ARMY RESEARCH LABORATORY

The Development of an Automated Armor Data Base - Phase 1

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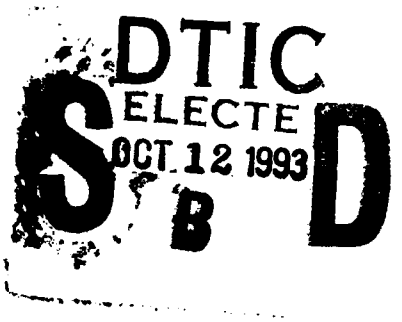

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13. ABSTRACT (Maximum 200 words)

This technical report is one of a set of three reports to be generated as a subtask under the project entitled "Development of an Improved High Hard Armor Steel (MIL-A-46100)" funded by the PM, Survivability (TACOM). The design of an Armor Steel Database to serve as a repository for MIL-A-46100 armor steel ballistically tested by the U.S. Combat Systems Test Activity (CSTA) is described. The microcomputer hardware and software used to accomplish this task is delineated. This microcomputer system is capable of being directly linked to the remotely situated CSTA host computer system to facilitate the efficient acquisition of additional ballistic test data. Reports representing the current contents of the Armor Steel Database are included as an example of the output available to the user (The producers and fabricators were removed from these reports to allow for unlimited distribution.). However, the manual input of data by the authors has been temporarily suspended until CSTA implements direct access to their automated ballistic ranges. The application of this database for the compilation and analysis of MIL-A-46100 data will be appropriately included in the overall report summarizing all three subtasks being generated for this project.

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Objective

The objective of this portion of the Improved High Hard Armor Steel Program is to establish a database that is automated and capable of being remotely linked to the Combat Systems Test Activity's (CSTA) host computer system to access on-line ballistic test results and supporting data. Accordingly, the results of all ballistic tests performed at CSTA would then be readily accessible. The database will be created and used initially as a repository for MIL-A-46100 Steel Armor Ballistic Data. The database design will be sufficiently generic so as to be able to accommodate all armor materials (Steel, Aluminum, Titanium, etc.).

Introduction

This Technical Report (TR) is one of three (3) TR's to be generated as subtasks under the "Development of an Improved High Hard Armor Steel (MIL-A-46100)" project funded by the PM, Survivability (TACOM). These three subtasks will be subsequently summarized in one overall report. This TR is the first of a set which explains the development of the database but the analysis of the generated data will be published in the overall report under the same title as the project.

Discussion

An Armor Steel Database has been established to function as a data repository for MIL-A-46100 (reference 1) steel ballistically tested by the U.S. Army Combat Systems Test Activity (CSTA) and to improve the accessibility and ease of analysis of the ballistic data. The ballistic testing of high hardness armor plate in accordance with MIL-A-46100 requires armor plates whose thicknesses fall within pre-specified thickness ranges to be ballistically tested using thickness-range-dependent test projectiles and target obliquities. Table 1 lists the required ballistic projectiles with respect to plate thickness. Accordingly, the Armor Database has been designed to reflect this dependence of armor plate thickness range upon a specific test projectile by defining its key index field to be essentially test projectile dependent.

TABLE 1

MIL SPEC MIL-A-46100 REVISIONS C AMD 2 & D TABLE OF REQUIRED ARMOR PLATE THICKNESS RANGES AS A FUNCTION OF PROJECTILE CALIBER		
PROJECTILE [CALIBER]	OBLIQUITY [DEGREES]	THICKNESS RANGE [INCHES]
CAL 0.30 AP M2	30	0.125-0.315
CAL 0.50 AP M2	30	0.316-0.590
14.5 MM API B32	30	0.591-0.765
14.5 MM API BS41	30	0.766-1.065
20 MM API-T M602	0	1.066-2.100

A modular approach was employed in the development of the database structure. The database structure is comprised of the following six (6) major database modules:

1. ARL/MD ID & MIL Spec Attributes
2. Plate Production History
3. Materials Properties
4. Ballistic Performance
5. Chemical Compositions
6. Target Damage Assessments

Each of these major database modules are, in turn, further subdivided into their respective database structural elements. In the current context, the term **database element** is used synonymously with the database term **database field.** The integration of these database structural elements into their respective database modules to form a **complete database structure** is shown in Table 2. A complete database structure exists for **each** of the five (5) test projectiles listed in Table 1. The database elements associated with the first five database modules in Table 2 represent **fifty-three (53)** database fields. These elements are currently available from the TAC forms (MIL-STD-367, Format I) supplied by industry when requesting ballistic testing.

TABLE 2

MIL-A-46100 STEEL ARMOR DATABASE

DATABASE STRUCTURAL ELEMENTS

1 ARL/MD ID & MIL SPEC ATTRIBUTES

* ARL/MD ID ATTRIBUTES
  ** PROJECTILE DIAMETER
  ** PROJECTILE TYPE
  ** PROJECTILE SIZE UNIT OF MEASUREMENT
* MIL SPEC NUMBER
* MIL SPEC REVISION
* MIL SPEC AMENDMENT
* MIL SPEC MATERIALS CLASS

2 PLATE PRODUCTION HISTORY

* PRODUCER
* FABRICATOR
* HEAT TREATER
* HEAT NUMBER
* LOT NUMBER
* PRODUCER PLATE NUMBER

3 MATERIALS PROPERTIES

* PLATE THICKNESS
* PLATE HARDNESS
* DI INDEX (HARDENABILITY)
* CHARPY LT
* CHARPY TL
* CHARPY HARDNESS
* TEMPERATURE (AUSTENITIZING)

4 BALLISTIC PERFORMANCE

* TEST PURPOSE
* SAMPLE PRIMARY/RETEST
* FIRING RECORD
* FIRING DATE
* FAIL FIRING RECORD
* TEST (SHOT AGGREGATE)
* PROJECTILE
* OBLIQUITY
* PLATE THICKNESS
* REQUIRED V_{50} VELOCITY
* ACTUAL V_{50} VELOCITY
* PASS/FAIL
* PASS/FAIL VELOCITY DIFF

5 CHEMICAL COMPOSITIONS

*C	*MN	*SI	*NI	*CR
*MO	*V	*B	*CU	*P
*S	*ZR	*AL	*TI	*SB
*AS	*SN	*PB	*N	*O
*H	*CB	*CO		

6 TARGET DAMAGE ASSESSMENTS

* SHOT VELOCITY
* SHOT RESULT
* SHOT BULGE
* SHOT SPALLING
* SHOT CRACKING
* SHOT PLUGGING
* SHOT PETALLING

The sixth module, Target Damage Assessments, contains **seven (7)** database fields which are associated with each constituent test shot of the test shot aggregate required to determine the V50 protection ballistic limit, BL(P), afforded by the armor plate being tested. Module 6 is capable of accommodating target damage assessment data for up to **twenty-eight (28)** individual test shots for a total of **one hundred ninety-six (196) [28x7]** database fields. Thus, a six (6) module database structure comprising **two hundred forty-nine (249)** database fields exists for each of the five (5) test projectiles. Module 6 represents a newly ARL/MD initiated enlargement of the data acquisition process by the U.S. Army Combat Systems Test Activity. The data associated with Module 6 will not be included in this TR because it is not currently recorded by CSTA. Once CSTA completes its effort to automate their ballistic ranges all this information will be available for analysis. The field attributes of Module 6 are shown in Table 3.

TABLE 3

MIL-A-46100 STEEL ARMOR DATABASE
TARGET DAMAGE ASSESSMENT FIELDS
FOR EACH SHOT VELOCITY

FIELD NAME	FIELD UNITS	FIELD ENTRY
SHOT VELOCITY	[FT/SEC]	VELOCITY VALUE
SHOT RESULT	[PARTIAL/COMPLETE]	'P' OR 'C'
SHOT BULGE	[YES/NO]	'Y' OR 'N'
SHOT SPALLING	[YES/NO]	'Y' OR 'N'
SHOT CRACKING	[YES/NO]	'Y' OR 'N'
SHOT PLUGGING	[YES/NO]	'Y' OR 'N'
SHOT PETALLING	[YES/NO]	'Y' OR 'N'

The current contents of the MIL-A-46100 Steel Armor Database also includes data previously published in Reference 2 and for clarification, henceforth, will be referred to as **old data.** Recently acquired, non-published data, which is being included in this report in **Appendix I**, will be referred to as the **new data.** The individual database contents for the old data and new data are summarized in Tables 4 and 5, respectively. It should be noted that the old data covers the MIL-A-46100 steel armor data associated with only two test projectiles and spans a significantly larger date range or time span than for the new data case. The combination of the old and new data represent **eight hundred ninety-five (895)** individual plates. The manual input of the new data

was temporarily suspended (March 1992) pending the implementation (by CSTA) of a direct access capability of their automated ballistic range by a remotely situated computer system. This was done to reduce the volume and size of this report without jeopardizing as an example what is contained in the database, that is, the various fields of information. Also, it was decided that the required time and manpower to manually load all of the data from the TAC Forms and ballistic records would be excessive. Please note that the purpose of this portion of the effort is to create the structure of the database and the mechanisms required for direct linkage to CSTA's computer system for accessing on-line ballistic test results and supporting data.

The MIL-A-46100 Steel Armor Database is located on a single-user microcomputer system possessing a **CS3** Level Accreditation to permit the processing of classified information up to a **SECRET** level. The devices and device attributes of the computer hardware comprising this microcomputer system is shown in Table 6. Similarly, the products and product attributes of the computer software installed on this microcomputer system is shown in Table 7. Regarding the system software, only those software products which were used for this program have been listed. It should also be noted that this microcomputer system possesses adequate data communications capabilities to permit the efficient transfer of ballistic data between the U.S. Army Combat Systems Activity and the U.S. Army Research Laboratory Materials Directorate currently situated at Watertown, Massachusetts. The administrative arrangements have been completed to permit the occurrence of this data transfer.

TABLE 4

MIL-A-46100 STEEL ARMOR DATABASE DATABASE CONTENTS*				
PROJECTILE	OBL	DATE RANGE [MO-YR]	THICK RANGE [IN]	DATA REC [NUM]
CAL 0.30 AP M2	30	N/A	N/A	N/A
CAL 0.50 AP M2	30	N/A	N/A	N/A
14.5 MM API B32	30	N/A	N/A	N/A
14.5 MM API BS41	30	MAY 84-OCT 90	0.759-1.061	169
20 MM API-T M602	0	JUL 85-OCT 90	1.083-1.978	356
*OLD DATA (REFERENCE 2)			REC TOTAL:	525

TABLE 5

MIL-A-46100 STEEL ARMOR DATABASE DATABASE CONTENTS*				
PROJECTILE	OBL	DATE RANGE [MO-YR]	THICK RANGE [IN]	DATA REC [NUM]
CAL 0.30 AP M2	30	OCT 90-FEB 92	0.170-0.306	92
CAL 0.50 AP M2	30	OCT 90-FEB 92	0.267-0.591	64
14.5 MM API B32	30	OCT 90-MAR 92	0.572-0.766	36
14.5 MM API BS41	30	OCT 90-MAR 92	0.754-1.023	82
20 MM API-T M602	0	OCT 90-MAR 92	1.088-2.014	96
*NEW DATA			REC TOTAL:	370

TABLE 6

MIL-A-46100 STEEL ARMOR DATABASE MICROCOMPUTER HARDWARE	
DEVICE	DEVICE ATTRIBUTES
IBM PS/2 MODEL 80 MICROCOMPUTER	PROCESSOR: INTEL 80386 MATH CO-PROCESSOR: INTEL 80387 20 MHZ PROCESSING SPEED 115 MB HARD DRIVE 16 MB RANDOM ACCESS MEMORY DUAL 3.5-IN 1.44 MB DISKETTE DRIVES PORTS: 3 SERIAL, 2 PARALLEL 101-KEY ENHANCED KEYBOARD
IBM MODEL 8514 COLOR DISPLAY	1024 X 768 RESOLUTION
LOGITECH PS/2 MOUSEMAN MOUSE	3 BUTTON BUS TYPE
IOMEGA DUAL 90 PRO BERNOULLI	DUAL 5.25-IN 90 MB DISK DRIVES 90 MB REMOVABLE DISK MEDIA 180 MB COMPRESSED STORAGE PER DISK
HP MODEL 7475A PLOTTER	6 PENS
C.ITOH MODEL CI-3500 PRINTER	PRINT SPEED: 350 CPS DRAFT 87.5 CPS LQ
HP MODEL LASERJET 4 PRINTER	PRINT SPEED: 8 PPM RESOLUTION: 600 DPI
HAYES SMARTMODEM 2400 MODEM	COMM SPEED: 2400 BPS CONNECTIVITY: DIRECT DIAL-UP
ARL-WATERTOWN LOCAL-AREA-NET-WORK	COMM SPEED: 9600 BPS CONNECTIVITY: UNISYS MINI DDN EMAIL: VIA UNISYS MINI

TABLE 7

MIL-A-46100 STEEL ARMOR DATABASE MICROCOMPUTER SOFTWARE	
PRODUCT	PRODUCT ATTRIBUTES
IBM PC/DOS 5.0 OPERATING SYSTEM	
LOTUS 1-2-3 3.1 SPREADSHEET	3-D SPREADSHEET ANALYSIS DATABASE MANAGEMENT SYSTEM 8,192 ROW X 256 COLUMN GRID PER WORKSHEET UP TO 256 WORKSHEETS PER 3-D MULTIPLE-SHEET FILE MULTIPLE WORKSHEET FILES IN MEMORY (SINGLE/MULTIPLE WORKSHEET FILE TYPES) GRAPHICAL ANALYSIS
FUNK SIDEWAYS 2.0	LOTUS 1-2-3 3.1 ADD-IN 90 DEGREE ROTATION OF DATA-BASE REPORTS LIMITLESS WIDTH DATABASE REPORTS
3-D VISIONS GRAFTOOL 3.3	SCIENTIFIC GRAPHICAL ANALYSIS
MANUGISTICS STATGRAPHICS + 6.0	STATISTICAL ANALYSIS
DCA CROSSTALK MK.4 2.0.1	DATA COMMUNICATIONS

The characteristics of Database Module 1, labelled 'ARL/MD ID & MIL SPEC ATTRIBUTES' and defined in Table 2, will now be further amplified. The label 'ARL/MD ID ATTRIBUTES 'is used to designate an arbitrarily defined **eight (8)** character, alphanumeric, key-field (index) identifier which inherently encodes:

1. Projectile Diameter - Characters 1 and 2

   [1-9] Character 1
   [0-9] Character 2

2. Projectile Type - Character 3

   [A-Z] where a single letter denotes a member of a projectile family possessing the same projectile diameter

3. Projectile Size Unit of Measurement - Character 4.

   'C' for English Units [IN]
   'M' for Metric Units [MM]

4. Database Record Number - Characters 5-8

   [0-9] Character 5 [0-9] Character 6
   [0-9] Character 7 [0-9] Character 8

This approach will now be illustrated by the following examples of key-field entries in the MIL-A-46100 Steel Armor Database.

* 30AC0001 - CAL 0.30 AP M2 PROJECTILE, RECORD 1
* 50AC0010 - CAL 0.50 AP M2 PROJECTILE, RECORD 10
* 14AM0020 - 14.5 MM API B32 PROJECTILE, RECORD 20
* 14BM0030 - 14.5 MM API BS41 PROJECTILE, RECORD 30
* 20AM0040 - 20 MM API-T M602 PROJECTILE, RECORD 40

The label 'MIL SPEC ATTRIBUTES' associated with Database Module 1 (Table 2) has been defined to include the following fields:

1. MIL SPEC NUMBER
2. MIL SPEC REVISION
3. MIL SPEC AMENDMENT
4. MIL SPEC MATERIALS CLASS

Although MIL SPEC MIL-A-46100 is the sole specification included in this database, the database design approach to Database Module 1 was to make this module as generic as possible to permit the extension of this approach to the possible creation of additional databases pertaining to any other pertinent Military Specifications.

The database contents of the **new data** associated with each of the five (5) test projectiles associated with MIL-A-46100 have been printed out modularly in the following **four (4)** parts and included in **Appendix I** of this document.

1. DATABASE MODULE 1: ARL/MD ID & MIL SPEC ATTRIBUTES
   DATABASE MODULE 2: PLATE PRODUCTION HISTORY
2. DATABASE MODULE 3: MATERIALS PROPERTIES
3. DATABASE MODULE 4: BALLISTIC PERFORMANCE
4. DATABASE MODULE 5: CHEMICAL COMPOSITIONS

Conclusions

An Armor Steel database has been designed, populated, and used for the analysis of MIL-A-46100 steel ballistically tested by the U.S. Army Combat Systems Test Activity (CSTA). This database is situated on a single-user, stand-a-lone, microcomputer system which is capable of being linked to a remotely-situated CSTA host computer system. As discussed previously this linkage has not been completed. Once completed (linkage) the database will be updated on a continuous basis. All requests for data/comparisons via this database should be sent through the PM Survivability to ARL/MD. Please note that the data is company sensitive and all non-government requests will be honored for data associated only with the requesting company.

Recommendations

* Continue effort to get CSTA on-line with an automated ballistic range so that all the data generated can be electronically transferred.

* Instruct the producers, etc. to completely utilize the required MIL-STD-367, Format I when requesting ballistic testing of MIL-A-46100 armor steel.

* Authorize CSTA the ability to return or deny requests for ballistic acceptance testing if the required Format I of MIL-STD-367 is not fully and accurately completed and signed-off by the appropriate government agency.

* Update MIL-STD-367, Format I to include the tempering temperature.

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CSTA

William H. Allison

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References

1. Military Specification MIL-A-46100.

2. Squillacioti, Richard, J. Preliminary Report: Analysis of Data Obtained from CSTA on MIL-A-46100 Material Ballistically Tested Between 1986 and 1990. U.S. Army Materials Technology Laboratory, Watertown, MA; August 1, 1991. Preliminary edition containing sensitive material for trial use and comment and not available for general distribution.

APPENDIX I

Appendix I contains the hardcopy database reports representing the contents of the MIL-A-46100 Steel Armor Database (The producers and the fabricators were removed for distribution purposes only.). The report format for each of the five (5) projectiles is as follows:

REPORT 1: DATABASE MODULE 1: ARL/MD ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

REPORT 2: DATABASE MODULE 3: MATERIALS PROPERTIES

REPORT 3: DATABASE MODULE 4: BALLISTIC PERFORMANCE

REPORT 4: DATABASE MODULE 5: CHEMICAL COMPOSITIONS

For **REPORT 2**, the database field **Actual Plate Thickness (ACT PLATE TH)**, which is situated in Database Module 4: Ballistic Performance, has been intentionally duplicated only for purposes of enhancement. Database design considerations preclude the duplication of any of the fields comprising the database. This consideration has been faithfully followed.

The page numbering format for each of the four (4) reports is **PAGE 1 OF N**, where N is the maximum number of pages and varies with the size of a report as per **TABLE A1.1**.

TABLE A1.1

MIL-A-46100 STEEL ARMOR DATABASE
REPORT SIZES AS A FUNCTION
PROJECTILE

PROJECTILE	REPORT 1 N [PGS]	REPORT 2 N [PGS]	REPORT 3 N [PGS]	REPORT 4 N [PGS]
CAL 0.30 AP M2	2	2	2	4
CAL 0.50 AP M2	2	2	2	4
14.5 MM API B32	1	1	1	2
14.5 MM API BS41	2	2	2	4
20 MM API-T M602	3	3	3	6

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
30AC0001	MIL-A-46100	D						B8660		B8660-86BB
30AC0002	MIL-A-46100	D						B8660		B8660-86AB
30AC0003	MIL-A-46100	D						B8660		B8660-86EB
30AC0004	MIL-A-46100	D						663455		168
30AC0005	MIL-A-46100	D						B8337		B8337-5CB
30AC0006	MIL-A-46100	D						661914		243
30AC0007	MIL-A-46100	D						435564		327A
30AC0008	MIL-A-46100	D						D3707		71147
30AC0009	MIL-A-46100	D						B9675		B9675-2BE
30AC0010	MIL-A-46100	D						B9675		B9675-5AD
30AC0011	MIL-A-46100	D						B9675		B9675-4BB
30AC0012	MIL-A-46100	C						B9628		B9628-8DE
30AC0013	MIL-A-46100	C						B8896		B8896-1DE
30AC0014	MIL-A-46100	C	2					R0112		R0112-2AE
30AC0015	MIL-A-46100	C						B8896		B8896-5CA
30AC0016	MIL-A-46100	C	2					B9628		B9628-2EF
30AC0017	MIL-A-46100	C	2					R0112		R0112-5BG
30AC0018	MIL-A-46100	C						R0538		R0538-2CD
30AC0019	MIL-A-46100	D						R0538		R0538-2BC
30AC0020	MIL-A-46100	D						R0326		R0326-9DB
30AC0021	MIL-A-46100	D						663527		344
30AC0022	MIL-A-46100	D						R0512		R0512-5AC
30AC0023	MIL-A-46100	D						R0602		R0602-4AC
30AC0024	MIL-A-46100	D						663809		672
30AC0025	MIL-A-46100	D						B7397		B7379-8CA
30AC0026	MIL-A-46100	D						B7397		B7397-8AD
30AC0027	MIL-A-46100	D						663810		755
30AC0028	MIL-A-46100	D						664154		604
30AC0029	MIL-A-46100	D						664155		872
30AC0030	MIL-A-46100	D						663810		617
30AC0031	MIL-A-46100	D						603809		622
30AC0032	MIL-A-46100	D						663527		287
30AC0033	MIL-A-46100	D						664154		620
30AC0034	MIL-A-46100	D						663810		766
30AC0035	MIL-A-46100	D						664155		614
30AC0036	MIL-A-46100	D						R0465		R0465-6BB
30AC0037	MIL-A-46100	D						B9628		B9628-2RC
30AC0038	MIL-A-46100	D						R0538		R0538-5GC
30AC0039	MIL-A-46100	D						435765		495
30AC0040	MIL-A-46100	D						664692		868
30AC0041	MIL-A-46100	D						664693		903
30AC0042	MIL-A-46100	D						500166		719
30AC0043	MIL-A-46100	D						R0602		R0602-2CD
30AC0044	MIL-A-46100	C	2					R0326		R0326-4CD
30AC0045	MIL-A-46100	C	2					R0326		R0326-2AC
30AC0046	MIL-A-46100	C	2					R1450		R1450-3BE

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
30AC0047	MIL-A-46100	D						R0326		R0326-8AC
30AC0048	MIL-A-46100	D						R0326		R0326-7JA
30AC0049	MIL-A-46100	D						R0326		R0326-5MF
30AC0050	MIL-A-46100	D						R0549		R0549-4BF
30AC0051	MIL-A-46100	D						R0549		R0549-5ED
30AC0052	MIL-A-46100	D						664693		898
30AC0053	MIL-A-46100	D						R1450		R1450-2AD
30AC0054	MIL-A-46100	D						B7397		B7379-1GB
30AC0055	MIL-A-46100	D						664155		380
30AC0056	MIL-A-46100	C	2					R1450		R1450-6MF
30AC0057	MIL-A-46100	D						B7397		B7397-2RA
30AC0058	MIL-A-46100	D						400296		144
30AC0059	MIL-A-46100	D						501651		170
30AC0060	MIL-A-46100	C	2					R2324		R2324-7ME
30AC0061	MIL-A-46100	C	2					R2324		R2324-4DE
30AC0062	MIL-A-46100	D						R2324		R2324-4GF
30AC0063	MIL-A-46100	D						R0538		R0538-39AC
30AC0064	MIL-A-46100	D						R0549		R0549-39AD
30AC0065	MIL-A-46100	D						G0808		52660
30AC0066	MIL-A-46100	D						829564		4116
30AC0067	MIL-A-46100	D						R2324		R2324-5BC
30AC0068	MIL-A-46100	D						R3614		R3614-1AC
30AC0069	MIL-A-46100	D						R2324		R2324-5AE
30AC0070	MIL-A-46100	D						829565		4129
30AC0071	MIL-A-46100	D						829564		4113
30AC0072	MIL-A-46100	D						R2324		R2324-8KC
30AC0073	MIL-A-46100	D						401085		119
30AC0074	MIL-A-46100	D						4859K		40463A
30AC0075	MIL-A-46100	D						4996K		42301
30AC0076	MIL-A-46100	D						4860K		40455A
30AC0077	MIL-A-46100	D						401085		129
30AC0078	MIL-A-46100	D						400296		681
30AC0079	MIL-A-46100	D						829565		4123
30AC0080	MIL-A-46100	D						401085		837
30AC0081	MIL-A-46100	D						R3614		R3614-9CD
30AC0082	MIL-A-46100	D						R3614		R3614-39FD
30AC0083	MIL-A-46100	D						R3796		R3796-5MC
30AC0084	MIL-A-46100	D						580031		3759451
30AC0085	MIL-A-46100	D						9266J		55077A
30AC0086	MIL-A-46100	C						R4848		R4848-2BF
30AC0087	MIL-A-46100	C						R4841		R4841-7AF
30AC0088	MIL-A-46100	D						R3620		R3620-4AE
30AC0089	MIL-A-46100	C						R4845		R4845-6AE
30AC0090	MIL-A-46100	D						R3960		R3960-4MC1
30AC0091	MIL-A-46100	C						R4845		R4845-5KF
30AC0092	MIL-A-46100	D						R5431		R5431-7AD

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
30AC0001	0.297	512	9.97	15.0	15.3		1660
30AC0002	0.188	512	9.97	13.3	16.3		1660
30AC0003	0.249	512	9.97	16.7	18.7		1660
30AC0004	0.270	495	4.30	8.0	6.0	495	1650
30AC0005	0.229	512	6.08	12.3	12.7		1660
30AC0006	0.201	477	4.20	9.0	6.0	477	1650
30AC0007	0.278	477	3.57	10.0	15.0	477	1650
30AC0008	0.170	514	5.20	11.7	10.3	495	1580
30AC0009	0.192	512	10.01	20.0	19.7	512	1660
30AC0010	0.253	512	5.63	24.0	23.7		1660
30AC0011	0.293	512	5.63	21.0	20.3		1660
30AC0012	0.243	512	6.95	21.7	21.0		1660
30AC0013	0.245	512	6.77	20.0	19.0		1660
30AC0014	0.233	477	6.57	14.0	18.7		1660
30AC0015	0.236	530	6.77	19.0	20.0		1660
30AC0016	0.243	504	6.95	15.7	15.7		1660
30AC0017	0.236	477	6.57	14.7	18.3		1660
30AC0018	0.244	477	6.17	21.0	21.3		1660
30AC0019	0.184	477	6.17	20.0	20.3		1660
30AC0020	0.250	477	6.04	11.7	14.0		1660
30AC0021	0.247	477	4.08	22.0	17.0	477	1650
30AC0022	0.306	477	6.52	31.7	24.0		1660
30AC0023	0.289	477	6.83	18.0	18.7		1660
30AC0024	0.202	477	4.04	12.0	11.0	477	1650
30AC0025	0.184	504	6.26	10.0	10.0		1660
30AC0026	0.189	512	6.26	10.0	10.0		1660
30AC0027	0.209	477	4.05	9.0	7.0	477	1650
30AC0028	0.252	495	4.28	20.0	14.0	495	1650
30AC0029	0.242	477	4.08	25.0	18.0	477	1650
30AC0030	0.260	514	4.05	23.0	16.0	514	1650
30AC0031	0.271	477	4.04	20.0	18.0	477	1650
30AC0032	0.212	477	4.08	13.0	10.0	477	1650
30AC0033	0.214	495	4.28	13.0	11.0	495	1650
30AC0034	0.259	495	4.05	28.0	19.0	495	1650
30AC0035	0.256	477	4.08	10.0	11.0		1650
30AC0036	0.293	512	6.44	22.0	18.7		1660
30AC0037	0.274	512	6.81	23.0	24.3		1660
30AC0038	0.278	512	6.13	16.7	17.0		1660
30AC0039	0.208	495	4.27	7.0	9.0	495	1650
30AC0040	0.201	477	4.09	7.0	10.0	477	1650
30AC0041	0.248	495	4.18	14.0	12.0	495	1650
30AC0042	0.213	495	4.14	10.0	8.0	495	1650
30AC0043	0.262	512	6.83	18.7	21.3		1660
30AC0044	0.228	512	6.04	19.3	23.0		1660
30AC0045	0.239	512	6.04	19.0	17.3		1660
30AC0046	0.230	490	6.28	11.0	12.3		1660

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
30AC0047	0.284	488	6.10	18.7	25.7		1660
30AC0048	0.248	510	6.10	17.7	19.7		1660
30AC0049	0.252	490	6.05	11.7	14.0		1660
30AC0050	0.241	486	6.63	13.0	17.7		1660
30AC0051	0.257	492	6.63	13.0	17.7		1660
30AC0052	0.218	495	4.35	10.0	10.0	495	1650
30AC0053	0.267	502	6.21	12.3	17.0		1660
30AC0054	0.287	477	6.31	14.7	16.3		1660
30AC0055	0.220	477	4.21	9.0	8.0	477	1650
30AC0056	0.250	506	10.19	11.3	13.0		1660
30AC0057	0.255	494	6.31	14.0	17.7		1660
30AC0058	0.266	514	4.14	9.0	10.0	514	1650
30AC0059	0.273	514	4.09	13.0	16.0	514	1650
30AC0060	0.244	495	6.51	11.0	10.3		1660
30AC0061	0.222	502	6.51	11.3	10.3		1660
30AC0062	0.249	514	6.54	10.3	11.7		1660
30AC0063	0.206	515	10.06	16.7	20.7		1660
30AC0064	0.250	490	6.67	16.3	18.7		1660
30AC0065	0.234	495	4.35	13.3	10.7	495	1580
30AC0066	0.210	495	4.16	9.6	10.0	495	1650
30AC0067	0.220	512	10.44	9.0	11.3		1660
30AC0068	0.293	477	6.14	21.3	20.3		1660
30AC0069	0.189	512	6.58	9.3	8.7		1660
30AC0070	0.260	514	4.33	15.0	12.0	514	1650
30AC0071	0.256	514	4.33	15.0	12.0	514	1650
30AC0072	0.272	522	6.58	9.7	10.3		1660
30AC0073	0.268	477	4.16	13.0	17.0	477	1650
30AC0074	0.258	514	4.85	15.7	11.3		1564
30AC0075	0.274	523	4.98	13.3	8.0		1567
30AC0076	0.260	518	5.01	13.3	8.7		1562
30AC0077	0.272	477	4.16	15.0	21.0	477	1650
30AC0078	0.228	495	4.14	11.0	9.0	495	1650
30AC0079	0.203	495	4.06	8.0	9.0	495	1650
30AC0080	0.208	477	4.16	10.0	10.0	477	1650
30AC0081	0.251	477	6.14	28.0	29.7		1660
30AC0082	0.188	477	6.14	12.3	11.3		1660
30AC0083	0.293	477	5.83	21.0	26.7		1660
30AC0084	0.254	511	7.69	18.0	16.0		1688
30AC0085	0.247	516	4.54	28.0	18.0		1573
30AC0086	0.220	477	2.75	9.7	9.7		1660
30AC0087	0.258	477	2.44	11.3	13.7		1660
30AC0088	0.241	512	5.89	13.0	19.7		1660
30AC0089	0.211	512	2.97	7.7	14.3		1660
30AC0090	0.298	477	6.16	16.3	17.0		1660
30AC0091	0.259	502	2.97	9.3	9.7		1660
30AC0092	0.194	477	5.81	19.0	23.7		1660

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
30AC0001	A	P	90001614	10/30/90		SIX	CAL30APM2	30	0.297	2510	2545	P	35
30AC0002	A	P	90001615	10/31/90		SIX	CAL30APM2	30	0.188	1811	2021	P	210
30AC0003	A	P	90001616	10/31/90		SIX	CAL30APM2	30	0.249	2231	2293	P	62
30AC0004	A	P	90001636	11/01/90		SIX	CAL30APM2	30	0.270	2357	2421	P	64
30AC0005	A	P	90001692	11/26/90		SIX	CAL30APM2	30	0.229	2105	2234	P	129
30AC0006	A	P	90001763	11/30/90		TWO	CAL30APM2	30	0.201	1915	1995	P	80
30AC0007	A	P	90001884	01/12/91		SIX	CAL30APM2	30	0.278	2403	2440	P	37
30AC0008	A	P	91000009	01/22/91		SIX	CAL30APM2	30	0.170	1682	1820	P	138
30AC0009	A	P	91000030	01/12/91		SIX	CAL30APM2	30	0.192	1850	1936	P	86
30AC0010	A	P	91000031	01/12/91		SIX	CAL30APM2	30	0.253	2255	2380	P	125
30AC0011	A	P	91000032	01/12/91		SIX	CAL30APM2	30	0.293	2488	2518	P	30
30AC0012	A	P	91000071	01/15/91		SIX	CAL30APM2	30	0.243	2194	2288	P	94
30AC0013	A	P	91000073	01/15/91		SIX	CAL30APM2	30	0.245	2207	2339	P	132
30AC0014	A	P	91000149	02/27/91		SIX	CAL30APM2	30	0.233	2131	2311	P	180
30AC0015	A	P	91000288	02/21/91		SIX	CAL30APM2	30	0.236	2150	2318	P	168
30AC0016	A	P	91000292	02/21/91		SIX	CAL30APM2	30	0.243	2194	2375	P	181
30AC0017	A	R	91000295	02/21/91		SIX	CAL30APM2	30	0.236	2150	2362	P	212
30AC0018	A	P	91000297	02/27/91		SIX	CAL30APM2	30	0.244	2201	2349	P	148
30AC0019	A	P	91000300	02/21/91		SIX	CAL30APM2	30	0.184	1791	2076	P	285
30AC0020	A	P	91000304	02/21/91		SIX	CAL30APM2	30	0.250	2237	2495	P	258
30AC0021	A	P	91000343	02/21/91		SIX	CAL30APM2	30	0.247	2219	2375	P	156
30AC0022	A	P	91000376	02/28/91		SIX	CAL30APM2	30	0.306	2559	2597	P	38
30AC0023	A	P	91000378	02/27/91		SIX	CAL30APM2	30	0.289	2465	2511	P	46
30AC0024	A	P	91000386	02/27/91		SIX	CAL30APM2	30	0.202	1922	2125	P	203
30AC0025	A	P	91000397	02/27/91		SIX	CAL30APM2	30	0.184	1791	1965	P	174
30AC0026	A	P	91000398	02/27/91		SIX	CAL30APM2	30	0.189	1824	2025	P	201
30AC0027	A	P	91000411	02/27/91		SIX	CAL30APM2	30	0.209	1971	2171	P	200
30AC0028	A	P	91000412	02/26/91		SIX	CAL30APM2	30	0.252	2249	2380	P	131
30AC0029	A	P	91000413	02/26/91		SIX	CAL30APM2	30	0.242	2188	2374	P	186
30AC0030	A	P	91000414	02/26/91		SIX	CAL30APM2	30	0.260	2298	2491	P	193
30AC0031	A	P	91000415	02/26/91		SIX	CAL30APM2	30	0.271	2363	2582	P	219
30AC0032	A	P	91000416	02/27/91		SIX	CAL30APM2	30	0.212	1992	2121	P	129
30AC0033	A	P	91000417	02/27/91		SIX	CAL30APM2	30	0.214	2005	2249	P	244
30AC0034	A	P	91000429	02/27/91		SIX	CAL30APM2	30	0.259	2292	2438	P	146
30AC0035	A	P	91000446	03/08/91		SIX	CAL30APM2	30	0.256	2274	2384	P	110
30AC0036	A	P	91000466	03/08/91		SIX	CAL30APM2	30	0.293	2488	2569	P	81
30AC0037	A	P	91000467	03/08/91		SIX	CAL30APM2	30	0.274	2380	2512	P	132
30AC0038	A	P	91000558	07/11/91		SIX	CAL30APM2	30	0.278	2403	2508	P	105
30AC0039	A	P	91000699	05/07/91		SIX	CAL30APM2	30	0.208	1964	2200	P	236
30AC0040	A	P	91000700	05/07/91		SIX	CAL30APM2	30	0.201	1915	2120	P	205
30AC0041	A	P	91000701	05/07/91		SIX	CAL30APM2	30	0.248	2225	2405	P	180
30AC0042	A	P	91000702	05/07/91		SIX	CAL30APM2	30	0.213	1998	2205	P	207
30AC0043	A	P	91000741	05/08/91		SIX	CAL30APM2	30	0.262	2310	2429	P	119
30AC0044	A	P	91000793	05/07/91		SIX	CAL30APM2	30	0.228	2098	2298	P	200
30AC0045	A	P	91000799	05/07/91		SIX	CAL30APM2	30	0.239	2169	2305	P	136
30AC0046	A	P	91000884	06/03/91		SIX	CAL30APM2	30	0.230	2111	2280	P	169

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
30AC0047	A	P	91000886	05/23/91		SIX	CAL30APM2	30	0.284	2437	2531	P	94
30AC0048	A	P	91000887	05/23/91		SIX	CAL30APM2	30	0.248	2225	2435	P	210
30AC0049	FA		91000891	05/23/91		SIX	CAL30APM2	30	0.252	2249	2342	P	93
30AC0050	FA		91000892	06/04/91		SIX	CAL30APM2	30	0.241	2181	2309	P	128
30AC0051	A	P	91000897	05/23/91		SIX	CAL30APM2	30	0.257	2280	2435	P	155
30AC0052	A	P	91000967	06/07/91		SIX	CAL30APM2	30	0.218	2032	2165	P	133
30AC0053	A	P	91000989	06/07/91		SIX	CAL30APM2	30	0.267	2340	2437	P	97
30AC0054	A	P	91001007	06/04/91		SIX	CAL30APM2	30	0.287	2454	2515	P	61
30AC0055	A	P	91001063	06/06/91		SIX	CAL30APM2	30	0.220	2046	2112	P	66
30AC0056	A	P	91001071	06/07/91		SIX	CAL30APM2	30	0.250	2237	2382	P	145
30AC0057	A	P	91001096	06/12/91		SIX	CAL30APM2	30	0.255	2268	2408	P	140
30AC0058	A	P	91001187	07/15/91		SIX	CAL30APM2	30	0.266	2334	2443	P	109
30AC0059	A	P	91001188	07/15/91		SIX	CAL30APM2	30	0.273	2374	2477	P	103
30AC0060	A	P	91001194	07/15/91		SIX	CAL30APM2	30	0.244	2201	2234	P	33
30AC0061	A	P	91001226	07/20/91		SIX	CAL30APM2	30	0.222	2059	2234	P	175
30AC0062	A	P	91001229	07/20/91		SIX	CAL30APM2	30	0.249	2231	2382	P	151
30AC0063	A	P	91001307	08/20/91		SIX	CAL30APM2	30	0.206	1950	2112	P	162
30AC0064	A	P	91001308	08/20/91		SIX	CAL30APM2	30	0.250	2237	2403	P	166
30AC0065	A	P	91001337	08/17/91		SIX	CAL30APM2	30	0.234	2137	2330	P	193
30AC0066	A	P	91001465	09/04/91		SIX	CAL30APM2	30	0.210	1978	2144	P	166
30AC0067	A	P	91001489	09/11/91		SIX	CAL30APM2	30	0.220	2046	2065	P	19
30AC0068	A	P	91001490	09/13/91		SIX	CAL30APM2	30	0.293	2488	2573	P	85
30AC0069	A	P	91001493	09/11/91		SIX	CAL30APM2	30	0.189	1824	1865	P	41
30AC0070	A	P	91001495	09/09/91		SIX	CAL30APM2	30	0.260	2298	2505	P	207
30AC0071	A	P	91001496	09/10/91		SIX	CAL30APM2	30	0.256	2274	2396	P	122
30AC0072	A	P	91001533	09/13/91		SIX	CAL30APM2	30	0.272	2369	2460	P	91
30AC0073	A	P	91001574	09/20/91		SIX	CAL30APM2	30	0.268	2345	2466	P	121
30AC0074	A	P	91001587	09/27/91		SIX	CAL30APM2	30	0.258	2286	2394	P	108
30AC0075	A	P	91001588	09/27/91		SIX	CAL30APM2	30	0.274	2380	2639	P	259
30AC0076	A	P	91001589	09/26/91		SIX	CAL30APM2	30	0.260	2298	2546	P	248
30AC0077	A	P	91001592	09/26/91		SIX	CAL30APM2	30	0.272	2369	2539	P	170
30AC0078	A	P	91001594	09/26/91		SIX	CAL30APM2	30	0.228	2098	2269	P	171
30AC0079	A	P	91001750	11/04/91		SIX	CAL30APM2	30	0.203	1929	2141	P	212
30AC0080	A	P	91001751	11/04/91		SIX	CAL30APM2	30	0.208	1964	2068	P	104
30AC0081	A	P	91001815	11/12/91		SIX	CAL30APM2	30	0.251	2243	2371	P	128
30AC0082	A	P	91001818	11/12/91		SIX	CAL30APM2	30	0.188	1811	1953	P	142
30AC0083	A	P	91001819	11/12/91		SIX	CAL30APM2	30	0.293	2488	2612	P	124
30AC0084	A	P	91001839	11/08/91		SIX	CAL30APM2	30	0.254	2261	2464	P	203
30AC0085	A	P	91001973	12/17/91		SIX	CAL30APM2	30	0.247	2219	2335	P	116
30AC0086	A	P	92000042	01/16/92		SIX	CAL30APM2	30	0.220	2046	2305	P	259
30AC0087	A	P	92000044	01/16/92		SIX	CAL30APM2	30	0.258	2286	2414	P	128
30AC0088	A	P	92000109	01/27/92		SIX	CAL30APM2	30	0.241	2181	2288	P	107
30AC0089	A	P	92000110	01/27/92		SIX	CAL30APM2	30	0.211	1985	2082	P	97
30AC0090	A	P	92000154	02/07/92		SIX	CAL30APM2	30	0.298	2515	2519	P	4
30AC0091	A	P	92000190	02/19/92		SIX	CAL30APM2	30	0.259	2292	2294	P	2
30AC0092	A	P	92000250	02/27/92		SIX	CAL30APM2	30	0.194	1865	1966	P	101

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
30AC0001	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400	0.0030	0.0003	0.1200	0.0080	0.0030	0.0040	0.0370
30AC0002	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400	0.0030	0.0003	0.1200	0.0080	0.0030	0.0040	0.0370
30AC0003	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400	0.0030	0.0003	0.1200	0.0080	0.0030	0.0040	0.0370
30AC0004	0.2800	1.4200	0.3000			0.2700		0.0015		0.0070	0.0030		
30AC0005	0.2900	0.8600	0.4300	0.9400	0.5000	0.5600			0.0900	0.0050	0.0010	0.0040	0.0270
30AC0006	0.2800	1.4100	0.3100			0.2800		0.0011		0.0080	0.0020		
30AC0007	0.2800	1.3700	0.0070			0.2700		0.0010		0.0120	0.0030		
30AC0008	0.2870	0.7480	0.3080	0.9360	0.9400	0.3150				0.0040	0.0002		
30AC0009	0.2700	0.8200	0.4700	0.9300	0.5000	0.5600	0.0040	0.0004	0.1000	0.0050	0.0030	0.0030	0.0390
30AC0010	0.2700	0.8200	0.4700	0.9300	0.5000	0.5600	0.0040		0.1000	0.0050	0.0030	0.0030	0.0390
30AC0011	0.2700	0.8200	0.4700	0.9300	0.5000	0.5600	0.0040		0.1000	0.0050	0.0030	0.0030	0.0390
30AC0012	0.2900	0.9000	0.4400	1.0000	0.5100	0.5700	0.0030		0.2400	0.0070	0.0010		0.0350
30AC0013	0.2900	0.9200	0.4400	0.9200	0.5100	0.5600	0.0030		0.2100	0.0090	0.0020		0.0310
30AC0014	0.3000	0.9000	0.4400	0.9200	0.5000	0.5600	0.0030		0.1000	0.0050	0.0010		0.0330
30AC0015	0.2900	0.9200	0.4400	0.9200	0.5100	0.5600	0.0030		0.2100	0.0090	0.0020		0.0310
30AC0016	0.2900	0.9000	0.4400	1.0000	0.5100	0.5700	0.0030		0.2400	0.0070	0.0010		0.0350
30AC0017	0.3000	0.9000	0.4400	0.9200	0.5000	0.5600	0.0030		0.1000	0.0050	0.0010		0.0330
30AC0018	0.3000	0.8600	0.4400	0.9300	0.5000	0.5400	0.0040		0.0700	0.0060	0.0020	0.0030	0.0280
30AC0019	0.3000	0.8600	0.4400	0.9300	0.5000	0.5400	0.0040		0.0700	0.0060	0.0020	0.0030	0.0280
30AC0020	0.2800	0.9100	0.4300	0.9100	0.5100	0.5400			0.1100	0.0080	0.0030	0.0030	0.0230
30AC0021	0.2800	1.3600	0.2700			0.2800		0.0014		0.0100	0.0020		
30AC0022	0.3000	0.8700	0.4500	0.9600	0.5000	0.5600	0.0040		0.1000	0.0080	0.0020	0.0030	0.0340
30AC0023	0.3000	0.9000	0.4400	0.9400	0.5000	0.5700	0.0040		0.1600	0.0070	0.0010	0.0040	0.0270
30AC0024	0.2800	1.3600	0.2800			0.2700		0.0014		0.0080	0.0020		
30AC0025	0.2900	0.8400	0.4800	0.9700	0.5100	0.5400			0.1600	0.0090	0.0020	0.0030	0.0240
30AC0026	0.2900	0.8400	0.4800	0.9700	0.5100	0.5400			0.1600	0.0090	0.0020	0.0030	0.0240
30AC0027	0.2800	1.3700	0.2600			0.2600		0.0011		0.0060	0.0060		
30AC0028	0.2900	1.3800	0.3000			0.2800		0.0015		0.0090	0.0020		
30AC0029	0.2700	1.3900	0.3000			0.2600		0.0017		0.0090	0.0030		
30AC0030	0.2800	1.3700	0.2600			0.2600		0.0011		0.0080	0.0030		
30AC0031	0.2800	1.3600	0.2800			0.2700		0.0011		0.0080	0.0020		
30AC0032	0.2800	1.3600	0.2700			0.2800		0.0014		0.0100	0.0020		
30AC0033	0.2900	1.3800	0.3000			0.2800		0.0150		0.0090	0.0020		
30AC0034	0.2800	1.3700	0.2600			0.2600		0.0011		0.0080	0.0030		
30AC0035	0.2700	1.3900	0.3000			0.2600		0.0017		0.0090	0.0030		
30AC0036	0.2900	0.8900	0.4500	0.9300	0.5100	0.5500	0.0040		0.1400	0.0070	0.0020	0.0030	0.0270
30AC0037	0.2900	0.8800	0.4300	1.0200	0.5100	0.5700	0.0030		0.2300	0.0080	0.0020	0.0030	0.0360
30AC0038	0.3000	0.8600	0.4400	0.9300	0.5000	0.5400			0.0700	0.0060	0.0020	0.0030	0.0280
30AC0039	0.2900	1.3900	0.3100			0.2700		0.0012		0.0070	0.0020		
30AC0040	0.2800	1.3600	0.3000			0.2700		0.0011		0.0110	0.0020		
30AC0041	0.2800	1.3600	0.3100			0.2800		0.0013		0.0120	0.0020		
30AC0042	0.2800	1.3700	0.2800			0.2800		0.0012		0.0070	0.0030		
30AC0043	0.3000	0.9000	0.4400	0.9400	0.5000	0.5700	0.0040		0.1600	0.0070	0.0010	0.0040	0.0270
30AC0044	0.2800	0.9100	0.4300	0.9200	0.5100	0.5300	0.0050		0.1100	0.0060	0.0030		0.0210
30AC0045	0.2800	0.9100	0.4300	0.9200	0.5100	0.5300	0.0050		0.1100	0.0060	0.0030		0.0210
30AC0046	0.3000	0.9000	0.4000	0.8900	0.5000	0.5500	0.0030		0.0900	0.0060	0.0010		0.0240

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
30AC0001	0.0290	0.0020	0.0050	0.0090	0.0030	0.0087	0.0020	0.4000	0.0020	
30AC0002	0.0290	0.0020	0.0050	0.0090	0.0030	0.0087	0.0020	0.4000		
30AC0003	0.0290	0.0020	0.0050	0.0090	0.0030	0.0087	0.0020	0.4000		
30AC0004										
30AC0005	0.0030	0.0020	0.0050							
30AC0006										
30AC0007										
30AC0008										
30AC0009	0.0290	0.0020	0.0060	0.0080	0.0030					
30AC0010	0.0290	0.0020							0.0040	
30AC0011	0.0290	0.0020							0.0040	
30AC0012	0.0280		0.0040						0.0010	0.0090
30AC0013	0.0250		0.0050						0.0030	0.0120
30AC0014	0.032		0.0040			0.0065	0.0020	0.7000	0.0010	0.0090
30AC0015	0.0250		0.0050			0.0048	0.0020	0.6000	0.0030	0.0120
30AC0016	0.0280		0.0040			0.0056	0.0020	0.5000	0.0010	0.0090
30AC0017	0.0320		0.0040			0.0065	0.0020	0.7000	0.0010	0.0090
30AC0018	0.0290	0.0030							0.0020	
30AC0019	0.0290	0.0030							0.0020	
30AC0020	0.0250	0.0030	0.0050	0.0070						
30AC0021										
30AC0022	0.0280	0.0030	0.0060	0.0120	0.0030	0.0068	0.0010	0.3000	0.0040	
30AC0023	0.0260	0.0020	0.0060	0.0140		0.0060	0.0010	0.2000	0.0020	
30AC0024										
30AC0025	0.0040	0.0020	0.0050	0.0130	0.0020					
30AC0026	0.0040	0.0020	0.0050	0.0130	0.0020					
30AC0027										
30AC0028										
30AC0029										
30AC0030										
30AC0031										
30AC0032										
30AC0033										
30AC0034										
30AC0035										
30AC0036	0.0290	0.0030	0.0050	0.0140	0.0030	0.0062	0.0020	0.4000	0.0030	
30AC0037	0.0270		0.0050	0.0070	0.0030	0.0057	0.0020	0.4000		
30AC0038	0.0290	0.0030	0.0040	0.0070	0.0030					
30AC0039										
30AC0040										
30AC0041										
30AC0042										
30AC0043	0.0260	0.0020	0.0060	0.0140		0.0060	0.0010	0.2000	0.0020	
30AC0044	0.0240		0.0050			0.0074	0.0020	0.9000	0.0010	0.0100
30AC0045	0.0240		0.0050			0.0074	0.0020	0.9000	0.0010	0.0100
30AC0046	0.0040		0.0040			0.0056	0.0020	0.9000	0.0010	0.0090

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
30AC0047	0.2800	0.9100	0.4300	0.9100	0.5100	0.5400	0.0050		0.1100	0.0080	0.0030	0.0030	0.0230
30AC0048	0.2800	0.9100	0.4300	0.9100	0.5100	0.5400	0.0050		0.1100	0.0080	0.0030	0.0030	0.0230
30AC0049	0.2800	0.9100	0.4300	0.9100	0.5100	0.5400			0.1100	0.0080	0.0030	0.0030	0.0230
30AC0050	0.2900	0.8800	0.4900	0.9700	0.5000	0.5800			0.1100	0.0120	0.0030	0.0030	0.0340
30AC0051	0.2900	0.8800	0.4900	0.9700	0.5000	0.5800			0.1100	0.0120	0.0030	0.0030	0.0340
30AC0052	0.2800	1.3600	0.3100	0.0410	0.0460	0.2800	0.0030	0.0013		0.0120	0.0020	0.0020	
30AC0053	0.3000	0.8700	0.4100	0.9000	0.5000	0.5600			0.0900	0.0080	0.0020	0.0030	0.0250
30AC0054	0.2900	0.8400	0.4800	0.9700	0.5100	0.5400	0.0040		0.1600	0.0090	0.0020	0.0030	0.0240
30AC0055	0.2700	1.3900	0.3000	0.0130	0.0270	0.2600	0.0040	0.0017		0.0090	0.0030	0.0040	
30AC0056	0.3000	0.8700	0.4100	0.9000	0.5000	0.5600	0.0030	0.0003	0.0900	0.0080	0.0020	0.0030	0.0250
30AC0057	0.2900	0.8400	0.4800	0.9700	0.5100	0.5400	0.0040		0.1600	0.0090	0.0020	0.0030	0.0240
30AC0058	0.2900	1.3500	0.2900			0.2800		0.0011		0.0080	0.0020		
30AC0059	0.2800	1.3500	0.2900			0.2800		0.0012		0.0090	0.0020		
30AC0060	0.3100	0.8800	0.4300	0.8700	0.5000	0.5500	0.0040		0.1100	0.0090	0.0010		0.0360
30AC0061	0.3100	0.8800	0.4300	0.8700	0.5000	0.5500	0.0040		0.1100	0.0090	0.0010		0.0360
30AC0062	0.3100	0.8600	0.4400	0.9000	0.5000	0.5600			0.1200	0.0110	0.0020	0.0030	0.0380
30AC0063	0.3000	0.8600	0.4400	0.9300	0.5000	0.5400	0.0040	0.0002	0.0700	0.0060	0.0020	0.0030	0.0280
30AC0064	0.2900	0.8800	0.4900	0.9700	0.5000	0.5800	0.0030		0.1100	0.0120	0.0030	0.0030	0.0340
30AC0065	0.2720	0.7300	0.2910	0.9260	0.8530	0.2950				0.0039	0.0008		
30AC0066	0.2900	1.3600	0.2800			0.2800		0.0013		0.0080	0.0020		
30AC0067	0.3100	0.8600	0.4400	0.9000	0.5000	0.5600	0.0040	0.0003	0.1200	0.0110	0.0020	0.0030	0.0380
30AC0068	0.2900	0.8200	0.4700	0.9400	0.5000	0.5600	0.0030		0.1400	0.0060	0.0010	0.0040	0.0360
30AC0069	0.3100	0.8600	0.4400	0.9000	0.5000	0.5600	0.0040		0.1200	0.0110	0.0020	0.0030	0.0380
30AC0070	0.2900	1.3400	0.2700	0.0070	0.0300	0.2800		0.0012		0.0080	0.0020		
30AC0071	0.2900	1.3600	0.2800	0.0090	0.0360	0.2800		0.0013		0.0080	0.0020		
30AC0072	0.3100	0.8600	0.4400	0.9000	0.5000	0.5600	0.0040		0.1200	0.0110	0.0020	0.0030	0.0380
30AC0073	0.2500	1.3400	0.3000			0.3400		0.0017		0.0070	0.0020		
30AC0074	0.2700	0.7000	0.2500	0.4500	0.5100	0.2500		0.0017		0.0070	0.0070		0.0700
30AC0075	0.2700	0.7200	0.2700	0.4700	0.5000	0.2500		0.0016		0.0080	0.0070		0.0820
30AC0076	0.2700	0.7200	0.2500	0.4600	0.5200	0.2500		0.0017		0.0080	0.0070		0.0690
30AC0077	0.2500	1.3400	0.3000			0.3400		0.0017		0.0070	0.0020		
30AC0078	0.2900	1.3500	0.2900			0.2800		0.0011		0.0080	0.0020		
30AC0079	0.2900	1.3400	0.2700			0.2800		0.0012		0.0080	0.0020		
30AC0080	0.2500	1.3400	0.3000			0.3400		0.0017		0.0070	0.0020		
30AC0081	0.2900	0.8200	0.4700	0.9400	0.5000	0.5600	0.0030		0.1400	0.0060	0.0010	0.0040	0.0360
30AC0082	0.2900	0.8200	0.4700	0.9400	0.5000	0.5600	0.0030		0.1400	0.0060	0.0010	0.0040	0.0360
30AC0083	0.2800	0.8300	0.4500	0.9400	0.5000	0.5500	0.0070		0.1100	0.0050	0.0010	0.0030	0.0320
30AC0084	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
30AC0085	0.2700	0.7600	0.0270	0.4800	0.5200	0.2400		0.0016	0.0010	0.0100	0.0060		0.0410
30AC0086	0.3000	0.5000	0.2500	0.1200	1.0000	0.1900	0.0040		0.1100	0.0050	0.0030	0.0010	0.0080
30AC0087	0.2900	0.4700	0.2300	0.1300	0.9700	0.1800	0.0040		0.1100	0.0070	0.0010	0.0010	0.0080
30AC0088	0.3000	0.8300	0.4500	0.8900	0.4900	0.5300			0.1100	0.0120	0.0020	0.0010	0.0400
30AC0089	0.3000	0.5000	0.2400	0.2600	1.0000	0.1900	0.0040		0.2100	0.0070	0.0040	0.0010	0.0050
30AC0090	0.3000	0.8400	0.4200	0.8800	0.5000	0.5700	0.0040		0.0900	0.0060	0.0030	0.0020	0.0330
30AC0091	0.3000	0.5000	0.2400	0.2600	1.0000	0.1900	0.0040		0.2100	0.0070	0.0040	0.0010	0.0050
30AC0092	0.2900	0.8400	0.4300	0.9100	0.5000	0.5400	0.0030		0.0800	0.0050	0.0020	0.0020	0.0310

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.30 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
30AC0047	0.0250	0.0030	0.0050	0.0070		0.0057	0.0020	0.3000	0.0020	
30AC0048	0.0250	0.0030	0.0050	0.0070		0.0057	0.0020	0.3000	0.0020	
30AC0049	0.0250	0.0030	0.0050	0.0070						
30AC0050	0.0270	0.0020	0.0070	0.0140	0.0030					
30AC0051	0.0270	0.0020	0.0070	0.0140	0.0030					
30AC0052										
30AC0053	0.0040	0.0020	0.0050	0.0070	0.0030					
30AC0054	0.0040	0.0020					0.0020	0.3000	0.0040	
30AC0055										
30AC0056	0.0040	0.0020	0.0050	0.0070	0.0030					
30AC0057	0.0040	0.0020	0.0050	0.0130	0.0020	0.0069			0.0040	
30AC0058										
30AC0059										
30AC0060	0.0040		0.0040			0.0080	0.0020	0.7000	0.0020	0.0120
30AC0061	0.0040		0.0040							0.0120
30AC0062	0.0040	0.0030	0.0050							
30AC0063	0.0290	0.0030	0.0040	0.0070	0.0030					
30AC0064	0.0270	0.0020	0.0070	0.0140	0.0030					
30AC0065										
30AC0066										
30AC0067	0.0040	0.0020	0.0050	0.0120	0.0030					
30AC0068	0.0280	0.0020	0.0050	0.0080	0.0020	0.0062			0.0030	
30AC0069	0.0040	0.0030	0.0050	0.0120	0.0030					
30AC0070										
30AC0071										
30AC0072	0.0040	0.0030	0.0050	0.0120	0.0030					
30AC0073										
30AC0074	0.0340									
30AC0075	0.0260									
30AC0076	0.0350									
30AC0077										
30AC0078										
30AC0079										
30AC0080										
30AC0081	0.0280	0.0020	0.0050	0.0080	0.0020	0.0062	0.0020	0.1000	0.0030	
30AC0082	0.0280	0.0020	0.0050	0.0080	0.0020	0.0062	0.0020	0.1000	0.0030	
30AC0083	0.0250	0.0020	0.0050	0.0060	0.0020	0.0050	0.0020	0.4000	0.0020	
30AC0084										
30AC0085	0.0300									
30AC0086	0.0290	0.0020	0.0050	0.0140	0.0020					
30AC0087	0.0300	0.0020	0.0060	0.0140	0.0020					
30AC0088	0.0020	0.0020	0.0050	0.0110	0.0030					
30AC0089	0.0300	0.0020	0.0070	0.0170	0.0020					
30AC0090	0.0270	0.0020	0.0050	0.0080	0.0030	0.0071	0.0020	0.4000	0.0030	
30AC0091	0.0300	0.0020	0.0070	0.0170	0.0020					
30AC0092	0.0290	0.0020	0.0040	0.0130		0.0054	0.0020	0.6000	0.0010	

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
50AC0001	MIL-A-46100	C						B7979		B7979-1KB
50AC0002	MIL-A-46100	D						B8660		B8660-86DB
50AC0003	MIL-A-46100	D						661914		612
50AC0004	MIL-A-46100	D						B8337		B8337-6AC
50AC0005	MIL-A-46100	C						B7397		B7397-1BC
50AC0006	MIL-A-46100	C						B8327		B8327-2MF
50AC0007	MIL-A-46100	D						B9675		B9675-4EE
50AC0008	MIL-A-46100	D						663455		307
50AC0009	MIL-A-46100	D						663454		68
50AC0010	MIL-A-46100	C	2					R0326		R0326-3AG
50AC0011	MIL-A-46100	C						B9641		B9641-6BD
50AC0012	MIL-A-46100	C						B9195		B9195-39EB
50AC0013	MIL-A-46100	D						B3645		B3645-1FE
50AC0014	MIL-A-46100	D						R0279		R0279-1DC
50AC0015	MIL-A-46100	D						664155		618
50AC0016	MIL-A-46100	D						664154		603
50AC0017	MIL-A-46100	D						664155		594
50AC0018	MIL-A-46100	D						664154		735A
50AC0019	MIL-A-46100	D						664154		743
50AC0020	MIL-A-46100	C	1					3252K		18325
50AC0021	MIL-A-46100	C	1					3252K		17427A
50AC0022	MIL-A-46100	C	1					3252K		17444B
50AC0023	MIL-A-46100	D						435564		98
50AC0024	MIL-A-46100	D						435765		475
50AC0025	MIL-A-46100	D						663810		469
50AC0026	MIL-A-46100	D						B9838		B9838-2AE
50AC0027	MIL-A-46100	D						R0549		R0549-1GB
50AC0028	MIL-A-46100	C	2					R0755		R0755-1GG
50AC0029	MIL-A-46100	C	2					R0755		R0755-2AF
50AC0030	MIL-A-46100	D						B9838		B9838-4BE
50AC0031	MIL-A-46100	C	2					R0755		R0755-39NC
50AC0032	MIL-A-46100	C	2					R1042		R1042-3HG
50AC0033	MIL-A-46100	C						7493J		27878
50AC0034	MIL-A-46100	C	2					R2241		R2241-1KG
50AC0035	MIL-A-46100	D						400296		173
50AC0036	MIL-A-46100	D						R2241		R2241-3AE
50AC0037	MIL-A-46100	C	1					3866K		25836
50AC0038	MIL-A-46100	C						7492J		27855
50AC0039	MIL-A-46100	D						R2324		R2324-4EC
50AC0040	MIL-A-46100	D						R3228		R3228-1EE
50AC0041	MIL-A-46100	D						R3228		R3228-1CC
50AC0042	MIL-A-46100	D						R1450		R1450-7CC
50AC0043	MIL-A-46100	C	2					R3662		R3662-2AF
50AC0044	MIL-A-46100	D						829564		4108
50AC0045	MIL-A-46100	C	2					R2324		R2324-39AC
50AC0046	MIL-A-46100	D						401085		125A

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
50AC0047	MIL-A-46100	D						400296		136D
50AC0048	MIL-A-46100	D						R3935		R3935-4ED
50AC0049	MIL-A-46100	D						401085		836
50AC0050	MIL-A-46100	D						R3711		R3711-2EI
50AC0051	MIL-A-46100	D						580031		3744693
50AC0052	MIL-A-46100	D						580031		3744648
50AC0053	MIL-A-46100	D						R3935		R3935-4ED1
50AC0054	MIL-A-46100	D						R3935		R3935-4ED2
50AC0055	MIL-A-46100	D						R3935		R3935-39AD
50AC0056	MIL-A-46100	D						R3711		R3711-2BG1
50AC0057	MIL-A-46100	D						R3711		R3711-2BG2
50AC0058	MIL-A-46100	D						580031		9579329
50AC0059	MIL-A-46100	D						580031		9579336
50AC0060	MIL-A-46100	D						R4421		R4421-39CE
50AC0061	MIL-A-46100	D						9266J		55072A
50AC0062	MIL-A-46100	C						R4845		R4845-3EH
50AC0063	MIL-A-46100	C						4859K		40511
50AC0064	MIL-A-46100	D						R3935		R3935-3CI

CSTA - ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
50AC0001	0.402	486	6.64	23.0	24.3		1660
50AC0002	0.384	512	8.91	23.3	23.3		1660
50AC0003	0.383	495	4.20	20.0	15.0	495	1650
50AC0004	0.320	512	10.27	16.3	18.7	512	1660
50AC0005	0.388	512	6.65	20.3	21.0		1660
50AC0006	0.405	477	6.69	20.7	23.3		1660
50AC0007	0.391	512	5.63	23.3	22.3		1660
50AC0008	0.324	477	4.27	12.0	10.0	477	1650
50AC0009	0.357	477	2.15	9.0	8.3	477	1650
50AC0010	0.267	477	6.04	25.7	25.3		1660
50AC0011	0.320	494	2.91	9.0	8.3		1660
50AC0012	0.384	521	7.24	15.3	19.3		1660
50AC0013	0.385	512	7.22	8.0	9.0		1660
50AC0014	0.502	504	6.85	15.7	16.3		1660
50AC0015	0.312	495	4.08	22.0	18.0	495	1650
50AC0016	0.355	514	4.28	15.0	19.0	514	1650
50AC0017	0.332	495	4.08	12.0	10.0	495	1650
50AC0018	0.314	495	4.28	11.6	12.0	495	1650
50AC0019	0.318	514	4.28	10.0	9.0	514	1650
50AC0020	0.491	495	5.09	27.3	18.7	495	1562
50AC0021	0.364	514	5.16	15.7	14.0	514	1560
50AC0022	0.346	514	5.17	16.0	11.7	514	1562
50AC0023	0.368	477	4.05	10.0	17.0	477	1650
50AC0024	0.318	495	4.27	9.0	10.0	495	1650
50AC0025	0.304	514	4.05	9.0	7.5	514	1650
50AC0026	0.380	504	6.52	14.0	15.0		1660
50AC0027	0.317	477	6.46	14.3	24.3		1660
50AC0028	0.591	504	7.06	19.0	19.3		1660
50AC0029	0.398	514	7.09	11.7	12.7		1660
50AC0030	0.504	502	6.52	12.3	17.3		1660
50AC0031	0.395	520	7.19	19.3	18.7		1660
50AC0032	0.382	500	7.55	14.7	17.3		1660
50AC0033	0.312	534	5.67	24.0	11.3		1562
50AC0034	0.383	506	5.67	14.7	16.3		1660
50AC0035	0.324	514	4.14	13.0	15.0	514	1650
50AC0036	0.467	487	5.97	15.3	18.3		1660
50AC0037	0.370	504	5.16	22.0	13.7		1562
50AC0038	0.328	520	5.33	22.3	11.0		1562
50AC0039	0.324	512	6.54	10.7	15.0		1660
50AC0040	0.390	492	5.23	23.0	29.3		1660
50AC0041	0.393	490	5.23	20.0	24.3		1660
50AC0042	0.332	510	10.19	16.7	22.0		1660
50AC0043	0.402	512	6.61	14.0	14.0		1660
50AC0044	0.319	477	4.16	12.0	10.0	477	1650
50AC0045	0.356	520	6.51	10.7	12.7		1660
50AC0046	0.314	477	4.16	22.0	15.0	477	1650

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
50AC0047	0.379	477	4.14	16.0	15.0	477	1650
50AC0048	0.313	477	5.60	25.0	27.3		1660
50AC0049	0.322	477	4.16	15.0	14.0	477	1650
50AC0050	0.394	497	6.21	25.7	30.3		1660
50AC0051	0.379	504	7.69	18.0	20.0		1688
50AC0052	0.486	481	7.69	32.0	30.0		1688
50AC0053	0.311	477	5.60	25.0	27.3		1660
50AC0054	0.312	477	5.60	25.0	27.3		1660
50AC0055	0.511	512	5.60	28.7	28.3		1660
50AC0056	0.386	507	6.21	25.7	30.3		1660
50AC0057	0.388	507	6.21	25.7	30.3		1660
50AC0058	0.367	498	7.69	18.0	20.0		1688
50AC0059	0.482	513	7.69	43.0	40.0		1688
50AC0060	0.500	512	5.52	25.3	25.3		1660
50AC0061	0.303	500	5.29	28.7	18.7		1573
50AC0062	0.324	477	2.97	8.7	11.0		1660
50AC0063	0.492	499	4.67	28.0	18.3		1565
50AC0064	0.381	477	5.60	18.7	22.7		1660

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
50AC0001	A	P	90001613	10/29/90		SIX	CAL50APM2	30	0.402	2157	2185	P	28
50AC0002	A	P	90001617	10/30/90		SIX	CAL50APM2	30	0.384	2101	2199	P	98
50AC0003	A	P	90001644	11/02/90		SIX	CAL50APM2	30	0.383	2098	2172	P	74
50AC0004	A	P	90001693	11/26/90		SIX	CAL50APM2	30	0.320	1890	1964	P	74
50AC0005	A	P	90001829	01/08/91		SIX	CAL50APM2	30	0.388	2114	2233	P	119
50AC0006	A	P	90001830	12/11/90		SIX	CAL50APM2	30	0.405	2166	2342	P	176
50AC0007	A	P	91000033	01/12/91		SIX	CAL50APM2	30	0.391	2123	2234	P	111
50AC0008	A	P	91000036	01/12/91		SIX	CAL50APM2	30	0.324	1904	1955	P	51
50AC0009	A	P	91000082	01/23/91		SIX	CAL50APM2	30	0.357	2015	2151	P	136
50AC0010	A	P	91000183	02/06/91		SIX	CAL50APM2	30	0.267	1398	1734	P	336
50AC0011	A	P	91000187	02/06/91		SIX	CAL50APM2	30	0.320	1890	2108	P	218
50AC0012	A	P	91000405	02/26/91		SIX	CAL50APM2	30	0.384	2101	2195	P	94
50AC0013	A	P	91000407	02/26/91		SIX	CAL50APM2	30	0.385	2104	2295	P	191
50AC0014	A	P	91000408	02/26/91		SIX	CAL50APM2	30	0.502	2446	2553	P	107
50AC0015	A	P	91000430	02/26/91		SIX	CAL50APM2	30	0.312	1862	1981	P	119
50AC0016	A	P	91000448	03/07/91		SIX	CAL50APM2	30	0.355	2008	2175	P	167
50AC0017	A	P	91000449	03/07/91		SIX	CAL50APM2	30	0.332	1932	2034	P	102
50AC0018	A	P	91000605	03/19/91		SIX	CAL50APM2	30	0.314	1869	1966	P	97
50AC0019	A	P	91000606	03/19/91		SIX	CAL50APM2	30	0.318	1883	1980	P	97
50AC0020	A	P	91000694	04/17/91		SIX	CAL50APM2	30	0.491	2416	2541	P	125
50AC0021	A	P	91000695	04/17/91		SIX	CAL50APM2	30	0.364	2038	2180	P	142
50AC0022	A	P	91000696	04/17/91		SIX	CAL50APM2	30	0.346	1978	2138	P	160
50AC0023	A	P	91000703	04/24/91		SIX	CAL50APM2	30	0.368	2051	2151	P	100
50AC0024	A	P	91000704	04/25/91		SIX	CAL50APM2	30	0.318	1883	1990	P	107
50AC0025	A	P	91000705	04/24/91		SIX	CAL50APM2	30	0.304	1833	1885	P	52
50AC0026	A	P	91000738	05/02/91		SIX	CAL50APM2	30	0.380	2089	2138	P	49
50AC0027	A	P	91000739	06/11/91		SIX	CAL50APM2	30	0.317	1880	1988	P	108
50AC0028	A	P	91000743	05/02/91		SIX	CAL50APM2	30	0.591	2678	2984	P	306
50AC0029	A	P	91000883	06/07/91		SIX	CAL50APM2	30	0.398	2145	2388	P	243
50AC0030	A	P	91000888	05/27/91		SIX	CAL50APM2	30	0.504	2451	2488	P	37
50AC0031	A	P	91001066	06/07/91		SIX	CAL50APM2	30	0.395	2136	2220	P	84
50AC0032	A	P	91001129	06/15/91		SIX	CAL50APM2	30	0.382	2095	2185	P	90
50AC0033	A	P	91001150	06/20/91		SIX	CAL50APM2	30	0.312	1862	1988	P	126
50AC0034	A	P	91001184	07/08/91		SIX	CAL50APM2	30	0.383	2098	2131	P	33
50AC0035	A	P	91001186	06/28/91		SIX	CAL50APM2	30	0.324	1904	2141	P	237
50AC0036	A	P	91001231	07/18/91		SIX	CAL50APM2	30	0.467	2349	2416	P	67
50AC0037	A	P	91001259	07/18/91		SIX	CAL50APM2	30	0.370	2057	2160	P	103
50AC0038	A	P	91001289	07/24/91		SIX	CAL50APM2	30	0.328	1918	2025	P	107
50AC0039	A	P	91001381	08/27/91		SIX	CAL50APM2	30	0.324	1904	1967	P	63
50AC0040	A	P	91001431	08/28/91		SIX	CAL50APM2	30	0.390	2120	2318	P	198
50AC0041	A	P	91001433	10/31/91		SIX	CAL50APM2	30	0.393	2130	2163	P	33
50AC0042	A	P	91001472	09/09/91		SIX	CAL50APM2	30	0.332	1932	1956	P	24
50AC0043	A	P	91001539	09/19/91		SIX	CAL50APM2	30	0.402	2157	2279	P	122
50AC0044	A	P	91001595	09/30/91		SIX	CAL50APM2	30	0.319	1887	2015	P	128
50AC0045	A	P	91001616	09/30/91		SIX	CAL50APM2	30	0.356	2011	2087	P	76
50AC0046	A	P	91001620	10/01/91		SIX	CAL50APM2	30	0.314	1869	1765	F	-104

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
50AC0047	A	P	91001626	10/01/91		SIX	CAL50APM2	30	0.379	2086	2190	P	104
50AC0048	A	P	91001747	11/04/91		SIX	CAL50APM2	30	0.313	1866	1821	F	-45
50AC0049	A	P	91001752	11/04/91		SIX	CAL50APM2	30	0.322	1897	1845	F	-52
50AC0050	A	P	91001817	11/15/91		SIX	CAL50APM2	30	0.394	2133	2129	F	-4
50AC0051	A	P	91001840	11/07/91		SIX	CAL50APM2	30	0.379	2086	2036	F	-50
50AC0052	A	P	91001841	11/07/91		SIX	CAL50APM2	30	0.486	2402	2362	F	-40
50AC0053	A	R	91001862	11/15/91	91001747	SIX	CAL50APM2	30	0.311	1859	1865	P	6
50AC0054	A	R	91001863	11/15/91	91001747	SIX	CAL50APM2	30	0.312	1862	1878	P	16
50AC0055	A	P	91001924	12/06/91		SIX	CAL50APM2	30	0.511	2470	2591	P	121
50AC0056	A	R	91001933	12/09/91	91001817	SIX	CAL50APM2	30	0.386	2107	2213	P	106
50AC0057	A	R	91001934	12/09/91	91001817	SIX	CAL50APM2	30	0.388	2114	2155	P	41
50AC0058	A	R	91001942	12/12/91		SIX	CAL50APM2	30	0.367	2047	2148	P	101
50AC0059	A	R	91001943	12/12/91		SIX	CAL50APM2	30	0.482	2391	2466	P	75
50AC0060	A	P	91001951	12/12/91		SIX	CAL50APM2	30	0.500	2440	2564	P	124
50AC0061	A	P	91001975	12/12/91		SIX	CAL50APM2	30	0.303	1828	1844	P	16
50AC0062	A	P	92000043	01/16/92		SIX	CAL50APM2	30	0.324	1904	1922	P	18
50AC0063	A	P	92000071	01/17/92		SIX	CAL50APM2	30	0.492	2419	2513	P	94
50AC0064	A	P	92000220	02/24/92		SIX	CAL50APM2	30	0.381	2092	2139	P	47

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
50AC0001	0.2900	0.8800	0.4400	0.9900	0.5400	0.5400	0.0030		0.1700	0.0070	0.0010		0.0260
50AC0002	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400	0.0030	0.0003	0.1200	0.0080	0.0030	0.0040	0.3700
50AC0003	0.2800	1.4100	0.3100			0.2800		0.0011		0.0080	0.0020		
50AC0004	0.2900	0.8600	0.4300	0.9400	0.5000	0.5600	0.0030	0.0004	0.0900	0.0050	0.0010	0.0040	0.0270
50AC0005	0.2900	0.8700	0.4900	0.9700	0.5200	0.5500	0.0040		0.1600	0.0070	0.0010		0.0230
50AC0006	0.2900	0.9200	0.4500	0.9000	0.5100	0.5700	0.0030		0.1400	0.0070	0.0010		0.0290
50AC0007	0.2700	0.8200	0.4700	0.9300	0.5000	0.5600	0.0040		0.1000	0.0050	0.0030	0.0030	0.0390
50AC0008	0.2800	1.4100	0.3000			0.2700		0.0015		0.0070	0.0030		
50AC0009	0.2900	1.3900	0.3000			0.3000		0.0016		0.0100	0.0040		
50AC0010	0.2800	0.9100	0.4300	0.9200	0.5100	0.5300	0.0050		0.1100	0.0060	0.0030		0.0210
50AC0011	0.3200	0.4900	0.2400	0.1500	0.9600	0.2000	0.0050		0.1300	0.0070	0.0030		0.0100
50AC0012	0.3000	0.9100	0.4300	0.9800	0.5600	0.5600	0.0030		0.1500	0.0070	0.0020		0.0230
50AC0013	0.3200	0.8900	0.4300	1.0000	0.5500	0.5400			0.1000	0.0120	0.0020	0.0030	0.0300
50AC0014	0.2900	0.8600	0.4500	1.1000	0.5500	0.5700			0.1000	0.0080	0.0020	0.0040	0.0350
50AC0015	0.2700	1.3900	0.3000			0.2600		0.0017		0.0090	0.0030		
50AC0016	0.2900	1.3800	0.3000			0.2800		0.0015		0.0090	0.0020		
50AC0017	0.2700	1.3900	0.3000			0.2600		0.0017		0.0090	0.0030		
50AC0018	0.2900	1.3800	0.3000			0.2800		0.0015		0.0090	0.0020		
50AC0019	0.2900	1.3800	0.3000			0.2800		0.0015		0.0090	0.0020		
50AC0020	0.2800	0.7300	0.3000	0.4600	0.5000	0.2500	0.0050	0.0019	0.0020	0.0100	0.0090		0.0440
50AC0021	0.2800	0.7300	0.3000	0.4600	0.5000	0.2500	0.0050	0.0019	0.0020	0.0100	0.0090		0.0490
50AC0022	0.2800	0.7300	0.3000	0.4600	0.5000	0.2500		0.0019	0.0020	0.0100	0.0090		0.0490
50AC0023	0.2800	1.3700	0.2700			0.2700		0.0010		0.0120	0.0030		
50AC0024	0.2900	1.3900	0.3100			0.2700		0.0012		0.0070	0.0020		
50AC0025	0.2800	1.3700	0.2600			0.2600		0.0011		0.0080	0.0030		
50AC0026	0.2900	0.9000	0.4500	0.9400	0.5000	0.5600			0.1600	0.0100	0.0060	0.0030	0.0160
50AC0027	0.2900	0.8500	0.4900	0.9700	0.5000	0.5800			0.1100	0.0120	0.0030	0.0030	0.0340
50AC0028	0.3000	0.9100	0.4300	1.0500	0.5500	0.5500	0.003		0.1000	0.0090	0.0010		0.0400
50AC0029	0.3000	0.9100	0.4300	1.0500	0.5500	0.5500	0.0030		0.1000	0.0090	0.0010		0.0400
50AC0030	0.2900	0.9000	0.4500	0.9400	0.5000	0.5600			0.1600	0.0100	0.0060	0.0030	0.0160
50AC0031	0.3000	0.9000	0.4400	1.0600	0.5600	0.5500	0.0030		0.1100	0.0080	0.0010		0.0410
50AC0032	0.3100	0.9000	0.4500	1.0400	0.5600	0.5600	0.0040		0.1200	0.0090	0.0030		0.0330
50AC0033	0.3100	0.8100	0.3100	0.4700	0.5000	0.2500		0.0010		0.0140	0.0110		0.0450
50AC0034	0.2600	0.8900	0.4200	0.9400	0.5000	0.5500	0.0030		0.1600	0.0090	0.0010		0.0270
50AC0035	0.2900	1.3500	0.2900			0.2800		0.0011		0.0080	0.0020		
50AC0036	0.2800	0.8600	0.4100	0.9500	0.5100	0.5500			0.1600	0.0100	0.0010	0.0030	0.0290
50AC0037	0.2700	0.7800	0.2400	0.4800	0.5100	0.2400		0.0015		0.0110	0.0110		0.0410
50AC0038	0.2800	0.7600	0.3200	0.4600	0.5000	0.2500		0.0008		0.0110	0.0110		0.0570
50AC0039	0.3100	0.8600	0.4400	0.9000	0.5000	0.5600			0.1200	0.0110	0.0020	0.0030	0.0380
50AC0040	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
50AC0041	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
50AC0042	0.3000	0.8700	0.4100	0.9000	0.5000	0.5600	0.0030	0.0003	0.0900	0.0080	0.0020	0.0030	0.0250
50AC0043	0.3000	0.9000	0.4400	0.9200	0.5100	0.5500	0.0030		0.1300	0.0090	0.0020		0.0400
50AC0044	0.2900	1.3600	0.2800			0.2800		0.0013		0.0080	0.0020		
50AC0045	0.3100	0.8800	0.4300	0.8700	0.5000	0.5500	0.0040		0.1100	0.0090	0.0010		0.0360
50AC0046	0.2500	1.3400	0.3000			0.3400		0.0017		0.0070	0.0020		

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
50AC0001	0.0040		0.0050			0.0056	0.0020	0.9000	0.0020	0.0100
50AC0002	0.0290	0.0020	0.0050	0.0090	0.0030	0.0087	0.0020	0.4000	0.0020	
50AC0003										
50AC0004	0.0030	0.0020	0.0050	0.0080	0.0040					
50AC0005	0.0040		0.0050			0.0067	0.0020	1.5000	0.0040	0.0130
50AC0006	0.0040		0.0050			0.0067	0.0020	0.2000	0.0020	0.0110
50AC0007	0.0290	0.002							0.0040	
50AC0008										
50AC0009										
50AC0010	0.0240		0.0050			0.0074	0.0020	0.9000	0.0010	0.0100
50AC0011	0.0290									
50AC0012	0.0050					0.0067	0.0020	0.6000	0.0020	0.0110
50AC0013	0.0050	0.0020	0.0040	0.0090	0.0020					
50AC0014	0.003	0.0020	0.0060	0.0080	0.0030					
50AC0015										
50AC0016										
50AC0017										
50AC0018										
50AC0019										
50AC0020	0.0420									
50AC0021	0.0420									
50AC0022	0.0420									
50AC0023										
50AC0024										
50AC0025										
50AC0026	0.0030	0.0030	0.0070	0.0140						
50AC0027	0.0270	0.0020	0.0070	0.0140	0.0030					
50AC0028	0.0030		0.0040			0.0068	0.0020	0.9000	0.0030	0.0090
50AC0029	0.0030		0.0040			0.0068	0.0020	0.9000	0.0030	0.0090
50AC0030	0.0030	0.0030	0.0070	0.0140						
50AC0031	0.0030		0.0040							
50AC0032	0.0040		0.0050							
50AC0033	0.0390									
50AC0034	0.0040		0.0050			0.0064	0.0020	0.4000	0.0020	0.0110
50AC0035										
50AC0036	0.0030	0.0020	0.0060							
50AC0037	0.0200									
50AC0038	0.0030									
50AC0039	0.0040	0.0030	0.0050	0.0120	0.0030					
50AC0040	0.0040	0.0020	0.0050	0.0080	0.0030					
50AC0041	0.0040	0.0020	0.0050	0.0080	0.0030					
50AC0042	0.0040	0.0020	0.0050							
50AC0043	0.0040		0.0050			0.0073	0.0030	0.4000	0.0030	0.0100
50AC0044										
50AC0045	0.0040		0.0040			0.0080	0.0020	0.7000	0.0020	0.0120
50AC0046										

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
50AC0047	0.2900	1.3500	0.2900			0.2800		0.0011		0.0080	0.0020		
50AC0048	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
50AC0049	0.2500	1.3400	0.3000			0.3400		0.0017		0.0070	0.0020		
50AC0050	0.3000	0.8300	0.4500	0.9700	0.5000	0.5400	0.0060		0.1100	0.0060	0.0020	0.0030	0.0340
50AC0051	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
50AC0052	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
50AC0053	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
50AC0054	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
50AC0055	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
50AC0056	0.3000	0.8300	0.4500	0.9700	0.5000	0.5400	0.0060		0.1100	0.0060	0.0020	0.0030	0.0340
50AC0057	0.3000	0.8300	0.4500	0.9700	0.5000	0.5400	0.0060		0.1100	0.0060	0.0020	0.0030	0.0340
50AC0058	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
50AC0059	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
50AC0060	0.2800	0.8100	0.4300	0.9000	0.5000	0.5400	0.0030		0.1200	0.0060	0.0020	0.0030	0.0230
50AC0061	0.2800	0.7600	0.2700	0.4900	0.5300	0.2400		0.0007	0.0010	0.0090	0.0070		0.0410
50AC0062	0.3000	0.5000	0.2400	0.2600	1.0000	0.1900	0.0040		0.2100	0.0070	0.0040	0.0010	0.0050
50AC0063	0.2500	0.7300	0.2500	0.4300	0.4900	0.2400		0.0015	0.0010	0.0070	0.0070		0.0650
50AC0064	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: CAL 0.50 AP M2
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
50AC0047										
50AC0048	0.0030	0.0020	0.0060	0.0100	0.0020					
50AC0049										
50AC0050	0.0260	0.0020	0.0060	0.0100	0.0020	0.0054	0.0010	0.3000	0.0030	
50AC0051										
50AC0052										
50AC0053	0.0030	0.0020	0.0060	0.0100	0.0020					
50AC0054	0.0030	0.0020	0.0060	0.0100	0.0020					
50AC0055	0.0030	0.0020	0.0060	0.0100	0.0020					
50AC0056	0.0260	0.0020	0.0060	0.0100	0.0020	0.0054	0.0010	0.3000	0.0030	
50AC0057	0.0260	0.0020	0.0060	0.0100	0.0020	0.0054	0.0010	0.3000	0.0030	
50AC0058										
50AC0059										
50AC0060	0.0030	0.0020	0.0060	0.0070	0.0020					
50AC0061	0.0290									
50AC0062	0.0300	0.0020	0.0070	0.0170	0.0020					
50AC0063	0.0320									
50AC0064	0.0030	0.0020	0.0060	0.0100	0.0020	0.0053	0.0020	0.3000	0.0030	

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API B32
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
14AM0001	MIL-A-46100	D						321163		321163-2
14AM0002	MIL-A-46100	D						663447		428
14AM0003	MIL-A-46100	C						B9195		B9195-39BE
14AM0004	MIL-A-46100	D						R0402		R0402-2DC
14AM0005	MIL-A-46100	D						435834		456
14AM0006	MIL-A-46100	D						663911		249
14AM0007	MIL-A-46100	C						3252K		17421
14AM0008	MIL-A-46100	D						B9838		B9838-4EC
14AM0009	MIL-A-46100	D						500841		117-1
14AM0010	MIL-A-46100	D						500841		120
14AM0011	MIL-A-46100	C						R1042		R1042-3CF
14AM0012	MIL-A-46100	D						B9838		B9838-39AC
14AM0013	MIL-A-46100	D						400221		904
14AM0014	MIL-A-46100	C						5179J		27808
14AM0015	MIL-A-46100	C						9253L		27810A
14AM0016	MIL-A-46100	C						7493J		27783
14AM0017	MIL-A-46100	C						3866K		25855
14AM0018	MIL-A-46100	C						3252K		27809
14AM0019	MIL-A-46100	D						B4518		B4518-39FC
14AM0020	MIL-A-46100	D						R2241		R2241-4CC
14AM0021	MIL-A-46100	D						600523		259
14AM0022	MIL-A-46100	D						R3228		R3228-39AC
14AM0023	MIL-A-46100	D						4859K		40522
14AM0024	MIL-A-46100	D						4860K		40521
14AM0025	MIL-A-46100	D						401580		977
14AM0026	MIL-A-46100	D						580031		3726082
14AM0027	MIL-A-46100	D						R3228		R3228-39AC1
14AM0028	MIL-A-46100	D						R3228		R3228-39AC2
14AM0029	MIL-A-46100	D						R3935		R3935-39CC
14AM0030	MIL-A-46100	D						R4241		R4241-1AI
14AM0031	MIL-A-46100	D						9266J		54901A
14AM0032	MIL-A-46100	D						R3228		R3228-39AC
14AM0033	MIL-A-46100	D						R3935		R3935-39CC1
14AM0034	MIL-A-46100	D						R3935		R3935-39CC2
14AM0035	MIL-A-46100	D						R3711		R3711
14AM0036	MIL-A-46100	D						503231		441

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API B32
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
14AM0001	0.752	514	7.84	23.3	18.0	477	1620
14AM0002	0.738	495	6.14	19.0	12.0	495	1650
14AM0003	0.586	486	6.86	21.3	26.0		1660
14AM0004	0.760	477	7.14	14.0	14.7		1660
14AM0005	0.747	495	5.95	20.0	15.0	495	1650
14AM0006	0.754	506	6.11	21.0	15.0	477	1650
14AM0007	0.742	504	5.16	23.3	18.3	514	1562
14AM0008	0.755	501	6.16	12.0	13.3		1660
14AM0009	0.728	495	7.99	16.0	11.0	495	1650
14AM0010	0.730	514	8.08	14.0	11.0	514	1650
14AM0011	0.572	507	7.10	21.7	28.3		1660
14AM0012	0.756	477	6.16	12.0	13.3		1660
14AM0013	0.758		6.22				1650
14AM0014	0.626	514	5.64	26.0	18.0		1562
14AM0015	0.625	514	5.16	27.7	15.3		1562
14AM0016	0.760	514	5.55	16.3	10.7		1569
14AM0017	0.743	489	5.45	24.3	16.7		1562
14AM0018	0.640	514	5.19	25.7	19.0		1562
14AM0019	0.634	494	5.88	16.0	17.3		1660
14AM0020	0.763	498	5.67	30.0	30.7		1660
14AM0021	0.740	495	5.88	21.0	13.0	495	1650
14AM0022	0.638	477	9.57	27.7	29.3		1660
14AM0023	0.766	486	4.85	28.7	21.0		1562
14AM0024	0.761	486	5.01	22.7	18.3		1562
14AM0025	0.746	514	5.99	20.0	14.0	514	1650
14AM0026	0.743	500	7.98	30.0	31.0		1688
14AM0027	0.631	477	5.23	27.7	29.3		1660
14AM0028	0.629	477	5.19	27.7	29.3		1660
14AM0029	0.754	512	5.36	28.0	29.0		1660
14AM0030	0.751	504	6.73	18.7	18.0		1635
14AM0031	0.745	498	5.40	25.7	19.7		1573
14AM0032	0.626	512	5.23	20.3	22.7		1660
14AM0033	0.753	512	5.58	28.0	29.0		1660
14AM0034	0.754	512	5.36	28.0	29.0		1660
14AM0035	0.755	514	5.92	31.7	25.7	514	1600
14AM0036	0.752	477	5.77	18.0	18.0	477	1650

CSTA - ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API B32
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
14AM0001	A	P	90001635	10/31/90		SIX	145MMAPIB32	30	0.752	2683	2826	P	143
14AM0002	A	P	90001764	12/03/90		SIX	145MMAPIB32	30	0.738	2655	2780	P	125
14AM0003	A	P	91000072	01/31/91		SIX	145MMAPIB32	30	0.586	2344	2392	P	48
14AM0004	A	P	91000303	03/04/91		SIX	145MMAPIB32	30	0.760	2698	2835	P	137
14AM0005	A	P	91000450	03/04/91		SIX	145MMAPIB32	30	0.747	2673	2815	P	142
14AM0006	A	P	91000493	03/11/91		SIX	145MMAPIB32	30	0.754	2686	2911	P	225
14AM0007	A	P	91000693	04/18/91		SIX	145MMAPIB32	30	0.742	2663	2922	P	259
14AM0008	A	P	91000801	06/11/91		SIX	145MMAPIB32	30	0.755	2688	2830	P	142
14AM0009	FA		91000861	06/04/91		SIX	145MMAPIB32	30	0.728	2636	2800	P	164
14AM0010	FA		91000862	06/04/91		SIX	145MMAPIB32	30	0.730	2640	2845	P	205
14AM0011	A	P	91000894	06/11/91		SIX	145MMAPIB32	30	0.572	2292	2490	P	198
14AM0012	A	P	91000987	06/11/91		SIX	145MMAPIB32	30	0.756	2690	2883	P	193
14AM0013	A	P	91001026	06/04/91		SIX	145MMAPIB32	30	0.758	2694	2881	P	187
14AM0014	A	P	91001090	06/07/91		SIX	145MMAPIB32	30	0.626	2430	2625	P	195
14AM0015	A	P	91001091	06/07/91		SIX	145MMAPIB32	30	0.625	2428	2581	P	153
14AM0016	A	P	91001147	07/08/91		SIX	145MMAPIB32	30	0.760	2698	2924	P	226
14AM0017	A	P	91001260	07/19/91		SIX	145MMAPIB32	30	0.743	2665	2827	P	162
14AM0018	A	P	91001290	07/29/91		SIX	145MMAPIB32	30	0.640	2459	2609	P	150
14AM0019	A	P	91001398	08/26/91		SIX	145MMAPIB32	30	0.634	2447	2486	P	39
14AM0020	A	P	91001432	09/11/91		SIX	145MMAPIB32	30	0.763	2703	2790	P	87
14AM0021	A	P	91001466	09/05/91		SIX	145MMAPIB32	30	0.740	2659	2709	P	50
14AM0022	A	P	91001471	09/11/91		SIX	145MMAPIB32	30	0.638	2455	2452	F	-3
14AM0023	A	P	91001586	09/30/91		SIX	145MMAPIB32	30	0.766	2709	2948	P	239
14AM0024	A	P	91001590	09/30/91		SIX	145MMAPIB32	30	0.761	2700	2902	P	202
14AM0025	A	P	91001687	10/09/91		SIX	145MMAPIB32	30	0.746	2671	2767	P	96
14AM0026	A	P	91001842	11/07/91		SIX	145MMAPIB32	30	0.743	2665	2798	P	133
14AM0027	A	R	91001860	11/18/91	91001471	SIX	145MMAPIB32	30	0.631	2440	2439	F	-1
14AM0028	A	R	91001861	11/18/91	91001471	SIX	145MMAPIB32	30	0.629	2436	2438	P	2
14AM0029	A	P	91001923	12/06/91		SIX	145MMAPIB32	30	0.754	2686	2681	F	-5
14AM0030	A	P	91001952	12/12/91		SIX	145MMAPIB32	30	0.751	2681	2720	P	39
14AM0031	A	P	91001974	12/12/91		SIX	145MMAPIB32	30	0.745	2669	2852	P	183
14AM0032	A	P	91001997	12/18/91		SIX	145MMAPIB32	30	0.626	2430	2489	P	59
14AM0033	A	R	92000013	01/09/92	91001923	SIX	145MMAPIB32	30	0.753	2684	2820	P	136
14AM0034	A	R	92000014	01/09/92	91001923	SIX	145MMAPIB32	30	0.754	2686	2719	P	33
14AM0035	A	P	92000247	02/26/92		SIX	145MMAPIB32	30	0.755	2688	2745	P	57
14AM0036	A	P	92000329	03/14/92		SIX	145MMAPIB32	30	0.752	2683	2788	P	105

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API B32
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
14AM0001	0.2900	1.0000	0.4300	0.5000	0.6400	0.2600		0.0020		0.0080	0.0020		0.0360
14AM0002	0.3000	1.5300	0.2300			0.5400		0.0007		0.0090	0.0040		
14AM0003	0.3000	0.9100	0.4300	0.9800	0.5600	0.5600	0.0030		0.1500	0.0070	0.0020		0.0230
14AM0004	0.3100	0.9300	0.4500	0.9500	0.5200	0.5900			0.1800	0.0100	0.0010	0.0030	0.0290
14AM0005	0.2800	1.4700	0.3000			0.5800		0.0011		0.0110	0.0020		
14AM0006	0.2800	1.5400	0.3100			0.5100		0.0015		0.0100	0.0020		
14AM0007	0.2800	0.7300	0.3000	0.4600	0.5000	0.2500	0.0050	0.0019	0.0020	0.0100	0.0090		0.0490
14AM0008	0.2900	0.9000	0.4500	0.9400	0.5000	0.5600			0.1600	0.0100	0.0060	0.0030	0.0160
14AM0009	0.3000	0.9600	0.3800	0.6200	0.6000	0.3100		0.0013		0.0090	0.0020		
14AM0010	0.3000	0.9600	0.3800	0.6200	0.6000	0.3100		0.0013		0.0090	0.0020		
14AM0011	0.3100	0.8900	0.4400	1.0300	0.5600	0.5600	0.0030		0.1300	0.0080	0.0020		0.0320
14AM0012	0.2900	0.9000	0.4500	0.9400	0.5000	0.5600			0.1600	0.0100	0.0060	0.0030	0.0160
14AM0013	0.2800	1.4800	0.3300	0.0050	0.0260	0.5500	0.0040	0.0014		0.0090	0.0020	0.0020	
14AM0014	0.2700	0.7600	0.3500	0.4800	0.5300	0.2700		0.0009		0.0030	0.0100		0.0400
14AM0015	0.2800	0.7900	0.3100	0.4700	0.4800	0.2300		0.0012		0.0100	0.0090		0.0350
14AM0016	0.2800	0.8100	0.3300	0.4600	0.5000	0.2500		0.0010		0.0150	0.0110		0.0420
14AM0017	0.2700	0.7800	0.2400	0.4800	0.5400	0.2400		0.0015		0.0110	0.0110		0.0410
14AM0018	0.2700	0.7200	0.2800	0.4600	0.4900	0.2500		0.0021		0.0100	0.0080		0.0410
14AM0019	0.3000	0.8400	0.4100	0.9000	0.5100	0.5500	0.0030		0.1200	0.0120	0.0030	0.0040	0.0340
14AM0020	0.2800	0.8600	0.4100	0.9500	0.5100	0.5500	0.0030		0.1600	0.0100	0.0010	0.0030	0.0290
14AM0021	0.2800	1.4700	0.3400			0.5500		0.0019		0.0100	0.0070		
14AM0022	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050	0.0006	0.1200	0.0090	0.0020	0.0040	0.0260
14AM0023	0.2700	0.7000	0.2500	0.4500	0.5100	0.2500		0.0017		0.0070	0.0070		0.0700
14AM0024	0.2700	0.7200	0.2500	0.4600	0.5200	0.2500		0.0017		0.0080	0.0070		0.0690
14AM0025	0.2700	1.4700	0.3300			0.5500		0.0013		0.0100	0.0030		
14AM0026	0.2800	0.8900	0.2700	0.9400	0.5300	0.3500	0.0300	0.0020		0.0060	0.0020		
14AM0027	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
14AM0028	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.005		0.1200	0.0090	0.0020	0.0040	0.0260
14AM0029	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14AM0030	0.3000	0.8800	0.4200	1.0000	0.5500	0.5400			0.1000	0.0060	0.0020	0.0020	0.0380
14AM0031	0.2800	0.7600	0.2800	0.4900	0.5300	0.2300		0.0014	0.0010	0.0080	0.0070		0.0400
14AM0032	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
14AM0033	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14AM0034	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14AM0035	0.3000	0.8300	0.4500	0.9700	0.5000	0.5400	0.0004		0.1100	0.0060	0.0020		0.0340
14AM0036	0.2600	1.4800	0.3200	0.0140	0.0050	0.5400		0.0013		0.0120	0.0030		

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API B32
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
14AM0001	0.0360									
14AM0002										
14AM0003	0.0050		0.0040						0.0020	0.0110
14AM0004	0.0030	0.0030	0.0060	0.0140	0.0030					
14AM0005										
14AM0006										
14AM0007	0.0420									
14AM0008	0.0030	0.0030	0.0070	0.0140						
14AM0009										
14AM0010										
14AM0011	0.0040		0.0060			0.0076	0.0020	0.8000	0.0020	0.0110
14AM0012	0.0030	0.0030	0.0070	0.0140						
14AM0013										
14AM0014	0.041									
14AM0015	0.0330									
14AM0016										
14AM0017	0.0200									
14AM0018	0.0400									
14AM0019	0.0040	0.0020	0.0040	0.0100	0.0010					
14AM0020	0.0030	0.0020	0.0060	0.0130	0.0030					
14AM0021										
14AM0022	0.0040	0.0020	0.0050							
14AM0023	0.0340									
14AM0024	0.0350									
14AM0025										
14AM0026										
14AM0027	0.0040	0.0020	0.0050	0.0080	0.0030					
14AM0028	0.0040	0.0020	0.0050	0.0080	0.0030					
14AM0029	0.0030	0.0020	0.0060	0.0100	0.0020					
14AM0030	0.0030	0.0020	0.0050	0.0080	0.0030					
14AM0031	0.0280									
14AM0032	0.0040	0.0020	0.0050	0.0080	0.0030					
14AM0033	0.0030	0.0020	0.0060	0.0100	0.0020					
14AM0034	0.0030	0.0020	0.0060	0.0100	0.0020					
14AM0035										
14AM0036										

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
14BM0001	MIL-A-46100	C	2					C7407		C7407-5E
14BM0002	MIL-A-46100	C						B8216		B8216-2CIR1
14BM0003	MIL-A-46100	C						B8216		B8216-2CIR2
14BM0004	MIL-A-46100	C						B8216		B8216-4BI2
14BM0005	MIL-A-46100	D						322650		322650-1
14BM0006	MIL-A-46100	D						663447		261R1
14BM0007	MIL-A-46100	D						663447		261R2
14BM0008	MIL-A-46100	C						B8211		B8211-1ABR1
14BM0009	MIL-A-46100	C						B8211		B8211-1ABR2
14BM0010	MIL-A-46100	C						B8211		B8211-1AA
14BM0011	MIL-A-46100	C						B6801		B6801-3AA1
14BM0012	MIL-A-46100	C						B6801		B6801-2BA
14BM0013	MIL-A-46100	C						B8165		B8165-59AA
14BM0014	MIL-A-46100	C						B9195		B9195-1DA
14BM0015	MIL-A-46100	C						B816		B8164-54CA
14BM0016	MIL-A-46100	D						3226[illegible]		322651-1
14BM0017	MIL-A-46100	C	2					R0005		R0005-39A
14BM0018	MIL-A-46100	C	2					B8216		B8216-5AB
14BM0019	MIL-A-46100	D						B9838		B9838-1AD
14BM0020	MIL-A-46100	C	2					B8211		B8211-3AAR1
14BM0021	MIL-A-46100	C	2					B8211		B8211-3AAR2
14BM0022	MIL-A-46100	C	2					R0402		R0402-3FC
14BM0023	MIL-A-46100	C	2					R0279		R0279-3AF
14BM0024	MIL-A-46100	C	2					B8216		B8216-3AL
14BM0026	MIL-A-46100	C	2					B9195		B9195-1DF
14BM0027	MIL-A-46100	C	2					R0407		R0407-1AC
14BM0028	MIL-A-46100	C	2					R0407		R0407-4CC
14BM0029	MIL-A-46100	D						R0279		R0279-1EC
14BM0030	MIL-A-46100	D						R0402		R0402-1BD
14BM0031	MIL-A-46100	C						R0722		R0722-2BG
14BM0032	MIL-A-46100	C	2					R0755		R0755-4EF
14BM0033	MIL-A-46100	C	2					R0722		R0722-2AE
14BM0034	MIL-A-46100	C	2					R0722		R0722-39DF
14BM0035	MIL-A-46100	C	2					R0407		R0407-39RC
14BM0036	MIL-A-46100	C						R0279		R0279-5DC
14BM0037	MIL-A-46100	C	2					R0407		R0407-4GF
14BM0038	MIL-A-46100	C	2					R0722		R0722-3DF
14BM0039	MIL-A-46100	C	2					R0402		R0402-39DE
14BM0040	MIL-A-46100	C	2					R0407		R0407-1FBR1
14BM0041	MIL-A-46100	C						R0407		R0407-1FBR2
14BM0042	MIL-A-46100	C	2					B7247		R7247-1A
14BM0043	MIL-A-46100	C	2					R0005		R0005-5E
14BM0044	MIL-A-46100	C	2					R1042		R1042-1DB
14BM0045	MIL-A-46100	D						500841		124
14BM0046	MIL-A-46100	D						500841		123
14BM0047	MIL-A-46100	C	2					R1042		R1042-2CF

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 1. MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
14BM0048	MIL-A-46100	C						R0402		R0402-1E1
14BM0049	MIL-A-46100	C						R0279		R0279-6GB
14BM0050	MIL-A-46100	C	2					R0402		R0402-2G
14BM0051	MIL-A-46100	D						663912		30-1
14BM0052	MIL-A-46100	C	2					R0279		R0279-4DAR1
14BM0053	MIL-A-46100	C	2					R0279		R0279-4DAR2
14BM0054	MIL-A-46100	C	2					R1042		R1042-39CF
14BM0055	MIL-A-46100	C	2					R0722		R0722-3CCR1
14BM0056	MIL-A-46100	C	2					R0722		R0722-3CCR2
14BM0057	MIL-A-46100	D						501551		838
14BM0058	MIL-A-46100	C						R1450		R1450-1K
14BM0059	MIL-A-46100	D						B6609		B6609-1
14BM0060	MIL-A-46100	D						R3228		R3228-39DD
14BM0061	MIL-A-46100	D						R3228		R3228-39BB2
14BM0062	MIL-A-46100	C						R3717		R3717-4DF1
14BM0063	MIL-A-46100	C	2					R3717		R3717-4DF2
14BM0064	MIL-A-46100	C	2					R2241		R2241-6A
14BM0065	MIL-A-46100	D						R3442		R3442-9AF
14BM0066	MIL-A-46100	D						R3442		R3442-1A
14BM0067	MIL-A-46100	D						R3442		R3442-11
14BM0068	MIL-A-46100	D						335042		1K0773
14BM0069	MIL-A-46100	D						R3935		R3935-39BC
14BM0070	MIL-A-46100	D						R4241		R4241-9BD
14BM0071	MIL-A-46100	D						R3442		R3442-11R2
14BM0072	MIL-A-46100	D						R3442		R3442-1AR1
14BM0073	MIL-A-46100	D						R3935		R3935-39BC1
14BM0074	MIL-A-46100	D						R4241		R4241-9BDR1
14BM0075	MIL-A-46100	D						R4241		R4241-9BDR2
14BM0076	MIL-A-46100	D						R4421		R4421-1AD
14BM0077	MIL-A-46100	D						503231		7
14BM0078	MIL-A-46100	D						R3442		R3442-11RR1
14BM0079	MIL-A-46100	D						R3442		R3442-1ARR1
14BM0080	MIL-A-46100	D						R4806		R4806
14BM0081	MIL-A-46100	D						R3935		R3935-39BCRR1
14BM0082	MIL-A-46100	D						R5048		R5048-2A

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT–LB]	CHARPY TL [FT–LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
14BM0001	0.773	477	7.30	10.0	12.0	477	1550
14BM0002	0.788	512	7.78	30.3	29.3		1660
14BM0003	0.793	512	7.78	30.3	29.3		1660
14BM0004	0.773	512	7.78	29.0	26.7		1660
14BM0005	0.979	486	7.99	18.3	18.0	495	1620
14BM0006	1.010	495	5.89	16.6	12.6	495	1650
14BM0007	1.006	495	5.89	16.6	12.6	495	1650
14BM0008	0.774	477	7.01	15.0	20.7		1550
14BM0009	0.785	477	7.01	15.0	20.7		1550
14BM0010	0.776	514	7.01	20.3	18.0		1550
14BM0011	0.780	512	7.05	23.7	24.7		1550
14BM0012	0.785	486	7.05	24.0	25.0		1550
14BM0013	0.784	512	7.31	22.0	20.3	512	1660
14BM0014	0.790	512	7.45	21.3	21.3	512	1660
14BM0015	0.783	517	7.73	20.3	22.0	517	1660
14BM0016	0.994	498	8.68	18.3	13.3	495	1620
14BM0017	0.774	494	6.62	20.3	21.7		1550
14BM0018	0.782	494	7.72	19.7	22.7		1550
14BM0019	0.774	477	6.52	13.3	16.7		1660
14BM0020	0.785	477	7.01	19.0	20.7		1550
14BM0021	0.786	477	7.01	19.0	20.7		1550
14BM0022	0.791	477	7.19	15.3	15.0		1660
14BM0023	0.793	506	7.18	22.7	23.7		1660
14BM0024	0.784	512	7.54	24.3	25.0		1550
14BM0026	0.780	507	7.15	21.3	21.3		1660
14BM0027	0.798	512	6.87	16.0	16.3		1660
14BM0028	0.796	477	6.87	12.7	12.3		1660
14BM0029	0.754	486	6.85	25.0	25.0		1660
14BM0030	0.775	512	7.61	17.0	16.3		1660
14BM0031	0.800	504	7.37	15.7	17.7		1660
14BM0032	0.798	477	7.09	17.0	15.3		1660
14BM0033	0.792	477	7.37	15.7	17.7		1660
14BM0034	0.801	494	7.37	18.3	16.3		1660
14BM0035	0.802	504	6.87	12.7	12.3		1660
14BM0036	0.800	494	7.18	21.0	24.7		1660
14BM0037	0.789	486	6.87	12.3	13.3		1660
14BM0038	0.796	486	7.37	16.0	14.0		1660
14BM0039	0.794	477	7.19	16.7	17.7		1660
14BM0040	0.793	524	6.87	16.0	16.3		1660
14BM0041	0.791	524	6.87	16.0	16.3		1660
14BM0042	0.800	504	7.19	17.7	17.0		1550
14BM0043	0.797	477	6.87	29.7	29.3		1550
14BM0044	0.784	477	7.44	21.7	32.0		1660
14BM0045	0.865	514	7.68	20.0	10.0	514	1650
14BM0046	0.877	514	7.68	17.0	11.0	514	1650
14BM0047	0.794	494	7.44	20.7	26.7		1660

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT–LB]	CHARPY TL [FT–LB]	CHARPY HARD [BRN]	AUS TEMP [DEG F]
14BM0048	0.791	510	7.19	22.7	24.3		1660
14BM0049	0.779	512	7.30	23.0	24.3		1550
14BM0050	0.780	494	7.34	22.3	24.7		1550
14BM0051	0.996	506	6.31				1650
14BM0052	0.780	512	7.30	20.3	22.7		1660
14BM0053	0.781	512	7.30	20.3	22.7		1660
14BM0054	0.804	512	7.55	18.7	24.0		1660
14BM0055	0.784	522	7.51	17.7	25.0		1660
14BM0056	0.784	522	7.51	17.7	25.0		1660
14BM0057	1.017	514	6.19	15.0	16.0	514	1650
14BM0058	0.777	477	6.28	24.7	28.7		1550
14BM0059	0.976	522	12.57	25.7	24.0	514	1620
14BM0060	0.778	512	5.23	28.0	29.3		1660
14BM0061	0.762	477	5.23	20.0	20.0		1660
14BM0062	0.796	486	7.51	26.0	29.0		1660
14BM0063	0.796	486	7.51	26.0	29.0		1660
14BM0064	1.012	477	6.10	21.7	22.3		1550
14BM0065	0.891	502	7.68	13.3	16.0		1660
14BM0066	1.003	534	12.30	18.7	19.7	534	1550
14BM0067	0.884	504	12.30	14.7	16.0	504	1550
14BM0068	0.778	514	5.98	17.0	16.5	495	1660
14BM0069	0.775	512	5.60	22.3	26.7		1660
14BM0070	0.882	512	6.68	17.3	19.0		1660
14BM0071	0.887	504	7.76	13.3	16.0		1550
14BM0072	1.023	534	7.76	13.0	18.0		1550
14BM0073	0.780	512	5.60	22.3	26.7		1660
14BM0074	0.886	512	6.68	17.3	19.0		1660
14BM0075	0.886	512	6.68	17.3	19.0		1660
14BM0076	0.784	484	5.52	18.3	19.0		1660
14BM0077	1.000	495	5.98	18.0	17.0	495	1650
14BM0078	0.882	504	12.30	14.7	16.0	504	1550
14BM0079	1.002	534	12.30	18.7	19.7	534	1550
14BM0080	1.006	514	10.96	20.0	20.0	514	1600
14BM0081	0.786	494	5.60	27.0	30.0		1660
14BM0082	1.003	504	7.47	19.0	21.7		1550

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
14BM0001	A	P	90001604	10/26/90		SIX	145MMAPIBS41	30	0.773	2300	2337	P	37
14BM0002	A	R	90001609	10/29/90	90001498	SIX	145MMAPIBS41	30	0.788	2338	2414	P	76
14BM0003	A	R	90001610	10/26/90	90001498	SIX	145MMAPIBS41	30	0.793	2351	2366	P	15
14BM0004	A	R	90001612	10/26/90	90001497	SIX	145MMAPIBS41	30	0.773	2300	2264	F	-36
14BM0005	A	P	90001634	10/31/90		SIX	145MMAPIBS41	30	0.979	2788	2899	P	111
14BM0006	A	R	90001645	11/05/90		SIX	145MMAPIBS41	30	1.010	2854	2956	P	102
14BM0007	A	R	90001646	11/14/90		SIX	145MMAPIBS41	30	1.006	2845	2845	P	0
14BM0008	A	R	90001792	12/12/90		SIX	145MMAPIBS41	30	0.774	2302	2375	P	73
14BM0009	A	R	90001793	12/11/90		SIX	145MMAPIBS41	30	0.785	2331	2398	P	67
14BM0010	A	P	90001815	01/17/91		SIX	145MMAPIBS41	30	0.776	2308	2327	P	19
14BM0011	A	P	90001817	12/12/90		SIX	145MMAPIBS41	30	0.780	2318	2439	P	121
14BM0012	A	P	90001818	12/11/90		SIX	145MMAPIBS41	30	0.785	2331	2278	F	-53
14BM0013	A	P	90001825	12/11/90		SIX	145MMAPIBS41	30	0.784	2328	2514	P	186
14BM0014	A	P	90001826	12/11/90		SIX	145MMAPIBS41	30	0.790	2343	2513	P	170
14BM0015	A	P	90001827	12/11/90		SIX	145MMAPIBS41	30	0.783	2326	2418	P	92
14BM0016	A	R	91000008	01/31/91		SIX	145MMAPIBS41	30	0.994	2820	2869	P	49
14BM0017	A	P	91000123	02/01/91		SIX	145MMAPIBS41	30	0.774	2302	2409	P	107
14BM0018	A	P	91000131	02/01/91		SIX	145MMAPIBS41	30	0.782	2323	2390	P	67
14BM0019	A	P	91000137	02/01/91		SIX	145MMAPIBS41	30	0.774	2302	2421	P	119
14BM0020	A	R	91000181	02/04/91		SIX	145MMAPIBS41	30	0.785	2331	2396	P	65
14BM0021	A	R	91000182	02/04/91		SIX	145MMAPIBS41	30	0.786	2333	2335	P	2
14BM0022	A	P	91000195	02/01/91		SIX	145MMAPIBS41	30	0.791	2346	2422	P	76
14BM0023	A	P	91000196	02/01/91		SIX	145MMAPIBS41	30	0.793	2351	2402	P	51
14BM0024	A	P	91000197	02/01/91		SIX	145MMAPIBS41	30	0.784	2328	2348	P	20
14BM0026	A	P	91000198	02/04/91		SIX	145MMAPIBS41	30	0.780	2318	2431	P	113
14BM0027	A	P	91000294	03/04/91		SIX	145MMAPIBS41	30	0.798	2364	2339	F	-25
14BM0028	A	P	91000296	03/04/91		SIX	145MMAPIBS41	30	0.796	2359	2386	P	27
14BM0029	A	P	91000406	03/11/91		SIX	145MMAPIBS41	30	0.754	2686	2807	P	121
14BM0030	A	P	91000561	03/12/91		SIX	145MMAPIBS41	30	0.775	2305	2313	P	8
14BM0031	A	P	91000676	04/22/91		SIX	145MMAPIBS41	30	0.800	2369	2408	P	39
14BM0032	A	P	91000678	04/22/91		SIX	145MMAPIBS41	30	0.798	2364	2419	P	55
14BM0033	A	P	91000679	04/18/91		SIX	145MMAPIBS41	30	0.792	2348	2532	P	184
14BM0034	A	P	91000680	04/19/91		SIX	145MMAPIBS41	30	0.801	2372	2405	P	33
14BM0035	A	P	91000683	04/22/91		SIX	145MMAPIBS41	30	0.802	2374	2436	P	62
14BM0036	A	P	91000684	04/19/91		SIX	145MMAPIBS41	30	0.800	2369	2283	F	-86
14BM0037	A	P	91000685	05/01/91		SIX	145MMAPIBS41	30	0.789	2341	2380	P	39
14BM0038	A	P	91000690	04/19/91		SIX	145MMAPIBS41	30	0.796	2359	2336	F	-23
14BM0039	A	P	91000742	05/15/91		SIX	145MMAPIBS41	30	0.794	2353	2528	P	175
14BM0040	A	R	91000746	05/15/91	91000294	SIX	145MMAPIBS41	30	0.793	2351	2477	P	126
14BM0041	A	R	91000747	05/15/91	91000294	SIX	145MMAPIBS41	30	0.791	2346	2401	P	55
14BM0042	A	P	91000767	05/16/91		SIX	145MMAPIBS41	30	0.800	2369	2501	P	132
14BM0043	A	P	91000777	05/16/91		SIX	145MMAPIBS41	30	0.797	2361	2446	P	85
14BM0044	A	P	91000798	05/16/91		SIX	145MMAPIBS41	30	0.784	2328	2428	P	100
14BM0045	FA		91000859	06/04/91		SIX	145MMAPIBS41	30	0.865	2529	2552	P	23
14BM0046	FA		91000860	06/04/91		SIX	145MMAPIBS41	30	0.877	2557	2576	P	19
14BM0047	A	P	91000893	06/04/91		SIX	145MMAPIBS41	30	0.794	2353	2456	P	103

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
14BM0048	A	P	91000896	05/16/91		SIX	145MMAPIBS41	30	0.791	2346	2463	P	117
14BM0049	A	P	91001008	06/04/91		SIX	145MMAPIBS41	30	0.779	2315	2405	P	90
14BM0050	A	P	91001011	06/04/91		SIX	145MMAPIBS41	30	0.780	2318	2358	P	40
14BM0051	A	P	91001025	06/18/91		SIX	145MMAPIBS41	30	0.996	2824	2942	P	118
14BM0052	A	R	91001068	06/11/91	91000684	SIX	145MMAPIBS41	30	0.780	2318	2600	P	282
14BM0053	A	R	91001069	06/11/91	91000684	SIX	145MMAPIBS41	30	0.781	2321	2618	P	297
14BM0054	A	P	91001070	06/04/91		SIX	145MMAPIBS41	30	0.804	2379	2433	P	54
14BM0055	A	R	91001072	06/11/91	91000690	SIX	145MMAPIBS41	30	0.784	2328	2532	P	204
14BM0056	A	R	91001073	06/11/91	91000690	SIX	145MMAPIBS41	30	0.784	2328	2578	P	250
14BM0057	A	P	91001161	06/21/91		SIX	145MMAPIBS41	30	1.017	2869	3091	P	222
14BM0058	A	P	91001172	07/02/91		SIX	145MMAPIBS41	30	0.777	2310	2368	P	58
14BM0059	A	P	91001462	09/05/91		SIX	145MMAPIBS41	30	0.976	2781	2788	P	7
14BM0060	A	P	91001532	09/16/91		SIX	145MMAPIBS41	30	0.778	2313	2460	P	147
14BM0061	FA		91001538	09/19/91		SIX	145MMAPIBS41	30	0.762	2702	2777	P	75
14BM0062	FA		91001617	09/30/91		SIX	145MMAPIBS41	30	0.796	2359	2435	P	76
14BM0063	FA		91001618	09/30/91		SIX	145MMAPIBS41	30	0.796	2359	2501	P	142
14BM0064	A	P	91001677	10/18/91		SIX	145MMAPIBS41	30	1.012	2858	2915	P	57
14BM0065	A	P	91001749	10/18/91		SIX	145MMAPIBS41	30	0.891	2590	2688	P	98
14BM0066	A	P	91001813	11/15/91		SIX	145MMAPIBS41	30	1.003	2839	2767	F	−72
14BM0067	A	P	91001814	11/15/91		SIX	145MMAPIBS41	30	0.884	2574	2377	F	−197
14BM0068	A	P	91001834	11/18/91		SIX	145MMAPIBS41	30	0.778	2313	2385	P	72
14BM0069	A	P	91001925	12/06/91		SIX	145MMAPIBS41	30	0.775	2305	2294	F	−11
14BM0070	A	P	91001949	12/12/91		SIX	145MMAPIBS41	30	0.882	2569	2562	F	−7
14BM0071	A	R	91002021	01/06/92	91001814	SIX	145MMAPIBS41	30	0.887	2581	2534	F	−47
14BM0072	A	R	91002023	01/06/92	91001813	SIX	145MMAPIBS41	30	1.023	2882	2803	F	−79
14BM0073	A	R	92000011	01/09/92	91001925	SIX	145MMAPIBS41	30	0.780	2318	2237	F	−81
14BM0074	A	R	92000016	01/09/92	91001949	SIX	145MMAPIBS41	30	0.886	2578	2636	P	58
14BM0075	A	R	92000017	01/09/92	91001949	SIX	145MMAPIBS41	30	0.886	2578	2632	P	54
14BM0076	A	P	92000108	01/28/92		SIX	145MMAPIBS41	30	0.784	2328	2376	P	48
14BM0077	A	P	92000206	02/26/92		SIX	145MMAPIBS41	30	1.000	2832	2836	P	4
14BM0078	A	R	92000209	02/19/92	91001814	SIX	145MMAPIBS41	30	0.882	2569	2655	P	86
14BM0079	A	R	92000210	02/19/92	91001813	SIX	145MMAPIBS41	30	1.002	2836	2895	P	59
14BM0080	A	P	92000248	02/27/92		SIX	145MMAPIBS41	30	1.006	2845	2874	P	29
14BM0081	A	R	92000251	02/26/92	92000011	SIX	145MMAPIBS41	30	0.786	2333	2472	P	139
14BM0082	A	P	92000258	03/05/92		SIX	145MMAPIBS41	30	1.003	2839	2828	F	−11

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
14BM0001	0.3200	0.9000	0.4300	1.0500	0.5300	0.5800				0.0150	0.0020		0.0210
14BM0002	0.3200	0.9000	0.4400	1.0100	0.5700	0.5600	0.0030		0.1300	0.0080	0.0010		0.0210
14BM0003	0.3200	0.9000	0.4400	1.0100	0.5700	0.5600	0.0030		0.1300	0.0080	0.0010		0.0210
14BM0004	0.3200	0.9000	0.4400	1.0100	0.5700	0.5600	0.0030		0.1300	0.0080	0.0010		0.0210
14BM0005	0.2900	0.9900	0.4300	0.5000	0.6400	0.3100		0.0016		0.0100	0.0010		0.0340
14BM0006	0.3000	1.5300	0.2300			0.5400		0.0007		0.0090	0.0040		
14BM0007	0.3000	1.5300	0.2300			0.5400		0.0007		0.0090	0.0040		
14BM0008	0.3100	0.8800	0.4200	0.9700	0.5500	0.5400	0.0020		0.1600	0.0060	0.0020		0.0260
14BM0009	0.3100	0.8800	0.4200	0.9700	0.5500	0.5400	0.0020		0.1600	0.0060	0.0020		0.0260
14BM0010	0.3100	0.8800	0.4200	0.9700	0.5500	0.5400	0.0020		0.1600	0.0060	0.0020		0.0260
14BM0011	0.3000	0.9000	0.4200	0.9600	0.5600	0.5600	0.0010		0.1400	0.0060	0.0010		0.0200
14BM0012	0.3000	0.9000	0.4200	0.9600	0.5600	0.5600	0.0010		0.1400	0.0060	0.0010		0.0200
14BM0013	0.3000	0.8900	0.4500	1.0700	0.5600	0.5500	0.0030		0.1600	0.0070	0.0020		0.0220
14BM0014	0.3000	0.9100	0.4500	0.9500	0.5700	0.5700	0.0040		0.1600	0.0090	0.0030		0.0250
14BM0015	0.3200	0.8900	0.4500	1.0100	0.5600	0.5500	0.0030		0.1800	0.0070	0.0010		0.0280
14BM0016	0.3000	1.0200	0.4400	0.5800	0.6500	0.3200		0.0017		0.0090	0.0020		0.0340
14BM0017	0.3100	0.8700	0.4200	0.9700	0.5500	0.5500				0.0070	0.0020		0.0300
14BM0018	0.3200	0.9100	0.4600	1.0000	0.5600	0.5500	0.0030		0.1200	0.0070	0.0010		0.0200
14BM0019	0.2900	0.9000	0.4500	0.9400	0.5000	0.5600			0.1600	0.0100	0.0060	0.0030	0.0160
14BM0020	0.3100	0.8800	0.4200	0.9700	0.5500	0.5400	0.0020		0.1600	0.0060	0.0020		0.0260
14BM0021	0.3100	0.8800	0.4200	0.9700	0.5500	0.5400	0.0020		0.1600	0.0060	0.0020		0.0260
14BM0022	0.3100	0.9100	0.4300	0.9600	0.5100	0.5700	0.0020		0.1700	0.0080	0.0010		0.0270
14BM0023	0.2900	0.8900	0.4400	1.1100	0.5700	0.5700	0.0030		0.1000	0.0070	0.0010		0.0320
14BM0024	0.3100	0.9000	0.4400	1.0100	0.5700	0.5600	0.0030		0.1300	0.0080	0.0010		0.0210
14BM0026	0.3000	0.9200	0.4400	0.9500	0.5500	0.5500	0.0030		0.1600	0.0080	0.0020		0.0220
14BM0027	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0028	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0029	0.2900	0.8600	0.4500	1.1000	0.5500	0.5700			0.1000	0.0080	0.0020	0.0040	0.0350
14BM0030	0.3100	0.9300	0.4500	0.9500	0.5200	0.5900			0.1800	0.0100	0.0010	0.0030	0.0290
14BM0031	0.3100	0.9000	0.4000	0.9700	0.5500	0.5800	0.0030		0.1500	0.0070	0.0020		0.0220
14BM0032	0.3000	0.9100	0.4300	1.0500	0.5500	0.5500	0.0030		0.1000	0.0090	0.0010		0.0400
14BM0033	0.3100	0.9000	0.4000	0.9700	0.5500	0.5800	0.0030		0.1500	0.0070	0.0020		0.0220
14BM0034	0.3100	0.9000	0.4000	0.9700	0.5500	0.5800	0.0030		0.1500	0.0070	0.0020		0.0220
14BM0035	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0036	0.2900	0.8900	0.4400	1.1100	0.5700	0.5700	0.0030		0.1000	0.0070	0.0010		0.0320
14BM0037	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0038	0.3100	0.9000	0.4000	0.9700	0.5500	0.5800	0.0030		0.1500	0.0070	0.0020		0.0220
14BM0039	0.3100	0.9100	0.4300	0.9600	0.5100	0.5700	0.0020		0.1700	0.0080	0.0010		0.0270
14BM0040	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0041	0.3000	0.8800	0.4200	1.1600	0.5000	0.5500	0.0030		0.1600	0.0070	0.0030		0.0280
14BM0042	0.2900	0.8800	0.4300	1.1000	0.5700	0.5800	0.0050		0.1100	0.0060	0.0020		0.0210
14BM0043	0.3100	0.8800	0.4100	0.9600	0.5400	0.5500	0.0020		0.1200	0.0060	0.0010		0.0310
14BM0044	0.3100	0.8900	0.4400	1.0300	0.5600	0.5600	0.0030		0.1300	0.0080	0.0020		0.0320
14BM0045	0.3000	0.9600	0.3800	0.6200	0.6000	0.3100		0.0013		0.0090	0.0020		
14BM0046	0.3000	0.9600	0.3800	0.6200	0.6000	0.3100		0.0013		0.0090	0.0020		
14BM0047	0.3100	0.8900	0.4400	1.0300	0.5600	0.5600	0.0030		0.1300	0.0080	0.0020		0.0320

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
14BM0001										
14BM0002	0.0030		0.0040			0.0056	0.0010	0.4000	0.0020	0.0100
14BM0003	0.0030		0.0040			0.0056	0.0010	0.4000	0.0020	0.0100
14BM0004	0.0030		0.0040			0.0056	0.0010	0.4000	0.0020	0.0100
14BM0005	0.0440									
14BM0006										
14BM0007										
14BM0008			0.0040			0.0080	0.0020	0.4000	0.0010	0.0100
14BM0009			0.0040			0.0080	0.0020	0.4000	0.0010	0.0100
14BM0010	0.0030		0.0040			0.0080	0.0020	0.4000	0.0010	0.0100
14BM0011	0.0030		0.0040			0.0048	0.0020	0.4000	0.0010	0.0100
14BM0012	0.0030		0.0040			0.0048	0.0020	0.4000	0.0010	0.0100
14BM0013	0.0030		0.0060							
14BM0014	0.0040		0.0050							
14BM0015	0.0030		0.0060							
14BM0016	0.0450									
14BM0017										
14BM0018	0.0030		0.0030							
14BM0019	0.0030	0.0030	0.0070	0.0140						
14BM0020	0.0030		0.0040			0.0080	0.0020	0.4000	0.0010	0.0100
14BM0021	0.0030		0.0040			0.0080	0.0020	0.4000	0.0010	0.0100
14BM0022	0.0030		0.0050			0.0084	0.0030	0.9000	0.0010	0.0120
14BM0023	0.0030		0.0050			0.0082	0.0020	0.7000	0.0040	0.0120
14BM0024	0.0030		0.0040						0.0020	0.0100
14BM0026	0.0040		0.0040							
14BM0027	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0028	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0029	0.0030	0.0020	0.0060	0.0080	0.0030					
14BM0030	0.0030	0.0030	0.0060	0.0140	0.0030					
14BM0031	0.0030		0.0050			0.0076	0.0030	0.9000	0.0010	0.0110
14BM0032	0.0030		0.0040			0.0068	0.0020	0.9000	0.0030	0.0090
14BM0033	0.0030		0.0050			0.0076	0.0030	0.9000	0.0010	0.0110
14BM0034	0.0030		0.0050			0.0076	0.0030	0.9000	0.0010	0.0110
14BM0035	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0036	0.0030		0.0050			0.0082	0.0020	0.7000	0.0040	0.0120
14BM0037	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0038	0.0030		0.0050			0.0076	0.0030	0.9000	0.0010	0.0110
14BM0039	0.0030		0.0050			0.0084	0.0030	0.9000	0.0010	0.0120
14BM0040	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0041	0.0040		0.0050			0.0086	0.0020	0.7000	0.0010	0.0140
14BM0042	0.0030		0.0050			0.0066	0.0020	0.2000	0.0050	0.0120
14BM0043	0.0030		0.0040			0.0068	0.0010	0.6000	0.0010	0.0100
14BM0044	0.0040		0.0060			0.0076	0.0020	0.8000	0.0020	0.0110
14BM0045										
14BM0046										
14BM0047	0.0040		0.0060			0.0076	0.0020	0.8000	0.0020	0.0110

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
14BM0048	0.3100	0.9100	0.4300	0.9600	0.5100	0.5700	0.0020		0.1700	0.0080	0.0010		0.0270
14BM0049	0.2900	0.8900	0.4500	1.1000	0.5800	0.5700	0.0030		0.1100	0.0080	0.0020		0.0330
14BM0050	0.3100	0.9000	0.4500	0.9700	0.5400	0.5600	0.0020		0.1600	0.0090	0.0020		0.0260
14BM0051	0.2900	1.4800	0.3400	0.0060	0.0230	0.5600		0.0015		0.0090	0.0040		
14BM0052	0.2900	0.8900	0.4500	1.1000	0.5800	0.5700	0.0030		0.1100	0.0080	0.0020		0.0330
14BM0053	0.2900	0.8900	0.4500	1.1000	0.5800	0.5700	0.0030		0.1100	0.0080	0.0020		0.0330
14BM0054	0.3100	0.9000	0.4500	1.0400	0.5600	0.5600	0.0040		0.1200	0.0090	0.0030		0.0330
14BM0055	0.3100	0.9100	0.4100	0.9800	0.5600	0.5700	0.0030		0.1600	0.0080	0.0020		0.0230
14BM0056	0.3100	0.9100	0.4100	0.9800	0.5600	0.5700	0.0030		0.1600	0.0080	0.0020		0.0230
14BM0057	0.2900	1.4700	0.3100	0.0060	0.0320	0.5500		0.0016		0.0100	0.0030		
14BM0058	0.3000	0.9000	0.4000	0.8900	0.5000	0.5500	0.0030		0.0900	0.0060	0.0010		0.0240
14BM0059	0.3200	0.9100	0.4700	1.0500	0.5700	0.5700		0.0003	0.1500	0.0120	0.0020		0.0220
14BM0060	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
14BM0061	0.2600	0.8500	0.4100	0.9100	0.5000	0.5300	0.0050		0.1200	0.0090	0.0020	0.0040	0.0260
14BM0062	0.3200	0.9000	0.4300	1.0400	0.5500	0.5500	0.0030		0.1100	0.0050	0.0010		0.0290
14BM0063	0.3200	0.9000	0.4300	1.0400	0.5500	0.5500	0.0030		0.1100	0.0050	0.0010		0.0290
14BM0064	0.2800	0.8900	0.4200	0.9400	0.5000	0.5500	0.0030		0.1600	0.0090	0.0010		0.0270
14BM0065	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500			0.1900	0.0120	0.0030	0.0030	0.0300
14BM0066	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060	0.0005	0.1900	0.0120	0.0030	0.0030	0.0300
14BM0067	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060	0.0005	0.1900	0.0120	0.0030	0.0030	0.0300
14BM0068	0.3100	0.8500	0.4300	0.4200	0.5400	0.1900		0.0019	0.1600	0.0060	0.0020		0.0370
14BM0069	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14BM0070	0.3000	0.8800	0.4200	1.0000	0.5500	0.5400			0.1000	0.0060	0.0020	0.0020	0.0380
14BM0071	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060		0.1900	0.0130	0.0030	0.0030	0.0300
14BM0072	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060		0.1900	0.0120	0.0030	0.0030	0.0300
14BM0073	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14BM0074	0.3000	0.8800	0.4200	1.0000	0.5500	0.5400			0.1000	0.0060	0.0020	0.0020	0.0380
14BM0075	0.3000	0.8800	0.4200	1.0000	0.5500	0.5400			0.1000	0.0060	0.0020	0.0020	0.0380
14BM0076	0.2800	0.8100	0.4300	0.9000	0.5000	0.5400	0.0030		0.1200	0.0060	0.0020	0.0030	0.0230
14BM0077	0.2600	1.4600	0.3100	0.0060	0.0470	0.5200	0.0040	0.0013		0.0100	0.0030	0.0020	
14BM0078	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060	0.0005	0.1900	0.0120	0.0030	0.0030	0.0300
14BM0079	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060	0.0005	0.1900	0.0120	0.0030	0.0030	0.0300
14BM0080	0.3100	0.8700	0.4400	1.0100	0.5400	0.5400		0.0002	0.1200	0.0060	0.0020		0.0210
14BM0081	0.2800	0.8200	0.4300	0.9200	0.4900	0.5500	0.0020		0.1200	0.0070	0.0010	0.0030	0.0350
14BM0082	0.3100	0.9100	0.4600	1.0000	0.5600	0.5600			0.1000	0.0050	0.0020	0.0020	0.0250

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 14.5 MM API BS41
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
14BM0048	0.0030		0.0050			0.0084	0.0030	0.9000	0.0010	0.0120
14BM0049	0.0030		0.0040							
14BM0050	0.0030		0.0040							
14BM0051										
14BM0052	0.0030		0.0040							
14BM0053	0.0030		0.0040							
14BM0054	0.0040		0.0050							
14BM0055	0.0030		0.0050							
14BM0056	0.0030		0.0050							
14BM0057										
14BM0058	0.0040		0.0040			0.0056	0.0020	0.9000	0.0010	0.0090
14BM0059										
14BM0060	0.0040	0.0020	0.0050	0.0080	0.0030					
14BM0061	0.0040	0.0020	0.0050	0.0080	0.0030					
14BM0062	0.0040		0.0050			0.0056	0.0020	1.0000	0.0050	0.0100
14BM0063	0.0040		0.0050			0.0056	0.0020	1.0000	0.0050	0.0100
14BM0064	0.0040		0.0050			0.0064	0.0020	0.4000	0.0020	0.0110
14BM0065	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0066	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0067	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0068	0.0540									
14BM0069	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0070	0.0030	0.0020	0.0050	0.0080	0.0030					
14BM0071	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0072	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0073	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0074	0.0030	0.0020	0.0050	0.0080	0.0030					
14BM0075	0.0030	0.0020	0.0050	0.0080	0.0030					
14BM0076	0.0030	0.0020	0.0060	0.0070	0.0020					
14BM0077										
14BM0078	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0079	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0080										
14BM0081	0.0030	0.0020	0.0060	0.0100	0.0020					
14BM0082	0.0030	0.0020	0.0060	0.0080	0.0030					

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API-T M602
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
20AM0001	MIL-A-46100	C	2					B8211		B8211-6B
20AM0002	MIL-A-46100	D						B8677		B8677-C11
20AM0003	MIL-A-46100	D						B8678		B8678-2B1
20AM0004	MIL-A-46100	C						B7422		B7422-5BA
20AM0005	MIL-A-46100	C	2					B8216		B8216-1AAR1
20AM0006	MIL-A-46100	C	2					B8216		B8216-1AAR2
20AM0007	MIL-A-46100	D						B7422		B7422-39A
20AM0008	MIL-A-46100	D						2T0230		2T0230
20AM0009	MIL-A-46100	C	2					B6801		B6801-39AB
20AM0010	MIL-A-46100	C						B8677		B8677-1E
20AM0011	MIL-A-46100	C	2					B8678		B8678-39A
20AM0012	MIL-A-46100	D						B8216		B8216-1CBR1
20AM0013	MIL-A-46100	D						B8216		B8216-1CBR2
20AM0014	MIL-A-46100	D						B7247		B7247-4BA
20AM0015	MIL-A-46100	D						320150		320150-1
20AM0016	MIL-A-46100	D						B8577		B8577D
20AM0017	MIL-A-46100	C	2					B7422		B7422-5BAR1
20AM0018	MIL-A-46100	C	2					B7422		B7422-5BAR2
20AM0019	MIL-A-46100	D						B8678		B8678-39E
20AM0020	MIL-A-46100	C	2					B8211		B8211-6A
20AM0021	MIL-A-46100	D						R0173		R0173-3AA
20AM0022	MIL-A-46100	C	2					B9623		B9623-5AB
20AM0023	MIL-A-46100	D						R0005		R0005-2AB
20AM0024	MIL-A-46100	C	2					R0005		R0005-39D
20AM0025	MIL-A-46100	D						B8933		B8933D
20AM0026	MIL-A-46100	D						B9553		BB9553D
20AM0027	MIL-A-46100	D						B9553		B9553
20AM0028	MIL-A-46100	D						R0356		R0356-1B1
20AM0029	MIL-A-46100	D						R0442		R0442-3E
20AM0030	MIL-A-46100	D						R0005		R0005-1D
20AM0031	MIL-A-46100	D						R0005		R0005-1B1
20AM0032	MIL-A-46100	D						R0569		R0569D
20AM0033	MIL-A-46100	D						320150		320150D
20AM0034	MIL-A-46100	D						R0356		R0356-1CB
20AM0035	MIL-A-46100	C	2					B7422		B7422-5BA1
20AM0036	MIL-A-46100	D						663911		90
20AM0037	MIL-A-46100	D						R0569		R0569D
20AM0038	MIL-A-46100	D						B8678		B8678-5DA
20AM0039	MIL-A-46100	D						B8660		B8660-81AB
20AM0040	MIL-A-46100	D						R0173		R0173-1J
20AM0041	MIL-A-46100	D						R1450		R1450-1B
20AM0042	MIL-A-46100	D						R0442		R0442-4K
20AM0043	MIL-A-46100	C	2					R0005		R0005-39DR1
20AM0044	MIL-A-46100	C	2					R0005		R0005-39DR2
20AM0045	MIL-A-46100	D						B7247		B7247-1C
20AM0046	MIL-A-46100	D						B8577		B8577

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API-T M602
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
20AM0047	MIL-A-46100	D						B8660		B8660-82B
20AM0048	MIL-A-46100	D						R1376		R1376D
20AM0049	MIL-A-46100	D						R1726		R1726-3B
20AM0050	MIL-A-46100	D						R1325		R1325D
20AM0051	MIL-A-46100	D						R1726		R1726-2AB
20AM0052	MIL-A-46100	D						R1726		R1726-5
20AM0053	MIL-A-46100	D						R0442		R0442-4KR1
20AM0054	MIL-A-46100	D						R0442		R0442-4KR2
20AM0055	MIL-A-46100	D						663447		258
20AM0056	MIL-A-46100	D						R2241		R2241-2A
20AM0057	MIL-A-46100	C						B8933		B8933-4
20AM0058	MIL-A-46100	D						B8577		B8577-1
20AM0059	MIL-A-46100	D						B8577		B8577-2
20AM0060	MIL-A-46100	D						B4582		B4582
20AM0061	MIL-A-46100	D						R3201		R3201-4B
20AM0062	MIL-A-46100	C	2					R2662		R2662-2A
20AM0063	MIL-A-46100	C	2					R3201		R3201-5A
20AM0064	MIL-A-46100	D						R2662		R2662-2E
20AM0065	MIL-A-46100	D						R2627		R2627D
20AM0066	MIL-A-46100	D						R2533		R2533D
20AM0067	MIL-A-46100	D						R3442		R3442-12A
20AM0068	MIL-A-46100	D						R3442		R3442-4
20AM0069	MIL-A-46100	D						R3309		R3309-4
20AM0070	MIL-A-46100	C						R1726		R1726-2D
20AM0071	MIL-A-46100	D						B4582		B4582-R1
20AM0072	MIL-A-46100	D						R2662		R2662-39A
20AM0073	MIL-A-46100	D						R3258		R3258-39
20AM0074	MIL-A-46100	D						R0569		R0569
20AM0075	MIL-A-46100	D						R3309		R3309-1D
20AM0076	MIL-A-46100	D						R3309		R3309-1F
20AM0077	MIL-A-46100	C						B8933		B8933-4-50
20AM0078	MIL-A-46100	D						R3650		R3650-3B4
20AM0079	MIL-A-46100	D						R2533		R2533
20AM0080	MIL-A-46100	D						B9623		B9623-8A
20AM0081	MIL-A-46100	C	2					R2662		R2662-2AR1
20AM0082	MIL-A-46100	C	2					R2662		R2662-2AR2
20AM0083	MIL-A-46100	D						R3309		R3309-1DR1
20AM0084	MIL-A-46100	D						R3309		R3309-1DR2
20AM0085	MIL-A-46100	D						R3309		R3309-4R1
20AM0086	MIL-A-46100	D						R3309		R3309-4R2
20AM0087	MIL-A-46100	D						R4181		R4181D
20AM0088	MIL-A-46100	D						R3442		R3442-2A
20AM0089	MIL-A-46100	D						R4820		R4820
20AM0090	MIL-A-46100	D						R3309		R3309-1DRR1
20AM0091	MIL-A-46100	D						R3662		R3662-1B
20AM0092	MIL-A-46100	D						R3650		R3650-39AB

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 1: MTL ID & MIL SPEC ATTRIBUTES
DATABASE MODULE 2: PLATE PRODUCTION HISTORY

ARL/MD ID	MIL SPEC NO	MIL SPEC REV	MIL SPEC AMD	MIL SPEC MAT CL	PROD	FABR	HEAT TR	HEAT NO	LOT NO	PRODUCER PLATE NO
20AM0093	MIL – A – 46100	D						R2241		R2241 – 2B
20AM0094	MIL – A – 46100	D						R0442		R0442 – 2G
20AM0095	MIL – A – 46100	D						B9623		B9623 – 8A1R1
20AM0096	MIL – A – 46100	D						R3258		R3258 – 1AA

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API-T M602
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT-LB]	CHARPY TL [FT-LB]	CHARPY HARD [RC]	AUS TEMP [DEG F]
20AM0001	1.240	477	6.66	11.7	12.3	477	1550
20AM0002	1.749	514	7.41	18.5	17.5	514	1600
20AM0003	1.748	514	7.51	15.0	14.5	514	1600
20AM0004	1.176	522	7.83	25.0	18.7		1550
20AM0005	1.380	486	7.69	11.3	14.7		1550
20AM0006	1.384	486	7.69	11.3	14.7		1550
20AM0007	1.963	504	7.68	14.3	17.0		1550
20AM0008	1.755	514	7.53	14.0	15.5	514	1600
20AM0009	1.251	504	6.65	14.7	19.3		1550
20AM0010	1.177	512	7.81	10.3	18.0		1550
20AM0011	1.249	477	7.51	14.7	16.0		1550
20AM0012	1.088	477	8.05	16.3	13.3		1550
20AM0013	1.094	477	8.05	16.3	13.3		1550
20AM0014	1.096	512	6.92	12.0	13.3		1550
20AM0015	1.387	516	8.18	20.3	13.3	495	1620
20AM0016	1.248	495	12.47	13.2	13.8	495	1600
20AM0017	1.171	522	7.83	18.7	25.0		1550
20AM0018	1.171	522	7.83	18.7	25.0		1550
20AM0019	1.951	486	7.89	10.7	9.7		1550
20AM0020	1.936	477	6.66	18.3	19.3		1550
20AM0021	1.131	494	7.43	10.0	13.3		1550
20AM0022	1.353	495	6.58	20.0	23.0		1550
20AM0023	1.266	477	6.94	19.3	20.3		1550
20AM0024	1.153	522	6.87	22.3	25.7		1550
20AM0025	1.254	477	11.68	13.5	13.8	477	1600
20AM0026	1.245	477	12.18	15.2	17.8	477	1600
20AM0027	1.357	506	12.89	21.0	19.3	514	1620
20AM0028	1.756	514	7.36	16.5	18.0	514	1600
20AM0029	1.237	477	7.44	10.7	14.3		1550
20AM0030	1.140	477	6.94	14.7	13.3		1550
20AM0031	1.759	514	5.53	25.3	19.0	514	1600
20AM0032	1.250	514	12.62	17.8	14.8	495	1600
20AM0033	1.381	495	10.43	13.8	11.8	477	1600
20AM0034	1.113	477	7.76	12.3	13.7		1550
20AM0035	1.180	522	7.64	26.3	28.3		1550
20AM0036	1.112	495	6.18	20.0	16.0	495	1650
20AM0037	1.236	514	12.62	17.8	14.8	495	1600
20AM0038	1.970	494	7.89	11.0	12.7		1550
20AM0039	1.112	486	5.91	21.0	19.0		1550
20AM0040	1.256	486	11.51	13.3	12.3		1550
20AM0041	1.226	477	6.21	15.3	19.3		1550
20AM0042	1.102	352	1.92	24.0	37.7		1660
20AM0043	1.147	522	7.04	22.3	25.7		1550
20AM0044	1.162	522	7.04	22.3	25.7		1550
20AM0045	1.755	514	6.92	25.3	19.0	514	1600
20AM0046	1.363	514	13.15	16.0	15.7	514	1600

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API–T M602
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT–LB]	CHARPY TL [FT–LB]	CHARPY HARD [RC]	AUS TEMP [DEG F]
20AM0047	1.222	495	5.91	26.0	26.3		1550
20AM0048	1.237	507	11.56	17.2	14.8	477	1600
20AM0049	1.759	514	7.89	10.7	21.0	514	1600
20AM0050	1.240	477	12.05	23.5	18.8	514	1600
20AM0051	1.102	534	13.74	20.0	26.7	534	1550
20AM0052	1.224	477	13.74	33.0	36.3	477	1550
20AM0053	1.102	512	11.90	23.3	23.7	512	1550
20AM0054	1.100	512	11.90	23.3	23.7	512	1550
20AM0055	1.142	514	5.89	14.0	12.0	514	1650
20AM0056	1.252	477	10.36	43.3	67.3		1550
20AM0057	1.120	512	7.58	25.0	24.3		1650
20AM0058	1.218	495	13.15	18.3	16.3	495	1650
20AM0059	1.366	495	13.15	18.3	16.3	495	1650
20AM0060	1.220	514	12.50	22.0	21.0	514	1650
20AM0061	1.781	506	11.04	19.5	21.5	514	1600
20AM0062	1.186	486	6.79	16.3	17.3		1550
20AM0063	1.175	486	7.45	17.0	19.0		1550
20AM0064	1.274	477	6.72	16.0	16.0		1550
20AM0065	1.262	514	12.49	17.2	16.8	514	1600
20AM0066	1.244	514	11.62	20.0	19.2	477	1600
20AM0067	1.378	477	7.76	16.7	20.7		1550
20AM0068	1.278	477	7.76	19.3	20.3		1550
20AM0069	1.152	514	11.75	30.0	26.0	514	1550
20AM0070	1.997	512	8.67	18.3	18.0	512	1550
20AM0071	1.224	504	12.51	17.3	12.3	495	1650
20AM0072	1.145	486	10.71	25.7	24.3	486	1550
20AM0073	1.776	506	11.27	12.3	15.7		1600
20AM0074	1.357	495	6.69	19.7	16.0	495	1600
20AM0075	1.236	486	7.63	18.3	23.7		1550
20AM0076	1.590	477	7.63	18.3	22.0		1550
20AM0077	1.107	512	7.58	25.0	24.3		1650
20AM0078	1.246	495	6.66	18.7	21.7		1550
20AM0079	1.367	514	12.21	17.0	16.3		1600
20AM0080	1.268	495	6.96	14.7	16.0		1550
20AM0081	1.170	486	6.77	16.3	17.3		1550
20AM0082	1.178	486	6.77	16.3	17.3		1550
20AM0083	1.245	514	7.63	30.0	26.0		1550
20AM0084	1.251	514	7.63	30.0	26.0		1550
20AM0085	1.147	514	11.75	30.0	26.0	514	1550
20AM0086	1.145	514	11.75	30.0	26.0	514	1550
20AM0087	1.242	495	11.56	20.8	16.0	477	1600
20AM0088	1.134	514	7.76	12.7	16.3		1550
20AM0089	1.362	514	12.83	20.3	20.0	514	1600
20AM0090	1.253	486	11.75	20.0	21.7	486	1550
20AM0091	1.152	495	10.17	16.3	19.0	495	1550
20AM0092	1.134	514	11.25	25.3	24.0	514	1550

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 3: MATERIALS PROPERTIES

ARL/MD ID	ACT PLATE TH [IN]	PLATE HARD [BRN]	DI [NUM]	CHARPY LT [FT–LB]	CHARPY TL [FT–LB]	CHARPY HARD [RC]	AUS TEMP [DEG F]
20AM0093	2.014	477	10.256	11.7	18.7	477	1550
20AM0094	1.578	486	11.903	14.7	15	486	1550
20AM0095	1.256	495	11.039	18.3	20.3	495	1550
20AM0096	1.228	477	10.609	15.3	16.3	477	1550

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API-T M602
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
20AM0001	A	P	90001603	10/24/90		SIX	20MMAPITM602	0	1.240	2169	2185	F	16
20AM0002	A	P	90001623	10/31/90		SIX	20MMAPITM602	0	1.749	2801	2926	P	125
20AM0003	A	P	90001637	11/05/90		SIX	20MMAPITM602	0	1.748	2801	2906	P	105
20AM0004	A	P	90001685	12/12/90		SIX	20MMAPITM602	0	1.176	2069	2054	F	-15
20AM0005	A	R	90001686	12/12/90	90001402	SIX	20MMAPITM602	0	1.380	2375	2399	P	24
20AM0006	A	R	90001687	12/12/90	90001402	SIX	20MMAPITM602	0	1.384	2381	2403	P	22
20AM0007	A	P	90001699	12/13/90		SIX	20MMAPITM602	0	1.963	3048	3149	P	101
20AM0008	A	P	90001767	12/03/90		SIX	20MMAPITM602	0	1.755	2813	2899	P	86
20AM0009	A	P	90001785	12/12/90		SIX	20MMAPITM602	0	1.251	2186	2256	P	70
20AM0010	A	P	90001851	12/13/90		SIX	20MMAPITM602	0	1.177	2070	2019	F	-51
20AM0011	A	P	90001852	12/13/90		SIX	20MMAPITM602	0	1.249	2183	2156	F	-27
20AM0012	A	R	90001853	12/13/90	90001689	SIX	20MMAPITM602	0	1.088	1879	1995	P	116
20AM0013	A	R	90001854	12/13/90	90001689	SIX	20MMAPITM602	0	1.094	1890	1950	P	60
20AM0014	A	R	90001855	12/13/90	90001208	SIX	20MMAPITM602	0	1.096	1894	1920	P	26
20AM0015	A	R	91000087	01/24/91		TEN	20MMAPITM602	0	1.387	2343	2254	F	-89
20AM0016	A	P	91000045	01/17/91		SIX	20MMAPITM602	0	1.248	2140	2205	P	65
20AM0017	A	R	91000126	01/24/91		SIX	20MMAPITM602	0	1.171	2061	1968	F	-93
20AM0018	A	R	91000127	02/04/91		SIX	20MMAPITM602	0	1.171	2061	2040	F	-21
20AM0019	A	P	91000128	01/25/91		SIX	20MMAPITM602	0	1.951	3034	3116	P	82
20AM0020	A	P	91000148	02/04/91		SIX	20MMAPITM602	0	1.936	3061	3089	P	28
20AM0021	A	P	91000193	02/04/91		SIX	20MMAPITM602	0	1.131	1953	1953	P	0
20AM0022	A	P	91000199	02/05/91		SIX	20MMAPITM602	0	1.353	2337	2422	P	85
20AM0023	A	P	91000269	02/14/91		SIX	20MMAPITM602	0	1.266	2167	2243	P	76
20AM0024	A	P	91000326	03/27/91		SIX	20MMAPITM602	0	1.153	2031	2022	F	-9
20AM0025	A	P	91000479	03/05/91		SIX	20MMAPITM602	0	1.254	2149	2210	P	61
20AM0026	A	P	91000480	03/05/91		SIX	20MMAPITM602	0	1.245	2135	2210	P	75
20AM0027	A	P	91000566	03/15/91		SIX	20MMAPITM602	0	1.357	2301	2310	P	9
20AM0028	A	P	91000584	03/15/91		SIX	20MMAPITM602	0	1.756	2814	2925	P	111
20AM0029	A	P	91000640	04/12/91		FOUR	20MMAPITM602	0	1.237	2123	2186	P	63
20AM0030	A	P	91000641	04/12/91		SIX	20MMAPITM602	0	1.140	1968	1989	P	21
20AM0031	A	P	91000723	04/14/91		SIX	20MMAPITM602	0	1.759	2818	2909	P	91
20AM0032	A	P	91000726	04/15/91		SIX	20MMAPITM602	0	1.250	2143	2223	P	80
20AM0033	A	P	91000727	04/15/91		SIX	20MMAPITM602	0	1.381	2334	2401	P	67
20AM0034	A	P	91000732	04/16/91		SIX	20MMAPITM602	0	1.113	1922	1965	P	43
20AM0035	A	P	91000781	05/16/91		SIX	20MMAPITM602	0	1.180	2075	2090	P	15
20AM0036	A	P	91000803	05/21/91		SIX	20MMAPITM602	0	1.112	1921	2039	P	118
20AM0037	A	P	91000810	05/31/91		SIX	20MMAPITM602	0	1.236	2121	2200	P	79
20AM0038	A	P	91000823	05/31/91		FOUR	20MMAPITM602	0	1.970	3056	3178	P	122
20AM0039	A	P	91000825	06/05/91		SIX	20MMAPITM602	0	1.112	1921	1962	P	41
20AM0040	A	P	91000831	05/17/91		SIX	20MMAPITM602	0	1.256	2152	2064	F	-88
20AM0041	A	P	91000998	06/06/91		SIX	20MMAPITM602	0	1.226	2106	2191	P	85
20AM0042	A	P	91001003	06/06/91		SIX	20MMAPITM602	0	1.102	1904	1874	F	-30
20AM0043	A	R	91001009	06/12/91	91000326	SIX	20MMAPITM602	0	1.147	2021	2065	P	44
20AM0044	A	R	91001010	06/06/91	91000326	SIX	20MMAPITM602	0	1.162	2046	2105	P	59
20AM0045	A	P	91001043	06/14/91		SIX	20MMAPITM602	0	1.755	2813	2859	P	46
20AM0046	A	P	91001047	06/13/91		SIX	20MMAPITM602	0	1.363	2309	2298	F	-11

CSTA-ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API-T M602
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
D = DEVELOPMENT
FA = FIRST ARTICLE
P = PRIMARY
R = RETEST

P = PASS
F = FAIL

ARL/MD ID	TEST PURPOSE (A/D/FA)	SAMPLE PRIM/RET (P/R)	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST (NUM)	PROJECTILE	OBL (DEG)	ACT PLATE TH (IN)	REQ VEL (FT/SEC)	ACT VEL (FT/SEC)	PASS FAIL (P/F)	VEL DIFF (FT/SEC)
20AM0047	A	P	91001103	06/12/91		SIX	20MMAPITM602	0	1.222	2099	2110	P	11
20AM0048	A	P	91001190	06/28/91		SIX	20MMAPITM602	0	1.237	2123	2218	P	95
20AM0049	A	P	91001191	06/28/91		SIX	20MMAPITM602	0	1.759	2818	2931	P	113
20AM0050	A	P	91001265	07/18/91		SIX	20MMAPITM602	0	1.240	2127	2204	P	77
20AM0051	A	P	91001278	07/24/91		SIX	20MMAPITM602	0	1.102	1904	1967	P	63
20AM0052	A	P	91001279	07/24/91		SIX	20MMAPITM602	0	1.224	2102	2131	P	29
20AM0053	A	R	91001280	07/29/91	91001003	SIX	20MMAPITM602	0	1.102	1904	2005	P	101
20AM0054	A	R	91001281	07/26/91	91001003	SIX	20MMAPITM602	0	1.100	1900	1995	P	95
20AM0055	A	P	91001286	07/25/91		SIX	20MMAPITM602	0	1.142	1971	2074	P	103
20AM0056	A	P	91001300	07/29/91		SIX	20MMAPITM602	0	1.252	2146	2226	P	80
20AM0057	A	P	91001330	08/05/91		SIX	20MMAPITM602	0	1.120	1977	1758	F	-219
20AM0058	FA		91001342	08/19/91		SIX	20MMAPITM602	0	1.218	2093	2293	P	200
20AM0059	FA		91001343	08/19/91		SIX	20MMAPITM602	0	1.366	2313	2406	P	93
20AM0060	A	P	91001344	08/19/91		SIX	20MMAPITM602	0	1.220	2096	1892	F	-204
20AM0061	A	P	91001597	10/01/91		SIX	20MMAPITM602	0	1.781	2843	2955	P	112
20AM0062	A	P	91001627	10/03/91		SIX	20MMAPITM602	0	1.186	2085	2068	F	-17
20AM0063	A	P	91001628	10/03/91		SIX	20MMAPITM602	0	1.175	2067	2136	P	69
20AM0064	A	P	91001632	10/03/91		SIX	20MMAPITM602	0	1.274	2179	2269	P	90
20AM0065	A	P	91001639	10/02/91		SIX	20MMAPITM602	0	1.262	2161	2301	P	140
20AM0066	A	P	91001640	10/02/91		SIX	20MMAPITM602	0	1.244	2133	2163	P	30
20AM0067	A	P	91001678	10/11/91		SIX	20MMAPITM602	0	1.378	2330	2350	P	20
20AM0068	A	P	91001679	10/11/91		SIX	20MMAPITM602	0	1.278	2185	2279	P	94
20AM0069	A	P	91001756	11/13/91		SIX	20MMAPITM602	0	1.152	1987	1840	F	-147
20AM0070	A	P	91001759	10/28/91		SIX	20MMAPITM602	0	1.997	3127	3226	P	99
20AM0071	A	R	91001760	10/18/91		SIX	20MMAPITM602	0	1.224	2102	1887	F	-215
20AM0072	A	P	91001807	11/13/91		SIX	20MMAPITM602	0	1.145	1976	2088	P	112
20AM0073	A	P	91001833	11/14/91		SIX	20MMAPITM602	0	1.776	2837	2990	P	153
20AM0074	A	P	91001859	11/25/91		SIX	20MMAPITM602	0	1.357	2301	2322	P	21
20AM0075	A	P	91001958	12/16/91		SIX	20MMAPITM602	0	1.236	2121	2060	F	-61
20AM0076	A	P	91001963	12/13/91		SIX	20MMAPITM602	0	1.590	2612	2678	P	66
20AM0077	A	R	91001988	12/17/91	91001330	SIX	20MMAPITM602	0	1.107	1955	1924	F	-31
20AM0078	A	P	92000002	01/14/92		SIX	20MMAPITM602	0	1.246	2137	2259	P	122
20AM0079	A	P	92000057	01/14/92		SIX	20MMAPITM602	0	1.367	2315	2400	P	85
20AM0080	A	P	92000058	01/16/92		SIX	20MMAPITM602	0	1.268	2170	2115	F	-55
20AM0081	A	R	92000060	01/17/92	91001627	SIX	20MMAPITM602	0	1.170	2059	2095	P	36
20AM0082	A	R	92000061	01/17/92	91001627	SIX	20MMAPITM602	0	1.178	2072	2136	P	64
20AM0083	A	R	92000063	01/17/92	91001756	SIX	20MMAPITM602	0	1.245	2135	2162	P	27
20AM0084	A	R	92000064	01/17/92	91001756	SIX	20MMAPITM602	0	1.251	2144	2055	F	-89
20AM0085	A	R	92000065	01/17/92	91001756	SIX	20MMAPITM602	0	1.147	1979	2032	P	53
20AM0086	A	R	92000069	01/22/92	91001756	SIX	20MMAPITM602	0	1.145	1976	2029	P	53
20AM0087	A	P	92000072	01/22/92		SIX	20MMAPITM602	0	1.242	2130	2273	P	143
20AM0088	A	P	92000075	01/28/92		SIX	20MMAPITM602	0	1.134	1957	2032	P	75
20AM0089	A	P	92000249	02/26/92		SIX	20MMAPITM602	0	1.362	2308	2221	F	-87
20AM0090	A	R	92000254	02/26/92	92000064	SIX	20MMAPITM602	0	1.253	2147	2171	P	24
20AM0091	A	P	92000255	03/03/92		SIX	20MMAPITM602	0	1.152	1987	1972	F	-15
20AM0092	A	P	92000256	03/03/92		SIX	20MMAPITM602	0	1.134	1957	1933	F	-24

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API–T M602
DATABASE MODULE 4: BALLISTIC PERFORMANCE

A = ACCEPTANCE
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FA = FIRST ARTICLE
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ARL/MD ID	TEST PURPOSE [A/D/FA]	SAMPLE PRIM/RET [P/R]	FIRING RECORD	FIRING DATE	FAIL FIRING RECORD	TEST [NUM]	PROJECTILE	OBL [DEG]	ACT PLATE TH [IN]	REQ VEL [FT/SEC]	ACT VEL [FT/SEC]	PASS FAIL [P/F]	VEL DIFF [FT/SEC]
20AM0093	A	P	92000257	33668		SIX	20MMAPITM602	0	2.014	3103	3059	F	−44
20AM0094	A	P	92000260	33666		SIX	20MMAPITM602	0	1.578	2597	2667	P	70
20AM0095	A	R	92000261	33662	92000058	SIX	20MMAPITM602	0	1.256	2152	2048	F	−104
20AM0096	A	P	92000288	33674		SIX	20MMAPITM602	0	1.228	2109	2109	P	0

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
20AM0001	0.3100	0.8700	0.4200	0.9900	0.5500	0.5500							0.0250
20AM0002	0.3200	0.9000	0.4300	1.0800	0.5600	0.5600				0.0100	0.0010	0.0020	0.0220
20AM0003	0.3100	0.9100	0.4600	1.0300	0.5600	0.5900				0.0110	0.0020	0.0020	0.0200
20AM0004	0.3100	0.9200	0.4500	1.0200	0.5700	0.5800	0.0040		0.1000	0.0070	0.0020		0.0220
20AM0005	0.3200	0.9100	0.4500	1.0300	0.5800	0.5700				0.0090	0.0020		0.0220
20AM0006	0.3200	0.9100	0.4500	1.0300	0.5800	0.5700				0.0090	0.0020		0.0220
20AM0007	0.3100	0.9100	0.4600	1.0100	0.5600	0.5800			0.1100	0.0090	0.0020	0.0030	0.0230
20AM0008	0.3000	0.8900	0.5300	1.2800	0.6100	0.5000	0.0040			0.0120	0.0060	0.0900	
20AM0009	0.3000	0.8800	0.4100	0.9800	0.5700	0.5600				0.0070	0.0020		0.0200
20AM0010	0.3200	0.9000	0.4300	1.0800	0.5600	0.5600	0.0030		0.1300	0.0100	0.0010		0.0220
20AM0011	0.3100	0.9100	0.4600	1.0300	0.5600	0.5900				0.0110	0.0020		0.0200
20AM0012	0.3200	0.9100	0.4500	1.0300	0.5800	0.5700			0.1300	0.0090	0.0020	0.0030	0.0220
20AM0013	0.3200	0.9100	0.4500	1.0300	0.5800	0.5700			0.1300	0.0090	0.0020	0.0030	0.0220
20AM0014	0.2900	0.8700	0.4200	1.0800	0.5700	0.5700			0.1100	0.0070	0.0020	0.0030	0.0210
20AM0015	0.3100	1.1100	0.0450	1.0300	0.6300	0.3200		0.0025		0.0080	0.0040		0.0360
20AM0016	0.3200	1.0900	0.4100	1.1900	0.6600	0.4200		0.0003		0.0110	0.0020		0.0210
20AM0017	0.3100	0.9200	0.4500	1.0200	0.5700	0.5800	0.0040		0.1000	0.0070	0.0020		0.0220
20AM0018	0.3100	0.9200	0.4500	1.0200	0.5700	0.5800	0.0040		0.1000	0.0070	0.0020		0.0220
20AM0019	0.3100	0.9100	0.4600	1.0300	0.5600	0.5900			0.1400	0.0110	0.0020	0.0020	0.0200
20AM0020	0.3100	0.8700	0.4200	0.9900	0.5500	0.5500				0.0070	0.0020		0.0250
20AM0021	0.3200	0.8800	0.4300	1.0000	0.5500	0.5600			0.1400	0.0090	0.0010	0.0040	0.0270
20AM0022	0.3100	0.8700	0.4300	1.0100	0.5500	0.5300				0.0080	0.0020		0.0300
20AM0023	0.3100	0.8700	0.4200	0.9700	0.5500	0.5500			0.1300	0.0070	0.0020	0.0030	0.0300
20AM0024	0.3100	0.8800	0.4100	0.9600	0.5400	0.5500	0.0020		0.1200	0.0060	0.0010		0.0310
20AM0025	0.3200	1.0700	0.3900	1.2100	0.6400	0.4000		0.0004		0.0070	0.0040		0.0220
20AM0026	0.3000	1.1100	0.4000	1.1800	0.6500	0.4100		0.0004		0.0070	0.0030		0.2000
20AM0027	0.3000	1.1100	0.4000	1.1800	0.6500	0.4100		0.0004	0.1600	0.0070	0.0030		0.0200
20AM0028	0.3100	0.9100	0.4400	1.0500	0.5800	0.5600				0.0090	0.0020	0.0040	0.0320
20AM0029	0.3100	0.9000	0.4400	0.9600	0.5500	0.5800			0.1400	0.0120	0.0020	0.0020	0.0160
20AM0030	0.3100	0.8700	0.4200	0.9700	0.5500	0.5500			0.1300	0.0070	0.0020	0.0030	0.0300
20AM0031	0.3100	0.8800	0.1200	0.9600	0.5400	0.5500				0.0060	0.0010	0.0030	0.0310
20AM0032	0.3200	1.1200	0.4000	1.1600	0.6500	0.4300		0.0012		0.0080	0.0070		0.0310
20AM0033	0.3100	1.1100	0.4500	1.0300	0.6300	0.3200		0.0025		0.0080	0.0040		0.0360
20AM0034	0.3100	0.9100	0.4400	1.0600	0.5800	0.5600			0.1400	0.0090	0.0020	0.0040	0.0320
20AM0035	0.3100	0.9100	0.4600	1.0100	0.5600	0.5700	0.0030		0.1100	0.0060	0.0010		0.0210
20AM0036	0.2800	1.5400	0.3100			0.5700		0.0015		0.0100	0.0020		
20AM0037	0.3200	1.1200	0.4000	1.1600	0.6500	0.4300		0.0012		0.0080	0.0070		0.0310
20AM0038	0.3100	0.9100	0.4600	1.0300	0.5600	0.5900			0.1400	0.0110	0.0020	0.0020	0.0200
20AM0039	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400			0.1200	0.0080	0.0030	0.0040	0.0370
20AM0040	0.3200	0.8800	0.4300	1.0000	0.5500	0.5600	0.0030	0.0003	0.1400	0.0090	0.0010	0.0040	0.0270
20AM0041	0.3000	0.8700	0.4100	0.9000	0.5000	0.5600			0.0900	0.0080	0.0020	0.0030	0.0250
20AM0042	0.2300	1.2500	0.2300			0.4800			0.1100	0.0080	0.0020	0.0030	0.0190
20AM0043	0.3100	0.8700	0.4200	0.9700	0.5500	0.5600	0.0020		0.1300	0.0050	0.0010		0.0300
20AM0044	0.3100	0.8700	0.4200	0.9700	0.5500	0.5600	0.0020		0.1300	0.0050	0.0010		0.0300
20AM0045	0.2900	0.8800	0.4300	1.1000	0.5700	0.5800	0.0050			0.0060	0.0020	0.0030	
20AM0046	0.3200	1.0900	0.4100	1.1900	0.6600	0.4200		0.0003	0.1500	0.0110	0.0020		0.0210

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
20AM0001										
20AM0002										
20AM0003										
20AM0004	0.0030		0.0050			0.0074	0.0020	0.3000	0.0060	0.0190
20AM0005										
20AM0006										
20AM0007	0.0030	0.0030	0.0060	0.0120	0.0030					
20AM0008										
20AM0009										
20AM0010	0.0030		0.0060			0.0064	0.0010	0.4000	0.0040	0.0140
20AM0011										
20AM0012	0.0030	0.0020	0.0050	0.0100	0.0030					
20AM0013	0.0030	0.0020	0.0050	0.0100	0.0030					
20AM0014	0.0030	0.0020	0.0050	0.0120	0.0020					
20AM0015	0.0410									
20AM0016										
20AM0017	0.0030		0.0050			0.0074	0.0020	0.3000	0.0060	0.0190
20AM0018	0.0030		0.0050			0.0074	0.0020	0.3000	0.0060	0.0190
20AM0019	0.0030	0.0020	0.0060	0.0140	0.0030					
20AM0020										
20AM0021	0.0030	0.0030	0.0060	0.0110	0.0030					
20AM0022										
20AM0023	0.0030	0.0020	0.0050	0.0080						
20AM0024	0.0030		0.0040			0.0068	0.0010	0.6000	0.0010	0.0100
20AM0025										
20AM0026										
20AM0027										
20AM0028										
20AM0029	0.0020	0.0020	0.0050	0.0140	0.0030					
20AM0030	0.0030	0.0020	0.0050	0.0080						
20AM0031										
20AM0032										
20AM0033										
20AM0034	0.0030	0.0030	0.0060	0.0080	0.0030					
20AM0035	0.0030		0.0040							
20AM0036										
20AM0037										
20AM0038	0.0030	0.0020	0.0060	0.0140	0.0030					
20AM0039	0.0290	0.0020	0.0050	0.0090	0.0030					
20AM0040	0.0030	0.0030	0.0060	0.0110	0.0030					
20AM0041	0.0040	0.0020	0.0050	0.0070	0.0030					
20AM0042	0.0330	0.0020	0.0050	0.0090	0.0030					
20AM0043	0.0030		0.0030							
20AM0044	0.0030		0.0030							
20AM0045										
20AM0046										

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
20AM0047	0.2900	0.8400	0.4300	0.9400	0.5000	0.5400			0.1200	0.0080	0.0030	0.0040	0.0370
20AM0048	0.3000	1.0800	0.3900	1.1900	0.6200	0.4100		0.0004		0.0090	0.0080		0.0290
20AM0049	0.3100	0.9100	0.4700	1.1900	0.6100	0.5500				0.0100	0.0010	0.0020	
20AM0050	0.3000	1.1100	0.4100	1.1700	0.6500	0.4000		0.0003		0.0060	0.0030		0.0290
20AM0051	0.3100	0.9200	0.4900	1.1700	0.6100	0.5600	0.0050	0.0005	0.1700	0.0110	0.0020	0.0030	0.0320
20AM0052	0.3100	0.9200	0.4900	1.1700	0.6100	0.5600	0.0050	0.0005	0.1700	0.0110	0.0020	0.0030	0.0320
20AM0053	0.3100	0.9000	0.4400	0.9600	0.5500	0.5800	0.0050	0.0008	0.1400	0.0120	0.0020	0.0020	0.0160
20AM0054	0.3100	0.9000	0.4400	0.9600	0.5500	0.5800	0.0050	0.0008	0.1400	0.0120	0.0020	0.0020	0.0160
20AM0055	0.3000	1.5300	0.2300			0.5400		0.0007		0.0090	0.0040		
20AM0056	0.2800	0.8600	0.4100	0.9500	0.5100	0.5500	0.0030	0.0003	0.1600	0.0100	0.0010	0.0030	0.0290
20AM0057	0.3200	1.0700	0.3900	1.2100	0.6400	0.4000				0.0070	0.0040		0.0220
20AM0058	0.3200	1.0900	0.4100	1.1900	0.6600	0.4200		0.0003	0.1500	0.0110	0.0020		0.0210
20AM0059	0.3200	1.0900	0.4100	1.1900	0.6600	0.4200		0.0003	0.1500	0.0110	0.0020		0.0210
20AM0060	0.3200	1.1200	0.4100	1.2500	0.6600	0.3800		0.0004	0.0600	0.0090	0.0060		0.0520
20AM0061	0.3200	0.9100	0.4100	1.0200	0.5500	0.5500	0.0030	0.0003		0.0070	0.0010	0.0030	
20AM0062	0.3100	0.9100	0.4300	0.8900	0.5000	0.5500	0.0030		0.1500	0.0100	0.0020		0.0270
20AM0063	0.3200	0.9100	0.4100	1.0200	0.5500	0.5500	0.0030		0.1100	0.0070	0.0010		0.0410
20AM0064	0.3100	0.9000	0.4400	0.8800	0.5000	0.5500			0.1500	0.0100	0.0020	0.0030	0.0280
20AM0065	0.3200	1.1100	0.4000	1.2500	0.6500	0.4100		0.0005		0.0100	0.0020		0.0160
20AM0066	0.3000	1.0600	0.4000	1.1900	0.6500	0.4000		0.0005		0.0080	0.0010		0.0250
20AM0067	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060		0.1900	0.0130	0.0030	0.0030	0.0300
20AM0068	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060		0.1900	0.0130	0.0030	0.0030	0.0300
20AM0069	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030	0.0004	0.1400	0.0100	0.0010	0.0030	0.0440
20AM0070	0.3100	0.9200	0.4900	1.1700	0.6100	0.5600	0.0050		0.1700	0.0110	0.0020		0.0320
20AM0071	0.3200	1.1200	0.4100	1.2500	0.6600	0.3800		0.0004	0.0600	0.0090	0.0060		0.0520
20AM0072	0.3100	0.9000	0.4400	0.8800	0.5000	0.5500	0.0030	0.0004	0.1500	0.0100	0.0020	0.0030	0.0280
20AM0073	0.3200	0.9000	0.4500	1.0100	0.5600	0.5500	0.0030	0.0011		0.0090	0.0020	0.0040	
20AM0074	0.3200	1.1200	0.4000	1.1600	0.0650	0.4300	0.0030	0.0012	0.1400	0.0080	0.0070		0.0310
20AM0075	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030		0.1400	0.0100	0.0010	0.0030	0.0440
20AM0076	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030		0.1400	0.0100	0.0010	0.0030	0.0440
20AM0077	0.3200	1.0700	0.3900	1.2100	0.6400	0.4000				0.0070	0.0040		0.0220
20AM0078	0.2900	0.8800	0.4300	0.9400	0.5400	0.5600	0.0030		0.1700	0.0150	0.0020	0.0040	0.0380
20AM0079	0.3000	1.0600	0.4000	1.1900	0.6500	0.4000		0.0005	0.1400	0.0080	0.0010		0.0250
20AM0080	0.3100	0.8700	0.4300	1.0100	0.5500	0.5300	0.0040		0.1400	0.0080	0.0020	0.0030	0.0300
20AM0081	0.3100	0.9100	0.4300	0.8900	0.5000	0.5500	0.0030		0.1500	0.0100	0.0020		0.0270
20AM0082	0.3100	0.9100	0.4300	0.8900	0.5000	0.5500	0.0030		0.1500	0.0100	0.0020		0.0270
20AM0083	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030		0.1400	0.0100	0.0010	0.0030	0.0440
20AM0084	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030		0.1400	0.0100	0.0010	0.0030	0.0440
20AM0085	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030	0.0004	0.1400	0.0100	0.0010	0.0030	0.0440
20AM0086	0.3200	0.8900	0.4600	1.0300	0.5500	0.5500	0.0030	0.0004	0.1400	0.0100	0.0010	0.0030	0.0440
20AM0087	0.3100	1.0800	0.4100	1.2200	0.6400	0.3800		0.0005		0.0060	0.0060		0.0110
20AM0088	0.3100	0.9100	0.4500	1.0500	0.5600	0.5500	0.0060		0.1900	0.0120	0.0030	0.0030	0.0300
20AM0089	0.3100	1000	0.4100	1.1800	0.6500	0.4100		0.0004	0.1400	0.0060	0.0020		0.0230
20AM0090	0.3200	3.8900	0.4600	1.0300	0.5500	0.5500	0.0030	0.0004	0.1400	0.0100	0.0010	0.0030	0.0440
20AM0091	0.3000	0.8800	0.4500	0.9000	0.4900	0.5300	0.0020	0.0003	0.1300	0.0080	0.0020	0.0010	0.0380
20AM0092	0.2900	0.8800	0.4300	0.9600	0.5400	0.5600	0.0030	0.0003	0.1700	0.0150	0.0020	0.0040	0.0380

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CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API–T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
20AM0047	0.0290	0.0020	0.0050	0.0090	0.0030					
20AM0048										
20AM0049										
20AM0050										
20AM0051	0.0050	0.0030	0.0070	0.0100	0.0030					
20AM0052	0.0050	0.0030	0.0070	0.0100	0.0030					
20AM0053	0.0020	0.0020	0.0050	0.0140	0.0030					
20AM0054	0.0020	0.0020	0.0050	0.0140	0.0030					
20AM0055										
20AM0056	0.0030	0.0020	0.0060	0.0130	0.0030					
20AM0057										
20AM0058										
20AM0059										
20AM0060										
20AM0061										
20AM0062	0.0040		0.0050			0.0056	0.0030	0.2000	0.0010	0.0100
20AM0063	0.0040		0.0040			0.0059	0.0020	0.3000	0.0010	0.0100
20AM0064	0.0040	0.0030	0.0060	0.0090	0.0030					
20AM0065										
20AM0066										
20AM0067	0.0030	0.0020	0.0060	0.0100	0.0020					
20AM0068	0.0030	0.0020	0.0060	0.0100	0.0020					
20AM0069	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0070	0.0050		0.0070							
20AM0071										
20AM0072	0.0040	0.0030	0.0060	0.0090	0.0030					
20AM0073										
20AM0074										
20AM0075	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0076	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0077										
20AM0078	0.0030	0.0010	0.0060	0.0140	0.0020					
20AM0079										
20AM0080	0.0020	0.0020	0.0040	0.0120						
20AM0081	0.0040		0.0050			0.0056	0.0030	0.2000	0.0010	0.0100
20AM0082	0.0040		0.0050			0.0056	0.0030	0.2000	0.0010	0.0100
20AM0083	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0084	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0085	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0086	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0087										
20AM0088	0.0030	0.0020	0.0060	0.0100	0.0020					
20AM0089										
20AM0090	0.0040	0.0020	0.0050	0.0070	0.0020					
20AM0091	0.0030	0.0030	0.0050	0.0120	0.0030					
20AM0092	0.0030	0.0010	0.0060	0.0140	0.0020					

CSTA – ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API – T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	C [WT%]	MN [WT%]	SI [WT%]	NI [WT%]	CR [WT%]	MO [WT%]	V [WT%]	B [WT%]	CU [WT%]	P [WT%]	S [WT%]	ZR [WT%]	AL [WT%]
20AM0093	0.2800	0.8600	0.4100	0.9500	0.5000	0.5500	0.0030	0.0003	0.1600	0.0100	0.0010	0.0030	0.0290
20AM0094	0.3100	0.9000	0.4400	0.9600	0.5500	0.5800	0.0050	0.0008	0.1400	0.0120	0.0020	0.0020	0.0160
20AM0095	0.3100	0.8700	0.4300	1.0100	0.5500	0.5300	0.0040	0.0004	0.1400	0.0080	0.0020	0.0030	0.0300
20AM0096	0.3000	0.8400	0.4300	0.9900	0.5700	0.5200	0.0030	0.0010	0.1100	0.0120	0.0040	0.0030	0.0420

CSTA–ARL/MD JOINT EFFORT FOR THE IMPROVEMENT OF THE
BALLISTIC PERFORMANCE OF ARMOR PLATE MATERIALS
PROJECTILE: 20 MM API–T M602
DATABASE MODULE 5: CHEMICAL COMPOSITIONS

ARL/MD ID	TI [WT%]	SB [WT%]	AS [WT%]	SN [WT%]	PB [WT%]	N [WT%]	O [WT%]	H [WT%]	CB [WT%]	CO [WT%]
20AM0093	0.0030	0.0020	0.0060	0.0130	0.0030					
20AM0094	0.0020	0.0020	0.0050	0.0140	0.0030					
20AM0095	0.0020	0.0020	0.0040	0.0120	0.0040					
20AM0096	0.0030	0.0030	0.0050	0.0100	0.0050					

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