG/L	15U	15U	15U	15U	15U
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	10U	10U	10U	10U	10U
WV08 DICHLOROETHYLENE,1,1-	UG/L	21	42	39	5U	5U
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	5U	5U	5U	5U	5U
WV11 CHLOROFORM, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	47	31	22	5U	5U
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV17 BENZENE, BY GC/MS	UG/L	5U	5U	5U	7700	5U
WV19 TRICHLOROETHYLENE	UG/L	1000	1200	1200	7	5U
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV24 BROMOFORM, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV25 TETRACHLOROETHYLENE	UG/L	29	37	33	5U	5U
WV26 TOLUENE, BY GC/MS	UG/L	5U	5U	5U	10000	5U
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV28 CHLOROBENZENE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV29 ETHYL BENZENE, BY GC/MS	UG/L	5U	5U	5U	430	5U
WV30 ACETONE, BY GC/MS	UG/L	10U	10U	10U	13U	10U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSDS2 VALIDATED DATA

COMPOUND	UNITS	126	127	128	129	134F
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	10U	10U	10U	10U	10U
WV34 HEXANONE, 2-	UG/L	10U	10U	10U	10U	10U
WV35 4-METHYL-2-PENTANONE	UG/L	10U	10U	10U	10U	10U
WV36 STYRENE, BY GC/MS	UG/L	5U	5U	5U	2100	5U
WV37 XYLENES, TOTAL, BY GC/MS	UG/L	NA 0	NA 0	NA 0	NA 0	NA 0
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	5U	5U	5U	5U	5U
WV67 XYLENE, M AND/OR P	UG/L	5U	5U	5U	1100	5U
WV70 XYLENE, ORTHO	UG/L	5U	5U	5U	1200	5U
ZZ01 SAMPLE NUMBER	NA	126	127	128	129	134
ZZ02 ACTIVITY CODE	NA	CSDS2	CSDS2	CSDS2	CSDS2	CSDS2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2

Groundwater Results MW-9
Environmental Protection Agency

May 1992

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT VALIDATED DATA

FOR ACTIVITY: CSGS2

S P F D 05/27/92 15:42:33 ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 92 ACTIVITY: CSGS2 DESCRIPTION: HASTINGS-SECOND STREET LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 5/ 2/92. REPORT DUE DATE IS 5/31/92.

INSPECTION DATE: 4/ 1/92 ALL SAMPLES RECEIVED DATE: 04/02/92

ALL DATA APPROVED BY LABO DATE: 05/13/92 FINAL REPORT TRANSMITTED DATE: 05/13/92

EXPECTED LABO TURNAROUND TIME IS 30 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 41 DAYS ACTUAL REPORT TURNAROUND TIME IS 42 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		W	WELL MW-2	1	HASTINGS	NEBRASKA				03/16/92	18:10	/ /	:
002		W	WELL MW-3	1	HASTINGS	NEBRASKA				03/16/92	18:00	/ /	:
003		W	WELL MW-4	1	HASTINGS	NEBRASKA				03/17/92	12:40	/ /	:
004		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	09:36	/ /	:
005		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	10:35	/ /	:
006		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	11:36	/ /	:
007		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	12:30	/ /	:
008		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	13:20	/ /	:
009		W	MW-22	1	HASTINGS	NEBRASKA				03/19/92	15:45	/ /	:
010		W	MW-9	1	HASTINGS	NEBRASKA				03/20/92	12:40	/ /	:
011		W	MW-11 (128' - 133')	1	HASTINGS	NEBRASKA				03/24/92	11:45	03/24/92	:
012		W	MW-10	1	HASTINGS	NEBRASKA				03/20/92	09:50	/ /	:
013		W	MW-12	1	HASTINGS	NEBRASKA				03/22/92	17:00	/ /	:
014		W	MW-9	1	HASTINGS	NEBRASKA				03/20/92	12:50	03/20/92	:
015		W	HWS-MW1	1	HASTINGS	NEBRASKA				04/01/92	:	/ /	:
016		W	HWS-MW2	1	HASTINGS	NEBRASKA				04/01/92	:	/ /	:
017		W	HWS-MW3	1	HASTINGS	NEBRASKA				04/01/92	:	/ /	:
019		W	HWS-MW5	1	HASTINGS	NEBRASKA				04/01/92	:	/ /	:
020		W	HWS-MW1	1	HASTINGS	NEBRASKA				04/01/92	:	/ /	:
021		W	HWS-MW2	1	HASTINGS	NEBRASKA				03/31/92	:	/ /	:
022		W	HWS-MW3	1	HASTINGS	NEBRASKA				03/31/92	14:50	/ /	:
023		W	HWS-MW4	1	HASTINGS	NEBRASKA				03/31/92	11:30	/ /	:
024		W	HWS-MW5	1	HASTINGS	NEBRASKA				03/31/92	10:15	/ /	:

VALIDATED DATA

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
025	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				03/31/92	:	/ /	:
026	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				04/01/92	13:00	/ /	:

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- A = TRUE VALUE FOR CALIBRATION STANDARD
- B = CONCENTRATION RESULTING FROM DUPLICATE LAB SPIKE
- C = MEASURED VALUE FOR CALIBRATION STANDARD
- D = MEASURED VALUE FOR FILED DUPLICATE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CONCENTRATION RESULTING FROM DUPLICATE FIELD SPIKE
- L = MEASURED VALUE FOR LAB DUPLICATE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED VALUE FOR DUPLICATE FIELD SPIKE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED VALUE FOR LAB SPIKE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED VALUE FOR DUPLICATE LAB SPIKE
- Y = MEASURED VALUE FOR FIELD SPIKE
- Z = CONCENTRATION RESULTING FROM FIELD SPIKE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR
- H = OTHER (DOES NOT FIT ANY OTHER CATEGORY)
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION IDENTIFICATION NUMBER FOR EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES:
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPCIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSGS2 VALIDATED DATA

COMPOUND	UNITS	006		007		008		009		010 #C1	
WS22 NAPHTHALENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	3800	
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	380	
WS35 ACENAPHTHENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	31	
WS43 FLUORENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	76	
WS50 PHENANTHRENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	71	
WS51 ANTHRACENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	12	
WS53 FLUORANTHENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS54 PYRENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	3.0	J
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS59 CHRYSENE, BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L	10	U	NA	O	10	U	10	U	10	U
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L	10	U	NA	O	10	U	10	U	10	U
ZZ01 SAMPLE NUMBER	NA	006		007		008		009		010	
ZZ02 ACTIVITY CODE	NA	CSGS2		CSGS2		CSGS2		CSGS2		CSGS2	
ZZ04 SUBSITE, IDENTIFIER		S2		S2		S2		S2		S2	

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSGS2 VALIDATED DATA

COMPOUND	UNITS	011	012	013	014 #6	015
WS22 NAPHTHALENE, BY GC/MS	UG/L	10 U	10 U	10 U		6800
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L	10 U	10 U	10 U		440
WS35 ACENAPHTHENE, BY GC/MS	UG/L	10 U	10 U	10 U		37
WS43 FLUORENE, BY GC/MS	UG/L	10 U	10 U	10 U		130
WS50 PHENANTHRENE, BY GC/MS	UG/L	10 U	10 U	10 U		550
WS51 ANTHRACENE, BY GC/MS	UG/L	10 U	10 U	10 U		83
WS53 FLUORANTHENE, BY GC/MS	UG/L	10 U	10 U	10 U		10 U
WS54 PYRENE, BY GC/MS	UG/L	10 U	10 U	10 U		90
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L	10 U	10 U	10 U		38
WS59 CHRYSENE, BY GC/MS	UG/L	10 U	10 U	10 U		10 U
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L	10 U	10 U	10 U		10 U
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L	10 U	10 U	10 U		19
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L	10 U	10 U	10 U		38
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L	10 U	10 U	10 U		6.0 J
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L	10 U	10 U	10 U		58
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L	10 U	10 U	10 U		10 U
WV03 CHLOROMETHANE, BY GC/MS	UG/L				10U	
WV04 BROMOMETHANE, BY GC/MS	UG/L				20U	
WV05 VINYL CHLORIDE, BY GC/MS	UG/L				15U	
WV06 CHLOROETHANE, BY GC/MS	UG/L				15U	
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L				10U	
WV08 DICHLOROETHYLENE,1,1-	UG/L				5U	
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L				5U	
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L				5U	
WV11 CHLOROFORM, BY GC/MS	UG/L				5U	
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L				5U	

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSGS2 VALIDATED DATA

COMPOUND	UNITS	011	012	013	014	015
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L				5U	
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L				5U	
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L				5U	
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L				5U	
WV17 BENZENE, BY GC/MS	UG/L				7600	
WV19 TRICHLOROETHYLENE	UG/L				5U	
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L				5U	
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L				5U	
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L				5U	
WV24 BROMOFORM, BY GC/MS	UG/L				5U	
WV25 TETRACHLOROETHYLENE	UG/L				5U	
WV26 TOLUENE, BY GC/MS	UG/L				12000	
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L				5U	
WV28 CHLOROBENZENE, BY GC/MS	UG/L				5U	
WV29 ETHYL BENZENE, BY GC/MS	UG/L				480	
WV30 ACETONE, BY GC/MS	UG/L				100	
WV31 CARBON DISULFIDE, BY GC/MS	UG/L				5U	
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L				18	
WV34 HEXANONE, 2-	UG/L				10U	
WV35 4-METHYL-2-PENTANONE	UG/L				10U	
WV36 STYRENE, BY GC/MS	UG/L				3700	
WV37 XYLENES, TOTAL, BY GC/MS	UG/L				NA 0	
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L				5U	
WV67 XYLENE, M AND/OR P	UG/L				1400	
WV70 XYLENE, ORTHO	UG/L				1400	
ZZ01 SAMPLE NUMBER	NA	011	012	013	014	015

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSGS2 VALIDATED DATA

COMPOUND	UNITS	011	012	013	014	015
ZZ02 ACTIVITY CODE	NA	CSGS2	CSGS2	CSGS2	CSGS2	CSGS2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2

Groundwater Results MW-9
Environmental Protection Agency

August 1992

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT — VALIDATED DATA

FOR ACTIVITY: CSLS2

S P F D — 08/03/92 10:20:10 — ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 92 ACTIVITY: CSLS2 DESCRIPTION: HASTINGS-2ND STREET LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 8/15/92. REPORT DUE DATE IS 8/12/92.

INSPECTION DATE: 6/13/92 ALL SAMPLES RECEIVED DATE: 06/16/92

ALL DATA APPROVED BY LABO DATE: 08/03/92 FINAL REPORT TRANSMITTED DATE: 08/03/92

EXPECTED LABO TURNAROUND TIME IS 60 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 48 DAYS ACTUAL REPORT TURNAROUND TIME IS 51 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		W	OW-5S	1	HASTINGS	NEBRASKA				06/13/92	12:45	/ /	:
002		W	OW-5D	1	HASTINGS	NEBRASKA				06/13/92	12:45	/ /	:
003		W	MW-22 125-130'	1	HASTINGS	NEBRASKA				06/13/92	11:45	/ /	:
004		W	MW-22 145-150'	1	HASTINGS	NEBRASKA				06/13/92	10:30	/ /	:
005		W	MW-22 180-185'	1	HASTINGS	NEBRASKA				06/13/92	09:10	/ /	:
006		W	OW-4S	1	HASTINGS	NEBRASKA				06/13/92	10:55	/ /	:
007		W	OW-4D	1	HASTINGS	NEBRASKA				06/13/92	:	/ /	:
008		W	MW-9	1	HASTINGS	NEBRASKA				06/13/92	17:40	/ /	:
009		W	MW-10	1	HASTINGS	NEBRASKA				06/13/92	17:45	/ /	:
011		W	MW-4	1	HASTINGS	NEBRASKA				06/13/92	11:00	/ /	:
011	D	W	MW-4. DUPLICATE OF 011	1	HASTINGS	NEBRASKA				06/13/92	11:00	/ /	:
012	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				06/12/92	18:00	/ /	:
014		W	OW-5S	1	HASTINGS	NEBRASKA				06/12/92	11:35	/ /	:
015		W	OW-5D	1	HASTINGS	NEBRASKA				06/12/92	12:40	/ /	:
016		W	MW-22 125-130'	1	HASTINGS	NEBRASKA				06/13/92	11:45	/ /	:
017		W	MW-4	1	HASTINGS	NEBRASKA				06/13/92	11:00	/ /	:
017	D	W	MW-4. DUPLICATE OF 017	1	HASTINGS	NEBRASKA				06/13/92	11:00	/ /	:
018		W	MW-22 145-150'	1	HASTINGS	NEBRASKA				06/13/92	10:30	/ /	:
019		W	MW-22 180-185'	1	HASTINGS	NEBRASKA				06/13/92	09:10	/ /	:
020		W	OW-4S	1	HASTINGS	NEBRASKA				06/13/92	10:55	/ /	:
021		W	OW-4D	1	HASTINGS	NEBRASKA				06/13/92	:	/ /	:
022		W	MW-9	1	HASTINGS	NEBRASKA				06/13/92	17:40	/ /	:
023		W	MW-10	1	HASTINGS	NEBRASKA				06/13/92	17:45	/ /	:

changed by DMD 8-4-92

VALIDATED DATA

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

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- G = MEASURED VALUE FOR METHOD STANDARD
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- K = CONCENTRATION RESULTING FROM DUPLICATE FIELD SPIKE
- L = MEASURED VALUE FOR LAB DUPLICATE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED VALUE FOR DUPLICATE FIELD SPIKE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED VALUE FOR LAB SPIKE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED VALUE FOR DUPLICATE LAB SPIKE
- Y = MEASURED VALUE FOR FIELD SPIKE
- Z = CONCENTRATION RESULTING FROM FIELD SPIKE

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  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

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- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
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- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
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- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSLS2 VALIDATED DATA

COMPOUND	UNITS	006 OW-4S		007 OW-4D		008 MW-9		009 MW-10		011 MW-4	
WV03 CHLOROMETHANE, BY GC/MS	UG/L	N/A	O	1.7		100	K	1.0	K	1.0	K
WV04 BROMOMETHANE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV06 CHLOROETHANE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.1	J	1.0	K
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	N/A	O	2.0	K	200	K	2.0	K	2.0	K
WV08 DICHLOROETHYLENE,1,1-	UG/L	N/A	O	1.0	K	100	K	86	J	18	J
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	15	J	21	J
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	N/A	O	1.0	K	100	K	16	J	17	
WV11 CHLOROFORM, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	360		170	
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.4	J	1.0	K
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV17 BENZENE, BY GC/MS	UG/L	N/A	O	1.0	K	6800		1.0	K	33	J
WV19 TRICHLOROETHYLENE	UG/L	N/A	O	3.6		890		3600		2800	
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV24 BROMOFORM, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV25 TETRACHLOROETHYLENE	UG/L	N/A	O	1.0	K	100	K	130	J	67	J
WV26 TOLUENE, BY GC/MS	UG/L	N/A	O	1.0	K	7200		1.0	K	1.0	K
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV28 CHLOROBENZENE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV29 ETHYL BENZENE, BY GC/MS	UG/L	N/A	O	1.0	K	520		1.0	K	1.0	K
WV30 ACETONE, BY GC/MS	UG/L	N/A	O	12	K	500	K	5.0	K	22	K

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSLS2 VALIDATED DATA

COMPOUND	UNITS	006 OW-4S		007 OW-4D		008 MW-9		009 MW-10		011 MW-4	
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	N/A	O	5.0	K	500	K	5.0	K	13	
WV34 HEXANONE, 2-	UG/L	N/A	O	5.0	K	500	K	5.0	K	5.0	K
WV35 4-METHYL-2-PENTANONE	UG/L	N/A	O	5.0	K	500	K	5.0	K	5.0	K
WV36 STYRENE, BY GC/MS	UG/L	N/A	O	1.0	K	2700		1.0	K	1.0	K
WV37 XYLENES, TOTAL, BY GC/MS	UG/L	N/A	O	1.0	K	3500		1.0	K	1.0	K
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	N/A	O	1.0	K	100	K	1.0	K	1.0	K
WV67 XYLENE, M AND/OR P	UG/L	N/A	O	N/A	O	N/A	O	N/A	O	N/A	O
WV70 XYLENE, ORTHO	UG/L	N/A	O	N/A	O	N/A	O	N/A	O	N/A	O
ZZ00		N/A	O								
ZZ01 SAMPLE NUMBER	NA	006		007		008		009		011	
ZZ02 ACTIVITY CODE	NA	CSLS2		CSLS2		CSLS2		CSLS2		CSLS2	
ZZ04 SUBSITE, IDENTIFIER		S2		S2		S2		S2		S2	

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 2-CSLS2 VALIDATED DATA

COMPOUND	UNITS	021 OW-4D		022 MW-9		023 MW-10			
WS22 NAPHTHALENE, BY GC/MS	UG/L	10	K	5500		10	K		
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS35 ACENAPHTHENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS43 FLUORENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS50 PHENANTHRENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS51 ANTHRACENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS53 FLUORANTHENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS54 PYRENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L	10	K	1400	K	10	K		
WS59 CHRYSENE, BY GC/MS	UG/L	10	K	1400	K	10	K		
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L	10	K	1400	K	10	K		
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L	10	K	1400	K	10	K		
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L	10	K	1400	K	10	K		
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L	10	K	1400	K	10	K		
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L	10	K	1400	K	10	K		
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L	10	K	1400	K	10	K		
ZZ01 SAMPLE NUMBER	NA	021		022		023			
ZZ02 ACTIVITY CODE	NA	CSLS2		CSLS2		CSLS2			
ZZ04 SUBSITE, IDENTIFIER		S2		S2					

Groundwater Results MW-9
Environmental Protection Agency

September 1992

Hastings Second Street Subsite

SITE: HASTINGS-SECOND STREET

ACTIVITY: CS1S2 ANALYSIS TYPE: VOLATILES MATRIX: WATER
LAB: REGION VII METHOD: DATA COMPLETED: 11/09/92

	EPA #	CS1S2018	CS1S2020
	SAMPLED	09/18/92	09/17/92
	SAMPLEID	HWS-4	MW-9
	SMO #		
PARAMETERS	UNITS		
CHLOROMETHANE	UG/L	50 K	10 K
BROMOMETHANE	UG/L	50 K	10 K
VINYL CHLORIDE	UG/L	50 K	10 K
CHLOROETHANE	UG/L	50 K	10 K
METHYLENE CHLORIDE	UG/L	50 K	10 K
1,1-DICHLOROETHENE	UG/L	50 K	10 K
1,1-DICHLOROETHANE	UG/L	50 K	10 K
1,2-DICHLOROETHENE, TOTAL	UG/L	50 K	10 K
CHLOROFORM	UG/L	50 K	10 K
1,2-DICHLOROETHANE	UG/L	72	10 K
1,1,1-TRICHLOROETHANE	UG/L	50 K	10 K
CARBON TETRACHLORIDE	UG/L	50 K	10 K
BROMODICHLOROMETHANE	UG/L	50 K	10 K
1,2-DICHLOROPROPANE	UG/L	50 K	10 K
BENZENE	UG/L	1800	6100
TRICHLOROETHENE	UG/L	50 K	25
CIS-1,3-DICHLOROPROPENE	UG/L	50 K	10 K
DIBROMOCHLOROMETHANE	UG/L	50 K	10 K
1,1,2-TRICHLOROETHANE	UG/L	50 K	10 K
BROMOFORM	UG/L	50 K	10 K
TETRACHLOROETHENE	UG/L	50 K	10 K
TOLUENE	UG/L	2300	7600
1,1,2,2-TETRACHLOROETHANE	UG/L	50 K	10 K
CHLOROBENZENE	UG/L	50 K	10 K
ETHYL BENZENE	UG/L	750	340
ACETONE	UG/L	50 K	50 K
CARBON DISULFIDE	UG/L	50 K	10 K
2-BUTANONE	UG/L	50 K	10 K
VINYL ACETATE	UG/L	50 K	10 K
2-HEXANONE	UG/L	50 K	10 K
4-METHYL-2-PENTANONE	UG/L	50 K	2700
STYRENE	UG/L	2100	2900
TRANS-1,3-DICHLOROPROPENE	UG/L	50 K	10 K

*** DATA QUALIFIER CODES ***

U: LESS THAN DETECTION LIMIT
I: INVALID - NO VALUE REPORTED
J: DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
K: ANALYTE NOT DETECTED AT VALUE REPORTED
N: PARAMETER NOT ANALYZED
M: DETECTED BUT BELOW LEVEL FOR ACCURATE QUANTIFICATION

Groundwater Results MW-9
Environmental Protection Agency

April 1993

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT

VALIDATED DATA

FOR ACTIVITY: CS8S2

S P F D

04/28/93 15:16:46

ALL SAMPLES

* FINAL REPORT

FY: 93 ACTIVITY: CS8S2 DESCRIPTION: HASTINGS-SECOND STREET SITE LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 4/ 9/93. REPORT DUE DATE IS 4/ 6/93.

INSPECTION DATE: 2/ 5/93 ALL SAMPLES RECEIVED DATE: 02/08/93

ALL DATA APPROVED BY LABO DATE: 04/22/93 FINAL REPORT TRANSMITTED DATE: 04/22/93

EXPECTED LABO TURNAROUND TIME IS 60 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 73 DAYS ACTUAL REPORT TURNAROUND TIME IS 76 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC	NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		W	OW-4D	1	HASTINGS	NEBRASKA					01/23/93	10:45	/ /	:
001	L	W	LAB DUPLICATE 001	0	HASTINGS	NEBRASKA					/ /	:	/ /	:
002		W	OW-4S	1	HASTINGS	NEBRASKA					01/29/93	11:15	/ /	:
003		W	MW-22	1	HASTINGS	NEBRASKA					01/23/93	12:45	/ /	:
004		W	MW-22 125-130'	1	HASTINGS	NEBRASKA					01/23/93	14:20	/ /	:
005		W	OW-5S	1	HASTINGS	NEBRASKA					01/23/93	17:15	/ /	:
006		W	OW-5D	1	HASTINGS	NEBRASKA					01/23/93	18:45	/ /	:
007		W	MW-4	1	HASTINGS	NEBRASKA					01/23/93	18:00	/ /	:
008		W	MW-9	1	HASTINGS	NEBRASKA					01/24/93	16:30	/ /	:
009		W	WELL HWS-4 (FOOTE OIL)	1	HASTINGS	NEBRASKA					01/26/93	15:00	/ /	:
010		W	WELL HWS-3 (FOOTE OIL)	1	HASTINGS	NEBRASKA					01/26/93	17:40	/ /	:
011		W	WELL HWS-1 (FOOTE OIL)	1	HASTINGS	NEBRASKA					01/27/93	09:35	/ /	:
012		W	WELL HWS-2 (FOOTE OIL)	1	HASTINGS	NEBRASKA					01/27/93	12:30	/ /	:
013		W	WELL HWS-5 (FOOTE OIL)	1	HASTINGS	NEBRASKA					01/28/93	08:55	/ /	:
013	D	W	WELL HWS-5 (FOOTE OIL)/DUPLICATE	1	HASTINGS	NEBRASKA					01/28/93	09:10	/ /	:
014	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA					02/05/93	10:00	/ /	:
015	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA					02/05/93	10:00	/ /	:
016	F	W	TB-3	1	HASTINGS	NEBRASKA					02/05/93	10:00	/ /	:
018	F	W	RINSE WATER FROM REDI-FLO 2 PUMP	1	HASTINGS	NEBRASKA					02/04/93	15:00	/ /	:
019		W	SW-3	1	HASTINGS	NEBRASKA					02/05/93	10:00	/ /	:
020		W	SW-1	1	HASTINGS	NEBRASKA					02/04/93	14:10	/ /	:
020	L	W	LAB DUPLICATE 020	0	HASTINGS	NEBRASKA					/ /	:	/ /	:
021		W	SW-2	1	HASTINGS	NEBRASKA					02/03/93	11:30	/ /	:

VALIDATED DATA

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE STATUS	# CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
021	D	W	SW-3	1	HASTINGS	NEBRASKA				02/04/93	17:00	/ /	:
023		W	OW-4D	1	HASTINGS	NEBRASKA				01/23/93	10:45	/ /	:
024		W	OW-4S	1	HASTINGS	NEBRASKA				01/23/93	11:15	/ /	:
025		W	MW-22(180-185')	1	HASTINGS	NEBRASKA				01/23/93	12:45	/ /	:
026		W	MW-22 (125-130)	1	HASTINGS	NEBRASKA				01/23/93	14:20	/ /	:
027		W	OW-5S	1	HASTINGS	NEBRASKA				01/23/93	17:15	/ /	:
028		W	OW-5D	1	HASTINGS	NEBRASKA				01/23/93	18:45	/ /	:
029		W	MW-4	1	HASTINGS	NEBRASKA				01/23/93	18:00	/ /	:
029	B	W	TRUE VALUE FOR MATRIX SPIKE DUP	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
029	R	W	TRUE VALUE FOR MATRIX SPIKE	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
029	S	W	MEASURED VALUE FOR MATRIX SPIKE	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
029	W	W	MEASURED VALUE FOR MATRIX SPIKE DUP	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
030		W	MW-9	1	HASTINGS	NEBRASKA				01/24/93	16:30	/ /	:
031		W	WELL HWS-4 (FOOTE OIL)	1	HASTINGS	NEBRASKA				01/26/93	15:00	/ /	:
032		W	WELL HWS-3 (FOOTE OIL)	1	HASTINGS	NEBRASKA				01/26/93	17:40	/ /	:
033		W	WELL HWS-1 (FOOTE OIL)	1	HASTINGS	NEBRASKA				01/27/93	09:35	/ /	:
034		W	WELL HWS-2 (FOOTE OIL)	1	HASTINGS	NEBRASKA				01/27/93	12:30	/ /	:
035		W	WELL HWS-5 (FOOTE OIL)	1	HASTINGS	NEBRASKA				01/28/93	08:55	/ /	:
035	D	W	WELL HWS-5 (FOOTE OIL)/DUPLICATE	1	HASTINGS	NEBRASKA				01/28/93	09:10	/ /	:
036	F	W	RINSE WATER	1	HASTINGS	NEBRASKA				02/04/93	15:00	/ /	:
037		W	SW-2	1	HASTINGS	NEBRASKA				02/03/93	11:30	/ /	:
038		W	SW-3	1	HASTINGS	NEBRASKA				02/04/93	17:00	/ /	:
039	D	W	SW-3	1	HASTINGS	NEBRASKA				02/04/93	17:00	/ /	:
040		W	SW-1	1	HASTINGS	NEBRASKA				02/04/93	14:10	/ /	:
041		W	SW-3	1	HASTINGS	NEBRASKA				02/04/93	12:00	/ /	:
041	L	W	LAB DUPLICATE 041	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
042		W	SW-1	1	HASTINGS	NEBRASKA				02/04/93	14:10	/ /	:
042	L	W	LAB DUPLICATE 042	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
042	R	W	TRUE VALUE MATRIX SPIKE	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
042	S	W	MEASURED VALUE FOR MATRIX SPIKE	0	HASTINGS	NEBRASKA				/ /	:	/ /	:
043		W	SW-2	1	HASTINGS	NEBRASKA				02/03/93	11:30	/ /	:
043	D	W	SW-2	1	HASTINGS	NEBRASKA				02/04/93	17:00	/ /	:
044	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				01/25/93	12:00	/ /	:
045	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				01/26/93	19:30	/ /	:

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- B = CAL INCREASED CONCENTRATION FOR A LAB SPIKED DUP SAMPLE
- D = MEASURED VALUE FOR FIELD DUPLICATE SAMPLE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CAL INCREASED CONCENTRATION FOR FIELD SPIKED DUP SAMPLE
- L = MEASURED VALUE FOR A LAB DUPLICATE SAMPLE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED CONCENTRATION OF FIELD SPIKED DUPLICATE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CALCULATED CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED CONCENTRATION OF LAB SPIKED SAMPLE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED CONCENTRATION OF LAB SPIKED DUPLICATE
- Y = MEASURED CONCENTRATION OF FIELD SPIKED SAMPLE
- Z = CALCULATED CONCENTRATION RESULTING FROM FIELD SPIKE
- 1 = MEASURED VALUE OF FIRST SPIKED REPLICATE
- 2 = MEASURED VALUE OF SECOND SPIKED REPLICATE
- 3 = MEASURED VALUE OF THIRD SPIKED REPLICATE
- 4 = MEASURED VALUE OF FOURTH SPIKED REPLICATE
- 5 = MEASURED VALUE OF FIFTH SPIKED REPLICATE
- 6 = MEASURED VALUE OF SIXTH SPIKED REPLICATE
- 7 = MEASURED VALUE OF SEVENTH SPIKED REPLICATE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR H = HAZARDOUS WASTE/OTHER
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION ID NUMBER OF EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPECIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS852 VALIDATED DATA

COMPOUND	UNITS	006		007		008		009		010	
WV03 CHLOROMETHANE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV04 BROMOMETHANE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV06 CHLOROETHANE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	2	K	2	K	2	K	2	K	2	K
WV08 DICHLOROETHYLENE,1,1-	UG/L	1	K	13		1	K	1	K	1	K
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	1	K	11		1	K	1	K	1	K
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	1	K	11		1	K	1	K	1	K
WV11 CHLOROFORM, BY GC/MS	UG/L	1	K	1		1	K	1	K	1	K
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	1	K	85		1	K	2		1	K
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV17 BENZENE, BY GC/MS	UG/L	1	K	48		1300		3800		960	
WV19 TRICHLOROETHYLENE	UG/L	1	K	1700		9		16		9	
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV24 BROMOFORM, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV25 TETRACHLOROETHYLENE	UG/L	1	K	53		1		1	K	1	K
WV26 TOLUENE, BY GC/MS	UG/L	1	K	1	K	1600		4600		1800	
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV28 CHLOROBENZENE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV29 ETHYL BENZENE, BY GC/MS	UG/L	1	K	1	K	650		770		290	
WV30 ACETONE, BY GC/MS	UG/L	5	K	5	K	5	K	5	K	5	K

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS8S2 VALIDATED DATA

COMPOUND	UNITS	006		007		008		009		010	
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	1	K	1	K	1	K	1	K	1	K
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	5	K	5	K	5	K	5	K	5	K
WV34 HEXANONE, 2-	UG/L	5	K	5	K	5	K	5	K	5	K
WV35 4-METHYL-2-PENTANONE	UG/L	5	K	5	K	5	K	5	K	5	K
WV36 STYRENE, BY GC/MS	UG/L	1	K	1	K	850		26		16	
WV37 XYLENES, TOTAL, BY GC/MS	UG/L	1	K	1	K	1300		3500		1900	
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	1	K	1	K	1	K	1	K	1	K
ZZ01 SAMPLE NUMBER	NA	006		007		008		009		010	
ZZ02 ACTIVITY CODE	NA	CS8S2		CS8S2		CS8S2		CS8S2		CS8S2	
ZZ04 SUBSITE, IDENTIFIER		S2		S2		S2		S2		S2	
ZZ05 OPERABLE UNIT		3		3		3		3		3	

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS8S2 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029 mwe		030 #1	
WS01 PHENOL, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS04 CHLOROPHENOL, 2-	UG/L	10	K	10	K	10	K	10	K	10	K
WS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS06 DICHLOROBENZENE,1,4-	UG/L	10	K	10	K	10	K	10	K	10	K
WS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/L	10	K	10	K	10	K	10	K	10	K
WS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/L	10	K	10	K	10	K	10	K	10	K
WS12 N-NITROSODIPROPYLAMINE	UG/L	10	K	10	K	10	K	10	K	10	K
WS13 HEXACHLOROETHANE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS14 NITROBENZENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS15 ISOPHORONE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS16 NITROPHENOL,2-	UG/L	10	K	10	K	10	K	10	K	10	K
WS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS20 DICHLOROPHENOL, 2,4-	UG/L	10	K	10	K	10	K	10	K	10	K
WS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS22 NAPHTHALENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	4500	
WS23 CHLOROANILINE,4-	UG/L	10	K	10	K	10	K	10	K	10	K
WS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS25 PHENOL,4-CHLORO-3-METHYL	UG/L	10	K	10	K	10	K	10	K	10	K
WS26 METHYLNAPHTHALENE, 2-	UG/L	10	K	10	K	10	K	10	K	1500	
WS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS28 TRICHLOROPHENOL,2,4,6	UG/L	10	K	10	K	10	K	10	K	10	K
WS29 TRICHLOROPHENOL,2,4,5	UG/L	25	K	25	K	25	K	25	K	25	K

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS852 VALIDATED DATA

COMPOUND	UNITS	026		027		028		029		030	
WS30 CHLORONAPHTHALENE, 2-	UG/L	10	K	10	K	10	K	10	K	10	K
WS31 NITROANILINE,2-(ORTHO)	UG/L	25	K	25	K	25	K	25	K	25	K
WS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	230	
WS34 NITROANILINE,3-	UG/L	25	K	25	K	25	K	25	K	25	K
WS35 ACENAPHTHENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	18	
WS36 DINITROPHENOL,2,4, BY GC/MS	UG/L	25	K	25	K	25	K	25	K	25	K
WS37 NITROPHENOL,4-	UG/L	25	K	25	K	25	K	25	K	25	K
WS38 DIBENZOFURAN	UG/L	10	K	10	K	10	K	10	K	13	
WS39 DINITROTOLUENE,2,4, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS40 DINITROTOLUENE,2,6-	UG/L	10	K	10	K	10	K	10	K	10	K
WS41 PHTHALATE, DIETHYL, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/L	10	K	10	K	10	K	10	K	10	K
WS43 FLUORENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	65	
WS44 NITROANILINE,4-	UG/L	25	K	25	K	25	K	25	K	25	K
WS45 PHENOL,4,6-DINITRO-2-METHYL	UG/L	25	K	25	K	25	K	25	K	25	K
WS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS47 ETHER, 4-BROMOPHENYL PHENYL	UG/L	10	K	10	K	10	K	10	K	10	K
WS48 HEXACHLOROBENZENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS49 PENTACHLOROPHENOL, BY GC/MS	UG/L	25	K	25	K	25	K	25	K	25	K
WS50 PHENANTHRENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	72	
WS51 ANTHRACENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS53 FLUORANTHENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS54 PYRENE, BY GC/MS	UG/L	10	K	10	K	10	K	10	K	10	K
WS55 PHTHALATE, BUTYL BENZYL	UG/L	10	K	10	K	10	K	10	K	10	K

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CS8S2 VALIDATED DATA

COMPOUND	UNITS	026	027	028	029	030
WS56 DICHLOROBENZIDINE, 3,3'	UG/L	10 K	10 K	10 K	10 K	10 K
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS59 CHRYSENE, BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L	10 K	10 K	10 K	10 K	10 K
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L	10 K	10 K	10 K	10 K	10 K
WS67 CARBAZOLE	UG/L	10 K	10 K	10 K	10 K	10 K
ZZ01 SAMPLE NUMBER	NA	026	027	028	029	030
ZZ02 ACTIVITY CODE	NA	CS8S2	CS8S2	CS8S2	CS8S2	CS8S2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		3	3	3	3	3

Groundwater Results MW-9
Environmental Protection Agency

May 1993

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT — VALIDATED DATA

FOR ACTIVITY: CSJS2

S P F D — 05/20/93 17:42:15 — ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 93 ACTIVITY: CSJS2 DESCRIPTION: HASTINGS-SECOND STREET LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 5/28/93. REPORT DUE DATE IS 5/25/93.

INSPECTION DATE: 3/26/93 ALL SAMPLES RECEIVED DATE: 03/29/93

ALL DATA APPROVED BY LABO DATE: 05/14/93 FINAL REPORT TRANSMITTED DATE: 05/20/93

EXPECTED LABO TURNAROUND TIME IS 60 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 46 DAYS ACTUAL REPORT TURNAROUND TIME IS 55 DAYS

SITE CODE: SITE:

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE STATUS	#	CITY	STATE	AIRS/ STORET LOC	NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001		W	WELL OW-4D		1	HASTINGS	NEBRASKA					03/23/93	19:30	/ /	:
002		W	WELL OW-4S		1	HASTINGS	NEBRASKA					03/23/93	19:17	/ /	:
003		W	MW-09		1	HASTINGS	NEBRASKA					03/24/93	13:30	/ /	:
004		W	GROUNDWATER WELL HWS-MW-1		1	HASTINGS	NEBRASKA					03/23/93	14:41	/ /	:
005		W	GROUNDWATER WELL HWS-MW-3		1	HASTINGS	NEBRASKA					03/23/93	11:42	/ /	:
006		W	GROUNDWATER WELL HWS-MW-4		1	HASTINGS	NEBRASKA					03/23/93	10:45	/ /	:
007		W	GROUNDWATER WELL HWS-MW-5		1	HASTINGS	NEBRASKA					03/23/93	09:35	/ /	:
008		W	GROUNDWATER WELL HWS-MW-2		1	HASTINGS	NEBRASKA					03/23/93	13:20	/ /	:
008	D	W	GROUNDWATER WELL HWS-MW-2/DUPLICATE		1	HASTINGS	NEBRASKA					03/23/93	13:20	/ /	:
009		W	OW-5S		1	HASTINGS	NEBRASKA					03/24/93	10:40	/ /	:
010		W	OW-5D		1	HASTINGS	NEBRASKA					03/24/93	14:10	/ /	:
011		W	MW-4		1	HASTINGS	NEBRASKA					03/24/93	16:05	/ /	:
012		W	MW-22		1	HASTINGS	NEBRASKA					03/24/93	16:35	/ /	:
013		W	MW-22		1	HASTINGS	NEBRASKA					03/24/93	17:40	/ /	:
014		W	SW-2		1	HASTINGS	NEBRASKA					03/25/93	18:40	/ /	:
015		W	SW-3		1	HASTINGS	NEBRASKA					03/26/93	09:15	/ /	:
016		W	SW-1		1	HASTINGS	NEBRASKA					03/25/93	16:20	/ /	:
016	D	W	SW-1/DUPLICATE OF 016		1	HASTINGS	NEBRASKA					03/25/93	16:20	/ /	:
017	F	W	RINSATE		1	HASTINGS	NEBRASKA					03/26/93	10:10	/ /	:
018	F	W	TRIP BLANK		1	HASTINGS	NEBRASKA					03/23/93	11:00	/ /	:
019	F	W	TRIP BLANK		1	HASTINGS	NEBRASKA					03/24/93	08:00	/ /	:
020		W	WELL OW-4D		1	HASTINGS	NEBRASKA					03/23/93	19:30	/ /	:
020	F	W	TRIP BLANK		1	HASTINGS	NEBRASKA					03/26/93	07:00	/ /	:

VALIDATED DATA

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	SECT	LAY-ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
021		W	WELL OW-4S	1	HASTINGS	NEBRASKA				03/23/93	19:17	/ /	:
022		W	OW-5S	1	HASTINGS	NEBRASKA				03/24/93	10:40	/ /	:
022	F	W	RINSE BLANK	1	HASTINGS	NEBRASKA				03/26/93	12:30	/ /	:
023		W	OW-5D	1	HASTINGS	NEBRASKA				03/24/93	14:10	/ /	:
024		W	MW-09	1	HASTINGS	NEBRASKA				03/24/93	13:30	/ /	:
025		W	MW-4	1	HASTINGS	NEBRASKA				03/24/93	16:05	/ /	:
026		W	MW-22	1	HASTINGS	NEBRASKA				03/24/93	16:35	/ /	:
027		W	MW-22	1	HASTINGS	NEBRASKA				03/24/93	17:40	/ /	:
028		W	SW-1	1	HASTINGS	NEBRASKA				03/25/93	16:20	/ /	:
028	D	W	SW-1	1	HASTINGS	NEBRASKA				03/25/93	16:20	/ /	:
029		W	SW-2	1	HASTINGS	NEBRASKA				03/25/93	18:40	/ /	:
030		W	SW-3	1	HASTINGS	NEBRASKA				03/26/93	09:15	/ /	:
032		W	GROUNDWATER WELL HWS-MW-1	1	HASTINGS	NEBRASKA				03/23/93	14:41	/ /	:
033		W	GROUNDWATER WELL HWS-MW-3	1	HASTINGS	NEBRASKA				03/23/93	11:42	/ /	:
034		W	GROUNDWATER WELL HWS-MW-4	1	HASTINGS	NEBRASKA				03/23/93	10:45	/ /	:
035		W	GROUNDWATER WELL HWS-MW-5	1	HASTINGS	NEBRASKA				03/23/93	09:35	/ /	:
036		W	GROUNDWATER WELL HWS-MW-2	1	HASTINGS	NEBRASKA				03/23/93	13:20	/ /	:
036	D	W	GROUNDWATER WELL HWS-MW-2/DUPLICATE	1	HASTINGS	NEBRASKA				03/23/93	13:20	/ /	:
037	F	W	RINSE BLANK	1	HASTINGS	NEBRASKA				03/26/93	13:45	/ /	:
038	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				03/27/93	13:45	/ /	:
040		W	PE Sample	1	HASTINGS	NEBRASKA				/ /	:	/ /	:

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- B = CAL INCREASED CONCENTRATION FOR A LAB SPIKED DUP SAMPLE
- D = MEASURED VALUE FOR FIELD DUPLICATE SAMPLE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CAL INCREASED CONCENTRATION FOR FIELD SPIKED DUP SAMPLE
- L = MEASURED VALUE FOR A LAB DUPLICATE SAMPLE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED CONCENTRATION OF FIELD SPIKED DUPLICATE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CAL INCREASED CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED CONCENTRATION OF LAB SPIKED SAMPLE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED CONCENTRATION OF LAB SPIKED DUPLICATE
- Y = MEASURED CONCENTRATION OF FIELD SPIKED SAMPLE
- Z = CAL INCREASED CONCENTRATION RESULTING FROM FIELD SPIKE
- 1 = MEASURED VALUE OF FIRST SPIKED REPLICATE
- 2 = MEASURED VALUE OF SECOND SPIKED REPLICATE
- 3 = MEASURED VALUE OF THIRD SPIKED REPLICATE
- 4 = MEASURED VALUE OF FOURTH SPIKED REPLICATE
- 5 = MEASURED VALUE OF FIFTH SPIKED REPLICATE
- 6 = MEASURED VALUE OF SIXTH SPIKED REPLICATE
- 7 = MEASURED VALUE OF SEVENTH SPIKED REPLICATE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR H = HAZARDOUS WASTE/OTHER
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION ID NUMBER OF EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPECIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	001 OW-4S	002 OW-4D	003 MW-9	004 HWS-1	005 HWS-3
WV03 CHLOROMETHANE, BY GC/MS	UG/L	10U	10U	10U	10U	10U
WV04 BROMOMETHANE, BY GC/MS	UG/L	20U	20U	20U	20U	20U
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	15U	15U	15U	15U	15U
WV06 CHLOROETHANE, BY GC/MS	UG/L	15U	15U	15U	15U	15U
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	10U	10U	10U	10U	10U
WV08 DICHLOROETHYLENE,1,1-	UG/L	5U	8	5U	5U	5U
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	5U	5U	5U	5U	5U
WV11 CHLOROFORM, BY GC/MS	UG/L	5U	5U	5U	71	19
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	5U	5U	5U	43	5U
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	5U	23	5U	5U	5U
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV17 BENZENE, BY GC/MS	UG/L	5U	5U	3000	5300	3600
WV19 TRICHLOROETHYLENE	UG/L	20	1000	5U	12	7
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	5U	5U	5U	180	5U
WV24 BROMOFORM, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV25 TETRACHLOROETHYLENE	UG/L	5U	20	5U	5U	5U
WV26 TOLUENE, BY GC/MS	UG/L	5U	5U	3100	14000	6400
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV28 CHLOROBENZENE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV29 ETHYL BENZENE, BY GC/MS	UG/L	5U	5U	130	2900	1600
WV30 ACETONE, BY GC/MS	UG/L	10U	10U	10U	400	61

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	001 OW-4S	002 OW-4D	003 MW-9	004 HWS-1	005 HWS-3
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	5U	5U	5U	5U	5U
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	10U	10U	10U	10U	10U
WV34 HEXANONE, 2-	UG/L	10U	10U	10U	500	10U
WV35 4-METHYL-2-PENTANONE	UG/L	10U	10U	10U	10U	10U
WV36 STYRENE, BY GC/MS	UG/L	5U	5U	950	1100	5U
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	5U	5U	5U	5U	5U
WV67 XYLENE, M AND/OR P	UG/L	5U	5U	720	5200	3000
WV70 XYLENE, ORTHO	UG/L	5U	5U	680	5000	1400
WV72 DICHLOROBENZENE,1,4-(PARA)	UG/L	5U	5U	5U	5U	5U
WV74 DICHLOROBENZENE,1,3-(META)	UG/L	5U	5U	5U	5U	5U
WV77 DICHLOROBENZENE,1,2-(ORTHO)	UG/L	5U	5U	5U	5U	5U
ZZ01 SAMPLE NUMBER	NA	001	002	003	004	005
ZZ02 ACTIVITY CODE	NA	CSJS2	CSJS2	CSJS2	CSJS2	CSJS2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		12	12	12	12	12

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	022 F	023 QW-5D	024 MW-9	025 MW-1	026 MW-22 (188 185)
WS01 PHENOL, BY GC/MS	UG/L		20U	20U	20 U	20U
WS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/L		20U	20U	20 U	20U
WS04 CHLOROPHENOL, 2-	UG/L		20U	20U	20 U	20U
WS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/L		20U	20U	20 U	20U
WS06 DICHLOROBENZENE,1,4-	UG/L		20U	20U	20 U	20U
WS07 BENZYL ALCOHOL	UG/L		20U	20U	20 U	20U
WS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/L		20U	20U	20 U	20U
WS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/L		20U	20U	20 U	20U
WS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/L		20U	20U	20 U	20U
WS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/L		20U	20U	20 U	20U
WS12 N-NITROSODIPROPYLAMINE	UG/L		20U	20U	20 U	20U
WS13 HEXACHLOROETHANE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS14 NITROBENZENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS15 ISOPHORONE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS16 NITROPHENOL,2-	UG/L		20U	20U	20 U	20U
WS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/L		20U	20U	20 U	20U
WS18 BENZOIC ACID, BY GC/MS	UG/L		100U	100U	100 U	100U
WS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/L		20U	20U	20 U	20U
WS20 DICHLOROPHENOL, 2,4-	UG/L		20U	20U	20 U	20U
WS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/L		20U	20U	20 U	20U
WS22 NAPHTHALENE, BY GC/MS	UG/L		20U	2900	20 U	20U
WS23 CHLOROANILINE,4-	UG/L		20U	200U	20 U	20U
WS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS25 PHENOL,4-CHLORO-3-METHYL	UG/L		20U	20U	20 U	20U
WS26 METHYLNAPHTHALENE, 2-	UG/L		20U	980	20 U	20U
WS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/L		20U	20U	20 U	20U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	022 F	023 OW-50	024 MW-9	025 MW-4	026 MW-22
WS28 TRICHLOROPHENOL,2,4,6	UG/L		20U	20U	20 U	20U
WS29 TRICHLOROPHENOL,2,4,5	UG/L		100U	100U	100 U	100U
WS30 CHLORONAPHTHALENE, 2-	UG/L		20U	20U	20 U	20U
WS31 NITROANILINE,2-(ORTHO)	UG/L		100U	100U	100 U	100U
WS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/L		20U	20U	20 U	20U
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L		20U	190	20 U	20U
WS34 NITROANILINE,3-	UG/L		100U	100U	100 U	100U
WS35 ACENAPHTHENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS36 DINITROPHENOL,2,4, BY GC/MS	UG/L		100U	100U	100 U	100U
WS37 NITROPHENOL,4-	UG/L		100U	100U	100 U	100U
WS38 DIBENZOFURAN	UG/L		20U	20U	20 U	20U
WS39 DINITROTOLUENE,2,4, BY GC/MS	UG/L		20U	20U	20 U	20U
WS40 DINITROTOLUENE,2,6-	UG/L		20U	20U	20 U	20U
WS41 PHTHALATE, DIETHYL, BY GC/MS	UG/L		20U	20U	20 U	20U
WS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/L		20U	20U	20 U	20U
WS43 FLUORENE, BY GC/MS	UG/L		20U	48	20 U	20U
WS44 NITROANILINE,4-	UG/L		100U	100U	100 U	100U
WS45 PHENOL,4,6-DINITRO-2-METHYL	UG/L		100U	100U	100 U	100U
WS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS47 ETHER, 4-BROMOPHENYL PHENYL	UG/L		20U	20U	20 U	20U
WS48 HEXACHLOROBENZENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS49 PENTACHLOROPHENOL, BY GC/MS	UG/L		100U	100U	100 U	100U
WS50 PHENANTHRENE, BY GC/MS	UG/L		20U	61	20 U	20U
WS51 ANTHRACENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/L		20U	20U	20 U	20U
WS53 FLUORANTHENE, BY GC/MS	UG/L		20U	20U	20 U	20U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	022 F	023 OW-5D	024 MW-9	025 MW-4	026 MW-22 180-185
WS54 PYRENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS55 PHTHALATE, BUTYL BENZYL	UG/L		20U	20U	20 U	20U
WS56 DICHLOROBENZIDINE, 3,3'	UG/L		40U	40U	40 U	40U
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L		20U	20U	20 U	20U
WS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/L		20U	20U	20 U	20U
WS59 CHRYSENE, BY GC/MS	UG/L		20U	20U	20 U	20U
WS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/L		20U	20U	20 U	20U
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L		20U	20U	20 U	20U
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L		20U	20U	20U	20U
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L		20U	20U	20U	20U
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L		20U	20U	20U	20U
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L		20U	20U	20U	20U
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L		20U	20U	20U	20U
WS67 CARBAZOLE	UG/L		20U	20U	20U	20U
WV03 CHLOROMETHANE, BY GC/MS	UG/L	10U				
WV04 BROMOMETHANE, BY GC/MS	UG/L	20U				
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	15U				
WV06 CHLOROETHANE, BY GC/MS	UG/L	15U				
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	10U				
WV08 DICHLOROETHYLENE,1,1-	UG/L	5U				
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	5U				
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	5U				
WV11 CHLOROFORM, BY GC/MS	UG/L	5U				
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	5U				4
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	5U				
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	5U				

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	022 F	023	024	025	026
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	5U				
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	5U				
WV17 BENZENE, BY GC/MS	UG/L	5U				
WV19 TRICHLOROETHYLENE	UG/L	17				
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	5U				
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	5U				
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	5U				
WV24 BROMOFORM, BY GC/MS	UG/L	5U				
WV25 TETRACHLOROETHYLENE	UG/L	5U				
WV26 TOLUENE, BY GC/MS	UG/L	5U				
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	5U				
WV28 CHLOROBENZENE, BY GC/MS	UG/L	5U				
WV29 ETHYL BENZENE, BY GC/MS	UG/L	5U				
WV30 ACETONE, BY GC/MS	UG/L	10U				
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	5U				
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	10U				
WV34 HEXANONE, 2-	UG/L	10U				
WV35 4-METHYL-2-PENTANONE	UG/L	10U				
WV36 STYRENE, BY GC/MS	UG/L	5U				
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	5U				
WV67 XYLENE, M AND/OR P	UG/L	5U				
WV70 XYLENE, ORTHO	UG/L	5U				
WV72 DICHLOROBENZENE,1,4-(PARA)	UG/L	5U				
WV74 DICHLOROBENZENE,1,3-(META)	UG/L	5U				
WV77 DICHLOROBENZENE,1,2-(ORTHO)	UG/L	5U				
Z201 SAMPLE NUMBER	NA	022	023	024	025	026

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSJS2 VALIDATED DATA

COMPOUND	UNITS	022 F	023	024	025	026
ZZ02 ACTIVITY CODE	NA	CSJS2	CSJS2	CSJS2	CSJS2	CSJS2
ZZ04 SUBSITE, IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		12	12	12	12	12

Groundwater Results MW-9
Environmental Protection Agency

October 1993

Hastings Second Street Subsite

ANALYSIS REQUEST REPORT — VALIDATED DATA

FOR ACTIVITY: CSTS2

S P F D — 10/18/93 11:22:02 — ALL REAL SAMPLES AND FIELD Q.C.

* FINAL REPORT

FY: 93 ACTIVITY: CSTS2 DESCRIPTION: HASTINGS-SECOND STREET LOCATION: HASTINGS NEBRASKA

STATUS: ACTIVE TYPE: SAMPLING - IN HOUSE ANALYSIS PROJECT: A33

LABO DUE DATE IS 10/20/93. REPORT DUE DATE IS 11/17/93.

INSPECTION DATE: 9/18/93 ALL SAMPLES RECEIVED DATE: 09/20/93

ALL DATA APPROVED BY LABO DATE: 10/12/93 FINAL REPORT TRANSMITTED DATE: 10/18/93

EXPECTED LABO TURNAROUND TIME IS 30 DAYS EXPECTED REPORT TURNAROUND TIME IS 60 DAYS

ACTUAL LABO TURNAROUND TIME IS 22 DAYS ACTUAL REPORT TURNAROUND TIME IS 30 DAYS

SITE CODE: S2 SITE: HASTINGS GW CONTAMINATION

SAMP. NO.	QCC	M	DESCRIPTION	SAMPLE # STATUS	CITY	STATE	AIRS/ STORET LOC NO	LAY- SECT	ER	BEG. DATE	BEG. TIME	END. DATE	END. TIME
001	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				09/14/93	08:00	/ /	:
002	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				09/15/93	08:00	/ /	:
003	F	W	TRIP BLANK	1	HASTINGS	NEBRASKA				09/17/93	08:00	/ /	:
004		W	HWS-5	1	HASTINGS	NEBRASKA				09/14/93	10:05	/ /	:
005		W	HWS-2	1	HASTINGS	NEBRASKA				09/14/93	12:00	/ /	:
006		W	WELL MW-9	1	HASTINGS	NEBRASKA				09/14/93	15:15	/ /	:
006	D	W	WELL MW-9/DUPLICATE OF 006	1	HASTINGS	NEBRASKA				09/14/93	15:15	/ /	:
007		W	HWS-1	1	HASTINGS	NEBRASKA				09/14/93	14:00	/ /	:
008		W	HWS-3	1	HASTINGS	NEBRASKA				09/14/93	15:00	/ /	:
009		W	HWS-4	1	HASTINGS	NEBRASKA				09/14/93	16:55	/ /	:
010		W	HWS-6	1	HASTINGS	NEBRASKA				09/14/93	18:15	/ /	:
011		W	WELL SW-1	1	HASTINGS	NEBRASKA				09/15/93	09:50	/ /	:
012		W	WELL SW-2	1	HASTINGS	NEBRASKA				09/15/93	13:00	/ /	:
013		W	RINSE BLANK	1	HASTINGS	NEBRASKA				09/15/93	16:20	/ /	:
014		W	HWS-7	1	HASTINGS	NEBRASKA				09/16/93	17:10	/ /	:
015		W	WELL SW-3	1	HASTINGS	NEBRASKA				09/15/93	15:10	/ /	:
015	D	W	WELL SW-3	1	HASTINGS	NEBRASKA				09/15/93	15:10	/ /	:
016		W	HWS-12	1	HASTINGS	NEBRASKA				09/16/93	18:35	/ /	:
018		W	HWS-8	1	HASTINGS	NEBRASKA				09/17/93	09:20	/ /	:
019		W	HWS-10	1	HASTINGS	NEBRASKA				09/17/93	11:15	/ /	:
020		W	HWS-11	1	HASTINGS	NEBRASKA				09/17/93	12:30	/ /	:
021		W	HWS-9	1	HASTINGS	NEBRASKA				09/17/93	14:15	/ /	:

EXPLANATION OF CODES AND INFORMATION ON ANALYSIS REQUEST DETAIL REPORT

SAMPLE INFORMATION:

SAMP. NO. = SAMPLE IDENTIFICATION NUMBER (A 3-DIGIT NUMBER WHICH IN COMBINATION WITH THE ACTIVITY NUMBER AND QCC, PROVIDES AN UNIQUE NUMBER FOR EACH SAMPLE FOR IDENTIFICATION PURPOSES)

QCC = QUALITY CONTROL CODE (A ONE-LETTER CODE USED TO DESIGNATE SPECIFIC QC SAMPLES. THIS FIELD WILL BE BLANK FOR ALL NON-QC OR ACTUAL SAMPLES):
- B = CAL INCREASED CONCENTRATION FOR A LAB SPIKED DUP SAMPLE
- D = MEASURED VALUE FOR FIELD DUPLICATE SAMPLE
- F = MEASURED VALUE FOR FIELD BLANK
- G = MEASURED VALUE FOR METHOD STANDARD
- H = TRUE VALUE FOR METHOD STANDARD
- K = CAL INCREASED CONCENTRATION FOR FIELD SPIKED DUP SAMPLE
- L = MEASURED VALUE FOR A LAB DUPLICATE SAMPLE
- M = MEASURED VALUE FOR LAB BLANK
- N = MEASURED CONCENTRATION OF FIELD SPIKED DUPLICATE
- P = MEASURED VALUE FOR PERFORMANCE STANDARD
- R = CAL INCREASED CONCENTRATION RESULTING FROM LAB SPIKE
- S = MEASURED CONCENTRATION OF LAB SPIKED SAMPLE
- T = TRUE VALUE OF PERFORMANCE STANDARD
- W = MEASURED CONCENTRATION OF LAB SPIKED DUPLICATE
- Y = MEASURED CONCENTRATION OF FIELD SPIKED SAMPLE
- Z = CAL INCREASED CONCENTRATION RESULTING FROM FIELD SPIKE
- 1 = MEASURED VALUE OF FIRST SPIKED REPLICATE
- 2 = MEASURED VALUE OF SECOND SPIKED REPLICATE
- 3 = MEASURED VALUE OF THIRD SPIKED REPLICATE
- 4 = MEASURED VALUE OF FOURTH SPIKED REPLICATE
- 5 = MEASURED VALUE OF FIFTH SPIKED REPLICATE
- 6 = MEASURED VALUE OF SIXTH SPIKED REPLICATE
- 7 = MEASURED VALUE OF SEVENTH SPIKED REPLICATE

M = MEDIA CODE (A ONE-LETTER CODE DESIGNATING THE MEDIA OF THE SAMPLE):
- A = AIR H = HAZARDOUS WASTE/OTHER
- S = SOLID (SOIL, SEDIMENT, SLUDGE)
- T = TISSUE (PLANT & ANIMAL)
- W = WATER (GROUND WATER, SURFACE WATER, WASTE WATER, DRINKING WATER)

DESCRIPTION = A SHORT DESCRIPTION OF THE LOCATION WHERE SAMPLE WAS COLLECTED

AIRS/STORET LOC. NO. = THE SPECIFIC LOCATION ID NUMBER OF EITHER OF THESE NATIONAL DATABASE SYSTEMS, AS APPROPRIATE

DATE/TIME INFORMATION = SPECIFIC INFORMATION REGARDING WHEN THE SAMPLE WAS COLLECTED
- BEG. DATE = DATE SAMPLING WAS STARTED
- BEG. TIME = TIME SAMPLING WAS STARTED
- END DATE = DATE SAMPLING WAS COMPLETED
- END TIME = TIME SAMPLING WAS COMPLETED
- NOTE: A GRAB SAMPLE WILL CONTAIN ONLY BEG. DATE/TIME
  A TIMED COMPOSITE SAMPLE WILL CONTAIN BOTH BEG AND END DATE/TIME TO DESIGNATE DURATION OF SAMPLE COLLECTION

OTHER CODES
- V = VALIDATED

ANALYTICAL RESULTS/MEASUREMENTS INFORMATION:

COMPOUND = MGP (MEDIA-GROUP-PARAMETER) CODE AND NAME OF THE MEASURED CONSTITUENT OR CHARACTERISTIC OF EACH SAMPLE

UNITS = SPECIFIC UNITS IN WHICH RESULTS ARE REPORTED:
- C = CENTIGRADE (CELSIUS) DEGREES
- CFS = CUBIC FEET PER SECOND
- GPM = GALLONS PER MINUTE
- IN = INCHES
- I.D. = SPECIES IDENTIFICATION
- KG = KILOGRAM
- L = LITER
- LB = POUNDS
- MG = MILLIGRAMS (1 X 10-3 GRAMS)
- MGD = MILLION GALLONS PER DAY
- MPH = MILES PER HOUR
- MV = MILLIVOLT
- M/F = MALE/FEMALE
- M2 = SQUARE METER
- M3 = CUBIC METER
- NA = NOT APPLICABLE
- NG = NANOGRAMS (1 X 10-9 GRAMS)
- NTU = NEPHELOMETRIC TURBIDITY UNITS
- PC/L = PICO (1 X 10-12) CURRIES PER LITER
- PG = PICOGRAMS (1 X 10-12 GRAMS)
- P/CM2 = PICOGRAMS PER SQUARE CENTIMETER
- SCM = STANDARD CUBIC METER (1 ATM, 25 C)
- SQ FT = SQUARE FEET
- SU = STANDARD UNITS (PH)
- UG = MICROGRAMS (1 X 10-6 GRAMS)
- UMHOS = MICROMHOS/CM (CONDUCTIVITY UNITS)
- U/CC2 = MICROGRAMS PER 100 SQUARE CENTIMETERS
- U/CM2 = MICROGRAMS PER SQUARE CENTIMETER
- 1000G = 1000 GALLONS
- +/- = POSITIVE/NEGATIVE
- # = NUMBER

DATA QUALIFIERS = SPECIFIC CODES USED IN CONJUNCTION WITH DATA VALUES TO PROVIDE ADDITIONAL INFORMATION ON THE REPORTED RESULTS, OR USED TO EXPLAIN THE ABSENCE OF A SPECIFIC VALUE:
- BLANK = IF FIELD IS BLANK, NO REMARKS OR QUALIFIERS ARE PERTINENT. FOR FINAL REPORTED DATA, THIS MEANS THAT THE VALUES HAVE BEEN REVIEWED AND FOUND TO BE ACCEPTABLE FOR USE.
- I = INVALID SAMPLE/DATA - VALUE NOT REPORTED
- J = DATA REPORTED BUT NOT VALID BY APPROVED QC PROCEDURES
- K = ACTUAL VALUE OF SAMPLE IS < VALUE REPORTED
- L = ACTUAL VALUE OF SAMPLE IS > VALUE REPORTED
- M = DETECTED BUT BELOW THE LEVEL OF REPORTED VALUE FOR ACCURATE QUANTIFICATION
- O = PARAMETER NOT ANALYZED
- U = ACTUAL VALUE OF SAMPLE IS < THE MEASUREMENT DETECTION LIMIT (REPORTED VALUE)

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSTS2 VALIDATED DATA

COMPOUND	UNITS	006		006 D		007		008		009	
WS01 PHENOL, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS03 ETHER,BIS(2-CHLOROETHYL), BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS04 CHLOROPHENOL, 2-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS05 DICHLOROBENZENE,1,3-, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS06 DICHLOROBENZENE,1,4-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS07 BENZYL ALCOHOL	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS08 DICHLOROBENZENE,1,2-, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS09 CRESOL, ORTHO(2-METHYLPHENOL)	UG/L	200	U	200	U	200	U	42.0		10.0	U
WS10 ETHER,BIS(2-CHLOROISOPROPYL), BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS11 CRESOL, PARA-(4-METHYLPHENOL)	UG/L	200	U	200	U	200	U	56.0		88.6	
WS12 N-NITROSODIPROPYLAMINE	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS13 HEXACHLOROETHANE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS14 NITROBENZENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS15 ISOPHORONE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS16 NITROPHENOL,2-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS17 DIMETHYLPHENOL,2,4, BY GC/MS	UG/L	200	U	200	U	200	U	56.0		51.9	
WS18 BENZOIC ACID, BY GC/MS	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS19 METHANE, BIS(2-CHLOROETHYOXY), BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS20 DICHLOROPHENOL, 2,4-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS21 TRICHLOROBENZENE,1,2,4, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS22 NAPHTHALENE, BY GC/MS	UG/L	2150		1450		3100		157		154	
WS23 CHLOROANILINE,4-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS24 HEXACHLOROBUTADIENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS25 PHENOL,4-CHLORO-3-METHYL	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS26 METHYLNAPHTHALENE, 2-	UG/L	819		496		828		77.0		81.3	
WS27 HEXACHLOROCYCLOPENTADIENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSTS2 VALIDATED DATA

COMPOUND	UNITS	006		006 D		007		008		009	
WS28 TRICHLOROPHENOL,2,4,6	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS29 TRICHLOROPHENOL,2,4,5	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS30 CHLORONAPHTHALENE, 2-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS31 NITROANILINE,2-(ORTHO)	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS32 PHTHALATE, DIMETHYL, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS33 ACENAPHTHYLENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS34 NITROANILINE,3-	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS35 ACENAPHTHENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS36 DINITROPHENOL,2,4, BY GC/MS	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS37 NITROPHENOL,4-	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS38 DIBENZOFURAN	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS39 DINITROTOLUENE,2,4, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS40 DINITROTOLUENE,2,6-	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS41 PHTHALATE, DIETHYL, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS42 ETHER, 4-CHLOROPHENYL PHENYL	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS43 FLUORENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS44 NITROANILINE,4-	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS45 PHENOL,4,6-DINITRO-2-METHYL	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS46 N-NITROSODIPHENYLAMINE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS47 ETHER, 4-BROMOPHENYL PHENYL	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS48 HEXACHLOROBENZENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS49 PENTACHLOROPHENOL, BY GC/MS	UG/L	1000	U	1000	U	1000	U	50.0	U	50.0	U
WS50 PHENANTHRENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS51 ANTHRACENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS52 PHTHALATE, DI-N-BUTYL-, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U
WS53 FLUORANTHENE, BY GC/MS	UG/L	200	U	200	U	200	U	10.0	U	10.0	U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSTS2 VALIDATED DATA

COMPOUND	UNITS	006	006 D	007	008	009
WS54 PYRENE, BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS55 PHTHALATE, BUTYL BENZYL	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS56 DICHLOROBENZIDINE, 3,3'	UG/L	400 U	400 U	400 U	20.0 U	20.0 U
WS57 ANTHRACENE, BENZO(A), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS58 PHTHALATE, BIS(2-ETHYLHEXYL), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS59 CHRYSENE, BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS60 PHTHALATE, DI-N-OCTYL-, BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS61 FLUORANTHENE, BENZO(B), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS62 FLUORANTHENE, BENZO(K), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS63 PYRENE, BENZO(A), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS64 PYRENE, INDENO(1,2,3-CD)	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS65 ANTHRACENE, DIBENZO(A,H), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WS66 PERYLENE,BENZO(G,H,I), BY GC/MS	UG/L	200 U	200 U	200 U	10.0 U	10.0 U
WV03 CHLOROMETHANE, BY GC/MS	UG/L	100 U	100 U	100 U	100 U	100 U
WV04 BROMOMETHANE, BY GC/MS	UG/L	200 U	200 U	200 U	200 U	200 U
WV05 VINYL CHLORIDE, BY GC/MS	UG/L	150 U	150 U	150 U	150 U	150 U
WV06 CHLOROETHANE, BY GC/MS	UG/L	150 U	150 U	150 U	150 U	150 U
WV07 METHYLENE CHLORIDE (DICHLOROMETHANE)	UG/L	230 U	240 U	210 U	210 U	200 U
WV08 DICHLOROETHYLENE,1,1-	UG/L	50 U	50 U	50 U	50 U	50 U
WV09 DICHLOROETHANE,1,1, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV10 DICHLOROETHYLENE, 1,2, TOTAL	UG/L	50 U	50 U	50 U	50 U	50 U
WV11 CHLOROFORM, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV12 DICHLOROETHANE,1,2, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	96
WV13 TRICHLOROETHANE,1,1,1-, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV14 CARBON TETRACHLORIDE, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV15 BROMODICHLOROMETHANE, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U

ANALYSIS REQUEST DETAIL REPORT ACTIVITY: 3-CSTS2 VALIDATED DATA

COMPOUND	UNITS	006	006 D	007	008	009
WV16 DICHLOROPROPANE,1,2, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV17 BENZENE, BY GC/MS	UG/L	2400	2300	1400	1300	4300
WV19 TRICHLOROETHYLENE	UG/L	50 U	50 U	50 U	50 U	50 U
WV20 DICHLOROPROPYLENE,CIS-1,3, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV21 DIBROMOCHLOROMETHANE, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV22 TRICHLOROETHANE,1,1,2-, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV24 BROMOFORM, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV25 TETRACHLOROETHYLENE	UG/L	50 U	50 U	50 U	50 U	50 U
WV26 TOLUENE, BY GC/MS	UG/L	2800	3000	12000	4000	4500
WV27 TETRACHLOROETHANE,1,1,2,2, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV28 CHLOROBENZENE, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV29 ETHYL BENZENE, BY GC/MS	UG/L	190	210	1300	630	730
WV30 ACETONE, BY GC/MS	UG/L	160 U	190 U	160 U	120 U	140 U
WV31 CARBON DISULFIDE, BY GC/MS	UG/L	50 U	50 U	50 U	50 U	50 U
WV32 METHYL ETHYL KETONE (2-BUTANONE)	UG/L	100 U	100 U	10 U	100 U	100 U
WV34 HEXANONE, 2-	UG/L	100 U	100 U	100 U	100 U	100 U
WV35 4-METHYL-2-PENTANONE(MIBK)	UG/L	100 U	100 U	100 U	100 U	100 U
WV36 STYRENE, BY GC/MS	UG/L	740	820	550	50 U	50 U
WV37 XYLENES, TOTAL, BY GC/MS	UG/L	750	840	4800	1500	1500
WV40 DICHLOROPROPYLENE,TRANS-1,3	UG/L	50 U	50 U	50 U	50 U	50 U
ZZ01 SAMPLE NUMBER	NA	006	006	007	008	009
ZZ02 ACTIVITY CODE	NA	CSTS2	CSTS2	CSTS2	CSTS2	CSTS2
ZZ04 SUBSITE IDENTIFIER		S2	S2	S2	S2	S2
ZZ05 OPERABLE UNIT		12	12	12	12	12

Appendix 6

Oral and Dermal Absorption Factors

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

AUG 0 6 1991

SUBJECT: Oral and Dermal Absorption Factors (Cardington Road Sanitary Landfill Site/Moraine, Ohio)

FROM: Pei-Fung Hurst
Coordinator
Superfund Health Risk Technology Support Center
Chemical Mixtures Assessment Branch

TO: Pat VanLeeuwen
U.S. EPA
Region V

THRU: W. Bruce Peirano
Acting Chief
Chemical Mixtures Assessment Branch

This memo is in response to a request from Amy Rosenstein of Gradient Corp. for oral and dermal absorption factors for several chemicals found at this site.

As per our conversation on 7/30/91, we are forwarding those oral absorption factors that are currently available. The dermal absorption factors and six oral absorption factors are being researched and will be forwarded as soon as they are available.

Please note that it is recommended that the feasibility of extrapolating oral toxicity data to dermal values should be considered when assessing dermal risk.

Please feel free to contact ECAO at FTS 684-7300 if we can be of further assistance.

Attachment

cc: C. Braverman (Region V)
J. Dinan (OS-230)
T. Harvey (ECAO-Cin)
B. Means (OS-230)
A. Rosenstein (Gradient Corp.)

Table 1. Oral Absorption Factors

CHEMICAL	EPA DOCUMENTS	ATSDR
Acetone	U.S. EPA, 1987a: readily absorbed but no quantitative data	No ATSDR
Aluminum	U.S. EPA 1987b: no data U.S. EPA 1984a Humans: 5% aluminum hydroxide	1990a Humans: absorbed but not quantified Rats: 27% aluminum chloride
Antimony	U.S. EPA 1989a: no quantitative data U.S. EPA 1987c Human: little absorption form GI tract, probable <1% for insoluble oxides Animal: approximately 15% for water soluble organics	1990b Humans: 10% antimony tartrate; 1% all other forms
Arsenic	U.S. EPA 1984b Humans: >95% absorption of inorganic arsenic Animals(Rats, pigs & monkeys): approximately 90% absorption of inorganic arsenic	1989a Humans: >95% absorption of inorganic arsenic Animals: >90% absorption of water soluble salts; 30-40% absorption of trioxide suspensions
Barium	U.S. EPA 1985a Animals: 3-11%	1990c Humans: <5% Dogs: 7% Rats <22 days old: 63-84% Rats >22 days old: 7%
Benzene	U.S. EPA, 1987d: no quantitative data U.S. EPA, 1989b: rats and mice >97%	1989b: Humans: expected to be high Animals: approximately 90% absorption in rabbits, rats & mice

Table 1. Oral Absorption Factors, Cont'd.

CHEMICAL	EPA DOCUMENTS	ATSDR
Benzoic acid	U.S. EPA, 1987e Humans: 95-99% Animals: almost completely absorbed in rats, hamsters & dogs	No ATSDR
Benzyl alcohol	U.S. EPA, 1989c Humans: 74-88% Animals: 73-98%	No ATSDR
Beryllium	U.S. EPA 1987f Animals: <1%	1988a Same as U.S. EPA
2-butanone	U.S. EPA 1985b, 1989c: no data	1990d Humans: absorbed but not quantified Rats: rapidly absorbed
Butylbenzylphthalate	U.S. EPA 1989d Rats: approximately 90%	No ATSDR
Chlorobenzene	U.S. EPA 1987g: no quantitative data	1989c Humans: minimum of 13% Animals: minimum of 18% in rats, minimum of 22% in rabbits
Chloroform	U.S. EPA 1980a Animals: approximately 100% U.S. EPA 1988a Humans: nearly complete Animals: 93-98% absorption in mice, rats & monkeys	1989d Humans: approximately 100% Animals: 93-98%
Cobalt	U.S. EPA 1991 Humans: no data	1990e Humans: 18-97% depending on the type of cobalt, dose and nutritional status Rats: 30%

Table 1. Oral Absorption Factors, Cont'd.

CHEMICAL	EPA DOCUMENTS	ATSDR
1,1-dichloroethane	U.S. EPA 1987h, 1984c: no quantitative data	1990f: absorbed but not quantified
1,2-dichloroethane (total)	U.S. EPA 1987i: no data U.S. EPA 1984d Rats: virtually complete	1989e Humans: rapidly absorbed Animals: 90-100%
Di-n-butylphthalate	U.S. EPA 1986a: >90%	1990g Animals: 79-100%
Ethylbenzene	U.S. EPA 1987j Rabbits: 90%	1990h Rabbits & rats: 72-92%
Lead	U.S. EPA 1990 Based on a UBK Model for children: 50% in diet, 50% in drinking water, 30% in dust/soil	1989f Humans: 7-15% in adults; 42-53% in infants and children Animals: 1-15%
Mercury	U.S. EPA 1987k Humans: 7% mercuric nitrate; 95% methyl mercury Rats: 1-2% mercuric chloride; 7% mercuric chloride in milk Suckling mice: 38% Other animals: <0.01% of metallic mercury U.S. EPA 1984e Humans: high rate for methyl mercury; 15% mercuric nitrate	1989g Humans: 0.1% metallic; 15% mercuric nitrate; approximately 95% methylmercuric nitrate Mice: mercuric chloride: suckling- 38% adult- 1% in regular diet, 7% in milk diet Organic mercury: >80%
Methylene chloride	U.S. EPA 1989e Rats & mice: almost 90%	1989h Human: no data Mice: minimum of 95% Rats: approximately 100%

Table 1. Oral Absorption Factors, Cont'd.

CHEMICAL	EPA DOCUMENTS	ATSDR
4-methylphenol	U.S. EPA 1985c Rats: 65-80%	1990i Humans: no data Rabbits: 65-84%
Nickel	U.S. EPA 1986b Humans: 1-10%	1988b Humans: 1-10% Rats, dogs & mice: 1-10%
n-nitroso- diphenylamine	U.S. EPA 1987l: absorbed but not quantified	1989i Humans: no data Rats: 98%
Pentachlorophenol	U.S. EPA 1987m: nearly complete absorption in humans and animals U.S. EPA 1986c Humans: minimum of 86% Animals: >70%	1989j Humans: readily absorbed but not quantified Rats & Monkeys: >90%
Phenol	U.S. EPA 1980b, 1989e: readily asorbed but not quantified	1989k Humans: 85-98% Rats: 95% Squirrel Monkey: 31%
Tetrachloroethene	U.S. EPA 1987n, 1988b Rats & mice: approximately 100%	1990j Humans: absorbed but not quantified Animals: rapid and virtually complete
Toluene	U.S. EPA 1985d Rabbits: >90% U.S. EPA 1987o Rats: rapid but not quantified U.S. EPA 1984f Rabbits: 92-99%	19891 Humans: no data Animals: absorbed but not quantified
Trichloroethene	U.S. EPA 1987p Rats: 97% U.S. EPA 1988c Rats & mice: 92-100%	1989m Humans: absorbed but not quantified Rats & mice: 93-98%
Vanadium	U.S. EPA 1987q Humans: 0.1-1%	1990k Humans: no data Rats: 2.6%

Table 1. Oral Absorption Factors, Cont'd.

CHEMICAL	EPA DOCUMENTS	ATSDR
Xylene	U.S. EPA 1986d, 1989f Rabbits: 85-90%	1989n Humans: absorbed but not quantified Animals: 87-92%

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Appendix 7

Toxicity Data for Multiple Chemicals
Hastings Second Street Subsite
Hastings, Nebraska

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

MEMORANDUM

DATE: October 5, 1993

SUBJECT: Toxicity data for multiple chemicals (Hastings Groundwater Contamination Superfund Site (subsite 12)/Hastings, NE)

FROM: Joan S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Mary Rouse
U.S. EPA
Region VII

This memorandum responds to your request for toxicity values for multiple chemicals for use at the Hastings Groundwater Contamination Superfund Site, Hastings, NE.

Attached please find the following **Risk Assessment Issue Papers:**

Attachment I.	**Feasibility of Developing an RfD for Acenaphthylene (CASRN 208-96-8) by Analogy to Potential Surrogates Phenanthrene (CASRN 85-01-8), Acenaphthene (CASRN 83-32-9)**
Attachment II.	**Derivation of a Provisional RfD for Benzene (CASRN 71-43-2)**
Attachment III.	**Derivation of a Provisional RfC for Benzene (CASRN 71-43-2)**
Attachment IV.	**Oral-to-Dermal Extrapolation for Fluorene (CASRN 86-73-7)**
Attachment V.	**Feasibility of RfD Derivation for 2-Methylnaphthalene (CASRN 91-57-6)**
Attachment VI.	**Feasibility of RfC Derivation for 2-Methylnaphthalene (CASRN 91-57-6)**
Attachment VII.	**Provisional RfC for Naphthalene (CASRN 91-20-3)**

Attachment VIII. **Provisional Oral RfD for Naphthalene (CASRN 91-20-3)**
Please note that the Oral RfD for Naphthalene is currently under review by the RfC/RfD Work Group which may result in changes to the RfD value.

Attachment IX. **Dermal Absorption of Styrene**

In **Attachment X.**, oral absorption information is presented in tabular form for the following chemicals:

- Acenaphthene (CASRN 83-32-9)
- 2-Methylnaphthalene (CASRN
- Phenanthrene (CASRN 85-01-8)

We have no available in-house information on the RfC for Acenaphthene, the RfC and Oral Absorption of Acenaphthylene, the RfC for Fluorene, the RfC and RfD for Phenanthrene, or the RfC for xylenes.

For the dermal permeability information you requested, we refer you to Dermal Exposure Assessment: Principles and Applications (U.S. EPA, 1992).

Please feel free to contact the Superfund Technical Support Center at (513) 569-7300 if you have any further questions.

Attachments

cc: M. Doolan (Region VII)
C. Sonich-Mullin (ECAO-Cin)

REFERENCES

U.S. EPA. January 1992. Dermal Exposure Assessment: Principles and Applications. Prepared by Office of Health and Environmental Assessment, Washington, DC. NTIS# PB92-205665.

Attachment I.

Risk Assessment Issue Paper for:
Feasibility of Developing an RfD for Acenaphthylene (CASRN 208-96-8) by Analogy to Potential Surrogates Phenanthrene (CASRN 85-01-8), Acenaphthene (CASRN 83-32-9)

In this paper, the adequacy of the database for acenaphthylene is addressed; the data are found to be inadequate for derivation of an RfD. In addition, the appropriateness of using an RfD for phenanthrene (proposed by requestor based on "GRI, 1987") or the RfD for acenaphthene as surrogates for acenaphthylene was considered.

An oral RfD or an inhalation RfC for acenaphthylene are not listed on IRIS (U.S. EPA, 1993a) or on the HEAST (U.S. EPA, 1993b). Acenaphthylene has been classified as a Group D compound (Not Classifiable as to Human Carcinogenicity) by the CRAVE Work Group on the basis of inadequate human and animal data for the assessment of its carcinogenicity (U.S. EPA, 1993a). Reports of 3 studies regarding the systemic toxicity of subchronic oral exposures to acenaphthylene are available, but the data are inadequate for the derivation of an RfD.

The data from 2 of the 3 studies are not suitable for RfD derivation because of inadequate reporting of experimental details. Knobloch et al. (1969) reported in an abstract that changes in peripheral blood pattern, renal function and morphology of the liver, kidney and lung were observed in a group of 7 rats given acenaphthylene orally at doses of 600 mg/kg for 40 days; information on incidence of the reported lesions, statistical analysis, or controls was not provided. Rotenberg and Mashbits (1965) reported that hemorrhaging of the lungs occurred in mice given oral doses of approximately 176 mg/kg acenaphthylene in oil every other day for 2 months; experimental details that were not reported included numbers of animals in treated or control groups, incidences of the reported lesions and statistical analysis.

In an adequately reported study, Hazelton Laboratories America, Inc. (1988) administered gavage doses of 0, 100, 200 or 400 mg/kg/day acenaphthylene to groups of 20 male and 20 female mice for 90 days. Endpoints examined included clinical signs, body weights, food consumption, ophthalmology, hematology, clinical chemistry, organ weights, gross pathology and histopathology of major organs and tissues. A statistically significant increase in incidence of death, accompanied by a significant increase in incidence of hepatocellular hypertrophy and nephropathy was observed in all treated groups of females. Similar liver and kidney changes at increased incidences were observed in high-dose males. The study did not identify a NOAEL or LOAEL. Because the lowest dosage level of 100 mg/kg/day produced frank effects, it can

not be used to derive an RfD.

The basis of the "GRI, 1987" RfD was not available for our consideration. However, no RfD for phenanthrene has been discussed or verified by the U.S. EPA (1993a,c). The recent Drinking Water Criteria Document on PAHs (U.S. EPA, 1991) found no information on the systemic toxicity of acute, subchronic or chronic oral exposure to phenanthrene and concluded that data were inadequate for the derivation of an RfD for phenanthrene. The only studies reviewed in the Drinking Water Criteria Document regarding the systemic toxicity of phenanthrene were an intraperitoneal LD_{50} mouse study (700 mg/kg) and an acute intraperitoneal rat study that observed congested livers and increased serum aspartate aminotransferase following injection of a 150-mg/kg dose of phenanthrene (Yoshikawa et al., 1985).

Even if adequate data were available for derivation of an RfD for phenanthrene, it is uncertain if the RfD for phenanthrene could serve as a surrogate for acenaphthylene. Although phenanthrene and acenaphthylene share some structural similarities (phenanthrene has 3 6-membered aromatic rings, while acenaphthylene has a 5-membered ring bordered by 2 6-membered rings in an aromatic configuration similar to that of phenanthrene), structural similarity alone is not a sufficient basis to support the hypothesis that the two compounds have similar potencies in causing similar effects.

A comparison of the subchronic toxicity of acenaphthylene and acenaphthene illustrates the pitfalls of relying on structural similarity alone. Acenaphthylene and acenaphthene have identical structures except that acenaphthylene has a double bond between carbons 1 and 2 (in its 5-membered ring), while acenaphthene has a single bond between the same carbons. However, acenaphthylene is more potent than acenaphthene as a toxic agent. As discussed in the previous paragraph, gavage dosages of acenaphthylene as low as 100 mg/kg/day produced lethal effects in a 90-day study with mice. In contrast, no adverse effects were observed at doses of acenaphthene as high as 175 mg/kg/day in a 90-day gavage study conducted by the same laboratory with the same strain of mice (U.S. EPA, 1989). Hepatic hypertrophy occurred in mice dosed with 350 or 700 mg/kg/day acenaphthene, but lethal effects were not observed even at the highest dose, 700 mg/kg/day (U.S. EPA, 1989). Therefore the RfD for acenaphthene would not be protective for acenaphthylene.

In conclusion, the use of the "GRI, 1987" RfD for phenanthrene as a surrogate RfD for acenaphthylene is not recommended, because the basis of the proposed RfD for phenanthrene is unknown, and the available data for phenanthrene, according to a recent Agency document (U.S. EPA, 1991), are inadequate for RfD derivation. Another potential surrogate, acenaphthene, is much less toxic than acenaphthylene, so its RfD cannot be used for acenaphthylene. The

data on acenaphthylene are inadequate for RfD derivation, and suggest that additional animal testing at doses below 100 mg/kg/day (the subchronic oral dosage level that produced frank effects in mice) is required before an RfD for acenaphthylene can be recommended.

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Attachment II.

Risk Assessment Issue Paper for: Derivation of a Provisional RfD for Benzene (CASRN 71-43-2)

INTRODUCTION

No chronic RfD or RfC is available on IRIS (U.S. EPA, 1993a) or HEAST (U.S. EPA, 1993b). Documents listed on the CARA list (U.S. EPA, 1993c) include an AWQCD (U.S. EPA, 1980, 1989a) and HEA (U.S. EPA, 1984, 1989b). None of these documents derived non-carcinogenic estimates of risk from benzene exposure. The Drinking Water Regulations and Health Advisories list indicates an MCLG of zero, an MCL of 0.005, and 1- and 10-day health advisories (10-kg child) of 0.2 mg/L (U.S. EPA, 1993d); the 1- and 10-day health advisories were derived from an inhalation study (U.S. EPA, 1993a). Longer-term health advisories for a child and/or adult were not derived for benzene because of its carcinogenicity. ATSDR has prepared a toxicological profile on benzene (ATSDR, 1991). This draft document did not derive acute, intermediate, or chronic oral MRLs. An acute inhalation MRL of 0.002 ppm was derived for benzene; no intermediate or chronic inhalation MRLs were derived (ATSDR, 1991).

To identify research reports pertinent to the derivation of a provisional chronic RfD for benzene, EPA and ATSDR documents (as cited above) were reviewed; in addition, a computer search of the literature was conducted from the HSDB, RTECS, TSCATS, and TOXLINE (July 1990 to April 1993, oral strategy) databases. The inhalation database was also considered.

REVIEW OF PERTINENT LITERATURE

Data regarding the toxicity of ingested benzene in humans were limited to reports on single exposures (ATSDR, 1991). Several studies reported very serious effects, including death, but did not report dose levels. One study reported very serious neurological effects and death in humans from a single oral dose of approximately 125 mg/kg (Theines and Haley, 1972; as cited in ATSDR, 1991).

Chronic oral studies. Chronic oral studies have been conducted in F344 rats and B6C3F1 mice (NTP, 1986; Huff et al., 1989), and Sprague-Dawley and Wistar rats and Swiss and RF/J mice (Maltoni et al., 1983, 1985, 1989).

In the NTP (1986) study, F344 rats and B6C3F1 mice of both sexes were treated by gavage with benzene, 5 days/week for 103 weeks. Results of this study have also been reported by Huff et al. (1989). For rats, males (60/group) were administered doses of 0, 50, 100, or 200 mg/kg (0, 36, 71, or 143 mg/kg/day) and

females (60/group) were administered doses of 0, 25, 50, or 100 mg/kg (0, 18, 36, or 71 mg/kg/day). Survival decreased with increasing dose in rats of both sexes, and was significantly decreased ($p<0.05$) at 200 mg/kg in males and at 50 and 100 mg/kg in females. Body weight depression of ≥10% relative to controls was observed in male rats treated with 200 mg/kg/day and female rats treated with 100 mg/kg. Dose-related leucopenia was significant ($p<0.05$) in female rats treated with 25 mg/kg or higher for 3, 6, 9, and 12 months; leukocyte levels were comparable to controls after 15, 18, 21, and 24 months of treatment. In male rats, dose-related leucopenia was significant ($p<0.05$) at 50 mg/kg or higher for 3, 6, 9, 12, 15, and 18 months. A similar pattern of significant ($p<0.05$), dose-related decrease, followed by eventual return to control levels, was observed for lymphocyte levels in female rats treated with 25 mg/kg or higher and in male rats treated with 50 mg/kg or higher. Lymphoid depletion was observed in the thymus of 0/44, 4/42, 8/41, and 10/34 male rats treated with 0, 50, 100,and 200 mg/kg benzene, respectively. In the spleen, lymphoid depletion was observed in 0/49, 19/58, 8/47, and 23/47 male rats treated with 0, 50, 100, and 200 mg/kg benzene, respectively, and in 0/50, 11/50, 8/49, and 10/49 female rats treated with 0, 25, 50, and 100 mg/kg benzene, respectively. Increased ($p<0.05$) incidences of malignant tumors were observed at dose levels of 50 mg/kg or greater in male rats (Zymbal gland carcinomas, squamous cell papillomas and squamous cell carcinomas of the oral cavity, and squamous cell papillomas and squamous cell carcinomas of the skin) and at 25 mg/kg or greater in female rats (Zymbal gland carcinomas, squamous cell papillomas and squamous cell carcinomas of the oral cavity). This study identified a LOAEL of 25 mg/kg (18 mg/kg/day) for leukopenia and lymphocytopenia in female F344 rats treated by gavage for 103 weeks. A LOAEL of 50 mg/kg (36 mg/kg/day) was identified for leukopenia and lymphocytopenia in male F344 rats treated by gavage for 103 weeks. The observed LOAELs were at the lowest dose level tested. Thus, no NOAELs for hematological effects in rats were identified in this study.

In the NTP (1986) study, mice (60/sex/group) were treated by gavage with doses of 0, 25, 50, or 100 mg/kg benzene (0, 18, 36, or 71 mg/kg/day). Survival decreased with increasing dose in mice of both sexes and was significantly decreased ($p<0.05$) at 100 mg/kg. Body weight depression of ≥10% relative to controls was observed in mice of both sexes treated with 100 mg/kg. Significantly ($p<0.05$) decreased leukocyte counts were observed in males after 3, 6, 9, 12, 15, 18, and 21 months of treatment with 50 and/or 100 mg/kg, but males treated with 25 mg/kg had significantly decreased leukocyte counts only after 6 and 21 months of treatment. In female mice, leucopenia was observed only at 12 and 18 months, in both cases significant ($p<0.05$) at all treatment levels. Significantly ($p<0.05$) decreased lymphocyte counts were observed in males after 3, 6, 9, 12, 15,

18, and 21 months of treatment with 50 and/or 100 mg/kg, but males treated with 25 mg/kg had significantly ($p<0.05$) decreased lymphocyte counts only after 12 months of treatment. In female mice, significant ($p<0.05$) lymphocytopenia was observed at 25 mg/kg or higher at 12 and 18 months, and at 100 mg/kg at 3 months. Hematopoietic hyperplasia of the bone marrow was observed in 0/49, 11/48, 10/50, and 25/49 male mice treated with 0, 25, 50, or 100 mg/kg, respectively, and in 3/49, 14/45, 8/50, and 13/49 female mice treated with 0, 25, 50, or 100 mg/kg, respectively. Increased splenic hematopoiesis was observed in 5/49, 9/48, 19/49, and 24/47 male mice treated with 0, 25, 50, or 100 mg/kg, respectively, and in 9/49, 10/45, 6/50, and 14/49 female mice treated with 0, 25, 50, or 100 mg/kg, respectively. In the female mice, increased incidences of epithelial hyperplasia of the ovary occurred at all three doses and of senile atrophy of the ovary occurred at the lower two doses compared with controls. Increased ($p<0.05$) incidences of malignant tumors were observed at 25 mg/kg or higher in both sexes of mice (Zymbal gland squamous cell carcinomas, malignant lymphomas, alveolar/bronchiolar carcinomas, alveolar/bronchiolar carcinomas and adenomas (combined), Harderian gland adenomas, and squamous cell carcinomas of the preputial gland in males and Zymbal gland squamous cell carcinomas, malignant lymphomas, ovarian granulosa cell tumors, ovarian benign mixed tumors, carcinomas and carcinosarcomas of the mammary gland, alveolar/bronchiolar carcinomas, and alveolar/bronchiolar adenomas in females). This study identified a LOAEL of 25 mg/kg (18 mg/kg/day) for leukopenia and lymphopenia in male and female B6C3F1 mice treated by gavage for 103 weeks. The observed LOAELs were at the lowest dose level tested. Thus, no NOAELs for hematological effects in mice were identified in this study.

Beginning in 1976, a series of carcinogenicity studies on oral treatment of rodents with benzene were performed at the Bologna Institute of Oncology, including 52-104 week studies on Sprague-Dawley and Wistar rats and Swiss and RF/J mice. The results of the studies from this laboratory were reported in numerous publications, including Maltoni et al. (1983, 1985, 1989). Limited information regarding non-carcinogenic effects were reported in the various publications since the major emphasis of the studies was the carcinogenic effects of benzene. No statistical information was included in the various publications, making interpretation of the data difficult.

Maltoni et al. (1985) treated Sprague-Dawley rats (13 weeks of age, 30-35/sex/group) by gavage with 0, 50, or 250 mg/kg benzene in oil, 4-5 days/week for 52 weeks, then observed until death; the expanded doses, assuming that the rats were treated an average of 4.5 times/week, were 0, 32, and 161 mg/kg/day, respectively. In addition, Sprague-Dawley rats (7 weeks of age, 40-50/sex/group) were treated by gavage with 0 or 500 mg/kg

benzene in oil, 4-5 days/week for 104 weeks, then observed until death; the expanded doses, assuming that the rats were treated an average of 4.5 times/week, were 0 and 321 mg/kg/day, respectively (Maltoni et al., 1985). Maltoni et al. (1983) reported some preliminary information on these studies, including some non-carcinogenic endpoints. Mortality was higher in benzene treated groups and appeared to be dose-related; body weights were not affected. Maltoni et al. (1983) stated that mortality in the first portion of the study was due to direct (toxic) effects of treatment and in the later portion, was partially due to tumors. Mortality was similar to that of controls during treatment with 500 mg/kg for 92 weeks (Maltoni et al., 1983); body weight appeared to be somewhat depressed relative to controls. No further information regarding survival or body weight was provided in the later reports on these studies (Maltoni et al., 1985, 1989). In Sprague-Dawley rats exposed to 500 mg/kg for 84 or 92 weeks, decreased total RBC (only at 92 weeks), WBC, and lymphocytes were observed (Maltoni et al., 1983, 1985). Multiple-site carcinomas developed at 50, 250, and/or 500 mg/kg in rats in these studies. Zymbal gland, oral cavity, nasal cavity, and skin carcinomas, forestomach tumors, subcutaneous angiosarcoma, mammary gland tumors, hepatomas, non-myeloid leukemias, and other tumors were observed, with greater incidence and more types of malignancies observed at the higher treatment levels.

Additional gavage studies of benzene (at 500 mg/kg, 4-5 days/week) by Maltoni et al. (1989) in Wistar rats, Swiss mice, and RF/J mice focussed entirely on carcinogenic effects, which were similar to those reported in the above studies and occurred in all three strains/species. The report of these studies did not discuss non-carcinogenic effects.

Subchronic oral studies. Subchronic oral studies have been conducted in F344 rats and B6C3F1 mice of both sexes (NTP 1986; Huff et al., 1989), female Wistar rats (Wolf et al., 1956), Charles River CD-1 male mice (Hsieh et al., 1988), and B6C3F1 female mice (White et al., 1984).

NTP (1986) treated F344 rats and B6C3F1 mice (10/species/group/sex; 6-8 weeks of age) with 0, 25, 50, 100, 200, 400, or 600 mg/kg benzene, by gavage in corn oil, 5 days/week for 17 weeks; the expanded doses were 0, 18, 36, 71, 143, 286, or 429 mg/kg/day. An additional 5 animals/species/group/sex were tested at the 0, 200 and 600 mg/kg dose levels and killed at 60 days of treatment. Hematological analyses were performed on all the animals killed at 60 days and on 5 animals/species/group/sex at the end of the study. Comprehensive histopathologic examinations were performed on all the animals killed at 60 days and on animals in the control and 600 mg/kg groups at the end of the study. In addition,

necropsies were performed on all animals and the spleens of all animals were examined histopathologically. Results of this study have also been reported by Huff et al. (1989).

No compound-related deaths were observed for rats. Final body weight depression of ≥10% relative to controls was observed in male and female rats at dose levels of 200 mg/kg and greater. Significant ($p<0.05$) leukopenia and lymphocytopenia were observed in male and female rats after 60 days of treatment with 200 or 600 mg/kg (the only treatment groups tested on day 60). On day 120 of treatment, significant ($p<0.05$) leucopenia and lymphocytopenia were observed in female rats at 25 mg/kg and higher and significant ($p<0.05$) lymphocytopenia was observed in male rats at 400 mg/kg (blood counts were performed on only 1 male given 600 mg/kg for 120 days). Lymphoid depletion of B-cells in the spleen was observed in 100% of male and female rats exposed to 600 mg/kg for 60 or 120 days, and in 3/5 male and 4/5 female rats exposed to 200 mg/kg for 60 days. Increased extramedullary hematopoiesis in the spleen was observed in 4/5 male and 3/5 female rats treated with 600 mg/kg for 120 days. Incidences of lymphoid depletion of B cells and extramedullary hematopoiesis in the spleen were not reported for controls (or other groups); the implication was that these conditions were seen only in the groups for which incidences were given. This study identified a LOAEL of 25 mg/kg (18 mg/kg/day) in female rats and LOAEL of 200 mg/kg (143 mg/kg/day) in male rats for hematological effects following treatment by gavage for 17 weeks. The observed LOAEL for female rats was at the lowest dose level tested. Thus, the study does not define a NOAEL for hematological effects in rats.

NTP (1986) reported no compound-related deaths in the mice; final body weight depression of ≈7% was seen at ≥100 mg/kg. Tremors were observed intermittently in male and female mice treated with 400 or 600 mg/kg. No leukopenia or lymphocytopenia was observed in male or female mice after 60 days of treatment with 200 or 600 mg/kg. At 120 days, significant ($p<0.05$) leukopenia and lymphocytopenia were observed in male mice at dose levels of 50 mg/kg and greater, and in female mice at 400 (only lymphocytopenia) and 600 mg/kg. A NOAEL of 25 mg/kg (18 mg/kg/day) and a LOAEL of 50 mg/kg (36 mg/kg/day) for hematological effects were identified in male mice treated by gavage for 17 weeks. A NOAEL of 200 mg/kg (143 mg/kg/day) and a LOAEL of 400 mg/kg (286 mg/kg/day) for hematological effects were identified in female mice treated by gavage for 17 weeks.

White et al. (1984) exposed female B6C3F1 mice (12/group; 6-7 weeks of age) to benzene in drinking water (containing emulphor to increase solubility of benzene) at exposure levels of 0, 50, 1000, and 2000 mg/L (0, 12, 195, or 350 mg/kg/day, respectively) for 30 days. Body weight was significantly ($p<0.05$) decreased,

relative to controls, at the high-exposure level. A dose-related ($p<0.01$) decrease in absolute and relative spleen weight was observed, significant at the high-exposure level ($p<0.01$). In one test, spleen cellularity was reported to be significantly ($p<0.05$) decreased at all exposure levels, and in a separate test, at only the mid- and high-exposure levels. Dose-related ($p<0.05$) leukopenia and lymphocytopenia were observed, significant ($p<0.05$) at the mid- and high-exposure level. A dose-related ($p<0.01$) decrease in eosinophils was observed, significant ($p<0.05$) at the high-exposure level. At the high-exposure level, significant ($p<0.05$) decreases in levels of erythrocytes and hemoglobin, and significant ($p<0.05$) increases in mean corpuscular volume and mean corpuscular hemoglobin were observed. No exposure-related effects were observed for levels of blood urea nitrogen, serum creatinine, serum glutamic oxaloacetic transaminase, or serum glutamic pyruvic transaminase, indicators of renal and hepatic damage. Dose-related ($p<0.05$) changes were observed in immunological tests on spleen cells and in assays of bone marrow: decreases were observed with respect to IgM antibody forming cells/spleen in response to sheep RBC, lymphocyte proliferation response to the T cell mitogen Con A and the B cell mitogen LPS, number of T lymphocytes, and femoral CFU-GM; an increase was observed in bone marrow cell DNA synthesis. These effects were not significant at 12 mg/kg/day, but were dose-related ($p<0.05$) and significant ($p<0.05$) at 195 and/or 350 mg/kg/day. Of all the immunological indices tested, only one endpoint (stimulation index for lymphocyte proliferation of spleen cells in response to medium containing 0.5 μg/ml of Con A) was significantly ($p<0.05$) decreased at 12 mg/kg/day. The number of B lymphocytes was not affected, but the investigators commented that the number of B lymphocytes in the controls was lower than for historical controls for their laboratory. This study identifies a marginal NOAEL of 12 mg/kg/day and a LOAEL of 195 mg/kg/day for hematological and immunological effects in mice exposed to benzene in drinking water for 30 days; the 12 mg/kg/day exposure level may approach the threshold of toxicity, as significance ($p<0.05$) was seen for two effects at this exposure level, and numerous hematological and immunological effects that were dose-related, but not significant at the 12 mg/kg level, were observed.

Hsieh et al. (1988) treated male Charles River CD-1 mice (5/group; 6-7 weeks of age) with benzene in the drinking water at exposure levels of 0, 40, 200, or 1000 mg/L (0, 8, 40, or 180 mg/kg/day, respectively) for 28 days. The treatment had no adverse effects with respect to mortality, clinical signs, body weight change, liver weight, or gross necropsy. A dose-related decrease in relative spleen weight was observed, significant ($p<0.05$) at the high-exposure level. In one test, spleen cellularity was reported to be significantly ($p<0.05$) decreased at all exposure levels, and in a separate test, only at the high-

exposure level. Although relative thymus weights were decreased at all exposure levels, the values were not statistically significantly different from controls. Dose-related hematological effects (erythrocytopenia, leucopenia, lymphocytopenia, increased mean corpuscular volumes) were observed at all exposure levels, significant at $p<0.05$; hematocrit was significantly ($p<0.05$) decreased at the mid- and high-exposure levels. The authors indicated that the increased mean corpuscular volume, and decreased hematocrit and numbers of RBC were indicative of severe macrocytic anemia. Biphasic responses were observed in immunological tests [mitogen-stimulated (LPS, PWM, Con A, PHA) splenic lymphocyte proliferation, mixed splenic lymphocyte culture response to allogenic YAC-1 cells, cytotoxic splenic T-lymphocyte response to allogenic YAC-1 cells], with a significantly ($p<0.05$) increased response at the low-exposure level, and significantly ($p<0.05$) decreased responses at the mid- and/or high-exposure level. Using several methods to determine primary antibody response to sheep RBC, significantly ($p<0.05$) decreased responsiveness was observed at the mid- and/or high-exposure levels; this response was either significantly ($p<0.05$) increased or not different from controls in mice exposed to the low-exposure level. This study identifies a LOAEL of 8 mg/kg/day (the lowest treatment level tested) for hematological and immunological effects in male mice exposed to benzene in drinking water for 30 days. No NOAEL for hematological effects in mice were identified in this study.

Wolf et al. (1956) treated female Wistar rats (10/group) by gavage with benzene in olive oil, 5 days/week for 6 months. The reported doses were 0, 1, 10, 50, or 100 mg/kg/day, but it was not clear whether these represented the dose on treatment days or the dose expanded from 5 to 7 days/week. The usual practice in the primary literature is to report the actual gavage doses given on treatment days. Assuming that the usual practice was followed for this study, the expanded doses would be 0, 0.7, 7.1, 35.7, and 71.4 mg/kg/day, respectively. Parameters measured included mortality, clinical signs, body and organ weights, hematology, blood biochemistry, bone marrow counts, and gross and microscopic pathology of lungs, heart, liver, kidneys, spleen, testes, adrenals and pancreas. Leucopenia (described as "very slight") was reported for 10 mg/kg; at higher dose levels erythrocytopenia and leucopenia were observed. No quantitative data or statistical analysis were reported. The authors reported that rats fed 1 mg/kg had "no evidence of ill effects" with respect to gross appearance, growth, periodic blood counts, blood urea nitrogen, average final body and organ weights, histopathological examination, and bone marrow counts. For higher treatment levels, only adverse effects were described, requiring the assumption that no adverse effects were observed with respect to the other tested parameters. This study identified a NOAEL of 1 mg/kg (0.7 mg/kg/day) and a LOAEL of 10 mg/kg (7.1 mg/kg/day) for

hematological effects in female rats treated by gavage for 6 months.

Developmental and reproductive toxicity studies. Developmental toxicity studies of orally administered benzene have been conducted in rats (Exxon Chemical Company, 1986) and mice (Nawrot and Staples, 1980; Seidenberg et al., 1986, as cited in ATSDR, 1991).

Exxon Chemical Company (1986) treated bred female Sprague-Dawley rats (20-22/group) by gavage with 0, 50, 250, 500, or 1000 mg/kg/day on gestation days 6-15. No dose-related mortality was observed. Significant ($p \leq 0.05$) findings in the treated dams as compared with controls were decreased food consumption at 250, 500 and 1000 mg/kg, decreased body weights and body weight gains at 500 or 1000 mg/kg/day, and increased incidence of alopecia at 1000 mg/kg. Developmental toxicity was limited to decreased ($p \leq 0.05$) fetal body weights in the 500 and 1000 mg/kg/day groups. Fetuses were examined only for external malformations, not for skeletal and visceral malformations. This study identified a NOAEL of 50 mg/kg/day and LOAEL of 250 mg/kg/day for maternal toxicity and tentative NOAEL of 250 mg/kg/day and LOAEL of 500 mg/kg/day for developmental toxicity in Sprague-Dawley rats.

Nawrot and Staples (1980) treated bred CD-1 mice (23-105/group) by gavage with benzene in cottonseed oil at dose levels of 0, 0.3, 0.5, or 1 ml/kg/dose, 3 times daily, on gestation days 6-15. Using a specific gravity of 0.8765 g/ml (ATSDR, 1991) and multiplying by 3 doses/day results in doses of 0, 789, 1315, and 2630 mg/kg/day, respectively. Additional groups of mice were similarly treated with 0 or 1 ml/kg/dose (0 or 2630 mg/kg/day) on gestation days 12-15. Morality rates in dams treated with 0, 789, 1315, and 2630 mg/kg/day were 2/105, 0/27, 6/48, and 7/23, respectively. Significant ($p<0.05$) findings in the dams included the increased mortality at the mid- and high doses, increased liver weights at the mid- and high doses, increased relative liver weights at all three doses, and a reduction in maternal weight gain only at the low dose. A dose-related decrease in apparent pregnancy rate at sacrifice was observed, significantly different ($p<0.05$) from controls at all dose levels; at the mid and high doses, this effect resulted from early resorption of entire litters ($p<0.05$). The decrease in apparent pregnancy rate at the low dose was attributed to an unusually high pregnancy rate in vehicle controls. Fetal body weights were decreased in all dose groups treated on days 6-15. In dams exposed on gestation days 12-15, no deaths occurred; significant ($p<0.05$) results included increased absolute maternal liver weight, decreased maternal weight gain and fetal body weight and increased number of resorptions. No increases relative to controls in external, visceral or skeletal defects were seen in any of the treatment groups. This study identified

a LOAEL of 789 mg/kg/day for developmental toxicity and possible maternal toxicity resulting from treatment on gestation days 6-15, and a LOAEL of 2630 mg/kg/day for maternal and developmental toxicity resulting from treatment on gestation days 12-15. The LOAELs were at the lowest (or only) treatment level used and no NOAELs were identified in this study.

In a developmental toxicity screening study, Seidenberg et al. (1986, as cited in ATSDR, 1991) treated bred mice by gavage with benzene in oil at dose levels of 0 or 1300 mg/kg/day on gestation days 8-12. Fetal body weights were decreased; no other effects were reported. This study identifies a LOAEL of 1300 mg/kg/day for developmental toxicity in mice.

Additional developmental toxicity studies of benzene have been conducted in animals using inhalation exposure. These studies identify hematopoietic effects in the animal fetus (Keller and Snyder, 1986, 1988) as a sensitive developmental toxicity endpoint for inhalation exposure to benzene.

Reproductive studies of orally administered benzene were not located in the literature searched. The NTP (1986) study reported increased incidences of hyperplasia and senile atrophy of the ovary in female B6C3F1 mice at ≥25 mg/kg (18 mg/kg/day) in the chronic oral study of benzene.

Histopathological changes in the testes in rabbits (Wolf et al., 1956) and testicular lesions and ovarian cysts in mice (Ward et al., 1985) were reported following exposure to relatively high concentrations of benzene by inhalation. A study on reproductive effects in female rats was conducted by the inhalation route. In this study, female Sprague-Dawley rats (26/group) were exposed to vapor concentrations of 0, 1, 10, 30, or 300 ppm benzene (0, 3, 32, 96, or 958 mg/m^3), 6 hours/day, 5 days/week during premating (10 weeks) and mating periods, then 6 hours/day, 7 days/week, on gestation days 1-20, and lactation days 5-21 (Bio/dynamics, 1980). The following parameters were used to assess toxicity: clinical signs, mortality rate, body weight gain, pregnancy rates, and gestation length in dams; number alive and dead at birth, sex distribution, survival, body weights, organ weights, and gross necropsy in pups. The treatment had no adverse effects with respect to reproduction or maternal toxicity. No additional information on reproductive effects is available from the inhalation database.

DERIVATION OF PROVISIONAL CHRONIC RfD

The critical effects of orally administered benzene were determined to be hematotoxicity and immunotoxicity, probably related to the adverse effects of benzene on hematopoiesis (Wolf et al., 1956; White et al., 1984; NTP, 1986; Hsieh et al., 1988;

Huff et al., 1989). This was not unexpected, because the extensive database on inhalation toxicity of benzene identifies hematological, hematopoietic and immunological toxicity as the critical effect, supported by human and animal data. The Health Risk Technical Support Center has derived a provisional RfC based on a free-standing NOEL of 0.045 ppm for hematological effects in occupationally exposed humans (Collins et al., 1991). Although no LOAEL was identified in this study, other occupational exposure studies reported hematological and/or hematopoietic effects at higher concentrations (Aksoy et al., 1971; Fishbeck et al., 1978), as did inhalation studies in experimental animals. Immunological effects have been reported in short-term inhalation studies of benzene in animals.

The NTP (1986) chronic and subchronic toxicity studies on rats and mice were not used as the basis for the RfD because the lowest dose tested, 18 mg/kg/day, was a LOAEL for hematological effects, and is higher than LOAELs for similar effects observed in other studies of subchronic duration. Wolf et al. (1956) reported very slight leukopenia in rats treated by gavage for 6 months with 10 mg/kg (7.1 mg/kg/day) and leukopenia and erythrocytopenia at higher dose levels; no effects were observed at 1 mg/kg (0.7 mg/kg/day). Hsieh et al. (1988) reported hematological and immunological effects in male CD-1 mice exposed to 8 mg/kg/day benzene in the drinking water. A marginal NOAEL of 12 mg/kg/day was identified for hematological and immunological effects in female B6C3F1 mice exposed to benzene in the drinking water (White et al., 1984); the 12 mg/kg/day exposure level may approach the threshold of toxicity, as discussed previously.

The 28-day study by Hsieh et al. (1988) was chosen as the principal study because it demonstrated significant ($p<0.05$) hematological and immunological toxicity. The lowest dose (8 mg/kg/day) was identified as a minimal LOAEL, because this dose enhanced the immune parameters measured in the study. The two higher doses significantly depressed immune function. This study examined primarily hematological and immunological effects; no effects were seen on clinical chemistry indices of renal and hepatic toxicity. The 6-month study by Wolf et al. (1956) was chosen as a co-principal study because it provides supporting information for the critical effect and threshold for toxicity. The LOAEL for hematological effects was 7.1 mg/kg/day, with a NOAEL of 0.7 mg/kg/day. No adverse effects were observed for non-hematological endpoints, including blood biochemistry, bone marrow counts, and gross and microscopic pathology of major tissues and organs. The Wolf et al. (1956) study was not chosen as the principal study because the results were presented only as a summary; actual data and statistical analysis were not reported. Results from chronic (NTP, 1986) and other subchronic studies (White et al., 1984; NTP, 1986) support the critical

effects (hematological, immunological) identified in the principal and co-principal studies.

A provisional RfD of 3E-4 mg/kg/day was determined based on the NOAEL of 0.7 mg/kg/day from the study by Wolf (1956). An uncertainty factor of 3000 was applied to account for interspecies (10) and intraspecies (10) differences, extrapolation from a subchronic study (10), and insufficient database (3). Uncertainty regarding deficiencies in the database is small because of the reasonably adequate oral database, which includes developmental toxicity studies, and the extensive supporting inhalation database, but some uncertainty remains due to the lack of a two-generation reproductive study.

Confidence in the principal study is medium to low. The critical effect (hematological and immunological) was investigated through the use of a battery of tests and a range of dose levels, appropriate statistical analyses were performed, a dose-effect relationship was established, and the LOAEL is consistent with the LOAEL and NOAEL from a 6 month study (Wolf et al., 1956) measuring hematological effects and other endpoints of toxicity. Confidence in the principal study is limited by the small group sizes (5 animals/dose), testing of only one sex, short duration, and limited range of endpoints examined. Confidence in the database is medium because the critical effect is supported by numerous studies on benzene by the oral and inhalation routes and for various durations, including chronic; confidence in the database is not higher because of the lack of a two-generation reproductive study. Reflecting the medium to low confidence in the key study and medium confidence in the database, confidence in this provisional RfD is medium.

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5×10^{-4} mg/m3

Attachment III.

Risk Assessment Issue Paper for:
Derivation of a Provisional RfC for Benzene (CASRN 71-43-2)

An RfC for benzene was discussed at the 5/18/89 and 7/20/89 meetings of the RfD/RfC Work Group. At the 7/20/89 meeting, an RfC of 0.01 mg/m^3 was proposed. The RfC was based on a LOAEL of 31.9 mg/m^3 for reduced ability of marrow progenitor cells to form colonies, depressed levels of marrow early nucleated red cells, and decreased numbers of GM-CFU-C (Baarson et al., 1984; Keller and Snyder, 1986; Keller and Snyder, 1988). An uncertainty factor of 1000 (for extrapolation from a subchronic to a chronic study, interspecies differences, and sensitive human populations) and a MF of 3 (for higher metabolic capabilities of human fetuses) were proposed. In a review of the cover sheet, OSW requested that OHEA consider using a LOAEL of 5 ppm (15.9 mg/m^3) for hematological effects observed in the Keller and Snyder (1988) study. The Work Group suggested that the 3 modifying factor was not needed. The file was placed under review and there has been no further Work Group action on the file.

The free-standing NOEL for hematological effects in individuals occupationally exposed to benzene (Collins et al., 1991) was considered as the basis of the RfC. Dr. Collins was contacted regarding the average exposure level. Dr. Collins stated that the mean TWA was 0.045 ppm. Thus, the resulting provisional RfC is **5 x 10^{-4}** mg/m^3 using an uncertainty factor of **100.**

0.144

INTRODUCTION

A chronic inhalation RfC for benzene is not available on IRIS (U.S. EPA, 1993a) or the HEAST (U.S. EPA, 1993b). The RfD/RfC status report (U.S. EPA, 1993c) states that the RfC is Under Review. This file was last discussed at the 7/20/89 RfD/RfC Work Group meeting. OHEA documents listed on the CARA list (U.S. EPA, 1993d) include an AWQCD (U.S. EPA, 1980) and HEA (U.S. EPA 1984, 1989). None of these documents derived an inhalation RfC for benzene. ATSDR has prepared a toxicological profile on benzene (ATSDR, 1991). This document did not derive intermediate or chronic inhalation MRLs for benzene.

OSHA lists an PEL TWA of 1 ppm; however, some segments of industry are exempt from the 1 ppm standard, and instead have a PEL TWA of 10 ppm (OSHA, 1989, 1992). ACGIH lists a TLV TWA of 10 ppm; however a TLV TWA of 0.1 ppm has been proposed and is awaiting verification (ACGIH, 1992). The NIOSH REL (10-hour TWA) is 0.1 ppm (NIOSH, 1991).

To identify research reports pertinent to the derivation of a provisional chronic RfC for benzene, EPA and ATSDR documents on benzene (as cited above) were reviewed; in addition, a computer search of the literature was conducted in February 1992 from the HSDB, RTECS, TSCATS, and TOXLINE (inhalation strategy, June 1986 - February 1992) databases. Update searches of TOXLINE (inhalation strategy) were conducted covering through April, 1993. Other sources of information consulted were the updated NTP Status Reports (NTP, 1993a,b).

TOXICITY

There is an extensive database on the non-carcinogenic toxicity of inhaled benzene. Secondary sources, as well as literature searches, were used to identify studies that defined the thresholds of toxicity. Specifically, studies were looked for that evaluated subchronic, chronic, developmental, and reproductive toxicity of inhaled benzene; when numerous studies were available, those were chosen for which toxic effects were observed at low concentrations of benzene. A number of epidemiology studies were available regarding chronic toxicity of inhaled benzene; 4 are reported herein, covering a wide range of exposure levels and effects.

Collins et al. (1991) examined hematological parameters (peripheral blood RBC, WBC, hemoglobin, platelets, and MCV) in workers (n=200) exposed to benzene over a 10-year period. Within this 10-year period the mean length of exposure was 7.3 years. The workers were exposed to an 8-hour TWA of 0.01-1.40 ppm benzene. The mean TWA exposure was 0.045 ppm (J. Collins, 1992, personal communication). A group (n=268) of non-benzene exposed workers in the same plant were used as controls. There were statistically significant differences on demographic (age, race, sex) and personal habit (currently smokers, regular exercise) variables between the benzene-exposed workers and the control group. Multiple regression analyses were applied using the confounding factors and current exposure as independent variables. No significant correlations between cumulative exposure and hematological parameters were identified. Thus, this study identifies a free-standing NOEL of 0.045 ppm (0.14 mg/m^3) for hematological effects in humans.

Aksoy et al. (1971) examined hematological parameters in 217 apparently healthy male workers (mean age 24.7 years) exposed to 30-218 ppm benzene (96-696 mg/m^3) for 3 months to 17 years, and in 100 male hospital workers and medical students (mean age 26.6 years). Peripheral blood samples were obtained for measurement of RBC, WBC, PCV, platelets, and differential counts. In 11 benzene-exposed workers known to have hematological abnormalities, bone marrow samples were obtained for

determination of cellularity and myeloid and erythroid series. Twenty-four percent of the exposed workers had hematological abnormalities, including leukopenia (9.7%), thrombocytopenia (1.84%), leukopenia associated with thrombocytopenia (4.6%), pancytopenia (2.76%), acquired pseudo-Pelger-Huet anomaly (0.46%), lymphocytosis (0.46%), giant platelets (0.46%), eosinophilia (2.3%), basophilia (0.46%), and eosinophilia associated with basophilia (0.46%). Low hemoglobin levels, PCV, and MCV, indicative of mild or moderate hypochromic or normochromic anemia, were observed in 33% of the benzene-exposed workers. In bone marrow tests, 9/11 workers had hematopoietic abnormalities, including hypercellularity (in 1 worker), hypocellularity (4), and maturation arrest (8) and vacuolization (4) in the erythroid and myeloid series. This study identifies a LOAEL of 30 ppm for hematopoietic effects in humans.

In a retrospective occupational exposure study, Kipen et al. (1988; 1989) examined 17,289 peripheral blood counts from hematologic surveillance records on 459 workers employed in the rubber industry between 1940 and 1975. The mean duration of employment was 5.9 years, with 73% of the workers employed for less than 6 years. A smaller subset (16,841 samples, 264 workers) consisting of workers with at least 5 blood counts was also used in the analysis. The mean length of employment in this subset was 9.31 years with 65% of the workers employed for less than 10 years. Estimated average benzene concentrations ranged from 32-137 ppm from 1940-1948, the estimated average concentration was 75 ppm. Air concentrations of benzene were measured at irregular intervals from 1946 to 1976 by several groups using different measurement devices. Data gaps were filled in using actual air concentration data from different time periods and information on allowable standards. Using the subset of data for hematological values between 1940 and 1948, analyzed, significant ($p<0.1$) negative correlations between estimated exposure level and WBC ($r= -0.76$) and RBC ($r= -0.56$) levels were observed. The authors (Kipen et al., 1988) noted a number of limitations of this study including poor control over collection and analysis of blood samples, RBC counts that may not be highly reliable, and lack of information on the selection of subjects.

Fishbeck et al. (1978) examined hematological parameters (RBC, WBC, hematocrit, hemoglobin, mean corpuscular volume, platelets, differential blood counts, clot retention determinations, sedimentation rate, and blood indices) in 10 employees exposed to high benzene concentrations [8-hour TWA of >25 ppm (>80 mg/m^3)] for 2.5-22.9 years, with an average of 9.6 years of exposure. Concentrations of benzene in the work area were especially high in 1963, with the 8-hour TWA ranging from 37-132 ppm (118-422 mg/m^3); after 1963, conditions were altered to assure that concentrations of benzene remained below 25 ppm

(the acceptable limit at that time). Examination of the 10 employees in 1963 revealed enlarged RBC's, high MCV (10/10), slightly low hemoglobin levels (9/10), and transient anemia; bone marrow was examined at this time and no abnormalities were found. After 1963, hematological values for these employees improved (in 1977, 5/10 workers had increased MCV values) and by 1978 none of the employees had developed serious health problems. The authors concluded that exposure of workers to high levels of benzene produced transient hematological effects, which did not influence the long-term overall health of the workers.

Male C57BL/J mice (sample size not reported; initial age 8 weeks) were exposed via inhalation to vapor concentrations of 0 or 10 ppm benzene (0 or 32 mg/m^3) for 6 hours/day, 5 days/week for up to 178 days (Baarson et al., 1984). After 32, 66, and 178 days of exposure, peripheral blood samples were obtained from all mice for determination of levels of RBC, lymphocytes, and neutrophils, and 5 mice/exposure level were sacrificed for measurement of erythroid progenitor cells [colony forming units - erythroid (CFU-E), burst forming units (BFU-E), nucleated red cells, and total cellularity] in bone marrow and spleen. There was a significant ($p<0.05$) decrease in levels of RBC (at 66 and 178 days) and lymphocytes (at all sampling times) in peripheral blood of benzene-exposed mice. CFU-E and BFU-E in bone marrow were significantly ($p<0.01$) decreased at all sacrifice times and at 66 days, respectively; after 178 days of treatment, bone marrow CFU-E was 5% of controls. Splenic CFU-E (10% of controls), nucleated red cells (15%), and total nucleated cellularity (84%) were significantly ($p<0.05$) decreased in mice sacrificed at 178 days. This study identifies a LOAEL of 10 ppm for depressed hematopoiesis in mice.

Male CD-1 mice (11-12/exposure level/exposure duration; 8-12 weeks of age) were exposed for 6 hours/day, 5 days/week to vapor concentrations of 0 or 9.6 ppm benzene for 10 weeks or to 0 or 302 ppm benzene for 26 weeks (Green et al., 1981a,b). On the day of the last exposure, samples (pooled from groups of 3-4 mice) were obtained from the peripheral blood, bone marrow and the spleen to evaluate hematological and hematopoietic cells. In mice exposed to 9.6 ppm, no adverse effects were observed with respect to mortality, body weights, or cells in the peripheral blood or bone marrow; splenic weight, nucleated cellularity, number of nucleated red blood cells, and number and concentration of multipotential hematopoietic stem cells were significantly ($p<0.05$) increased in mice exposed to 9.6 ppm. Mice exposed to 302 ppm had the following significant ($p<0.05$) changes: increased mortality rate; decreased numbers of lymphocytes and RBC in peripheral blood; decreased numbers of lymphocytes, granulocytes, multipotential hematopoietic stem cells, and committed granulocyte/macrophage progenitor cells in bone marrow; decreased splenic weight, and numbers of lymphocytes, multipotential

hematopoietic stem cells and committed granulocyte/macrophage progenitor cells in the spleen; increased incidence of atypical cell morphology in peripheral blood, bone marrow, and spleen. This study identifies a LOAEL of 9.6 ppm for slight hematopoietic effects in mice exposed to benzene for 10 weeks and a LOAEL of 302 ppm for severe hematopoietic toxicity in mice exposed for 26 weeks.

Sprague-Dawley rats (50/sex/group; 12 weeks of age) and CD-1 mice (150/sex/group; 9 weeks of age) were exposed to nominal vapor concentrations of 0, 1, 10, 30, or 300 ppm benzene (99.9% purity) (0, 3, 32, 96, or 959 mg/m^3), 6 hours/day, 5 days/week, for 13 weeks (Ward et al., 1985). Clinical observations and body weight data were normal in both species. High-exposure level rats had leukopenia and significantly ($p<0.05$) decreased femoral marrow cellularity. High-exposure level mice had leukopenia, anemia, thrombocytopenia, and significant increases in MCV, MCH, glycerol lysis time, and incidence and severity of morphological changes in RBC. Relative testes weights were significantly decreased in high-dose male mice. High-dose mice had histological abnormalities in the thymus (atrophy), bone marrow (myeloid hyperplasia), lymph nodes (lymphoid depletion of mesenteric and mandibular lymph nodes; plasma cell infiltration into mandibular lymph node), spleen (increased incidence of extramedullary hematopoiesis; periarteriolar lymphoid sheath depletion), ovaries (bilateral ovarian cysts), and testes (bilateral atrophy/degeneration; decreases in spermatozoa in the epididymal ducts; increased numbers of abnormal sperm types); similar lesions were observed in the testes and ovaries of mice exposed to concentrations lower than 300 ppm, but the authors did not consider these effects to be biologically significant. The incidence and severity of most benzene effects were greater in male mice than in female mice. This study identifies a NOAEL of 30 ppm and a LOAEL of 300 ppm for these effects in rats and mice.

Male Sprague-Dawley rats (40/group) were exposed to vapor concentrations of 0 or 100 ppm benzene (0 or 319 mg/m^3), 6 hours/day/ 5 days/week, for life (American Petroleum Institute, 1983). Blood samples were obtained at 2-4 week intervals throughout the treatment period. The treatment had no adverse effects with respect to mortality rates or body weight gain. Peripheral erythrocyte and lymphocyte counts were depressed at nearly every sampling time in treated rats, but the extent of decrease was not statistically significant at $p<0.05$. Significantly increased incidence of splenic hyperplasia ($p<0.005$) and hemosiderin pigments ($p<0.001$) were observed in benzene-exposed rats. The incidences of normally rare tumors in treated rats were liver (4/40), Zymbal gland (2/40), and chronic myelogenous leukemia (1/40); the authors considered these tumors to be related to the benzene exposure. This study identifies a LOAEL of 100 ppm for slight hematological effects in rats.

Male AKR/J (50/group) and C57BL/6J mice (40/group) were exposed to vapor concentrations of 0, 100 (319 mg/m^3; AKR mice only), or 300 ppm (958 mg/m^3; C57BL/J mice only) benzene, 6 hours/day, 5 days/week for life (Snyder et al., 1980). The following parameters were used to assess toxicity: clinical signs (observed daily), body weights (measured biweekly), hematology (RBC, WBC, WBC differentials, absolute neutrophil and lymphocyte; measured biweekly in 10 control and 10 treated mice from each strain), and gross and microscopic necropsy (lung, liver, spleen, kidney, and bone marrow). The treatment had no adverse effects with respect to life span, body weight, or incidence of lymphoma in AKR mice. Treated AKR mice had significant (± 2 standard errors) degrees of lymphocytopenia, neutrophilia, erythropenia, and bone marrow hypoplasia ($p<0.05$). Treated C57BL mice had significant (± 2 standard errors) degrees of lymphocytopenia, neutrophilia, erythropenia, morphological changes in peripheral blood cells, and bone marrow and splenic hyperplasia ($p<0.05$). The incidence of hematopoietic neoplasms was significantly ($p<0.05$) increased in C57BL mice, including 6 cases of thymic lymphoma. This study identifies a LOAEL of 100 ppm for hematopoietic effects in mice.

Pregnant Swiss Webster mice (5/exposure level/progeny age group; initial age 8-12 weeks) were exposed via inhalation to nominal vapor concentrations of 0, 5, 10, or 20 ppm benzene (0, 16, 32, or 64 mg/m^3) for 6 hours/day on gestation days 6-15 (Keller and Snyder, 1988). On gestation day 16 (fetuses), 2 days after birth (neonates), and 6 weeks after birth (adults), progeny (1-2 males and 1-2 females/litter) were sacrificed to determine the amounts and types of hemoglobin produced, and hemopoietic cells in the peripheral blood and hematopoietic organs. No evidence of maternal or non-hematopoietic developmental toxicity was observed in treated mice, and no adverse hematopoietic effects were observed in fetuses. The treatment had no adverse effects in any progeny with respect to peripheral blood levels of RBC, MCH, blasts, dividing granulocytes, lymphocytes, or ratio of hemoglobin A major to hemoglobin A minor. There was a concentration-related decrease in peripheral blood levels of early nucleated red cells in neonates, significant ($p<0.05$) at all exposure levels. High-exposure level neonates had significantly ($p<0.05$) increased numbers of nondividing granulocytes and decreased numbers of late nucleated red cells in peripheral blood. In high-exposure level neonates, hepatic levels of blasts, dividing granulocytes, non-dividing granulocytes, and lymphocytes were significantly ($p<0.05$) increased and late nucleated red cells were significantly ($p<0.05$) decreased; hepatic levels of blasts were also significantly ($p<0.05$) increased at the low-exposure level in neonates. In adults, there was a concentration-related decrease in early nucleated red cells in bone marrow, significant ($p<0.05$) at the high-exposure level. High-exposure level adults also had

significant ($p<0.05$) increases in splenic levels of blasts, dividing granulocytes, and nondividing granulocytes; splenic levels of non-dividing granulocytes were also increased in low-exposure level adults. This study identifies a LOAEL of 5 ppm for developmental hematopoietic effects in mice.

Pregnant Swiss-Webster mice (5/exposure level/progeny age group; initial age 8-12 weeks) were exposed via inhalation to nominal vapor concentrations of 0, 5, 10, or 20 ppm benzene (0, 16, 32, or 64 mg/m^3) for 6 hours/day on gestation days 6-15 (Keller and Snyder, 1986). On gestation day 16 (fetuses), 2 days after birth (neonates), and 6 weeks after birth (adults), progeny (1-2 males and 1-2 females/litter) were sacrificed for measurement of hematopoietic progenitor cells [colony forming units - erythroid (CFU-E), burst forming units - erythroid (BFU-E), and granulocytic colony forming cells (GC-CFU-C)] from the liver (fetuses and neonates), and bone marrow and spleen (adults). In addition, 10-week old progeny from litters in the control and mid-exposure group were exposed for 2 weeks to 10 ppm benzene, then sacrificed for measurement of hematopoietic progenitor cells from the bone marrow and spleen. There was no evidence of maternal or non-hematopoietic developmental toxicity in benzene-exposed mice. There was a significant ($p<0.05$) increase in the numbers of erythroid burst forming units from livers of male and female fetuses exposed to the low- and mid-exposure level, respectively. The following significant ($p<0.05$) changes were observed with respect to CFU-E: in fetuses, there were increases in liver CFU-E at the low- and mid-exposure levels and decreases at the high-exposure level; in male neonates, there were increases and decreases in liver CFU-E at the mid-exposure level, and increases at the high-exposure level; in adult mice there were decreases in bone marrow CFU-E and increases in spleen CFU-E in males exposed to 10 ppm *in utero*. Liver GM-CFU-C in neonates was significantly ($p<0.05$) decreased at the mid-exposure level (males only) and increased at the high-exposure level. Mice exposed to 10 ppm benzene *in utero* and for 2 weeks as adults had significantly ($p<0.05$) decreased bone marrow CFU-E (males only) and splenic GM-CFU-C; mice exposed to air *in utero* and 10 ppm benzene for 2 weeks as adults had no changes in bone marrow or splenic CFU-E, but had a significant ($p<0.05$) decrease in splenic GM-CFU-C (females only). The authors concluded that benzene treatment *in utero* induced hematopoietic alterations in fetuses, persisting until at least 10 weeks after birth. This study identifies a LOAEL of 5 ppm for developmental hematopoietic effects in mice.

Bred Sprague-Dawley rats (17-20/group; initial body weights 210-223 g) were exposed via inhalation to nominal vapor concentrations of 0, 10, 50, or 500 ppm benzene (0, 32, 160, and 1600 mg/m^3) for 7 hours/day, on gestation days 6-15, followed by sacrifice on gestation day 20 for determination of developmental

abnormalities (Kuna and Kapp, 1981). The treatment had no adverse effects on dams with respect to mortality rate, hematology, or gross necropsy. Body weight gain over gestation days 5-15 was significantly ($p<0.05$) decreased in mid- and high-exposure level dams. Fetal body weight was significantly ($p<0.05$) decreased at the mid- and high-exposure levels and fetal crown-rump length was decreased at the high-exposure level. The number of litters with skeletal and visceral variants was significantly ($p<0.05$) increased at the mid- and high-exposure levels. The skeletal and visceral abnormalities observed included exencephaly, angulated ribs, dilated lateral and third ventricles of the brain, forefeet ossification out of sequence, generalized lagging ossification, and decreased numbers of caudals, and metacarpals, metatarsals, and phalanges/foot; the authors considered these abnormalities to be related to the benzene treatment. This study identifies a NOAEL of 10 ppm and a LOAEL of 50 ppm for maternal toxicity and developmental effects in rats.

Bred Sprague-Dawley rats (26-31/group) were exposed to nominal vapor concentrations of 0, 10, or 40 ppm benzene (0, 32, or 128 mg/m^3) for 6 hours/day on gestation days 6-15 (Litton Bionetics, 1978). The treatment had no adverse effects on mortality rate, body weight gain, or food consumption in dams. Pregnancy ratio, fetal weight, live litter size, and incidence of variants and malformations were similar in control and treatment groups. Benzene-exposed rats had significantly ($p<0.05$) decreased ratio of live fetuses/implantation site. The number of resorption sites was increased in benzene-exposed rats, but the difference was only significant ($p<0.05$) in the low-exposure group. This study identifies a LOAEL of 10 ppm for developmental effects in rats.

Female Sprague-Dawley rats (26/group) were exposed to vapor concentrations of 0, 1, 10, 30, or 300 ppm benzene (0, 3, 32, 96, or 958 mg/m^3), 6 hours/day, 5 days/week during premating (10 weeks) and mating periods, then 6 hours/day, 7 days/week, on gestation days 1-20, and lactation days 5-21 (Bio/dynamics, 1980). The following parameters were used to assess toxicity: clinical signs, mortality rate, body weight gain, pregnancy rates, and gestation length in dams; number alive and dead at birth, sex distribution, survival, body weights, organ weights, and gross necropsy in pups. The treatment had no adverse effects with respect to reproduction or maternal toxicity. This study identifies a NOAEL of 300 ppm for reproductive effects and maternal and developmental toxicity in rats.

No multigeneration reproductive toxicity studies following exposure to benzene by any route were located. Effects on reproductive organs were observed in mice exposed to 300 ppm for 13 weeks (decreased relative testes weights, testicular lesions,

and ovarian cysts) and in male rabbits exposed to 80 ppm for 175 days (unspecified histopathological changes in testes; Wolf et al., 1956), but not in mice exposed to 30 ppm (Ward et al., 1985), or in female rats exposed to 300 ppm for 17 weeks during premating, mating, gestation, and lactation (Bio/dynamics, 1980).

DERIVATION OF PROVISIONAL INHALATION RfC

Chronic exposure of humans to benzene vapor in the work place resulted in hematological and/or hematopoietic effects at concentrations of 30-218 ppm (Askoy et al., 1971; Fishbeck et al., 1978). At lower concentrations (0.01-1.40 ppm, mean 0.045 ppm), no adverse hematological effects were observed in peripheral blood of humans (Collins et al., 1991).

In animals, the most sensitive endpoint for long-term exposure to benzene vapor is toxicity to hematopoietic progenitor cells. The lowest LOAELs identified for this effect are 5 and 10 ppm in mice exposed to benzene *in utero* or subchronically, respectively (Green et al., 1981a,b; Baarson et al., 1984; Keller and Snyder, 1986,1988). NOAELs for damage to hematopoietic progenitor cells have not been established. Several lifetime inhalation exposure studies have been conducted, however the lowest concentration tested was 100 ppm. The lifetime studies provide evidence that mice are more sensitive to the long-term effects of benzene than are rats (Snyder et al., 1980; American Petroleum Institute, 1983). Reproductive effects (testicular lesions and ovarian cysts) were observed in mice exposed to 300 ppm for 13 weeks, but not in mice exposed to 30 ppm (Ward et al., 1985), or in female rats exposed to 300 ppm for 17 weeks during premating, mating, gestation, and lactation (Bio/dynamics, 1980). No multigeneration reproduction studies were located in the available literature; thus, no NOAEL can be established for reproductive effects due to benzene exposure.

A free-standing NOEL of 0.045 ppm (0.1438 mg/m^3) for hematological effects in individuals occupationally exposed to benzene was identified in the Collins et al. (1991) study. Adjusting for intermittent exposure (10 m^3/20 m^3 x 5 days/7 days), the $NOEL_{ADJ}$ is 0.0514 mg/m^3. The $NOEL_{HEC}$ is equal to the $NOEL_{ADJ}$. An uncertainty factor of 100 was applied to the $NOEL_{HEC}$ of 0.0514 mg/m^3, to yield a provisional RfC of 5×10^{-4} mg/m^3. The uncertainty factor of 100 includes 10 for intraspecies variability, 3 for data base deficiencies including the lack of a multigeneration reproduction study and 3 for a less than chronic exposure period in the occupational population.

Confidence in the principal study (Collins et al., 1991) is medium. Differences in the demographic and personal habit variables between the benzene-exposed and control workers

decreases the confidence in this study. Confidence in the data base is medium. A large number of human and animal studies corroborate that hematological effects are endpoints of concern. Testicular lesions were reported by Ward et al. (1985); however, male reproductive performance tests and/or a multigeneration reproduction study were not identified. Reflecting the medium confidence in the key study and the data base, confidence in this provisional RfC is medium.

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Attachment IV.

(O.A.=92-32/1/8/92. Revised by R. Schoeny for Rocky Flats 8/23/93)

**Risk Assessment Issue Paper for:
Oral-to-Dermal Extrapolation for
Fluorene (CASRN 86-73-7)**

Human data regarding carcinogenic or noncarcinogenic effects following inhalation, oral and dermal exposure were not available. However, fluorene can be a component of mixtures (e.g. tobacco smoke, coal tar, soot and coke oven emissions) that have been associated with human cancer.

Hematological and hepatic effects in mice have been observed following subchronic gavage exposure to fluorene. Reports of noncarcinogenic effects in animals following inhalation or dermal exposure are not available.

The U.S. EPA (1993) has verified a chronic oral RfD for fluorene based on a NOAEL for hematological effects in subchronically exposed mice.

No evidence for carcinogenicity was observed in dietary studies with rats, in mouse skin-painting assays (including assays for tumor initiation and co-carcinogenicity with 3-methyl-cholanthrene or in subcutaneous injection studies). The U.S. EPA (U.S. EPA, 1993) has classified fluorene as Group D - not classifiable as to human carcinogenicity based on the availability of no human data and insufficient data in animal tests.

Since data indicate that no dermal effects are expected after dermal exposure to fluorene, oral-to-dermal extrapolation appears appropriate.

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Attachment V.

(93-30/08-04-93)

Risk Assessment Issue Paper for:
Feasibility of RfD Derivation for 2-Methylnaphthalene
(CASRN 91-57-6)

INTRODUCTION

The TOXLINE (1981-1991) and TSCATS data bases were examined in October 1991 to identify literature regarding health effects associated with exposure to 2-methylnaphthalene and 1-methylnaphthalene (as a possible surrogate). Update searches of TOXLINE (1991-1993, CAS number and chemical names strategy, all cites), CANCERLINE (1963-1993, CAS number and chemical names strategy, all cites), TSCATS, RTECS, and HSDB were performed and screened in April 1993.

In addition to the literature searches, IRIS (U.S. EPA, 1993a), the RfD/RfC Monthly Status Report (U.S. EPA, 1993b), the Drinking Water Regulations and Health Advisories list (U.S. EPA, 1993c), the HEAST and Supplements (U.S. EPA, 1993), the NTP Chemical Status Reports (NTP, 1993a;b) and the OHEA CARA lists (U.S. EPA, 1991, 1993d), were used to identify sources of additional information. The ATSDR (1990) Toxicological Profile for Naphthalene and 2-Methylnaphthalene and a report by Buckpitt and Franklin (1989) were also reviewed for pertinent literature.

The U.S. EPA (1993a) has not derived an RfD for 2-methylnaphthalene, nor is this chemical under consideration by the RfD/RfC Work Group (U.S. EPA, 1993b) or listed on the HEAST (U.S. EPA, 1993). ATSDR (1990) has not derived MRL values.

REVIEW OF PERTINENT LITERATURE

Data were not located regarding effects in humans or animals following inhalation or oral exposure to 2-methylnaphthalene (or 1-methylnaphthalene). Information regarding the health effects of 2-methylnaphthalene is restricted to examinations of cell damage in the bronchiolar epithelium of mice (Griffin et al., 1981; Rasmussen et al., 1986; Buckpitt and Franklin, 1989; Honda et al., 1990) and rats (Dinsdale and Verschoyle, 1987) given intraperitoneal injections of 2-methylnaphthalene, and to studies of mononucleated giant cell formation and proteinosis in pulmonary alveoli of mice dermally exposed over a period of 30 weeks to a mixture of 1- and 2-methylnaphthalene (Murata et al., 1992).

Because no data on 2-methylnaphthalene that are suitable for derivation of the requested provisional oral RfD were located, use of the toxicity data for naphthalene as a surrogate for 2-methylnaphthalene have been considered. Intraperitoneal

injections of either naphthalene, 1-methylnaphthalene or 2-methylnaphthalene caused cell damage in the bronchiolar epithelium of mice (Rasmussen et al., 1986). Naphthalene and 2-methylnaphthalene were about equally toxic, but changes associated with 1-methylnaphthalene exposure were less severe. Other reports of similar results in similar mouse experiments comparing only naphthalene and 2-methylnaphthalene are available (Griffin et al., 1981; Buckpitt and Franklin, 1989; Honda et al., 1990). Although these comparisons suggest that naphthalene and its methylated derivatives may cause similar health effects in acutely exposed animals, it is uncertain if similarities in health effects would be observed in humans repeatedly exposed to any one of these compounds in the environment. It is possible that the observed effect in mice is a special case that may not apply to other species, since no bronchiolar cell damage was detected in rats following intraperitoneal doses of naphthalene, 1-methylnaphthalene or 2-methylnaphthalene (Dinsdale and Verschoyle, 1987). Furthermore, hemolytic anemia has been identified in case reports to be the primary effect in humans associated with acute exposure to naphthalene (ATSDR, 1990). Because no hemolytic effects were observed in mice orally exposed for 14 days to naphthalene doses as high as 267 mg/kg/day (Shopp et al., 1984), the use of rodents as an experimental model to assess health hazards for humans exposed to naphthalene or its methylated derivatives has been questioned (ATSDR, 1990).

Limited data are available concerning the relative acute lethality of naphthalene and 2-methylnaphthalene. Intraperitoneal doses of 2-methylnaphthalene as high as 800 mg/kg have been administered to mice without mortality (Griffin et al., 1981), but the intraperitoneal LD_{50} value for naphthalene is 380 mg/kg in mice (Warren et al., 1982), and intraperitoneal doses of naphthalene as low as 150 mg/kg have been reported to produce lethality in this species (Sandmeyer, 1981).

An oral RfD for naphthalene is not on IRIS (U.S. EPA, 1993a). The issue is under review by the RfD Work Group to determine the most appropriate basis for RfD derivation for naphthalene (U.S. EPA, 1992, 1993b).

Comparison of the metabolism of 2-methylnaphthalene and naphthalene indicate that the addition of a methyl group can make a significant difference in metabolic fate (Buckpitt and Franklin, 1989). 2-Methylnaphthalene metabolism proceeds via two divergent pathways, methyl group oxidation and epoxidation of the aromatic ring. Naphthalene metabolism occurs via the aromatic ring epoxidation pathway only. The methyl group oxidation pathway is the major metabolic fate of 2-methylnaphthalene in guinea pigs (Teshima et al., 1983) and rats (Melancon et al., 1982). Further differences between the metabolism of naphthalene and that of its methylated derivatives can be inferred from reports that treatment of mice with inhibitors of cytochrome P-

450 monooxygenase activity (i.e., SKF 525-A and piperonyl butoxide) did not inhibit the development of 2-methylnaphthalene-induced bronchiolar cellular damage, but markedly protected against naphthalene-induced damage (see Buckpitt and Franklin, 1989). The possible differences between metabolic fate of naphthalene and that of its methylated derivatives, in addition to the uncertainty of how these differences may affect the toxicities of the methylated derivatives relative to that of naphthalene, adds further uncertainty to the use of naphthalene toxicity data as a surrogate for 2-methylnaphthalene.

DERIVATION OF A CHRONIC ORAL RfD

Oral and inhalation toxicity data for 2-methylnaphthalene are lacking, precluding derivation of a provisional oral RfD for 2-methylnaphthalene. The use of toxicity data for naphthalene as a surrogate for 2-methylnaphthalene was considered, but the uncertainties in such an approach appear to be too great to warrant its adoption.

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Attachment VI.

(93-30/08-04-93)

Risk Assessment Issue Paper for:
Feasibility of RfC Derivation for
2-Methylnaphthalene (CASRN 91-57-6)

The following computer searches for 2-methylnaphthalene were conducted in August 1992: TOXLINE (1988-1992), TSCATS, HSDB, and RTECS. In addition, searches of TOXLINE (1991-1993, CAS number and chemical names strategy, all cites), CANCERLINE (1963-1993, CAS number and chemical names strategy, all cites), TSCATS, HSDB, and RTECS were conducted and screened in April, 1993. Also, IRIS (U.S. EPA, 1993a), the RfD/RfC Monthly Status Report (U.S. EPA, 1993b), the Drinking Water Regulations and Health Advisories (U.S. EPA, 1993c), the HEAST and Supplements (U.S. EPA, 1993), the NTP Chemical Status Reports (NTP, 1993a,b) and the OHEA CARA lists (U.S. EPA, 1991, 1993d), were used to identify sources of additional information. Review documents on 2-methylnaphthalene are an ATSDR (1990) Toxicological Profile for Naphthalene and 2-Methylnaphthalene and a report by Buckpitt and Franklin (1989).

The U.S. EPA (1993a) has not derived an RfC for 2-methylnaphthalene, nor is this chemical under consideration by the RfD/RfC Work Group (U.S. EPA, 1993b). ATSDR (1990) has not derived MRL values. No occupational guidelines and/or regulations were located for 2-methylnaphthalene.

Studies regarding health effects in humans or animals following inhalation, oral, or dermal exposure to 2-methylnaphthalene are not available, but data are available on metabolism and health effects following acute intraperitoneal injection of 2-methylnaphthalene in rodents. By themselves, these data do not provide a sufficient base for the derivation of an RfC for 2-methylnaphthalene.

COMPARATIVE TOXICITY AND BIOACTIVATION OF NAPHTHALENE AND 2-METHYLNAPHTHALENE

Since the data are insufficient to derive an RfC for 2-methylnaphthalene, one possible approach would be to develop an RfC for 2-methylnaphthalene by analogy to naphthalene. In a separate issue paper, the Technical Support Center derived a provisional RfC for naphthalene based on nasal effects in mice exposed to naphthalene vapor for 2 years (NTP, 1992). A comparison of mechanism of naphthalene and 2-methylnaphthalene is useful to assess the feasibility of using naphthalene as a surrogate.

Necrosis of the Clara cells of the bronchiolar epithelium was observed in mice receiving single intraperitoneal injections of 2-methylnaphthalene and naphthalene (Griffin et al., 1981;

Rasmussen et al., 1986; Honda et al., 1990); these studies suggest the respiratory system is a target for both compounds. Rasmussen et al. (1986) showed that the severity of Clara cell necrosis in mice given single injections of 2 mmol/kg naphthalene was equivalent to the severity in mice given the same doses of 2-methylnaphthalene. However, Dinsdale and Verschoyle (1987) showed that similar treatment of rats did not lead to bronchiolar necrosis, suggesting mice are more sensitive to the Clara cell toxicity of 2-methylnaphthalene than are rats. The relevance of Clara cell necrosis following acute exposure to the lesions observed in the naphthalene chronic inhalation study (chronic inflammation in the nose and lung, and metaplasia and hyperplasia in the nasal epithelial cells [NTP, 1992]) and the methylnaphthalene (mixture of the 1- and 2- isomers) chronic skin painting study (pulmonary alveolar proteinosis in mice [Murata et al., 1992]) is uncertain because of the different features of the acute and chronic responses (Buckpitt and Franklin, 1989). The lung injury following acute intraperitoneal exposure to naphthalene and 2-methylnaphthalene appears to be restricted to Clara cells; concurrent alterations of squamous alveolar epithelial cells and granular pneumocytes are not observed (Rasmussen et al., 1986; Buckpitt and Franklin, 1989). The response to chronic exposure does not appear to be restricted to Clara cells (NTP, 1992; Murata et al., 1992).

An additional uncertainty concerning the possible equivalence of 2-methylnaphthalene and naphthalene in producing the same health effects is illustrated by data suggesting that the two compounds may produce their acute toxic effects on the lung by different mechanisms. The mechanism by which naphthalene causes Clara cell necrosis has been proposed to involve the formation of reactive metabolic intermediates by cytochrome P-450 monooxygenases (Buckpitt and Franklin, 1989). Key data in support of this hypothesis include observations that pretreatment with inhibitors of cytochrome P-450 monooxygenases (e.g., piperonyl butoxide) immediately before administration of naphthalene inhibits the development of naphthalene-induced Clara cell necrosis, and that treatment with diethylmaleate (which depletes tissue levels of reduced glutathione, which conjugates and detoxifies reactive metabolites of naphthalene) enhances naphthalene-induced lung injury (Buckpitt and Franklin, 1989). In contrast, the pulmonary toxicity of single intraperitoneal injections of 2-methylnaphthalene was not affected in mice pretreated with cytochrome P-450 inhibitors (piperonyl butoxide or SKF 525-A) or diethylmaleate (Griffin et al., 1982).

Limited data are available concerning the relative acute lethality of naphthalene and 2-methylnaphthalene. Intraperitoneal doses of 2-methylnaphthalene as high as 800 mg/kg have been administered to mice without mortality (Griffin et al., 1981), but the intraperitoneal LD_{50} value for naphthalene is 380 mg/kg in mice (Warren et al., 1982), and intraperitoneal doses of

naphthalene as low as 150 mg/kg have been reported to produce mortality in this species (Sandmeyer, 1981). The differences between naphthalene and 2-methylnaphthalene in acute lethality and susceptibility of the acute pulmonary toxicity to metabolic perturbations may involve demonstrated differences in their metabolism. 2-Methylnaphthalene metabolism proceeds by two different pathways, methyl group oxidation and epoxidation of the aromatic ring. Evidence is available that the methyl group oxidation pathway is the major metabolic fate of 2-methylnaphthalene in guinea pigs (Teshima et al., 1983) and rats (Melancon et al., 1982). Naphthalene metabolism occurs via the aromatic ring epoxidation pathway only (Buckpitt and Franklin, 1989).

In conclusion, although there is limited information indicating that the acute lung toxicities of naphthalene and 2-methylnaphthalene are similar, the uncertainties associated with the assumption that chronic exposure to either of the chemicals will produce similar effects are sufficiently numerous to preclude assessment of the risk of exposure to inhaled 2-methylnaphthalene based upon the RfC for naphthalene.

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Attachment VII.

1.3×10^{-3} mg/m³

Risk Assessment Issue Paper for:
Provisional RfC for Naphthalene (CASRN 91-20-3)

Naphthalene is commonly used as a moth repellent. The primary effects of naphthalene in humans following inhalation and oral exposure are effects on the gastrointestinal system (nausea, vomiting, diarrhea), hemolytic anemia, jaundice and the development of cataracts (ATSDR, 1989). Exposure to naphthalene was not quantitated following any route of exposure because the majority of exposures resulted from inhalation or ingestion of mothballs.

Neonatal hemolytic anemia has been reported in humans following ingestion of naphthalene by the mother during pregnancy (Anziulewicz et al., 1959; Zinkham and Childs, 1957, 1958). In animals, developmental toxicity (reduced number of live young at birth) and maternal toxicity (increased mortality and reduced body weight gain) were found in mice treated with 300 mg/kg/day naphthalene by gavage from gestation day 7-14 (Plasterer et al., 1985). The administration (route not specific) of 2-naphthol, a metabolite of naphthalene, to pregnant rabbits resulted in cataracts and retinal damage in the offspring (Van der Hoeve, 1913).

The only subchronic or chronic inhalation study available for naphthalene is a chronic study conducted by NTP (1991). This study is currently in the post peer-review stage and not available at this time. In this study, groups of male and female B6C3F1 mice were exposed to 0 (75 mice/sex), 10 (75 mice/sex) or 30 ppm (150 mice/sex) naphthalene 6 hours/day, 5 days/week for 2 years. A comprehensive histological examination was performed on all control and high dose animals and on low dose animals that died or were sacrificed before 21 months of exposure (after 21 months of exposure, only the nasal cavity and lung were examined in the low dose group). Survival was significantly decreased in the control male mice (38% survival at 2 years) due to increased fighting within the group. Survival was comparable in the exposed groups of males (74% in 10 ppm group and 86% in 30 ppm group) and in all groups of female mice (86% in controls, 85% in 10 ppm group and 74% in 30 ppm group). Hematological evaluations were planned after 14 days and 3, 6, 12 and 18 months of exposure. Due to the high mortality in the control males, however, these evaluations were only performed after 14 days of exposure and no effects were observed. Body weights were not affected by exposure in either sex. Significant increases in the incidence of nonneoplastic lesions were found in the lung and nose of both the males and female mice at both exposure levels. The effects included chronic inflammation of the lung and chronic

inflammation, metaplasia of the olfactory epithelium, and hyperplasia of the respiratory epithelium in the nose. These lesions were generally more severe in the 30 ppm groups. The incidences of inflammation in the lung in the male and female mice were 3/137, 34/133, 98/269 in the 0, 10 and 30 ppm groups, respectively. The incidences of nasal lesions in the 0, 10, and 30 ppm groups for the male and female mice were 0/137, 130/133, and 268/269, respectively.

NTP (1991) determined there was no evidence of carcinogenicity of naphthalene in male mice. In female mice, some evidence of carcinogenicity was found based on a significant ($p<0.001$) increase in the incidence of alveolar/bronchiolar adenomas in the 30 ppm group (5/68 control; 2/64, 10 ppm group; 28/134, 30 ppm group). One alveolar/bronchiolar carcinoma was reported in a female mouse exposed to 30 ppm.

Several approaches to deriving a provisional inhalation RfC for naphathlene can be taken. The RfC could be based on the nasal effects, lung effects, or both the nasal and lung effects reported in the NTP (1991) study. Below are the calculations of the $LOAEL_{HEC}$ for each of these approaches.

1. LOAEL of 10 ppm (52.4 mg/m^3) adjusted for intermittent exposure:

$$LOAEL_{ADJ} = 52.4\ mg/m^3 \times 6\ hours/24\ hours \times 5\ days/7\ days = 9.4\ mg/m^3.$$

2. Calculation of inhalation rate based on the female body weight of 0.027 kg using the algorithm presented in U.S. EPA (1987a):

$$\text{Inhalation rate} = 1.99\ (\text{body weight})^{1.0496} = 0.045\ m^3/day$$

3. Derivation of the $LOAEL_{HEC}$:

$$LOAEL_{HEC} = LOAEL_{ADJ} \times \text{Regional Deposited Gas Ratio (RDGR)}$$

where: $$RDGR = \frac{(\text{Inhalation rate/Surface Area})_A}{(\text{Inhalation rate/Surface Area})_H}.$$

a. For nasal effects:

$$LOAEL_{HEC} = 9.4\ mg/m^3 \times \frac{(0.045\ m^3/day)\ /\ (2.9\ cm^2)}{(20\ m^3/day)\ /\ (177\ cm^2)}$$

$$= 1.3\ mg/m^3.$$

b. For lung effects:

$$LOAEL_{HEC} = 9.4\ mg/m^3 \times \frac{(0.045\ m^3/day)\ /\ (291\ cm^2)}{}$$

$(20\ m^3/day) / (635{,}545\ cm^2)$

$= 46\ mg/m^3$.

c. For nasal and lung effects combined:

$LOAEL_{HEC} = LOAEL_{ADJ} \times (RDGR_{ET} + RDGR_{PU})$

$$RDGR_{ET} = \frac{(0.045\ m^3/day) / (2.9\ cm^2)}{(20\ m^3/day) / (177\ cm^2)}$$

$= 0.1373$

$$RDGR_{PU} = \frac{(0.045\ m^3/day) / (291\ cm^2)}{(20\ m^3/day) / (635{,}545\ cm^2)}$$

$= 4.914$

$LOAEL_{HEC} = 9.4\ mg/m^3 \times (0.1373 + 4.914)$

$= 47.5\ mg/m^3$

The provisional RfC for naphthalene should be based on the $LOAEL_{HEC}$ for nasal effects for two reasons. The dose response curve for the nasal effects appear to be steeper than that of the lung effects, suggesting that this may be a more sensitive target. In addition, basing the RfC on the nasal effects would yield the most conservative inhalation RfC. Application of an uncertainty factor of 1000 (30 for extrapolation from animals to humans since a dosimetric adjustment was used, 10 for the use of a LOAEL and 10 to protect sensitive individuals and 3 for lack of complete database namely reproductive and developmental toxicity studies) to the $LOAEL_{HEC}$ yields a provisional inhalation RfCs of $1.3 \times 10^{-3}\ mg/m^3$ for nasal effects.

Confidence in the key study is medium. The study was well-designed and performed a comprehensive histological examination on the lung and nasal cavity of all animals. Although the hematological system is a target for naphthalene toxicity, hematological effects were only examined after 14 days of exposure due to high mortality in the control male mice. Confidence in the database is low: studies assessing the reproductive and developmental toxicity of naphthalene were limited, human studies did not quantitate naphthalene exposure and the one chronic inhalation study was done in only species of animal. Low confidence in the provisional inhalation chronic RfC follows.

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Attachment VIII.

Risk Assessment Issue Paper for:
Provisional Oral RfD for Naphthalene (CASRN 91-20-3)

The FY 1992 Health Effects Assessment Summary Tables (HEAST) March 1992 Annual Update (U.S. EPA, 1992a) presented provisional chronic and subchronic oral [RfD]s for naphthalene, both equal to 4E-2 mg/kg/day. These provisional [RfD]s were based on a subchronic study by NTP (1980) in which rats were administered naphthalene by gavage 5 days/week for 13 weeks. A NOEL of 50 mg/kg/day was identified and a provisional [RfD] calculated as follows:

[RfD] = 50 mg/kg/day X (5days/7days) / 1000 (UF)

[RfD] = 4E-2 mg/kg/day

The uncertainty factor of 1000 included 10 for interspecies extrapolation, 10 to protect sensitive subpopulations and 10 for the use of a subchronic study. The chronic oral [RfD] was adopted as the subchronic oral [RfD]. Even though a subchronic to chronic UF was used for the chronic [RfD], concern over the health effects of naphthalene precluded adjusting the subchronic [RfD] upwards.

The HEAST only presents provisional toxicity values that are calculated in EPA documents or are the verified results of RfD/RfC or CRAVE Work Group deliberations that are pending input to the Integrated Risk Information System (IRIS) (U.S. EPA, 1992b). The [RfD] of 4E-2 mg/kg/day for naphthalene meets neither of these requirements. The chronic RfD calculated in the Health Effects Assessment (HEA) document for Naphthalene (U.S. EPA, 1988) is based on a dietary cancer study by Schmahl (1955) with the NTP (1980) study presented as <u>supporting</u> information. In reviewing the literature on naphthalene, the RfD/RfC Work Group rejected the Schmahl (1955) study in favor of the NTP (1980) study and is currently reviewing, but has not verified, the provisional chronic [RfD] value of 4E-2 mg/kg/day.

Because of this uncertainty over the calculation of the provisional [RfD] for naphthalene, both the chronic and subchronic [RfD]s have been removed from the HEAST in the November 1992 Supplement No. 2 to the March 1992 Annual Update (U.S. EPA, 1992c). However, the chronic and subchronic oral [RfD] values of 4E-2 mg/kg/day remain the most current values available for the risk assessment of naphthalene.

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Attachment IX.

Risk Assessment Issue Paper for: Oral Absorption for Styrene

Quantitative data for dermal absorption in humans or animals were not reviewed in available U.S. EPA (1985, 1989) documents on styrene. Data regarding the percentage absorption of dermally applied styrene were not located by ATSDR (1990), but two studies in humans measured dermal absorption rate estimates of 9-15 $mg/cm^2/hr$ (Dutkiewicz and Tyras, 1968) and 1 $\mu g/cm^2/hr$ (Berode et al., 1985). The larger of these estimates was obtained in experiments in which an occluded 0.2 mL dose of liquid styrene was applied to the arms of male subjects (Dutkiewicz and Tyras, 1967; 1968). In the experiments of Berode et al. (1985), subjects immersed a hand in liquid styrene. In a recent study, Morgan et al. (1991) reported that 0.31 mL of a 2-mL occluded dermal dose of liquid styrene was absorbed by rats in a 24-hour period (15% absorption); measured values of percentage dermal absorption for benzene and m-xylene were 31% and 33%, respectively, in the same experiment.

The fractional dermal absorption of styrene from soil is likely to be less than the 15% measured under occluded conditions (Morgan et al., 1991) due to volatilization and soil adsorption of styrene. Styrene has a vapor pressure (5 mm Hg at 20 C; ATSDR, 1990) similar to those of xylene isomers (5-6.5 mm Hg at 25 C; U.S. EPA, 1985), but considerably less than that of benzene (95.2 mm Hg at 25 C). In vivo experiments showed that more than 99% of undiluted benzene applied to uncovered skin was lost to volatilization (Franz, 1984). It is possible that the fractional volatilization loss would be less for styrene due to its considerably lower vapor pressure; however experimental validation is not available. Data from experiments in which styrene (either undiluted or in soil) is applied to uncovered skin are not available.

In the absence of data for styrene, the "proposed value" of 3% is recommended for use in estimating absorbed doses from dermal exposure to styrene in soil, rather than adopting the recommended value for benzene of 0.05%. The decision to not use the benzene value is based on the difference in vapor pressures between the two substances.

As reviewed by the U.S. EPA (1985, 1989) and the ATSDR (1990), rat studies indicated that orally administered styrene was nearly completely absorbed; data for humans are not available. Plotnick and Weigel (1979) reported that rats eliminated about 90% of a 20-mg/kg gavage dose of styrene in corn oil in the urine within 24 hours of dose administration; fecal excretion accounted for <2% of the dose. In rats given 50- and

500-mg/kg doses of styrene in corn oil, minimal estimates of percentage absorption (based on urinary and expired air elimination) were 96 and 99%, respectively (Sauerhoff et al., 1976). Withey (1976) reported that the rate of gastrointestinal absorption of styrene was slower with vegetable oil as a vehicle compared with aqueous solutions of styrene.

The "proposed" oral absorption efficiency value of 0.90 is reasonably consistent with the animal data for orally administered styrene; however, a value of 100% is recommended to encompass the upper range of the experimental estimates.

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Attachment X. Oral Absorbtion for Multiple Chemicals

Chemical Name	EPA Documents	ATSDR Toxicological Profiles
Acenaphthene	U.S. EPA, 1990a: No quantitative data.	ATSDR, 1990: No data available.
2-Methylnaphthalene	U.S. EPA, 1984b: Animals: Absorption can be inferred from systemic effects. U.S. EPA, 1990c: Animals: Absorption can be inferred from systemic effects and excretion data.	ATSDR, 1990: No quantitative data.
Phenanthrene	1990 DWCD: No quantitative data. 1984 HEA: No specific data. 1987 HEEP: No pertinent data located. ATSDR, 1990: No quantitative data.	ATSDR, 1993: No quantitative data.

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still current as of 11/1/12

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

MAY 18 1992

SUBJECT: Carcinogenicity Characterization of Trichloroethylene (CASRN 79-01-6), Tetrachloroethylene (CASRN 127-18-4) and Styrene (CASRN 100-42-5)

FROM: Joan S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Dave Crawford
U.S. EPA
Region VII

This memorandum is in response to your request to the STSC for carcinogenicity information on trichloroethylene, tetrachloroethylene and styrene as is listed in the HEAST FY-1992 Annual.

Attached is the current carcinogenicity characterization for trichloroethylene, tetrachloroethylene and styrene as provided to us by the Office of Health and Environmental Assessment (OHEA). Questions regarding this information should be directed to Charles Ris/OHEA at (202) 260-5898 or Jeanette Wilcse/OHEA at (202) 260-7315.

Please contact the Superfund Technical Support Center at (513) 569-7300 if you need further assistance.

Attachment

cc: J. Dinan (OS-230)
B. Means (OS-230)
K. Poirier (ECAO-Cin)
[redacted]

OPTIONAL FORM 99 (7-90)
FAX TRANSMITTAL # of pages ▶ 6

To Sue Dempsey	From M. Rouse
Dept./Agency NDOH	Phone # EPA R7
Fax # 402-471-0383	Fax # 913-551-7765

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

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MAY 21 1992

Styrene

Recent efforts to characterize the presence or absence of a carcinogen potential for styrene monomer go back to a January 1988 Drinking Water Criteria Document for Styrene, EPA# ECAO-C-409 and an October 1989 Health Effects Assessment Document, EPA# 600/8-88/054. The Agency's Science Advisory Board offered advice on the carcinogenicity weight-of-evidence classification in 1988 and 1990.

At the present time, the Agency has not decided how to describe the carcinogenicity evidence. Those needing a position may find the International Agency for Research on Cancer (IARC) view useful. IARC has classified styrene as a "Possible " human Carcinogen according to their classification criteria because of positive but limited animal data. IARC does not include human dose-response evaluations in their reviews.

When the Agency adopts a carcinogenicity characterization for styrene, the information will be entered into IRIS.

See 7/15/92 FAX from ECAO

SUBJECT: Carcinogenicity Characterization of Tetrachloroethylene (PERC) (CASRN 127-18-4), Trichloroethylene (TCE) (CASRN 79-01-6) and Styrene (CASRN 100-42-5)

FROM: Jean S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO:

This memorandum is in response to your request

Attached is the current carcinogenic characterization for tetrachloroethylene, trichloroethylene and styrene as provided to us by the Office of Health and Environmental Assessment (OHEA).

Please contact the Superfund Technical Support Center at (513) 569-7300 if you need further assistance.

Attachment

cc: J. Dinan (OS-230)
B. Means (OS-230)
K. Poirier (ECAO-Cin)

Script for Superfund Technical Support Center Questions on Tetrachloroethylene, Trichloroethylene and Styrene

Tetrachloroethylene (perchloroethylene, PERC)

The carcinogenicity characterization has a long history. A July 1985 Health Assessment Document for Tetrachloroethylene (Perchloroethylene), EPA # 600/8-82/005F, classified the agent in Weight-of-Evidence Group "C - Possible Human Carcinogen" mentioning that this would be reevaluated because of new information. The 1985 document also provided upper bound inhalation and oral risk estimates. An April 1987 Addendum to the Health Assessment Document, EPA# 600/8-82/005FA, proposed that the Weight-of-Evidence be upgraded to "B2 - Probable Human Carcinogen" and provided a revised inhalation risk estimate. A February 1991 document titled Response to Issues and Data Submissions on the Carcinogenicity of Tetrachloroethylene, EPA# 600/6-91/002A discussed newer data relative to weight-of-evidence classification. The Agency's Science Advisory Board has reviewed these documents finding them to be technically adequate while offering an opinion that the weight-of-evidence is on C-B2 continuum (C=Possible Human Carcinogen, B2=Probable Human Carcinogen). At present time, the Agency has not adopted a final position on the weight-of-evidence classification.

The upper bound risk estimates from the 1985 Health Assessment Document as amended by updated inhalation values from the 1987 Addendum have not as yet been verified by the IRIS-CRAVE Workgroup. The estimates are viewed as useful information in the context of the information available in the 1985-1987 period.

ORAL: 1985 HAD; Unit risk = 1.5E-6 per ug/L

Slope Factor = 5.2E-2 per mg/kg/day

INHALATION: 1987 Addendum; Unit risk = range form 2.9E-7 to 9.5E-7 with a geometric mean of 5.8E-7 per ug/cu.m

Slope factor = 2.0E-3 per mg/kg/day

Those needing to make a choice about carcinogenicity have found the 1985, 1987 and 1991 EPA documents and the 1988 and 1991 Science Advisory Board letters of advice useful background information. When the Agency makes a decision about weight-of-evidence, the CRAVE-IRIS verification will be completed and the information put on IRIS.

Trichloroethylene (TCE)

The current phase of the carcinogenicity characterization for trichloroethylene started with a July 1985 Health Assessment Document for Trichloroethylene, EPA# 600/8-82/006F which classified trichloroethylene in Weight-of-Evidence Group "B2 - Probable Human Carcinogen". Inhalation and oral upper bound risk estimates were provided. This information was verified on IRIS from 3/87 through 7/89. A June 1987 Addendum to the Health Assessment Document for Trichloroethylene, EPA# 600/8-82/006FA proposed that the Weight-of-Evidence finding of "B2" was further supported by newly available animal bioassay data and offered a minor revision to the inhalation upper bound risk estimate. In 1988 the Agency's Science Advisory Board offered an opinion that the weight-of-evidence was on C-B2 continuum (C=Possible Human Carcinogen, B2=Probable Human Carcinogen). The Agency withdrew the IRIS carcinogenicity file in 7/89 and has not adopted a current position on the weight-of-evidence classification.

The quantitative risk estimates provided in the 1985 Health Assessment Document and 1987 Addendum have been reviewed by the IRIS-Crave Workgroup but are not verified as such pending resolution of the weight-of-evidence classification. The upper bound risk values in these documents are as follows:

ORAL: 1985 HAD; Unit Risk = 3.2E-7 per ug/L
Slope Factor = 1.1E-2 per mg/kg/day

INHALATION: 1987 Addendum; Unit Risk = 1.7E-6 per ug/cu.m.
Slope Factor = 6.0E-3 per mg/kg/day

When the Agency adopts a current position on weight-of-evidence classification, the trichloroethylene file will be reentered on IRIS.

Styrene (CASRN 100-42-5)

Recent efforts to characterize the presence or absence of a carcinogen potential for styrene monomer go back to a January 1988 Drinking Water Criteria Document for Styrene, EPA# ECAO-C-409 and an October 1989 Health Effects Assessment Document, EPA# 600/8-88/054. The Agency's Science Advisory Board offered advice on the carcinogenicity weight-of-evidence classification in 1988 and 1990.

At the present time, the Agency has not decided how to describe the carcinogenicity evidence. Those needing a position may find the International Agency for Research on Cancer (IARC) view useful. IARC has classified styrene as a "possible " human carcinogen according to their classification criteria because of positive but limited animal data. Traditionally, IARC does not attempt to provide estimates of cancer unit risk or potency.

When the Agency adopts a carcinogenicity characterization for styrene, the information will be entered into IRIS.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

MEMORANDUM

DATE: December 9, 1993

SUBJECT: Provisional Oral RfD for Trichloroethylene (CASRN 79-01-6) (Hastings Groundwater Contamination Second Street/Hastings, NE)

FROM: Joan S. Dollarhide
Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Mary Rouse
U.S. EPA
Region VII

This memorandum responds to your request for an oral RfD for trichloroethylene for use at the Hastings Groundwater Contamination Second Street site, Hastings, NE.

Attached please find the following:

- **Risk Assessment Issue Paper for: Provisional Oral RfD for Trichloroethylene (CASRN 79-01-6)**

Please feel free to contact the Superfund Health Risk Technical Support Center at (513) 569-7300 if you have additional questions.

Attachment

cc: D. Crawford (Region VII)

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 16
To Sue Dempsey	From Mary Rouse
Co. NDOH	Co. EPA Region VII
Dept.	Phone # (913) 551-7415
Fax # 402-471-0383	Fax # 913-551-7765

Attachment

Risk Assessment Issue Paper for:
Provisional Oral RfD for Trichloroethylene
(CASRN 79-01-6)

INTRODUCTION

An oral RfD is not available for trichloroethylene on IRIS (U.S. EPA, 1993a) or the HEAST (U.S. EPA, 1993b). The RfD/RfC status report (U.S. EPA, 1993c) states that the RfD is under review, but cites 6/23/92 as the last Work Group meeting concerning this RfD. OHEA documents listed on the CARA list (U.S. EPA, 1993d) include WQCD (U.S. EPA, 1980), HADs (U.S. EPA, 1985; 1987a), and HEAs (U.S. EPA, 1984; 1988). None of these documents derived an oral RfD for trichloroethylene.

The Drinking Water Regulations and Health Advisories (U.S. EPA, 1993e) provides a Drinking Water Equivalent Level (DWEL) of 0.3 mg/l; this toxicity value was derived in an ODW Health Advisory on trichloroethylene (U.S. EPA, 1987b). The basis was a free-standing LOAEL for elevated liver weights in rats exposed to inhaled trichloroethylene for 14 weeks (Kimmerle and Eben, 1973). The derivation involved a determination of an absorbed dose for humans using the rat LOAEL, human inhalation rates and body weights, an absorption efficiency ratio of 0.3, and adjustments for continuous exposure. The absorbed dose (7.35 mg/kg/day) was divided by an uncertainty factor of 1000 (10 for the use of a LOAEL, 10 for interspecies extrapolation, and 10 for intraspecies variation).

ATSDR has prepared two Toxicological Profiles on trichloroethylene (ATSDR, 1989; 1991). The 1989 document derived an intermediate oral MRL of 2.2 E+0 mg/kg/day based on a NOAEL (217 mg/kg/day) for renal effects (increased urinary ketone and protein levels) in mice exposed to trichloroethylene in drinking water for six months (Tucker et al., 1982). The 1991 document derived an intermediate oral MRL of 1E-1 mg/kg/day based on a LOAEL of 100 mg/kg/day for increased liver weight in mice exposed by gavage for 4 weeks (Buben and O'Flaherty, 1985). Neither document derived a chronic oral MRL for trichloroethylene.

To identify research reports pertinent to the derivation of a chronic RfD for trichloroethylene, EPA and ATSDR documents on trichloroethylene (as cited above) and the HSDB, RTECS and TSCATS databases were reviewed; in addition, a computer search of the literature was conducted (TOXLINE, 1989 - January, 1992).

As reviewed by U.S. EPA (1985) and ATSDR (1989; 1991), trichloroethylene has been used as a surgical anesthetic, and effects on neurobehavior and the central nervous system are well studied in humans and animals exposed acutely to the inhaled compound. The effects of repeated exposures of humans to trichloroethylene are less well studied. Occupational exposure to trichlorethylene in air has been associated with symptoms of effects on the central nervous system (e.g., nausea, headache, reduced cognitive performance, and sleep disturbances), but not on the kidney or liver (ATSDR, 1989, 1991; U.S. EPA, 1985; Nagaya et al., 1989; Ruijten et al., 1991). Data regarding effects in humans repeatedly exposed to trichloroethylene in drinking water are confounded by concurrent exposure to other chemicals (ATSDR, 1991; Goldberg et al., 1990). However, several studies are available in which animals have been repeatedly exposed to orally administered trichloroethylene. The data are reviewed herein, and a chronic RfD for trichloroethylene is derived.

CHRONIC ORAL TOXICITY

Nonneoplastic kidney lesions, in addition to carcinogenic responses, have been observed in studies designed to examine the carcinogenicity of chronic oral exposures to trichloroethylene in rodents.

NCI (1976) studied the carcinogenicity of trichloroethylene in corn oil in 78-week chronic gavage studies with rats and mice. The trichloroethylene sample used in these studies was ≥ 99.0% pure, but contained 0.09% epichlorohydrin, a demonstrated carcinogenic agent.

Groups of 50 male and 50 female rats were provided time-weighted average doses of 549 or 1,097 mg/kg/day (NCI, 1976). A matched vehicle control group contained 20 males and 20 females, and an unmatched vehicle control group contained an additional 79 male rats and 78 female rats. Rats were allowed to survive until 32 weeks after exposure. The exposed rat groups did not display statistically significant increases in incidences of tumors compared with control rats, but both exposed groups displayed decreased peak body weights and survival compared with controls. Nephropathy was common in both treated groups. The nephropathy was described as slight to moderate degenerative and regenerative changes in the tubular epithelium; the authors stated that these lesions were unlike those that frequently occur in aging Osborne-Mendel control rats.

Groups of 50 male and 50 female B6C3F1 mice were provided time-weighted average doses of 1,169 or 2,339 mg/kg/day for males and 869 or 1,739 mg/kg/day for females (NCI, 1976). A matched

vehicle control group contained 20 males and 20 females, and an unmatched control group contained an additional 57 male and 60 female mice. Significantly reduced survival was observed in both exposed groups compared with matched vehicle controls. Significantly increased incidences of liver tumors were observed in both exposed groups of both sexes compared with the matched vehicle control groups. The occurrence of nonneoplastic lesions of the kidney were not mentioned in the report of this study.

In a second series of chronic gavage studies, NTP (1988, 1990) studied the carcinogenicity of epichlorohydrin-free trichloroethylene in rats and mice. The test chemical (designated as "Hi-Tri") used in these studies was tested to be > 99.9% pure and contained 8 ppm diisopropylamine as a stabilizer.

Trichloroethylene in corn oil was administered by gavage at doses of 0 or 1000 mg/kg to groups of 50 male and 50 female B6C3F1 mice for 5 days/week for up to 103 weeks (NTP, 1990). Adjustment for partial weekly exposures gives average daily doses of 0 and 714 mg/kg/day. Statistically significant differences between dosed and control mice included decreased survival in males, decreased body weights in male mice, increased hepatocellular carcinoma incidence in both sexes, increased adenoma incidence in male mice, and toxic nephrosis in both sexes. Toxic nephrosis, described as cytomegaly of the renal tubular cells, was observed in 45/50 male and 48/49 female dosed mice, but was absent in the vehicle controls.

Groups of 50 male and 50 female F344/N rats were administered gavage doses of 0, 500 or 1000 mg/kg trichloroethylene in corn oil for 5 days/week for up to 103 weeks (average daily doses of 0, 357, and 714 mg/kg/day) (NTP, 1990). Statistically significant differences between dosed and control rats included decreased survival of both low- and high-dose male rats, decreased body weights in both sexes of rats at both doses, increased incidence of renal tubular adenocarcinomas in male rats killed at the end of the study, and cytomegaly of the kidney. Renal cytomegaly was observed in 96/98 dosed male and 97/97 dosed female rats; no vehicle control rats displayed renal cytomegaly.

In another bioassay, groups of 50 male and 50 female rats of four strains (ACI, August, Marshall, and Osborne-Mendel) were administered 0, 500 and 1000 mg/kg trichloroethylene in corn oil by gavage 5 days/week for 103 weeks (average daily doses were 0, 357 and 714 mg/kg/day) (NTP, 1988). Depressions in final body weights ≥ 10%, compared with controls, were observed in ACI, August and Osborne-Mendel male rats and Marshall female rats exposed to 1000 mg/kg; final body weight depression ≥ 10% were observed only in ACI males at the 500-mg/kg dose level. Survival was significantly reduced in 7 of the 16 dosed groups compared

with respective control groups. Clinical signs of central nervous toxicity (sedation, loss of consciousness, tremors, convulsions, and hindlimb paralysis) were observed following dose administration in male and female rats of all strains. Significantly increased incidence of renal tubular cell adenomas or adenomacarcinomas were observed only in low-dose male Osborne-Mendel rats, and interstitial cell neoplasms of the testis were observed in dosed Marshall rats. Exposure to trichloroethylene caused renal tubular cell cytomegaly in 82-100% of all dosed rats. Toxic nephropathy, described as dilated tubules lined by elongated and flattened epithelial cells, was observed in 17%-80% of the animals in the dosed groups. Cytomegaly or toxic nephropathy were not observed in untreated or vehicle control groups. NTP (1988) concluded that these studies were inadequate tests of the carcinogenicity of trichloroethylene because of deficiencies in study-conduct and decreased survival, but clearly demonstrated the nephrotoxicity of trichloroethylene. NTP (1988) also concluded that the cause of early mortality in the dosed rats was not known but could have been due to gavage-related trauma, anesthetic properties of the chemical, nephrotoxicity or a combination of these factors.

SUBCHRONIC AND NEAR SUBCHRONIC ORAL TOXICITY

NTP has published results from 13-week gavage studies with rats exposed to trichloroethylene (NTP, 1988, 1990) and mice (NTP, 1990). The test chemical in this series of experiments was the same as designated for the chronic NTP studies reviewed in the previous section.

Groups of 10 male F344/N rats were administered gavage doses of 0, 125, 250, 500, 1,000 or 2,000 mg/kg trichloroethylene in corn oil 5 days per week for 13 weeks (NTP, 1990). Adjusting for the partial weekly exposure protocol, average daily doses are 0, 89, 179, 357, 714, or 1429 mg/kg/day. Groups of 10 female rats received doses of 0, 62.5, 125, 250, 500 or 1,000 mg/kg by the same schedule. (Adjusted doses were 0, 45, 89, 179, 357, or 714 mg/kg/day.) All rats survived to the end of the exposure period and only male rats dosed with 2,000 mg/kg exhibited depressions of body weight gain > 10%. Organ weight data were not reported. Histopathological examinations of major organs and tissues from the high-dose and control groups revealed cytomegaly and karyomegaly of the renal tubular epithelial cells in 8/9 high-dose males and 5/10 high-dose females, but not in the controls. The lesions were graded as minimal or mild in males and equivocal to minimal in females; these minimal renal effects were diagnosed during a reevaluation of the tissues after observation of pronounced renal effects in the subsequent 2-year study. Pulmonary vasculitis was observed in 6/10 high-dose males and

6/10 high-dose females (compared with 1/10 male and 1/10 female control rats).

In a separate rat study (NTP, 1988), groups of 10 male ACI and 10 male August rats were administered gavage doses of 0, 125, 250, 500, 1,000 or 2,000 mg/kg trichloroethylene in corn oil 5 days per week for 13 weeks (adjusted doses of 0, 89, 179, 357, 714, or 1429 mg/kg/day); groups of 10 females of these strains received doses of 0, 62.5, 125, 250, 500 or 1,000 mg/kg (adjusted doses of 0, 45, 89, 179, 357, or 714 mg/kg/day). Groups of 10 male Marshall rats received doses of 268, 308, 495, 932, or 1834 mg/kg by the same schedule (0, 191, 220, 354, 666, or 1310 mg/kg/day, adjusted doses); groups of 10 female Marshall rats received 0, 134, 153, 248, 466 or 918 mg/kg (0, 96, 109, 177, 333, 656 mg/kg/day, adjusted doses). All rats survived to the end of the study with the exception of 3 high-dose male August rats. Average depressions in final body weight > 10% (relative to control values) were observed only in the high-dose male groups. Organ weight data were not reported. No clinical signs of central nervous system toxicity were recorded, and histological examination of major tissues and organs from high-dose rats did not reveal alterations compared with control tissues.

In the final NTP subchronic study (NTP, 1990), gavage doses of 0, 375, 750, 1500, 3000 or 6000 mg/kg were administered to groups of 10 male and 10 female B6C3F1 mice 5 days per week for 13 weeks (0, 268, 536, 1071, 2143, or 4286 mg/kg/day, adjusted doses). Deaths occurred in 2/10 males and 1/10 females at 1500 mg/kg, 7/10 males and 1/10 females at 3000 mg/kg, and all male and 9/10 females at 6000 mg/kg. Depressions in mean body weights were > 10% relative to controls in male mice receiving doses ≥ 750 mg/kg; body weight alterations were not apparent in female mice. Liver weight elevations (both absolute and relative) > 10% relative to controls were observed in male mice at doses ≥ 750 mg/kg and in females at doses ≥ 1500 mg/kg. Centrilobular necrosis was observed in 6/10 males and 1/10 females exposed to 6000 mg/kg. At the 3000 mg/kg level centrilobular necrosis was not observed in either sex, but 2/10 males had multifocal areas of calcification in their livers. Histopathological examinations of tissues from mice treated with the 3 lowest doses were not conducted. Mild to moderate cytomegaly and karyomegaly of the renal tubular epithelial cells was observed in all of the mice that received the two highest doses and survived for more than 6 weeks.

Stott et al. (1982) administered gavage doses of trichloroethylene (> 99.9% pure, stabilized with diisopropylamine) in corn oil at levels of 0, 250, 500, 1200 or 2400 mg/kg, 5 days/week for 3 weeks to groups of 10-12 male

B6C3F1 mice. Adjusting for the partial weekly exposures gives average daily doses of 0, 179, 357, 857, or 1714 mg/kg/day. No exposure-related effects were observed on body weight, kidney weight or kidney histopathology. Increased relative liver weights and decreased DNA content per gram of hepatic tissue were observed at doses ≥ 500 mg/kg. Histopathological changes in hepatic tissues were observed at all dose levels. The severity of the changes increased with increasing dosage level. Slight increases in cytoplasmic eosinophilic staining of the centrilobular hepatocytes were observed at 250 and 500 mg/kg. At 1200 mg/kg increased centrilobular hepatocellular swelling was observed, and at 2400 mg/kg, more severe hepatocellular swelling, giant cell inflammation and mineralized cells were observed. Under the conditions of this study, the lowest dosage level of 250 mg/kg (179 mg/kg/day) was the LOAEL for response of the liver to trichloroethylene.

Stott et al. (1982) also administered gavage doses of trichloroethylene in corn oil of 0 or 1100 mg/kg, 5 days per week for 3 weeks, to groups of 4 male Osborne-Mendel rats. No treatment-related alterations in body weight, kidney weight, histopathology of the kidney or liver, or DNA content per gram of renal or hepatic tissue were observed. Increased relative liver weight was the only significant treatment-related change observed in this study.

Tucker et al. (1982) provided trichloroethylene (reagent grade containing 0.004% diisopropylamine as stabilizer) in drinking water containing 1% emulphor at concentrations of 0, 0.1, 1.0, 2.5 and 5.0 mg/mL to groups of 30 male and 30 female CD-1 mice for 4 or 6 months. Average dosage levels estimated from water consumption data were reported to be 0, 18.4, 216.7, 393.0, and 660.2 mg/kg/day for males and 0, 17.9, 193.0, 437.1, and 793.3 mg/kg/day for females. No significant effects on weight gain were observed in the treated groups compared with the control group. The results of gross pathological examination of tissues at 4 and 6 months were reported to be unremarkable. Microscopic examinations of tissues and organs were not performed. Terminal body weights of male and female mice treated with the highest concentration of trichloroethylene were significantly decreased compared with the vehicle control terminal body weights. Increased relative liver weights were observed in males at both exposure times at the three higher doses and in females at the highest dose. Significantly increased kidney weights were observed in high-dose males at 4 and 6 months and in high-dose females at 6 months; urinalysis at 6 months of exposure showed elevated protein and ketone levels in high-dose females and males treated with the two highest concentrations of trichloroethylene. The NOEL of 0.1 mg/mL (18.4 mg/kg/day) and LOAEL of 1.0 mg/mL (216.7 mg/kg/day) for increased

relative liver weight in mice describes the most sensitive toxicity threshold identified in this study. The LOAEL for kidney effects was 2.5 mg/mL (393 mg/kg/day).

In a study restricted to the hepatotoxicity of trichloroethylene, male Swiss-Cox mice (age 3-5 months, body weight 34-45 g) were administered distilled trichloroethylene (% purity not reported) in corn oil by gavage in doses of 0, 100, 200, 400, 800, 1600, 2400 or 3200 mg/kg on five days a week for 6 weeks (Buben and O'Flaherty, 1985). Adjusting for the partial weekly exposure gives average daily dosages of 71.4, 142.9, 285.7, 571.4, 1142.9, 1714.3 and 2285.7 mg/kg/day. Twelve mice per dosage were tested except for 5 mice at 100 mg/kg/day, 4 mice at 3200 mg/kg/day and 24 mice in the control group. The following endpoints were assessed on the day following treatment at all dosages: relative liver weight, liver glucose-6-phosphatase (G6P) activity, concentrations of liver triglycerides, serum glutamate-pyruvate transaminase (SGPT) activity. Liver DNA concentration and histology were evaluated at 285.7 and 1142.9 mg/kg/day. Statistically significant ($p < 0.05$) increases in relative liver weight at ≥ 71.4 mg/kg/day, G6P at ≥ 571.4 mg/kg/day, and SGPT at ≥1714.3 mg/kg/day were observed. The changes in relative liver weight and G6P were clearly dose-related. Liver triglycerides were significantly increased only at 1714.3 mg/kg/day ($p<0.01$); a comparable increase occurred at 2285.7 mg/kg/day but was not statistically significant, apparently due to the small number of animals (4). The increases in liver size were attributed to hepatocellular hypertrophy based on histology and decreased hepatic DNA concentrations. Other hepatic histologic effects included degeneration, karyorrhexis (disintegration of the nucleus) and polyploidy at 285.7 and 1142.9 mg/kg/day, and necrosis at 1142.9 mg/kg/day. The degeneration was manifested by swollen hepatocytes that were not due simply to edema, as liver wet weight/dry weight ratios did not increase. Under the conditions of this experiment, the lowest dosage level (71.4 mg/kg/day) was a LOAEL for a dose-related response of the mouse liver to trichloroethylene which caused hepatocellular hypertrophy, and progressing to hepatocellular necrosis.

REPRODUCTIVE AND DEVELOPMENTAL TOXICITY

In a 2-generation fertility study (NTP, 1986), groups of 20 F_0 breeding pairs of F344 rats (11 weeks of age at the start) were provided diets containing nominal trichloroethylene concentrations of 0.15, 0.30 and 0.60% for a 7-day mating period, a 98-day cohabitation period, and a subsequent 28-day segregation period. A control group of 40 F_0 breeding pairs was provided a normal diet for the same period of time. Trichloroethylene

(designated as "Hi-Tri Purity grade") was microencapsulated in a gelatin/sorbitol shell. Estimated average dosage levels were calculated from initial and week 13 body weight data reported by the authors and the allometric equation recommended by the U.S. EPA (1987c) for calculating food consumption by laboratory mammals. The estimated doses for male F_0 rats were 0, 130.2, 261.1, and 523.9 mg/kg/day; for F_0 females the doses were 0, 147.8, 301.7, and 599.3 mg/kg/day.

Statistically significant ($p < 0.05$) differences between the dosed and control F_0 groups were not observed in the following parameters: the proportion of breeding pairs able to produce at least one litter, the number of live litters per pair, the number of live pups per litter, the proportion of pups born alive, the sex of pups born alive (NTP, 1986). Dam body weights on postnatal day 0 were significantly depressed in all of the exposed F_0 groups compared with the control. Statistically significant ($p < 0.05$) trends with increasing dose were observed for decreased numbers of live litters per pair and for decreased numbers of live pups per litter. A crossover mating trial was subsequently conducted using three combinations of F_0 breeding pairs (20 pairs per combination) as follows: control male x control female; 0.6% male x control female; and control male x 0.6% female. In this trial, the only significant differences between the mating pairs with exposed partners and the control pairs were decreased proportion of detected matings (observed when either the male or female partners were exposed), and decreased bodyweight of the 0.6% dams on postnatal day 0. Exposure of either the male or female partner had no significant effect on the other indices of fertility and reproductive performance listed above for the initial F_0 breeding trial.

Continuous exposure of F_1 rats (81 days $\pm$ 10) to the same dietary concentrations of trichloroethylene fed to their parents (14-20 breeding pairs were evaluated for each exposure level) had no effect on indices of mating, fertility or reproductive performance (NTP, 1986). As in the F_0 generation, treated F_1 dams displayed depressed body weight on postnatal day 0, indicating generalized maternal toxicity. Microscopic examination of major tissues and organs revealed no treatment-related pathological changes in either sex in the F_0 or the F_1 generations. At necropsy, body weights were depressed and liver weights (adjusted for body weight by an analysis of covariance) were increased in male and female F_0 rats treated with 0.6% trichloroethylene compared with control F_0 rats. F_1 male and female rats from all treatment groups displayed significantly decreased body weights at 21 and 81 (necropsy) days after birth. Significantly increased adjusted liver weights were observed for all treated F_1 male groups and for F_1 female rats treated with 0.3 or 0.6% trichloroethylene. Under the conditions of this experiment, the

lowest exposure level (0.15% trichloroethylene) was a LOAEL for maternal toxicity demonstrated by decreased body weight (147.8 mg/kg/day), for decreased body weight and increased liver weight in F_1 males (130.2 mg/kg/day), and for decreased body weight in F_1 females (147.8 mg/kg/day).

In a similarly designed mouse study, NTP (1985) provided nominal concentrations of 0, 0.15, 0.30 and 0.60% trichloroethylene ("Hi-Tri Purity grade") in the diet of groups of breeding pairs of CD-1 mice starting at 11 weeks of age and continuing as described for the rat fertility study (NTP, 1986). The groups contained 35, 17, 18, and 19 pairs of mice, respectively. Average doses, in units of mg/kg/day, were reported to be 0, 63.8, 247.5, for week 1, 0, 52.5, 266.5, and 615.0 for week 2, and 0, 187.5, 375.0, and 750.0 for the remainder of the 18-week exposure period. Time-weighted average doses are calculated to be 0, 173, 362, and 737 mg/kg/day. No clinical signs of toxicity were observed throughout the exposure period. Indices of fertility and reproductive performance for the F_0 generation were not affected by exposure, except for a slight (< 10%), but statistically significant ($p < 0.05$), depression of birth body weights of live male pups or combined male and female pups compared with controls. The depression was only significant when adjustments were made for the total number of live and dead pups per litter by an analysis of variance.

Litters from the control and high-dose mouse groups were raised to sexual maturity to assess fertility and reproductive performance. Perinatal mortality was pronounced in the 0.6% group; a 61.3% mortality rate was observed compared with a 28.3% mortality rate for the control group. Survival after weaning was the same for both control and exposed F_1 groups. Surviving F_1 mice were provided the same feed level of trichloroethylene as their parents for 74 ± 10 days; breeding pairs were then established and the F_1 females were allowed to deliver their litters. Indices of mating, fertility or reproductive performance for the 0.6% F_1 group were not significantly different from those for the control group.

Tissues from the control and high-dose F_0 and F_1 mice were weighed and examined microscopically (approximately 18 and 15 weeks of exposure for the F_0 and F_1 generations, respectively). Body weights at necropsy were not affected by high-dose exposure in either generation. Liver weights (absolute and adjusted) were increased by high-dose exposure in both sexes of both generations. Liver and kidney lesions (hypertrophy of the centrilobular liver cells and tubular degeneration and karyomegaly of the renal tubular epithelium) were also observed in high-dose F_0 and F_1 mice of both sexes. Significantly decreased proportions of sperm that were motile were observed in

high-dose F_0 and F_1 males (45 and 18% decreases compared with controls). In summary, although trichloroethylene treatment at dietary concentrations as high as 0.6% did not alter several indices of fertility or reproductive performance, organ-specific effects on the F_0 and F_1 male reproductive tract and increased perinatal mortality of F_1 pups were observed. The authors concluded that trichloroethylene may present a selective risk to the neonatal mouse (NTP, 1985). The study identified 0.6% (737 mg/kg/day) as a FEL for the effects on the male mouse reproductive tract and neonatal survival, but did not identify a NOEL or NOAEL for these effects (neither endpoints were assessed at the lower exposure levels).

Manson et al. (1984) administered gavage doses of 0, 10, 100 or 1000 mg/kg trichloroethylene in corn oil to groups of 23 female Long-Evans hooded rats. Exposure commenced 2 weeks before mating, continued throughout mating (1 week), and was stopped on day 21 of pregnancy. Doses were administered 5 days/week for the first 3 weeks and 7 days/weeks for the last 3 weeks. Adjusting for the partial weekly exposure during the first part of the study, average daily doses were 0, 8.6, 85.7, or 857.1 mg/kg/day. Females were bred to untreated males. Indices of fertility (i.e., the average number of mating trials required for insemination and the number of rats which became pregnant) were not affected by exposure to any level of trichloroethylene. Maternal body weight gain during pregnancy, litter size at birth, and neonatal survival (up to 31 days after birth) were not altered in the groups exposed to 10 or 100 mg/kg. Body weight gains during the premating period and during pregnancy were significantly depressed only in the high-dose dams, as was decreased neonatal survival up to 18 days after birth (16.9% of 1000-mg/kg pups died compared with 7.7% in the control). Four deaths occurred among the 23 dams exposed to 1000 mg/kg. No major malformations were revealed by gross examinations of the pups. The authors speculated that the decreased neonatal survival was related to maternal toxicity rather than to specific developmental toxicity. Under the conditions of this study, 100 mg/kg (85.7 mg/kg/day) was the NOAEL, and 1000 mg/kg/day (857.1 mg/kg/day) was the LOAEL for maternal toxicity and FEL for decreased neonatal survival.

DERIVATION OF A PROVISIONAL RfD

The chronic and subchronic mouse and rat gavage bioassays conducted by NCI (1976) and NTP (1988, 1990) identify the kidney (in mice and rats) and the liver (in mice) as target organs for trichloroethylene-induced nonneoplastic effects, however the data are not suitable bases for an RfD. The lowest doses in the chronic studies produced reduced survival, and, as FELs, cannot

be used to derive an RfD. Deficiencies in the design of the subchronic NTP (1988, 1990) studies compromise their usefulness; histological examinations were conducted only on high-dose animals and controls, and organ weight data was reported for only one of the studies. In general, the NTP studies provide insufficient information for exposure to doses less than 500 mg/kg, a level identified as producing frank effects; the only exception is the mouse subchronic study (NTP) which identified 375 mg/kg (268 mg/kg/day adjusted for partial weekly exposure) as a NOAEL and 675 mg/kg as the LOAEL for increased liver weight in male mice. Other subchronic studies are available that identified LOAELs lower than 268 mg/kg/day (NTP, 1986; Tucker et al., 1982; Buben and O'Flaherty, 1985) .

The 2-generation fertility study of B6C3F1 mice (NTP, 1985) indicated that reduced neonatal survival during lactation is a significant effect produced by exposure to trichloroethylene. However, the study did not identify a NOAEL for this frank effect, and thus the data cannot be used to derive an RfD.

The 2-generation fertility study of F344 rats exposed to trichloroethylene in the diet (NTP, 1986) identified a free-standing LOAEL of 130.2 mg/kg/day for decreased body weight and increased liver weight in F_1 male rats exposed for 18 weeks to trichloroethylene; indices of fertility and reproductive performance and histological features of major organs and tissues in rats exposed to this dose or higher doses were not significantly different from comparable endpoints in controls.

While the 1986 NTP study is suitable for consideration as a basis for the RfD, the 6-month drinking water study of mice by Tucker et al. (1982) provides a better basis because it identified both NOAELs and LOAELs for the responses of the liver and kidney to orally administered trichloroethylene. The threshold for liver toxicity (NOAEL of 18.4 and LOAEL of 216.7 mg/kg/day for increased relative liver weight) was lower than that for renal effects (NOAEL of 216.7 and LOAEL of 393.0 mg/kg/day for elevated levels of protein and ketones; increased kidney weight was observed at the highest dose, 660.2 mg/kg/day). Although the Tucker et al. (1982) study did not include histological examinations of the liver and kidney, a more comprehensive examination of hepatotoxicity in mice orally exposed to trichloroethylene for 6 weeks showed that liver weight increases were attributable to hypertrophy of the liver cells and that the hepatic response progressed to degenerative changes at higher doses (Buben and O'Flaherty, 1985). The study by Tucker et al. (1982) is a better basis for derivation of the RfD than the study by Buben and O'Flaherty (1985) because a NOAEL was identified and the duration of exposure was closer to a life-time.

A provisional chronic RfD of 6E-3 mg/kg/day is derived by dividing the mouse NOAEL of 18.4 mg/kg/day from the study by Tucker et al. (1982) by an uncertainty factor of 3000 (10 for interspecies extrapolation, 10 for intraspecies variation, 10 for extrapolation to chronic duration and 3 for weakness of the data base).

Confidence in the principal study is low. Adequate numbers of animals were exposed by a relevant route and were evaluated for several endpoints. However, histological examinations were not conducted on the tissues, and the duration of exposure was only one-quarter of a life-time. Confidence in the data base is low. Several subchronic toxicity studies in rats and mice are available, as are studies of reproductive performance in rats and mice. However, chronic oral bioassays do not adequately describe dose-response relationships for chronic oral exposure to low doses of trichloroethylene and comprehensive developmental toxicity studies are not available. Reflecting low confidence in the principal study and the data base, confidence in the provisional RfD for trichloroethylene is low.

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Appendix 8

Toxicity Profile for Benzene
Hastings Second Street Subsite
Hastings, Nebraska

Prepared by:

Nebraka Department of Health
State Toxicologist

BENZENE

Benzene has had a long history of extensive use in industry, first as a volatile solvent, later as a starting material for the synthesis of chemicals and today as an additive to gasoline replacing alkyl lead compounds.

Approximately 50 percent of inhaled benzene and virtually all ingested benzene is absorbed. In contrast, dermal absorption through the intact skin is extremely low. Because of its volatility, inhalation is the primary route of uptake for benzene under most circumstances. Benzene is lipid-soluble and accumulates preferably in the adipose tissue, bone marrow and liver.

Acute lethal concentrations of benzene have been determined for both animals and humans. Sandmeyer (1981) reported that a 5- to 10-minute inhalation exposure to 20,000 ppm was fatal in humans. Death in humans from benzene exposure has been attributed to asphyxiation, respiratory arrest, central nervous system depression, or cardiac collapse (Hamilton 1992; Winek and Collum 1971). The LD50 value for a 4-hour inhalation exposure in rats has been reported at 13,700 ppm (Drew and Fouts, 1974). Lethal oral doses in humans have been reported as low as 8.8 grams (Thienes and Haley, 1972) and up to 30 grams (Moeschlin, 1965). On a weight equivalent basis, these doses range from 128 to 428 mg/kg. The lethal dose is apparently higher in rodents, with a reported LD50 in rats of 930 mg/kg (Cornish and Ryan, 1965), and in mice at 4,700 mg/kg (Savchenko, 1967).

Toxicity arising from subacute or chronic exposure to benzene is almost exclusively limited to the hemopoietic and immune system. Immune suppression occurs because of damage to the pluripotent stem cells, where damage has been reported for both erythroid and myeloid cell types (Toft et al., 1982; Green et al., 1981). This type of injury can occur with short-term exposure to benzene concentrations as low as 10 ppm, and may be due to the buildup of benzene metabolites in the bone marrow (Rickert et al., 1979). Depressed leukocyte counts have been reported in rats exposed to 50 ppm, 8-hours per day, for 7 days (Li et al., 1986), and red blood cell counts are depressed at 100 ppm (Rosenthal and Snyder, 1986). Some CNS effects have been reported in humans exposed to benzene. Relatively low concentrations (50 to 150 ppm for 5 hours) are sufficient to cause headache, dizziness, and fatigue. Relatively high doses (7,500 ppm) are required to produce signs of overt toxicity (Sandmeyer, 1981).

Benzene has been reported to be a developmental toxin resulting in reduction of fetal weight at low levels. Significant weight reduction has been reported for concentrations as low as 50 ppm in rats (Kuna and Kapp, 1981), 156 ppm in mice, and 313 ppm in rabbits (Ungvary and Tatvai, 1985). Increases in the number of fetal resorptions have been reported from ingestion studies (Nawrot and Staples, 1979), but only at concentrations which were overtly toxic to the mother (0.5 mg/kg/day). At the present time, there is no evidence to suggest that benzene is a teratogen.

Reproductive effects of benzene exposure have been reported from animal studies only. A concentration of 2,300 ppm is sufficient to cause histopathologic changes in the ovaries of mice, primarily as ovarian cysts. In addition, this concentration has been shown to cause degeneration of the testes, decreases in sperm mobility, sperm count, and the percentage of abnormal sperm (Ward et al., 1985).

Numerous studies have investigated the mutagenicity of benzene (see IARC, 1982 for review). Epidemiological studies demonstrate a strong correlation of chromosomal aberrations in human lymphocytes in response to occupational exposure. These abnormalities may persist for years after exposure has been terminated (Dean, 1985). Mutagenicity has also been confirmed in numerous in vivo and in vitro studies. Of particular interest is a study by Tice et al. (1980) in which exposure to 28 ppm for 4 hours was sufficient to cause sister chromatin exchanges in mouse lymphocytes.

Epidemiological studies provide strong evidence for the role of benzene as a human carcinogen. Statistically significant increases in the incidence of leukemia have been demonstrated in populations occupationally exposed to benzene (Ott et al., 1978; Infante et al., 1977; Rinsky et al., 1981). Animal studies tend to support the human data. Maltoni et al. (1985) have shown that benzene increases the incidence of several types of tumors in rats. Increases in the number of lymphomas have also been reported in mice (Cronkite et al., 1985). While the majority of the studies have focused on carcinogenicity via benzene inhalation, research now indicates that ingestion of benzene produces similar effects (Maltoni et al., 1985). USEPA has classified benzene as a Class A carcinogen based upon extensive epidemiological evidence.

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Appendix 9

Slope Factors for Polynuclear Aromatic Hydrocarbons

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101

DEC 10 1992

MEMORANDUM

SUBJECT: Slope Factors for Polynuclear Aromatic Hydrocarbons

FROM: Robert L. Morby
Chief, Superfund Branch

TO: Superfund Branch

For some time it has been the general rule to use the slope factor for benzo-A-pyrene (BaP) for all of the potentially carcinogenic polynuclear aromatic hydrocarbons (PAHs), because BaP is the only PAH for which IRIS (EPA's Integrated Risk Information System) has a slope factor. It is generally agreed that using the BaP slope factor is excessively conservative because the other PAHs are not as strongly carcinogenic as BaP.

Using the research of ICF Clement, an EPA contractor, several EPA regions have adopted modifications of the BaP slope factor for the other carcinogenic PAHs. Under this approach, Clement's research is used to modify the slope factors for the other PAHs, rounded off to the nearest order of magnitude.

As an interim policy the EPA Region VII Superfund Branch **adopts** for general use **on Region VII Superfund sites the following policy.** Until such time as this interim policy is amended or until EPA establishes slope factors for these PAHs in IRIS, EPA Region VII Superfund Branch adopts the following carcinogenic equivalency factors (CEFs):

Compound	CEF
benzo-A-pyrene	1.0
benzo-A-anthracene	0.1
benzo-B-flouranthene	0.1
benzo-K-flouranthene	0.1
chrysene	0.01
dibenzo-A,H-anthracene	1.0
indeno-1,2,3,C,D-pyrene	0.1

These CEFs should be used on all Region VII Superfund sites when preparing baseline or residual risk assessments or when

Appendix 10

Benzene Concentration in Groundwater Over Time
Hastings Second Street Subsite
Hastings, Nebraska

Benzene Concentration

MW-9