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CONTROLLED HAZARDOUS SUBSTANCE (CHS) FACILITY PERMIT APPLICATION NSWC  
INDIAN HEAD MD  
4/1/1995  
RADIAN CORPORATION

# Controlled Hazardous Substance (CHS) Facility Permit Application



Prepared for:  
Indian Head Division  
Naval Surface Warfare Center

Prepared by:  
**RADIAN**  
CORPORATION

April 1995

**Controlled Hazardous Substance (CHS)  
Facility Permit Application**

**Indian Head Division  
Naval Surface Warfare Center**

April 1995

Submitted by:

Department of the Navy  
Indian Head Division  
Naval Surface Warfare Center  
Indian Head, Maryland

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## Section A Permit Application

The Indian Head Division, Naval Surface Warfare Center (IHDIIVNAVSURFWARCEN) is located at Indian Head, Maryland, and encompasses approximately 3,400 acres of land divided between two peninsulas along the eastern shore of the Potomac River. The larger peninsula is designated as the Indian Head Division, Naval Surface Warfare Center (IHDIIVNAVSURFWARCEN); the smaller peninsula (about 1,100 acres) is designated as the Naval Warfare Center, Stump Neck Annex (Stump Neck Annex). Operations at IHDIIVNAVSURFWARCEN are conducted under the IHDIIVNAVSURFWARCEN command, while operations at Stump Neck Annex are conducted by a tenant command of IHDIIVNAVSURFWARCEN, the Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV). In addition, the Naval Explosive Ordnance Disposal School (NAVSCOLEOD), which is also a tenant of IHDIIVNAVSURFWARCEN, conducts operations both mainside and at Stump Neck. However, some functions for both facilities are handled by the IHDIIVNAVSURFWARCEN. These include the analysis of material or waste samples, contingency planning and emergency response, and personnel training as they pertain to hazardous waste operations.

In July 1985, the IHDIIVNAVSURFWARCEN submitted a controlled hazardous substance (CHS) permit application to the State of Maryland for the treatment and storage of CHS at IHDIIVNAVSURFWARCEN. As a matter of clarification, the State of Maryland designation of "controlled hazardous substance" is synonymous with the Environmental Protection Agency's (EPA's) designation of "hazardous waste." After the Maryland Department of the Environment (MDE) reviewed the application and completed the public hearing process, they issued the CHS permit No. A-223 on April 14, 1988 for the storage facilities at IHDIIVNAVSURFWARCEN. The original CHS permit No. A-223 was to expire on April 13, 1991.

A renewal permit application was submitted to the State of Maryland on October 2, 1990. That application addressed the management of Controlled Hazardous Substances (CHS) associated with

operations conducted at the IHDIVNAV SURFWARCEN and reflected all relevant changes that had taken place at the IHDIVNAV SURFWARCEN since the State of Maryland issued CHS Permit No. A-223 on April 14, 1988. An updated version incorporating the MDE's comments was submitted October 1992. This resubmittal application incorporates all known environmental changes in the operations at IHDIVNAV SURFWARCEN since the October 1992 document was submitted, as well as clarifications/modifications based on responses to the MDE comments on that submittal.

Applicable documents included in Section A:

- Appendix A.1 - CHS Permit Application
- Appendix A.2 - Additional Environmental Permits

**Appendix A.1**  
**CHS Application**

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

For EPA Regional Use Only	<h1 style="margin:0;">EPA</h1> United States Environmental Protection Agency Washington, DC 20460  <h2 style="margin:0;">Hazardous Waste Permit Application Part A</h2> <p style="margin:0;"><i>(Read the instructions before starting)</i></p>	
Date Received Month      Day      Year _____		
I. Installation's EPA ID Number <i>(Mark 'X' in the appropriate box)</i>		
<input type="checkbox"/> A. First Part A Submission		<input type="checkbox"/> B. Part A Amendment #
C. Installation's EPA ID Number		D. Secondary ID Number <i>(if applicable)</i>
M D 4 1 7 0 0 2 4 1 0 9		_____
II. Name of Facility		
N A V A L    S U R F A C E    W A R F A R E    C E N T E R		
III. Facility Location <i>(Physical address not P.O. Box or Route Number)</i>		
A. Street		
1 0 1    S T R A U S S    A V E N U E		
Street <i>(continued)</i>		
_____		
City or Town		State    ZIP Code
I N D I A N    H E A D		M D    2 0 6 4 0 - 5 0 3 5
County Code <i>(if known)</i>	County Name	
_____	C H A R L E S	
B. Land Type	C. Geographic Location	D. Facility Existence Date
<i>(enter code)</i> F	LATITUDE <i>(degrees, minutes, &amp; seconds)</i> 3 8    3 3    0 4 5	LONGITUDE <i>(degrees, minutes, &amp; seconds)</i> 0 7 7    1 2    0 0 3
Month    Day    Year _____    _____    _____		
_____		
IV. Facility Mailing Address		
Street or P.O. Box		
S A M E		
City or Town		State    ZIP Code
_____		_____
V. Facility Contact <i>(Person to be contacted regarding waste activities at facility)</i>		
Name <i>(last)</i>		Name <i>(first)</i>
A D A M S		S U S A N    P.
Job Title		Phone Number <i>(area code and number)</i>
D I R    E N V I R O N M E N T A L		3 0 1 - 7 4 3 - 4 7 1 1
VI. Facility Contact Address <i>(See instructions)</i>		
A. Contact Address		B. Street or P.O. Box
Location    Mailing    Other	_____	
<input checked="" type="checkbox"/> _____    _____	C O D E    0 9 5	
City or Town		State    ZIP Code
_____		_____

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EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												

**VII. Operator Information (see instructions)**

Name of Operator  
 U N I T E D S T A T E S N A V Y

Street or P.O. Box  
 1 0 1 S T R A U S S A V E N U E

City or Town										State		ZIP Code									
I N D I A N H E A D										M D		2 0 6 4 0 - 5 0 3 5									

Phone Number (area code and number)										B. Operator Type		C. Change of Operator Indicator		Date Changed		
3 0 1 - 7 4 3 - 4 7 1 1										F		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>				

**VIII. Facility Owner (see instructions)**

A. Name of Facility's Legal Owner  
 U N I T E D S T A T E S N A V Y

Street or P.O. Box  
 1 0 1 S T R A U S S A V E N U E

City or Town										State		ZIP Code									
I N D I A N H E A D										M D		2 0 6 4 0 - 5 0 3 5									

Phone Number (area code and number)										B. Owner Type		C. Change of Owner Indicator		Date Changed		
3 0 1 - 7 4 3 - 4 7 1 1										F		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>				

**IX. SIC Codes (4-digit, in order of significance)**

Primary					Secondary				
2	8	6	9	(description) Propellants for missiles	2	8	9	2	(description) Manufacture of explosives
Secondary					Secondary				
8	0	7	2	(description) Engineering-Industrial civil, elec, chem, mech, aero	9	7	1	1	(description) National Security

**X. Other Environmental Permits (see instructions)**

A. Permit Type (enter code)		B. Permit Number										C. Description											
E		C	H	9	1	G	0	4	4	0	1	Water Appropriation and Use (MD)											
E		8	9	-	O	P	-	0	6	6	6	Oil Operation (MD)											
R		A	-	2	2	3a						NAVEODTEHCEN Part B											
R		M	D	4	1	7	0	0	9	0	0	0	1	Part B Subpart X for NAVEODTEHCEN									
R		M	D	4	1	7	0	0	2	4	1	0	9	Part B Subpart X for IHDIVNAVSURFWARCEN									
E		A	P	-	9	1	-	2	9	0				IHDIVNAVSURFWARCEN Air Permit, Open Burning (County)									
E		9	3	-	4	4	-	A	P					NAVEODTEHCEN Air Permit, Open Burning (County)									
E		0	8	-	0	0	0	4	0					Air Operating Permit for Rocket Fuel Manufacturing Plant									
N		M	D	0	0	0	3	1	5	8				Industrial NPDES									



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<b>EPA I.D. Number (enter from page 1)</b>	<b>Secondary ID Number (enter from page 1)</b>
M D 4 1 7 0 0 2 4 1 0 9	

**XI. Nature of Business (provide a brief description)**

The IHDIVNAVSURFWARCEN is comprised of the Main Center and the Stump Neck Annex which total approximately 3,400 acres of land. The Naval Explosive Ordnance Disposal Technology Division (NAVEDTECHDIV) and the Naval Explosive Ordnance Disposal School (NAVSCOLEOD) are two of the tenant command operations hosted by IHDIVNAVSURFWARCEN. For purposes of this application, the term IHDIVNAVSURFWARCEN will refer to the Main Center. The IHDIVNAVSURFWARCEN is located at Indian Head, Maryland, approximately 25 miles south of Washington, DC, at the southern terminus of Maryland Route 210. IHDIVNAVSURFWARCEN is situated on a peninsula formed at the confluence of the Potomac River and the Mattawoman Creek, in the west-central portion of Charles County, Maryland. Presently, there are four waste management units at IHDIVNAVSURFWARCEN that require CHS permitting. The IHDIVNAVSURFWARCEN also maintains numerous satellite and less-than-90-day sites. The principal missions of the IHDIVNAVSURFWARCEN is research, development, and production of propellants and explosives for the United States Navy. The scope of operations ranges from laboratory research to full-scale production and testing.

**XII. Process Codes and Design Capacities**

- A. PROCESS CODE** - Enter the code from the list of process codes below that best describes each process to be used at the facility. Thirteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04, and X99), describe the process including its design capacity in the space provided in Item XIII.
- B. PROCESS DESIGN CAPACITY** - For each code entered in column A, enter the capacity of the process.
- 1. AMOUNT** - Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.
  - 2. UNIT OF MEASURE** - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.
- C. PROCESS TOTAL NUMBER OF UNITS** - Enter the total number of units used with the corresponding process code.

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
D79	<u>Disposal:</u> Underground Injection	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	<u>Landfill</u>	Acre-feet or Hectare-meter
D81	<u>Land Treatment</u>	Acres of Hectares
D82	<u>Ocean Disposal</u>	Gallons Per Day r Liters Per Day
D83	<u>Surface Impoundment</u>	Gallons or Liters
D99	<u>Other Disposal</u>	Any Unit of Measure Listed Below
S01	<u>Storage:</u> Container (Barrel, Drum, Etc.)	Gallons or Liters
S02	<u>Tank</u>	Cubic Yards or Cubic Meters
S03	<u>Waste Pile</u>	Gallons or Liters
S04	<u>Surface Impoundment</u>	Gallons or Liters
S06	<u>Drip Pad</u>	Cubic Yards or Cubic Meters
S06	<u>Containment</u>	Any Unit of Measure Listed Below
S99	<u>Building-Storage</u> <u>Other Storage</u>	Any Unit of Measure Listed Below
T01	<u>Treatment:</u> <u>Tank</u>	Gallons Per Day or Liters Per Day
T02	<u>Surface Impoundment</u>	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per Hour; or Btu's Per Hour
T03	<u>Incinerator</u>	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
T04	<u>Other Treatment</u>	Gallons or Liters
T80	<u>Boiler</u>	Gallons Per Day; Liters Per Day;
T81	<u>Cement Kiln</u>	Pounds Per Hour; Short Tons Per Hour;
T82	<u>Lime Kiln</u>	Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour;
T83	<u>Aggregate Kiln</u>	Short Tons Per Day; or Btu's Per Hour
T84	<u>Phosphate Kiln</u>	
T86	<u>Coke Oven</u>	
T86	<u>Blast Furnace</u>	

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
T87	<u>Smelting, Melting, or Refining Furnace</u>	
T88	<u>Titanium Dioxide Oxidation Process</u>	
T89	<u>Oxidation Reactor</u>	
T90	<u>Methane Reforming Furnace</u>	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour;
T90	<u>Pulping Liquor</u>	Per Hour; Metric Tons Per Day; Metric Tons Per Hour;
T90	<u>Recovery Furnace</u>	Short Tons Per Day; or Btu's Per Hour
T91	<u>Combustion Device Used In The Recovery Of Sulfur Values From Spent Sulfuric Acid</u>	
T92	<u>Halogen Acid Furnaces</u>	
T93	<u>Other Industrial Furnaces Listed In 40 CFR §260.10</u>	Cubic Yards or Cubic Meters
T94	<u>Containment</u> <u>Building-Treatment</u> <u>Miscellaneous (Subpart X):</u>	Any Unit of Measure Listed Below
X01	<u>Open Burning/Open Detonation</u>	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; or Kilograms Per Hour
X02	<u>Mechanical Processing</u>	
X03	<u>Thermal Unit</u>	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or Btu's Per Hour
X04	<u>Geologic Repository</u>	Cubic Yards or Cubic Meters
X99	<u>Other Subpart X</u>	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H

UNIT OF MEASURE	UNIT OF MEASURE CODE
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J

UNIT OF MEASURE	UNIT OF MEASURE CODE
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q

<b>EPA I.D. Number (enter from page 1)</b>	<b>Secondary ID Number (enter from page 1)</b>
M D 4 1 7 0 0 2 4 1 0 9	

**XII. Process Codes and Design Capacities (continued)**

*EXAMPLE FOR COMPLETING ITEM XII (shown in line number X-1 below): A facility has a storage tank, which can hold 533 788 gallons.*

Line Number	A. PROCESS CODE (from list above)			B. PROCESS DESIGN CAPACITY		C. PROCESS TOTAL NUMBER OF UNITS			FOR OFFICIAL USE ONLY			
				1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)							
1	S	0	1	9,716 .	G	0	0	1				
2	S	0	1	294,500 .	G	0	0	1				
3	T	0	4	230 .	U	0	0	1				
4	T	0	1	1,000 .	U	0	0	1				
5	T	0	1	300 .	U	0	0	1				
6	T	0	4	165 .	U	0	0	1				
7				.								
8				.								
9				.								
10				.								
11				.								
12				.								
13				* SEE NOTE								

*NOTE: If you need to list more than 13 process codes, attach an additional sheet(s) with the information in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04, and X99) in Item XIII.*

**XIII. Additional Treatment Processes (follow instructions from item XII for D99, S99, T04 and X99 process codes)**

Line Number (enter #s in seq w/XII)	A. PROCESS CODE (From list above)			B. PROCESS DESIGN CAPACITY		C. PROCESS TOTAL NUMBER OF UNITS	D. DESCRIPTION OF PROCESS
				1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)		
3	T	0	4	230 .	U	001	Spent carbon from the treatment of nitrate ester contaminated wastewater is mixed with coal. This mixture is used as a fuel in the Goddard Power Plant.
6	T	0	4	165 .	U	001	Spent carbon from the treatment of pink water is mixed with coal. This mixture is used as a fuel in the Goddard Power Plant.
3				.			
4				.			

\*Note: Elementary neutralization is used at several locations on-site. This treatment is performed in containers.

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EPA I.D. Number (enter from page 1)

M D 4 1 7 0 0 2 4 1 0 9

Secondary ID Number (enter from page 1)

Grid for Secondary ID Number

**XIV. Description of Hazardous Wastes**

- A. EPA HAZARDOUS WASTE NUMBER - Enter the four-digit number from 40 CFR, Part 261 Subpart D of each listed hazardous waste you will handle. For hazardous wastes which are not listed in 40 CFR, Part 261 Subpart D, enter the four-digit number(s) from 40 CFR, Part 261 Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.
- B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A, estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A, estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.
- C. UNIT OF MEASURE - For each quantity entered in column B, enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

**D. PROCESSES**

**1. PROCESS CODES:**

For listed hazardous waste: For each listed hazardous waste entered in column A, select the code(s) from the list of process codes contained in Item XII A. on page 3 to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed hazardous waste: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process codes contained in Item XII A. on page 3 to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that possess that characteristic or toxic contaminant.

**NOTE: THREE SPACES ARE PROVIDED FOR ENTERING PROCESS CODES. IF MORE ARE NEEDED:**

1. Enter the first two as described above.
2. Enter "000" in the extreme right box of Item XIV-D(1).
3. Enter in the space provided on page 7, Item XIV-E, the line number and the additional code(s).

**2. PROCESS DESCRIPTION:** If a code is not listed for a process that will be used, describe the process in the space provided on the form (D.(2)).

**NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER - Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:**

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each EPA Hazardous Waste Number that can be used to describe the hazardous waste.

**EXAMPLE FOR COMPLETING ITEM XIV (shown in line numbers X-1, X-2, X-3, and X-4 below) - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.**

Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESS											
	(1) PROCESS CODES (enter)						(2) PROCESS DESCRIPTION (if a code is not entered in D(1))											
X 1	K	0	5	4	900	P	T	0	3	D	8	0						
X 2	D	0	0	2	400	P	T	0	3	D	8	0						
X 3	D	0	0	1	100	P	T	0	3	D	8	0						
X 4	D	0	0	2									Included With Above					

EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												

**XIV. Description of Hazardous Wastes (continued)**

Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)		B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES																	
					(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))												
1	D	0 0 1	105,371	P	S	0	1															
2	D	0 0 2	294,985	P	S	0	1															
3	D	0 0 3	23,371	P	S	0	1															
4	D	0 0 4	1,014	P	S	0	1															
5	D	0 0 5	1,023	P	S	0	1															
6	D	0 0 6	18,764	P	S	0	1	T	0	1												A small portion of this waste is treated in a tank.
7	D	0 0 7	293,118	P	S	0	1	T	0	1												A small portion of this waste is treated in a tank.
8	D	0 0 8	292,831	P	S	0	1	T	0	1												A small portion of this waste is treated in a tank.
9	D	0 0 9	277,060	P	S	0	1															
1 0	D	0 1 0	515	P	S	0	1															
1 1	D	0 1 1	1,014	P	S	0	1															
1 2	D	0 1 2	500	P	S	0	1															
1 3	D	0 1 3	500	P	S	0	1															
1 4	D	0 1 4	500	P	S	0	1															
1 5	D	0 1 5	500	P	S	0	1															
1 6	D	0 1 6	500	P	S	0	1															
1 7	D	0 1 7	500	P	S	0	1															
1 8	D	0 1 8	101,209	P	S	0	1															
1 9	D	0 1 9	10,042	P	S	0	1															
2 0	D	0 2 0	1	T	S	0	1															
2 1	D	0 2 1	100,010	P	S	0	1															
2 2	D	0 2 2	100,042	P	S	0	1															
2 3	D	0 2 3	100,010	P	S	0	1															
2 4	D	0 2 4	50	T	S	0	1															
2 5	D	0 2 5	50	T	S	0	1															
2 6	D	0 2 6	50	T	S	0	1															
2 7	D	0 2 7	50	T	S	0	1															
2 8	D	0 2 8	50	T	S	0	1															
2 9	D	0 2 9	50	T	S	0	1															
3 0	D	0 3 0	100,010	P	S	0	1															
3 1	D	0 3 1	1	T	S	0	1															
3 2	D	0 3 2	100,010	P	S	0	1															
3 3	D	0 3 3	10,010	P	S	0	1															
3 4	D	0 3 4	5	T	S	0	1															
3 5	D	0 3 5	3,238	P	S	0	1															
3 6	D	0 3 6	100,010	P	S	0	1															

EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												

**XIV. Description of Hazardous Wastes (continued)**

Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)					B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES														
								(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))									
3	7	D	0	3	7	5	T	S	0	1												
3	8	D	0	3	8	15,372	P	S	0	1												
3	9	D	0	3	9	10	T	S	0	1												
4	0	D	0	4	0	50	T	S	0	1												
4	1	D	0	4	1	5	T	S	0	1												
4	2	D	0	4	2	5	T	S	0	1												
4	3	D	0	4	3	5	T	S	0	1												
4	4	F	0	0	1	13,523	P	S	0	1												
4	5	F	0	0	2	9,188	P	S	0	1												
4	6	F	0	0	3	18,766	P	S	0	1												
4	7	F	0	0	4	4,000	P	S	0	1												
4	8	F	0	0	5	5,250	P	S	0	1												
4	9	F	0	0	6	500	P	S	0	1												
5	0	F	0	0	7	1,000	P	S	0	1												
5	1	F	0	0	8	1	T	S	0	1												
5	2	F	0	0	9	5	T	S	0	1												
5	3	F	0	1	0	5	T	S	0	1												
5	4	F	0	1	1	5	T	S	0	1												
5	5	F	0	1	2	5	T	S	0	1												
5	6	F	0	1	9	500	P	S	0	1												
5	7	F	0	2	4	5	T	S	0	1												
5	8	F	0	2	7	10	P	S	0	1												
5	9	K	0	4	4	5	T	S	0	1												
6	0	K	0	4	5	410,000	P	S	0	1												
6	1	K	0	4	6	5	T	S	0	1												
6	2	K	0	4	7	50	T	S	0	1												
6	3	M	0	0	1	3,800	G	S	0	1												
6	4	M	0	0	1	20	T	S	0	1												
6	5	M	T	0	1	1,300	G	S	0	1												
6	6	M	T	0	1	20	T	S	0	1												
6	7	M	X	0	1	473	P	S	0	1												
6	8	N	0	S		8,617	P	S	0	1												Adhesives, Epoxy, Stencil Ink, etc.
6	9	P	0	0	1	50	P	S	0	1												
7	0	P	0	0	2	50	P	S	0	1												
7	1	P	0	0	3	50	P	S	0	1												
7	2	P	0	0	4	50	P	S	0	1												
7	3	P	0	0	5	50	P	S	0	1												
7	4	P	0	0	6	50	P	S	0	1												







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EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												
XIV. Description of Hazardous Wastes (continued)																							
Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES																
							(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))											
1	84	U	0	0	7	.1	T	S	0	1													
1	85	U	0	0	8	.1	T	S	0	1													
1	86	U	0	0	9	.1	T	S	0	1													
1	87	U	0	1	0	.1	T	S	0	1													
1	88	U	0	1	1	.1	T	S	0	1													
1	89	U	0	1	2	236	P	S	0	1													
1	90	U	0	1	4	.1	T	S	0	1													
1	91	U	0	1	5	.1	T	S	0	1													
1	92	U	0	1	6	.1	T	S	0	1													
1	93	U	0	1	7	.1	T	S	0	1													
1	94	U	0	1	8	.1	T	S	0	1													
1	95	U	0	1	9	380	P	S	0	1													
1	96	U	0	2	0	.1	T	S	0	1													
1	97	U	0	2	1	200	P	S	0	1													
1	98	U	0	2	2	.1	T	S	0	1													
1	99	U	0	2	3	.1	T	S	0	1													
2	00	U	0	2	4	.1	T	S	0	1													
1	01	U	0	2	5	.1	T	S	0	1													
2	02	U	0	2	6	.1	T	S	0	1													
2	03	U	0	2	7	.1	T	S	0	1													
2	04	U	0	2	8	.1	T	S	0	1													
2	05	U	0	2	9	.1	T	S	0	1													
2	06	U	0	3	0	.1	T	S	0	1													
2	07	U	0	3	1	375	P	S	0	1													
2	08	U	0	3	2	206	P	S	0	1													
2	09	U	0	3	3	.1	T	S	0	1													
2	10	U	0	3	4	.1	T	S	0	1													
2	11	U	0	3	5	.1	T	S	0	1													
2	12	U	0	3	6	.1	T	S	0	1													
2	13	U	0	3	7	253	P	S	0	1													
2	14	U	0	3	8	.1	T	S	0	1													
2	15	U	0	3	9	.1	T	S	0	1													
2	16	U	0	4	1	210	P	S	0	1													
2	17	U	0	4	2	.1	T	S	0	1													
2	18	U	0	4	3	.1	T	S	0	1													
2	19	U	0	4	4	866	P	S	0	1													

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EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												

**XIV. Description of Hazardous Wastes (continued)**

Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)					B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES														
								(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))									
2	20	U	0	4	5	.1	T	S	0	1												
2	21	U	0	4	6	.1	T	S	0	1												
2	22	U	0	4	7	.1	T	S	0	1												
2	23	U	0	4	8	.1	T	S	0	1												
2	24	U	0	4	9	.1	T	S	0	1												
2	25	U	0	5	0	.1	T	S	0	1												
2	26	U	0	5	1	.1	T	S	0	1												
2	27	U	0	5	2	200	P	S	0	1												
2	28	U	0	5	3	210	P	S	0	1												
2	29	U	0	5	5	210	P	S	0	1												
2	30	U	0	5	6	225	P	S	0	1												
2	31	U	0	5	7	204	P	S	0	1												
2	32	U	0	5	8	.1	T	S	0	1												
2	33	U	0	5	9	.1	T	S	0	1												
2	34	U	0	6	0	.1	T	S	0	1												
2	35	U	0	6	2	.1	T	S	0	1												
2	36	U	0	6	3	.1	T	S	0	1												
2	37	U	0	6	4	.1	T	S	0	1												
2	38	U	0	6	6	.1	T	S	0	1												
2	39	U	0	6	7	.1	T	S	0	1												
2	40	U	0	6	8	.1	T	S	0	1												
2	41	U	0	6	9	225	P	S	0	1												
2	42	U	0	7	0	200	P	S	0	1												
2	43	U	0	7	1	.1	T	S	0	1												
2	44	U	0	7	2	.1	T	S	0	1												
2	45	U	0	7	3	.1	T	S	0	1												
2	46	U	0	7	4	.1	T	S	0	1												
2	47	U	0	7	5	.1	T	S	0	1												
2	48	U	0	7	6	210	P	S	0	1												
2	49	U	0	7	7	210	P	S	0	1												
2	50	U	0	7	8	200	P	S	0	1												
2	51	U	0	7	9	.1	T	S	0	1												
2	52	U	0	8	0	218	P	S	0	1												
2	53	U	0	8	1	.1	T	S	0	1												
2	54	U	0	8	2	.1	T	S	0	1												
2	55	U	0	8	3	.1	T	S	0	1												

EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												
XIV. Description of Hazardous Wastes (continued)																							
Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES																
							(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))											
2	56	U	0	8	4	.1	T	S	0	1													
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2	60	U	0	8	8	202	P	S	0	1													
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2	63	U	0	9	1	.1	T	S	0	1													
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2	72	U	1	0	0	.1	T	S	0	1													
2	73	U	1	0	1	.1	T	S	0	1													
2	74	U	1	0	2	.1	T	S	0	1													
2	75	U	1	0	3	200	P	S	0	1													
2	76	U	1	0	5	210	P	S	0	1													
2	77	U	1	0	6	210	P	S	0	1													
2	78	U	1	0	7	200	P	S	0	1													
2	79	U	1	0	8	892	P	S	0	1													
2	80	U	1	0	9	.1	T	S	0	1													
2	81	U	1	1	0	.1	T	S	0	1													
2	82	U	1	1	1	.1	T	S	0	1													
2	83	U	1	1	2	825	P	S	0	1													
2	84	U	1	1	3	.1	T	S	0	1													
2	85	U	1	1	4	.1	T	S	0	1													
2	86	U	1	1	5	.1	T	S	0	1													
2	87	U	1	1	6	.1	T	S	0	1													
2	88	U	1	1	7	4,700	P	S	0	1													
2	89	U	1	1	8	.1	T	S	0	1													
2	90	U	1	1	9	.1	T	S	0	1													
2	91	U	1	2	0	.1	T	S	0	1													

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EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												
XIV. Description of Hazardous Wastes (continued)																							
Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)					B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES															
	(1) PROCESS CODES (enter)														(2) PROCESS DESCRIPTION (if a code is not entered in D(1))								
2	92	U	1	2	1	.1	T	S	0	1													
2	93	U	1	2	2	242	P	S	0	1													
2	94	U	1	2	3	211	P	S	0	1													
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2	97	U	1	2	6	.1	T	S	0	1													
2	98	U	1	2	7	202	P	S	0	1													
2	99	U	1	2	8	203	P	S	0	1													
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3	10	U	1	3	9	.1	T	S	0	1													
3	11	U	1	4	0	210	P	S	0	1													
3	12	U	1	4	1	.1	T	S	0	1													
3	13	U	1	4	2	10	P	S	0	1													
3	14	U	1	4	3	.1	T	S	0	1													
3	15	U	1	4	4	983	P	S	0	1													
3	16	U	1	4	5	.1	T	S	0	1													
3	17	U	1	4	6	.1	T	S	0	1													
3	18	U	1	4	7	210	P	S	0	1													
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3	20	U	1	4	9	.1	T	S	0	1													
3	21	U	1	5	0	.1	T	S	0	1													
3	22	U	1	5	1	201	P	S	0	1													
3	23	U	1	5	2	.1	T	S	0	1													
3	24	U	1	5	3	.1	T	S	0	1													
3	25	U	1	5	4	682	P	S	0	1													
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**XIV. Description of Hazardous Wastes (continued)**

Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)			B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES																
						(1) PROCESS CODES (enter)					(2) PROCESS DESCRIPTION (if a code is not entered in D(1))											
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3	30	U	1	5	9	212	P	S	0	1												
3	31	U	1	6	0	245	P	S	0	1												
3	32	U	1	6	1	210	P	S	0	1												
3	33	U	1	6	2	.1	T	S	0	1												
3	34	U	1	6	3	.1	T	S	0	1												
3	35	U	1	6	4	.1	T	S	0	1												
3	36	U	1	6	5	290	P	S	0	1												
3	37	U	1	6	6	.1	T	S	0	1												
3	38	U	1	6	7	210	P	S	0	1												
3	39	U	1	6	8	210	P	S	0	1												
3	40	U	1	6	9	248	P	S	0	1												
3	41	U	1	7	0	.1	T	S	0	1												
3	42	U	1	7	1	202	P	S	0	1												
3	43	U	1	7	2	.1	T	S	0	1												
3	44	U	1	7	3	.1	T	S	0	1												
3	45	U	1	7	4	.1	T	S	0	1												
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3	47	U	1	7	7	.1	T	S	0	1												
3	48	U	1	7	8	.1	T	S	0	1												
3	49	U	1	7	9	.1	T	S	0	1												
3	50	U	1	8	0	.1	T	S	0	1												
3	51	U	1	8	1	.1	T	S	0	1												
3	52	U	1	8	2	.1	T	S	0	1												
3	53	U	1	8	3	.1	T	S	0	1												
3	54	U	1	8	4	202	P	S	0	1												
3	55	U	1	8	5	.1	T	S	0	1												
3	56	U	1	8	6	200	P	S	0	1												
3	57	U	1	8	7	.1	T	S	0	1												
3	58	U	1	8	8	203	P	S	0	1												
3	59	U	1	8	9	.1	T	S	0	1												
3	60	U	1	9	0	204	P	S	0	1												
3	61	U	1	9	1	.1	T	S	0	1												
3	62	U	1	9	2	.1	T	S	0	1												
3	63	U	1	9	3	.1	T	S	0	1												

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

EPA I.D. Number (enter from page 1)										Secondary ID Number (enter from page 1)													
M	D	4	1	7	0	0	2	4	1	0	9												
XIV. Description of Hazardous Wastes (continued)																							
Line Number	A. EPA HAZARDOUS WASTE NO. (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES																
	(1) PROCESS CODES (enter)															(2) PROCESS DESCRIPTION (if a code is not entered in D(1))							
3	64	U	1	9	4	.1	T	S	0	1													
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3	66	U	1	9	7	.1	T	S	0	1													
3	67	U	2	0	0	.1	T	S	0	1													
3	68	U	2	0	1	202	P	S	0	1													
3	69	U	2	0	2	.1	T	S	0	1													
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3	84	U	2	1	7	.1	T	S	0	1													
3	85	U	2	1	8	.1	T	S	0	1													
3	86	U	2	1	9	.1	T	S	0	1													
3	87	U	2	2	0	290	P	S	0	1													
3	88	U	2	2	1	203	P	S	0	1													
3	89	U	2	2	2	.1	T	S	0	1													
3	90	U	2	2	3	657	P	S	0	1													
3	91	U	2	2	5	201	P	S	0	1													
3	92	U	2	2	6	596	P	S	0	1													
3	93	U	2	2	7	.1	T	S	0	1													
3	94	U	2	2	8	7,568	P	S	0	1													
3	95	U	2	3	0	.1	T	S	0	1													
3	96	U	2	3	1	.1	T	S	0	1													
3	97	U	2	3	2	.1	T	S	0	1													
3	98	U	2	3	3	.1	T	S	0	1													
3	99	U	2	3	4	.1	T	S	0	1													



<b>EPA I.D. Number (enter from page 1)</b>												<b>Secondary ID Number (enter from page 1)</b>											
M	D	4	1	7	0	0	2	4	6	8	7	N	A										

**XV. Map**

*Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in this map area. See instructions for precise requirements.*

**XVI. Facility Drawing**

*All existing facilities must include a scale drawing of the facility (see instructions for more detail).*

**XVII. Photographs**

*All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).*

**XVIII. Certification (s)**

*I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to be the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*

Owner Signature	Date Signed
-----------------	-------------

Name and Official Title (type or print) W.J. Newton, CAPT., USN, Commander

Owner Signature	Date Signed
-----------------	-------------

Name and Official Title (type or print)

Operator Signature	Date Signed
--------------------	-------------

Name and Official Title (type or print) W.J. Newton, CAPT., USN, Commander

Operator Signature	Date Signed
--------------------	-------------

Name and Official Title (type or print)

**XIX. Comments**

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**Note:** Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

A. Permit Application

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- XV            Map - Please See Figures B-3 and B-4
- XVI           Facility Drawings - Please see Figures D-7, D-8, D-10, and D-12,
- XVII          Photographs - Please see Figures D-9, D-11, D-13, and D-14

**Appendix A.2  
Additional Environmental  
Permits**

A. Permit Application

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Additional Environmental Permits

NAVEODTEHCEN Part B Permit (11/13/87 - 11/13/90) (Resubmitted 5/17/90 and July 1994)	#A-223a (MDE)
Water Appropriation and Use Permit (7/1/91 - 7/1/2003)	#CH91G044(01) (MD DNR)
Oil Operation Permit (12/28/93 - 12/28/98)	#94-OP-0666 (MDE)
NAVEODTEHCEN Part B, Permit Application for 40 CFR Subpart X, Miscellaneous Units (Submitted 11/8/88)	#MD4170090001
IHDIVNAVSURFWARCEN Part B, Permit Application for 40 CFR, Subpart X, Miscellaneous Units (Submitted 11/8/88)	#MD4170024109
IHDIVNAVSURFWARCEN Air Permit for Open Burning of Propellants, Explosives, Pyrotechnics, and Explosive-Contaminated Waste (Expires 9/30/95)	#94-266-AP (Charles Ctny.) Health Dept.)
NAVEODTEHCEN Air Permit for Open Burning of Propellants, Explosives, Pyrotechnics, and Explosive-Contaminated Waste (Expires 9/30/95)	#94-232-AP (Charles Ctny.) Health Dept.)
Air Operating Permit for "Rocket Fuel Manufacturing Plant" (Goddard Power Plant) (5/1/92 - 4/30/99)	#08-00040 (MDE)
NPDES (Industrial) (4/1/94 - 3/31/99)	#MD0003158 (EPA) #88-DP-2515 (MDE)
NPDES (Sanitary) (4/1/94 - 3/31/99)	#MD0020885 (EPA) #88-DP-2528 (MDE)
Earth Fill Discharge (9/5/80 - N/A)	#NABOP-FR (ACOE) (Naval Ordnance Station) 79-1025

## Section B Facility Description

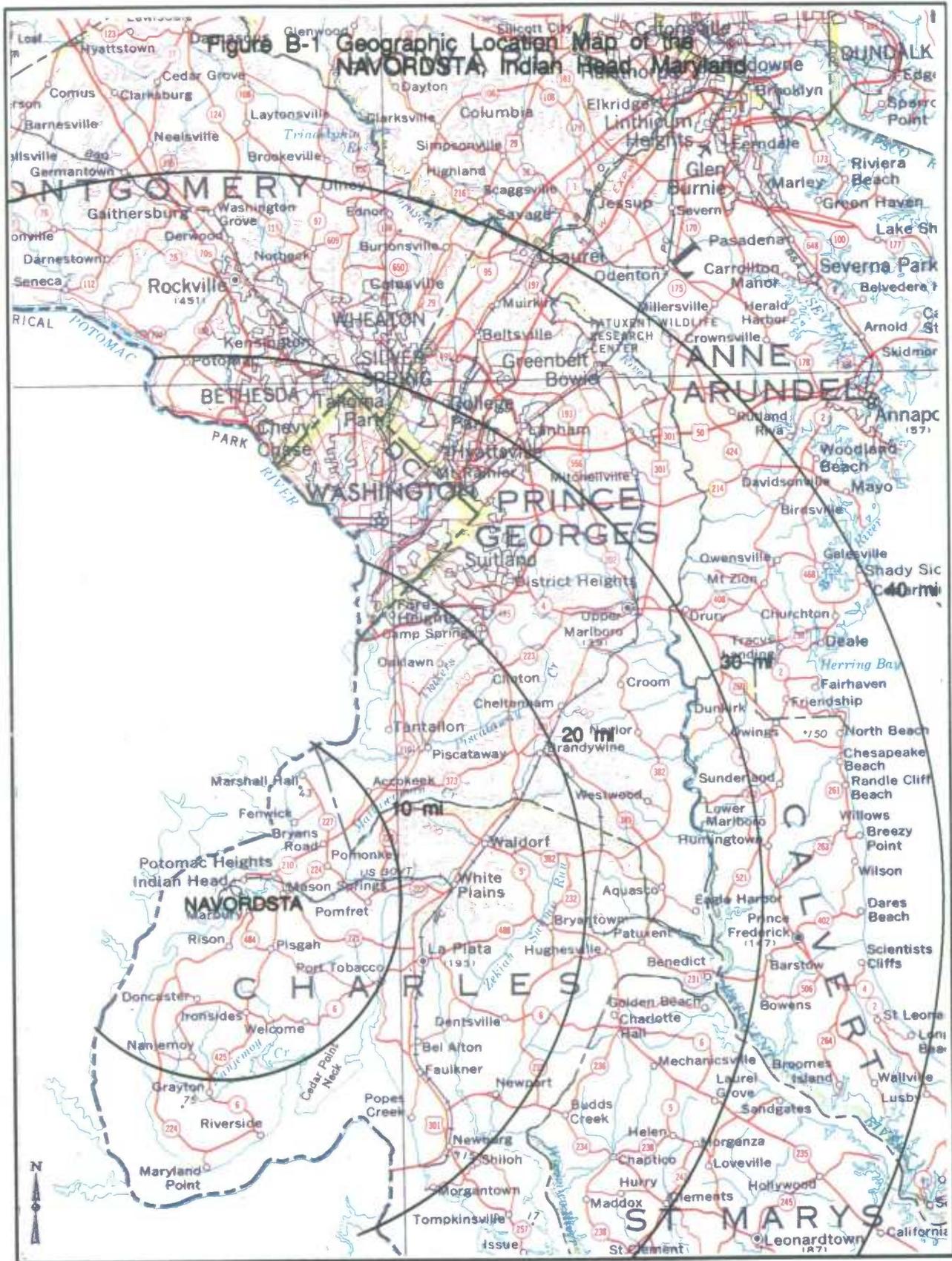
This section contains a description of the Indian Head Division, Naval Surface Warfare Center (IHDIVNAVSURFWARCEN) in accordance with the requirements of COMAR 26.13.07.02D (15) and 40 CFR 270.14(b)(1).

### B-1 General Description

The principal mission of the IHDIVNAVSURFWARCEN is research, development, and production of propellants and explosives for the United States Navy. The scope of operations ranges from laboratory research to full-scale production and testing. The IHDIVNAVSURFWARCEN is the largest employer in Charles County, Maryland, and for the last 100 years has consistently proven to be a vital economic force in Southern Maryland.

The IHDIVNAVSURFWARCEN is located at Indian Head, Maryland, approximately 25 miles south of Washington, DC, at the southern terminus of Maryland Route 210 (Figure B-1). The IHDIVNAVSURFWARCEN occupies approximately 2,400 acres of land and is situated on a peninsula formed at the confluence of the Potomac River and the Mattawoman Creek, in the west-central portion of Charles County, Maryland (Figure B-2). Figure B-3 is the 7.5-minute U.S. Geological Survey contour map of the Indian Head Quadrangle, which shows the IHDIVNAVSURFWARCEN and nearby surrounding areas. Figure B-4 is a detailed map of the IHDIVNAVSURFWARCEN. This map shows property lines, gates, and fencing.

Past and present site operations at the IHDIVNAVSURFWARCEN utilize materials and generate wastes listed as controlled hazardous substances (CHS), which are regulated by the Maryland Department of the Environment (MDE). The Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV) and the Naval Ordnance Disposal School (NAVSCOLEOD), tenant-command operations, utilize/generate controlled hazardous substances. The NAVEODTECHDIV and part of the



Scale 1:500,000

1 inch equals approximately 8 miles

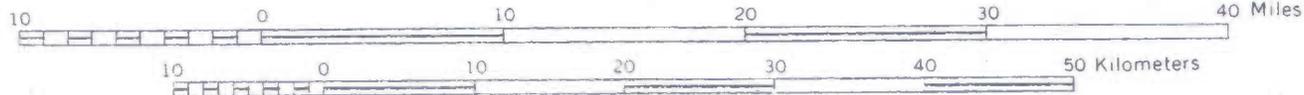




Figure B-2  
Aerial View of the NAVORDSTA

NAVSCOLEOD are located on a separate 1,100 acre peninsula (Stump Neck Annex) and are independently permitted (EPA ID number MD4170090001). In addition to these tenant commands, IHDIVNAVSURFWARCEN has several detachments. One is White Oak, located in White Oak, Maryland, which will be physically moved to Indian Head by the end of 1996; another is Yorktown, located at a Weapons Station in Yorktown, Virginia. Both White Oak and Yorktown are independently permitted for storage under their own EPA identification numbers.

The IHDIVNAVSURFWARCEN generates explosive and non-explosive hazardous wastes. These two categories of wastes are managed separately by the IHDIVNAVSURFWARCEN as separate entities. This CHS permit application addresses the treatment and storage of non-explosive hazardous wastes as well as storage of explosive hazardous wastes (EHW). However, EHWs are treated according to the information contained in the IHDIVNAVSURFWARCEN's RCRA Subpart X Miscellaneous Unit permit application.

The acronym (EHW) will be used throughout to refer to explosive hazardous wastes.

The Waste Management Units at the IHDIVNAVSURFWARCEN that require CHS permitting are the following:

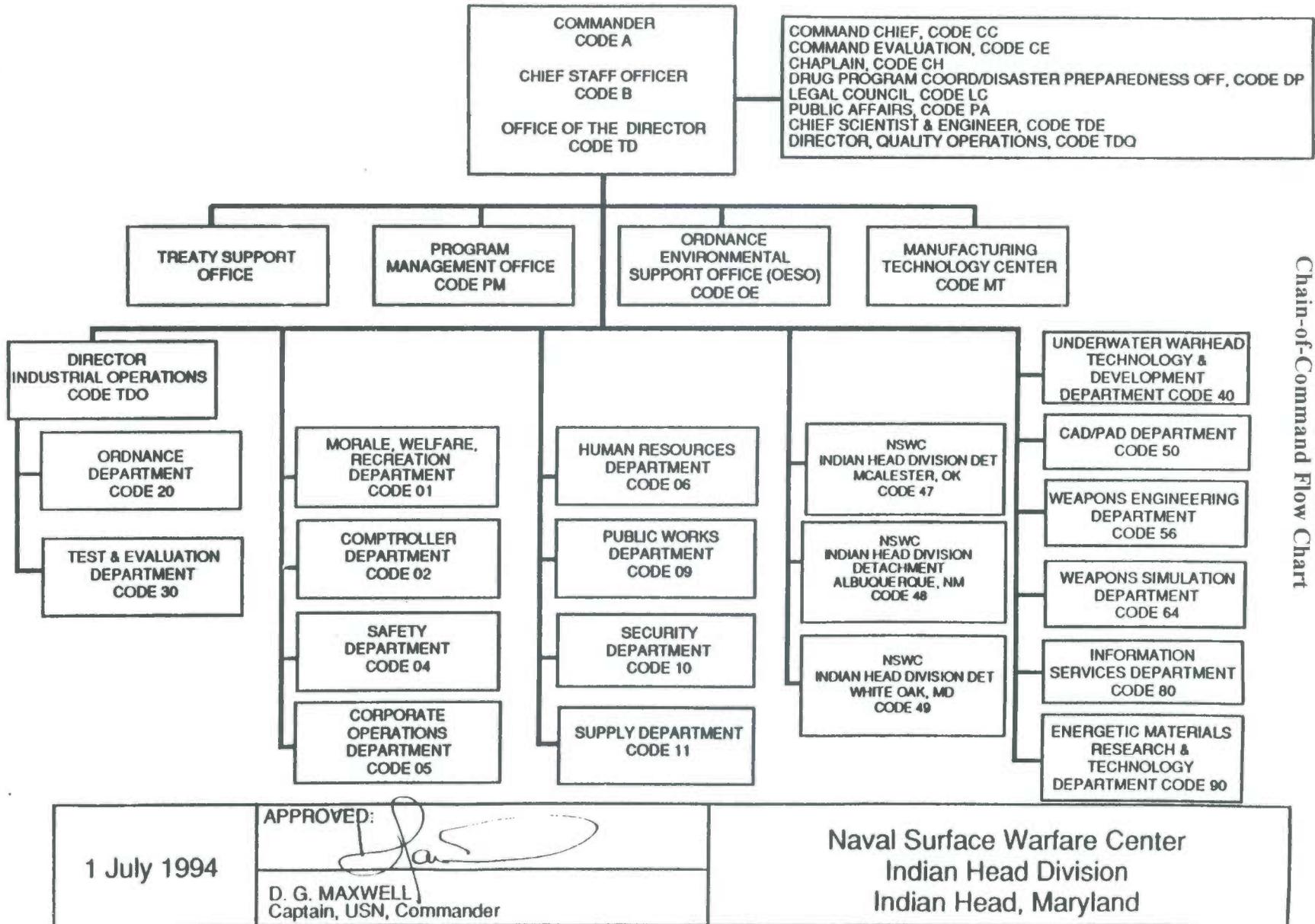
- CHS Container Storage Building 455 (liquid and solid hazardous waste)
- PCB Storage Facility 1440 (PCB hazardous waste)
- EHW Storage Buildings 212 and 328 (solid explosive hazardous waste)

Detailed information and drawings of each of these facilities can be found in Section D, Process Information. The IHDIVNAVSURFWARCEN also maintains numerous satellite and less-than-90-day sites. Although there is no regulatory requirement to obtain a permit for either of these types of sites, the IHDIVNAVSURFWARCEN's current less-than-90-day sites are listed in Section J (Other Environmental Issues) for reference purposes. This list will change based on operational needs.

The chain-of-command/organizational chart for the IHDIVNAVSURFWARCEN is shown in Figure B-5. Within this chain, the Environmental Division/Public Works Department is responsible for monitoring the

Chain-of-Command Flow Chart

Figure B-5



1 July 1994	APPROVED: 	Naval Surface Warfare Center Indian Head Division Indian Head, Maryland
	D. G. MAXWELL Captain, USN, Commander	

IHDIVNAVSURFWARCEN's environmental program. The Waste Management and Prevention Branch and the Air and Water Management Branch are responsible for the preparation of environmental permits. Transportation of CHS within the IHDIVNAVSURFWARCEN is provided by each individual department. The Supply Department operates the PCB Storage Facility (Building 1440) and the CHS Container Storage Building (Building 455) and is responsible for manifesting the CHS. The Ordnance Department operates the EHW Storage Buildings (Buildings 212 and 328) and is responsible for the management and treatment of these wastes. Each department that generates any CHS, explosive or non-explosive, is responsible for properly packaging, labeling, and dating CHS regulated by the Code of Maryland Regulations (COMAR).

## **B-2 Topographic Maps, Existing Utilities, and Appurtenant Information**

Figure B-4 delineates the CHS facility locations as well as the legal boundaries (property lines) of the IHDIVNAVSURFWARCEN. Building 455 is located in map area K-36 and Building 1440 is located in map area J-8 in Figure B-4, Building 212 is located in map area I-29, and Building 328 is located in map area M-26 in Figure B-4. Individual plans for each CHS facility showing topographic and planimetric features, within a 1,000-foot radius of each facility, are provided in Section D. These features are provided on a series of four figures in Section D.

The source of potable water and power plant cooling water (Goddard Power Plant) at the IHDIVNAVSURFWARCEN is ground water. Three 6-inch-diameter wells (130,000 to 250,000 gallons/day each) and one 4-inch-diameter well (35,000 gallons/day) supply low-silica ground water to feed the Goddard Power Plant boiler. Cooling water is collected in Building 143 and/or Building 128. Seven 4-inch-diameter wells (each has approximately a 175,000 gallons/day capacity) supply high-silica ground water for the IHDIVNAVSURFWARCEN's drinking water requirements. All 11 production wells are 300 to 550 feet deep. Table B-1 summarizes all known wells at the IHDIVNAVSURFWARCEN. Fire-fighting water and various other cooling water applications on-site are provided through a river water pumping and distribution system. Figures B-6a, B-6b, and B-6c show the location of functional ground water wells at the IHDIVNAVSURFWARCEN, in addition to wells within a one-half-mile radius of the IHDIVNAVSURFWARCEN.

Table B-1

Indian Head Division  
Naval Surface Warfare Center Wells

NOS Well No.	USGS Well No. (CH)	Year Drilled	Depth Drilled (ft.)	Casing Diameter (in.)	Casing Depth (ft.)	Openings Diameter (in.)	Openings Interval (ft.)	Aquifer	Status
1, Group 1	Bb1	1899	388	8	0-206	8	206-218	Patapsco	Abandoned
				8	218-331	8	331-345		
				8	345-372	8	372-388		
1A	Bb14	1952	452	8	0-209	8	209-234	Patapsco	Abandoned
				8	234-336	8	336-350		
				8	350-437	8	437-452		
2, Group 1	Bb2	1902	409	8	0-207	8	207-226	Patapsco	Abandoned
				8	226-293	8	293-333		
				8	333-369	8	369-390		
2A	Bb19	1972	405	20	0-250	12	270-380	Lower Patapsco	In Use
				12	250-370				
3, Group 1	Bb3	1910	432	8				Patapsco	Abandoned
3	Cb16		605	3			208-220	Patapsco	Abandoned Test for Cb19
3A	Cb34	1972	233	20	0-200	12	217-232	Lower Patapsco	In Use
				12	0-217				
4, Group 1	Bb4	1910	394	8	0-265	8	265-276	Patapsco	Test; Poor Yield - Abandoned
				8	276-312	8	312-323		
				8	323-365	8	365-381		
4	Cb17	1953	454	8	381-385	8	385-394	Patapsco	Test; Abandoned
				8		8			
				8		8			
5, Group 1	Bb5	1910	395	8	0-271	8	271-281	Patapsco	Test; Abandoned
				8	281-320	8	320-332		
				8	332-381	8	381-391		
5	Cb15	1953	452	2		8	261-295	Patapsco	Abandoned; Test for Cb18
6, Group 1	Bb6	1915	398	8	0-251	8	251-261	Upper Middle Patapsco and Lower Patapsco	In Use
				8	261-301	8	301-311		
				8	311-376	8	376-397		
Test Well 6	Bb13	1953	456						Abandoned
7, Group 1	Bb7	1915	419	8	0-255	8	255-265	Patapsco	In Use
				8	265-308	8	308-317		
				8	317-377	8	377-396		
8, Group 1	Bb8	1915	397	8	0-223	8	223-231	Patapsco	Abandoned
				8	231-262	8	262-273		
				8	273-310	8	310-321		

Table B-1

Indian Head Division  
Naval Surface Warfare Center Wells (Continued)

NOS Well No.	USGS Well No. (CH)	Year Drilled	Depth Drilled (ft.)	Casing Diameter (in.)	Casing Depth (ft.)	Openings Diameter (in.)	Openings Interval (ft.)	Aquifer	Status
9, Group 1	Bb9	1915	399	8	321-372	8	372-394	Upper Middle Patapsco and Lower Patapsco	In Use
				8	0-185	8	185-195		
				8	195-235	8	235-245		
				8	245-285	8	284-294		
10, Group 2	Bc1	1918	396	8	294-355	8	355-376	Lower Patapsco	Abandoned
				8	195-235	8	235-245		
				8	245-285	8	284-294		
11, Group 2	Bc2	1918	409	8				Lower Patapsco	MGS - Observation Well; Capped
12, Group 2	Bc3	1918	390	8				Lower Patapsco	In Use
13, Group 2	Bc4	1918	393	8					MGS - Observation Well
13, Test Well D	Bb15	1955	600						Abandoned
14, Group 2	Bc5	1918	430	8				Lower Patapsco	Observation Available for Use
15	Cb9	1953	623	16	0-150	8	191-206	Upper Middle Patapsco and Lower Patapsco	Replacement being drilled
				10	0-191	8	230-234		
				8	206-230	8	241-245		
				8	234-241	8	268-280		
				6	245-268				
15A	Bb10	1920	1200						Abandoned - Cemented; Covered by Road
16	Cb8	1953	615	20	0-82	12	85-93	Upper Middle Patapsco and Lower Patapsco	Abandoned
				12	0-85	12	124-133		
				12	93-124	10	221-229		
				12	133-153	10	234-242		
				10	153-221				
				10	229-234				
16A	Cb35	1984	503	6	0-433	4	433-461	Patuxent	In Use
				4	461-467	4	467-486		
				4	486-488				
17	Cb18	1954	452	16	0-185	8	261-285	Lower Patapsco	In Use
				10	185-261				
				12	0-85	12	124-133		

Table B-1

Indian Head Division  
Naval Surface Warfare Center Wells (Continued)

NOS Well No.	USGS Well No. (CH)	Year Drilled	Depth Drilled (ft.)	Casing Diameter (in.)	Casing Depth (ft.)	Openings Diameter (in.)	Openings Interval (ft.)	Aquifer	Status
18	Cb19	1954	605	16	0-120	8	208-220	Upper Middle Patapsco and Lower Patapsco	In Use
				10	0-208	8	274-302		
19	Cb7	1952	400	8	0-154	6	154-167	Lower Patapsco	MGS Observation Well
				8	167-400				
20	Bb11	1952	542	8	1-263	8	263-279	Patapsco	Test Well; Abandoned, Cemented
				8	279-347	8	347-378		
21	Bc17	1952	450	8	0-345	8	345-361	Patapsco	Abandoned, Replaced CH Bc16
				8	361-450				
23	Bc16	1952	450	8		8	345-361	Patapsco	MGS Observation Well, Sealed, Abandoned
22	Bc15	1952	258	8	0-242	8	242-250	Patapsco	Test Well, Abandoned - Cemented
				8	250-258				
23(A) Test Well E	Bb16	1956	600						Abandoned
23(B)	Bb17	1957	330	16	0-230	10	240-294	Patapsco	Observation Well
				10	230-240				
24(A) "A" Well	Cb29	1956	350	16	0-220	10	228-239	Upper Middle Patapsco and Lower Patapsco	In Use
				10	0-228	10	269-286		
(C)	Bc21	1956	600						Test Well, Abandoned - Cemented
Test Well for Cb29	Cb31	1956	600					Patuxent	Pump Test; Abandoned, Core 0-600 ft.
MCA* Test Well 1	Cb36	1970	425	6	0-190	6	190-212	Patapsco	Abandoned
				6	212-220	6	220-240		
MCA* Test Well 2	Bb18	1970	405	6	0-320	6	320-360	Patapsco	Abandoned

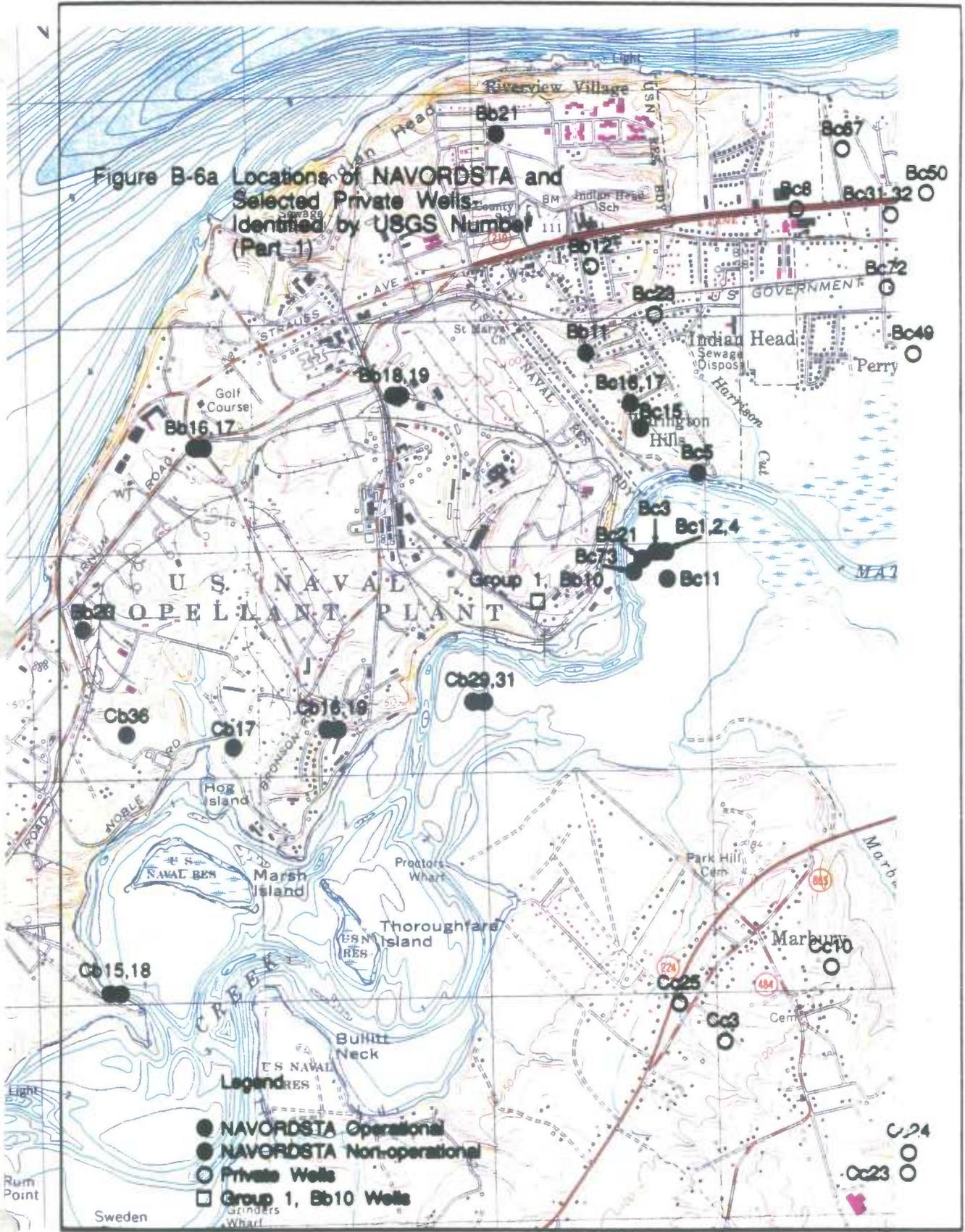
Table B-1

Indian Head Division  
Naval Surface Warfare Center Wells (Continued)

NOS Well No.	USGS Well No. (CH)	Year Drilled	Depth Drilled (ft.)	Casing Diameter (in.)	Casing Depth (ft.)	Openings Diameter (in.)	Openings Interval (ft.)	Aquifer	Status
MCA* Test Well 3	Bc73	1970	408						Abandoned
MCA* Test Well 3A	Bb20	1971	408	6	0-199	6	199-224	Patapsco	Abandoned
MCA* Test Well 4	Bb21	1970	405	6	0-200	6	200-230	Patapsco	Abandoned
MCA* Test Well 4A	Cb37	1971	403	6	0-276	6	276-296	Patapsco	Abandoned
Rum Point	Cb38	1978	250	4 2	0-210 210-231	2	231-246	Patapsco	In Use

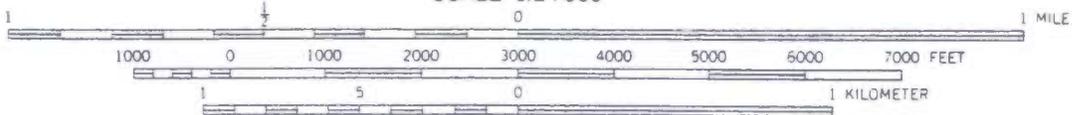
\*MCA = Matz, Childs, and Assoc.

Figure B-6a Locations of NAVORDSTA and Selected Private Wells Identified by USGS Number (Part 1)



- NAVORDSTA Operational
- NAVORDSTA Non-operational
- Private Wells
- Group 1, Bb10 Wells

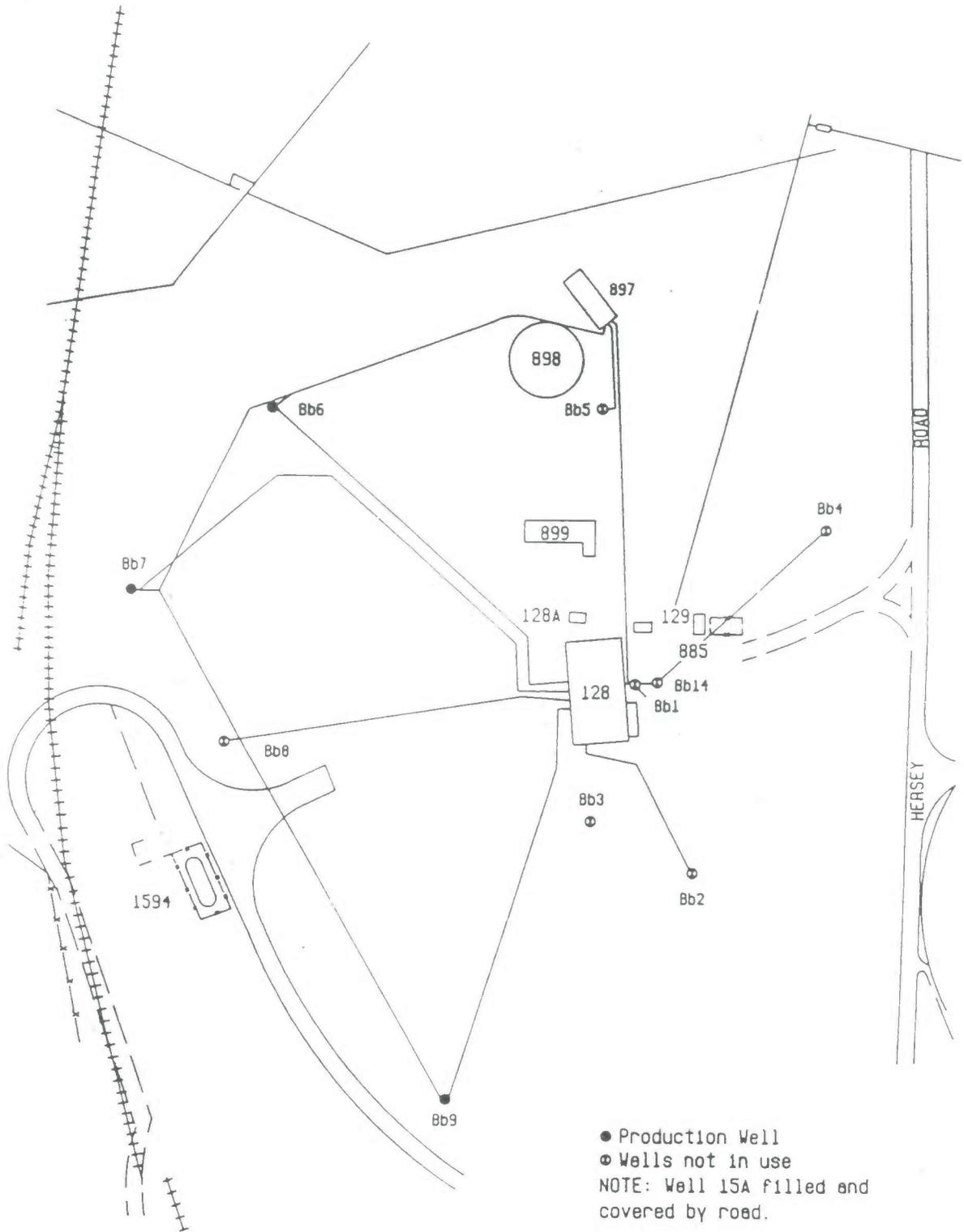
SCALE 1:24 000





B. Facility Description

Figure B-6c  
Group 1 Wells



## B. Facility Description

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The IHDIVNAVSURFWARCEN has a sanitary sewage treatment plant. A gravity/force main collection system conveys sewage flows throughout the Activity to the treatment plant. The storm sewer system consists of a series of gravity-draining pipes and ditches/swales to direct run-off from roadways and around the bases of buildings or other facilities.

Figure B-7 depicts the current surrounding land uses.

The wind rose for the IHDIVNAVSURFWARCEN is presented in Figure B-8. The winds of greatest velocity are generally from the northwest at 17 to 21 knots. Median wind velocity is about 5 knots, originating most frequently from the south or northwest. The wind rose was developed at the U.S. Marine Corps Base at Quantico, Virginia, which is located approximately 6 miles downstream and across the Potomac River from the IHDIVNAVSURFWARCEN.

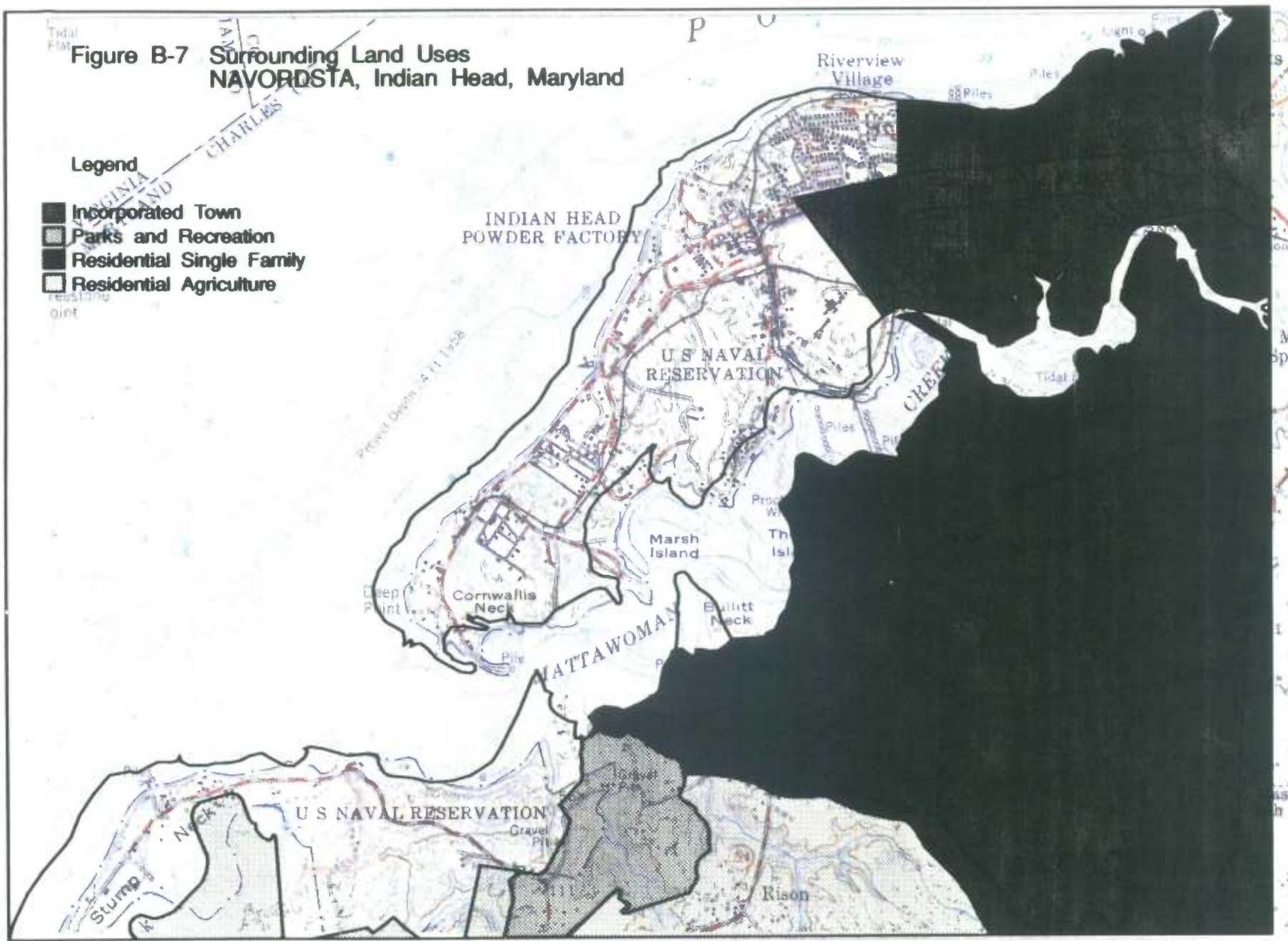
Vehicular and personnel access control is strictly monitored by Security Department personnel at the IHDIVNAVSURFWARCEN. Guarded gate(s)/entrances exist at various locations, and a 7-foot-high chain-link fence with three strands of barbed wire surrounds the IHDIVNAVSURFWARCEN reservation. A second fence delineates the restricted area within the reservation. Figure B-4 shows the locations and types of access control. Although fencing is not provided along all parts of the shorelines bordering the Potomac River and Mattawoman Creek, large warning signs posted along the banks of these waters forbid trespassing and warn of danger. These signs state, "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT," and are legible from a distance of at least 25 feet. The shoreline is inspected by personnel during the course of routine operations. In addition, nightly on-shore inspections are performed by IHDIVNAVSURFWARCEN security guards.

Table B-2 contains a list of structural features of interest keyed to Figure B-4. The identification of intake and discharge structures is in compliance with COMAR 26.13.07.02D6.

Figure B-7 Surrounding Land Uses  
 NAVORDSTA, Indian Head, Maryland

Legend

-  Incorporated Town
-  Parks and Recreation
-  Residential Single Family
-  Residential Agriculture



SCALE 1:62500

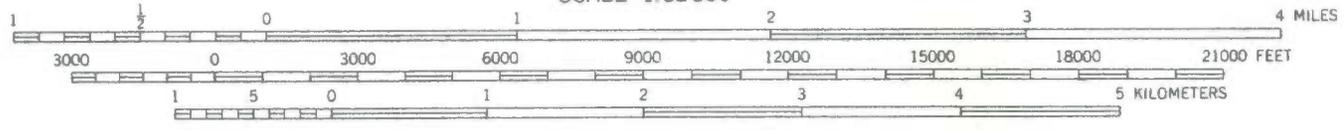
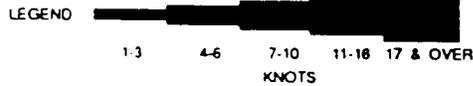
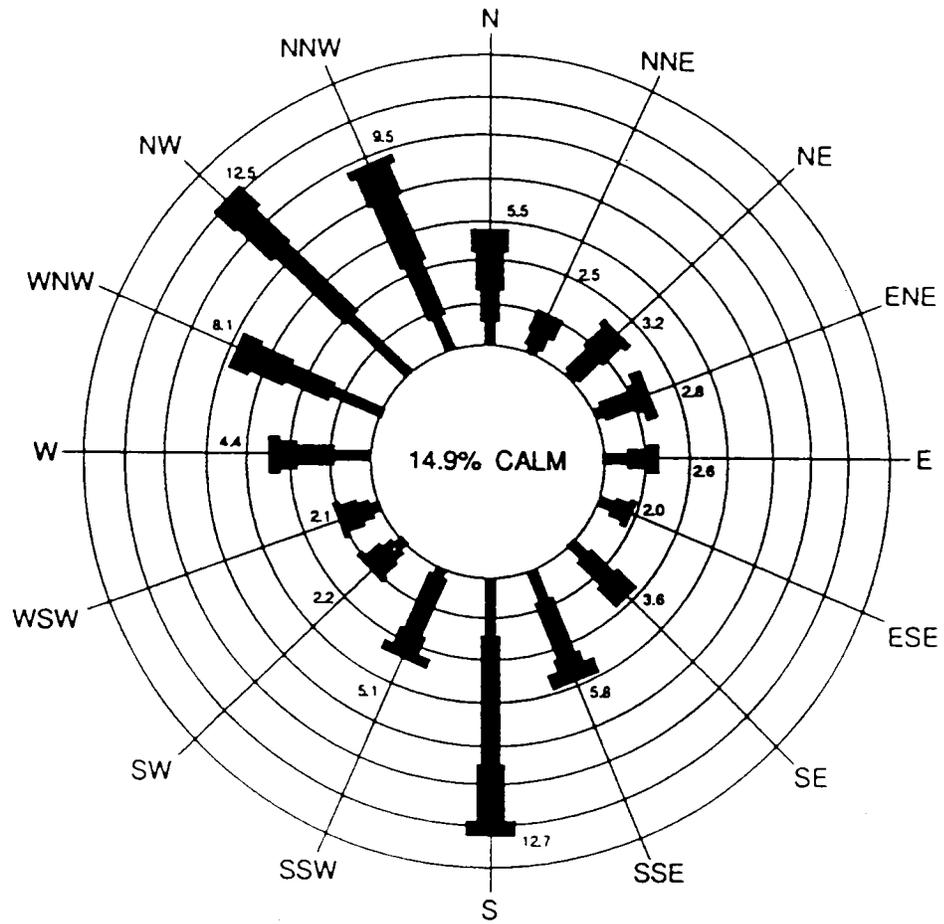


Figure B-8  
Wind Rose



Source: Naval Weather Service Detachment, Asheville, N.C.  
for Quantico, VA Station. Distance to Navordsta,  
Stump Neck Annex: 6 miles.

Period: 1969-71, 1973-78. Based on 20811 Observations.

**Table B-2**  
**Structural Features Keyed to Figure B-4**

<u>Structure of Interest</u>	<u>Building Number</u>	<u>Map Grid Coordinates</u>
Main Entrance		I-41
Restricted Area Entrance		I-36
Hazardous Waste Storehouse	455	K-36
PCB Transformer Storage	1440	J-8
Explosive Hazardous Waste Storehouse	312	I-29
Explosive Hazardous Waste Storehouse	328	M-26
Firehouse	878	H-35
Public Works Office	551	K-33
Medical Clinic	1600	F-43
Helicopter Pad	1535	C-35
Base Command and Administration Building	20	G-36
Caffee Road Thermal Treatment Point		L-6
Strauss Avenue Thermal Treatment Point		K-1
Safety Thermal Treatment Point		F-1/G-1
Intake Structures:		
River Pump House	100	A-38
River Pump House	739	B-8
Discharge Structures:		
IW 03		D-17
IW 04		D-11
IW 05		P-29
IW 07		T-34
IW 09		G-(-11)
IW 10		K-17
IW 18		P-24
IW 21		J-7
IW 23		B-5
IW 24		C-2
IW 25		D-1
IW 28		B-8
IW 33		D-15
IW 34		F-15
IW 35		K-18
IW 37		H-2
IW 38		B-8
IW 40		T-31
IW 45		P-22
IW 46		P-27
IW 48		A-37

**Table B-2**  
**Structural Features Keyed to Figure B-4 (cont'd.)**

<u>Structure of Interest</u>	<u>Building Number</u>	<u>Map Grid Coordinates</u>
IW 49		N-(-16)
IW 50		Q-20
IW 53		Q-26
IW 55		O-19
IW 56		O-19
IW 61		B-3
IW 62		B-5
IW 64		T-(-9)
IW 65		G-(-11)
IW 66		VV-21
IW 68		T-32
IW 71		G-6
IW 72		G-6
IW 77		J-5
IW 78		E-36
IW 79		K-7
IW 80		S-32
IW 81		T-32
IW 82		K-24
IW 83		J-24
IW 84		H-24
IW 85		I-26
IW 86		I-21
IW 87		I-21
IW 88		C-7
IW 89		O-23/O-24/O-25
IW 90		K-23
IW 91		D-20
IW 92		H-25
IW 93		R-(-12)
IW 94		XX-(-22)
IW 96		T-33
IW 97		L-35
IW 98		E-8
IW 100		T-35
IW 101		Q-32
IW 102		O-23
IW 103		E-16
IW 104		I-13
MP 105		P-29

(IW - Industrial Wastewater)

(MP - Monitoring Point)

### **B-3 Location/Information**

#### **B-3a Environmental Information**

The local geology is typical of the low-lying Coastal Plain region. Soils are unconsolidated sediments varying in classification from clays to sands. Interbedded coarser-graded materials generally overlie extensive layers of fine-grained clay. In some areas a hard dense fragipan layer exists in the subsoil which restricts the downward movement of water.

Potable water wells are located in the Patuxent, Raritan, and Patapsco Formations that underlie the IHDIVNAVSURFWARCEN at depths ranging from 200 to 600 feet below sea level. Moisture from the shallow water-bearing zone, which is present in the surficial deposits, is expected to move laterally downgradient toward nearby sea level surface waters, namely, the Potomac River and Mattawoman Creek. There are no IHDIVNAVSURFWARCEN wells and no wells in the town of Indian Head, Maryland located in the shallow water zone.

IHDIVNAVSURFWARCEN is located in Charles County, Maryland; this county is not listed in 40 CFR Part 264, Appendix VI as a political jurisdiction in which compliance with the seismic standard must be demonstrated.

#### **B-3b Flood Plain Standard**

The Potomac River and its tributaries (including Mattawoman Creek) in the vicinity of the IHDIVNAVSURFWARCEN are characterized as an estuary and are therefore subject to tidal action/saltwater intrusion. The mean river level for the Potomac is approximately 0.5 feet above mean sea level (MSL), with mean high water at about 1.5 feet above MSL and mean low water at about 0.5 feet below MSL. MSL is essentially equivalent to the National Geodetic Vertical Datum (NGVD). Low-lying marsh areas at the IHDIVNAVSURFWARCEN are subject to periodic flooding. Some areas of the

## B. Facility Description

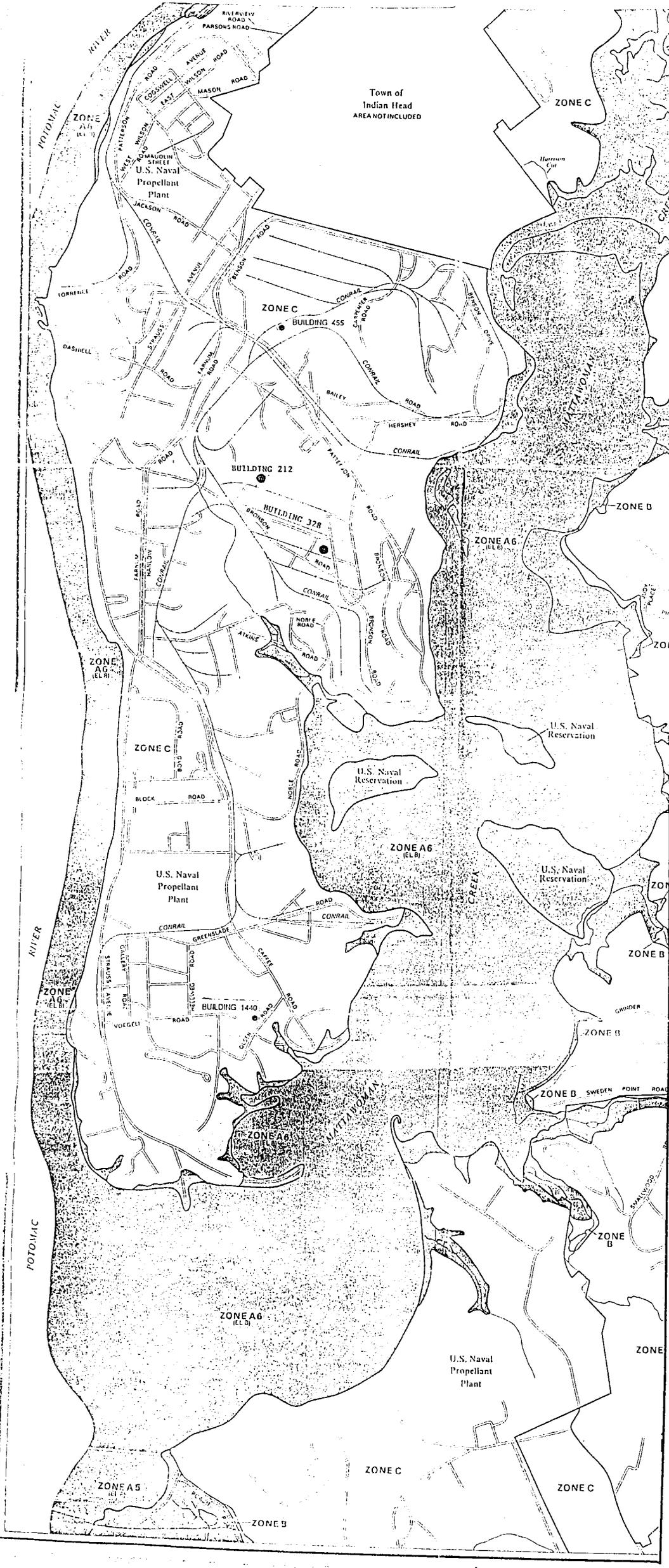
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Activity (estimated at over 100 acres) are located within the flood plain. The contours of the 100-year flood plain have been calculated by the Federal Emergency Management Agency (FEMA) in the IHDIVNAVSURFWARCEN area. The flood insurance map of the IHDIVNAVSURFWARCEN, dated 5 June 1985, shows a Zone A6, 100-year flood elevation, at elevation 8 +/- MSL around the IHDIVNAVSURFWARCEN as referenced in Figure B-9. The extent of the flood plain and the locations of Buildings 455, 1440, 212, and 328 are also shown in Figure B-9. None of the CHS storage locations at the IHDIVNAVSURFWARCEN are located in the 100-year flood plain.

### **B-4 Traffic Information**

The internal traffic routes within the IHDIVNAVSURFWARCEN are depicted in Figure B-4. Clear visibility and adequate vehicle turning distances are provided at intersections where CHS are transported. The road widths range up to 20 feet and minimal steep roadway slopes exist. Access to and from the CHS facilities is adequate for the minimal traffic volume (less than 30 trips per week). There are no measurable impacts on surrounding road networks due to CHS transported from the IHDIVNAVSURFWARCEN. The roadway system of the IHDIVNAVSURFWARCEN has been designed and constructed for supporting vehicles that have a gross weight of up to 79,800 pounds. This includes vehicles transporting CHS. Traffic control is achieved through the use of security personnel and common traffic signs including "stop," "yield," and "slow" signs. The speed limit at the IHDIVNAVSURFWARCEN is 25 mph or less. As a safety precaution, the IHDIVNAVSURFWARCEN requires vehicles to pull over to the side of the road when trucks carrying explosive material pass by. This includes trucks carrying explosive hazardous waste.

According to information gathered in July 1983 by the Public Works Department, the average daily two-way traffic volume on the main roadway at the IHDIVNAVSURFWARCEN, Strauss Avenue, is approximately 6,700 vehicles per day. The traffic volume at present is slightly smaller due to personnel decreases since 1993. The types of vehicles range from passenger cars to heavy trucks.



**KEY TO MAP**

100 Year Flood Boundary	-----
500 Year Flood Boundary	-----
Base Flood Elevation Line With Elevation In Feet**	----- 513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	BM7X
Zone B Boundary	-----
River Mile	*M1.5

**\*EXPLANATION OF ZONE DESIGNATIONS**

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
A1	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

**NOTES TO USER**

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance and flood plain management purposes only; it does not necessarily show all areas subject to flooding in the community or all planning features outside special flood hazard areas. The coastal flooding elevations shown may differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

For adjoining map panels, see separately printed Index To Map Panels.

Coastal base flood elevations shown on this map include the effects of wave action.

Coastal base flood elevations apply only landward of 0.0 NGVD.

**INITIAL IDENTIFICATION:**  
FEBRUARY 1975

**FLOOD HAZARD BOUNDARY MAP REVISIONS:**  
SEPTEMBER 17, 1982

**FLOOD INSURANCE RATE MAP EFFECTIVE:**  
JUNE 5, 1985

**FLOOD INSURANCE RATE MAP REVISIONS:**

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.



**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM**  
FLOOD INSURANCE RATE MAP

**CHARLES COUNTY, MARYLAND**  
(UNINCORPORATED AREAS)

PANEL 70 OF 170  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**COMMUNITY-PANEL NUMBER**  
240089 0070 B

**EFFECTIVE DATE:**  
JUNE 5, 1985



Federal Emergency Management Agency

## **Section C Waste Characteristics**

This section contains a description of the chemical and physical characteristics of the controlled hazardous substances (CHS) generated, stored, or otherwise managed at the IHDIVNAVSURFWARCEN. The Waste Analysis Plan (WAP) for sampling, testing, and evaluating is included to ensure safe handling and storage and to provide the information required for disposal. This information is submitted in accordance with the requirements of COMAR 26.13.07.02D(16) and (17) and 40 CFR 270.14 (b) (2) and (3).

### **C-1 Chemical and Physical Characteristics**

The IHDIVNAVSURFWARCEN generates a wide variety of hazardous waste in the course of its operational, educational, and research activities. Historically, most of the wastes generated at the facility are explosive and explosive-contaminated wastes. Relatively small quantities of used solvents, excess reagents, or other chemicals that may still be in their original containers are also generated.

Annual reports filed by the IHDIVNAVSURFWARCEN with the State of Maryland illustrate the CHS that have been generated by the facility. Annual reports have been submitted by the IHDIVNAVSURFWARCEN from 1983 through 1993. Copies of the complete reports are available upon request. The chemical and physical natures of the various categories of CHS typically managed at the IHDIVNAVSURFWARCEN are presented in Table C-1. Table C-2 provides information regarding the following:

- Hazardous characteristics or basis for hazard designation.
- EPA hazardous waste code.

**Table C-1**  
**Chemical and Physical Nature of Typical Controlled**  
**Hazardous Substances at the IHDI VNAVSURFWARCEN**

Category	Typical Constituents	Physical State	Color	Container/Method of Storage
Oxidizers	Ammonium Nitrate Ammonium Perchlorate	Solid-crystals Solid-crystals	Colorless White	Steel container color-coded orange or silver with conductive plastic bag
Reactive Metals	Magnesium Aluminum Zirconium/Nickel	Solid-powder Solid-powder Solid-powder	Silvery Silvery/white	Steel container color-coded orange or silver with conductive plastic bag
PCBs	Polychlorinated Biphenyl	Liquid-oils	Yellow-orange	Transformers and capacitors
Solvents	Acetone Hexane Ethyl Ether Heptane	Liquid Liquid Liquid Liquid	Colorless Colorless Colorless Colorless	Glass bottles < 1 gallon; steel can or drum Glass bottles < 1 gallon; steel can or drum Glass bottles < 1 gallon; steel can or drum Glass bottles < 1 gallon; steel can or drum
Cyanides/Sulfides	Potassium Cyanate	Solid (crystals)	Colorless	Glass bottles < 1 gallon; steel can or drum
Halogenated/Nitrated Hydrocarbons	Methylene Chloride Perchloroethylene Trichloroethane	Liquid Liquid Liquid	Colorless Colorless Colorless	Glass bottles < 1 gallon; steel can or drum Glass bottles < 1 gallon; steel can or drum Glass bottles < 1 gallon; steel can or drum
Alcohols	Ethanol	Liquid	Colorless	Glass bottles < 1 gallon; steel can or drum
Acids	Nitric Acid Sulfuric Acid Phosphoric Acid	Liquid Liquid Liquid	Colorless Colorless Colorless	Glass bottles < 1 gallon; lined can or drums Glass bottles < 1 gallon; lined can or drums Glass bottles < 1 gallon; lined can or drums
Explosive/Explosive Contaminated Wastes	Nitroglycerine, desensitized Fluorocarbon Propellants Black powder Nitrocellulose	Liquid (Viscous) <sup>1</sup> Solid Solid Solid (Amorphous) <sup>1</sup>	Pale yellow White or silver Black White	Steel containers color-coded yellow or blue with conductive plastic bag
High Explosives	Nitroguanidine HMX, RDX	Solid	White	Conductive plastic bag

**Table C-2**

**Basis for Hazard Designation and  
EPA Hazardous Waste Code**

<b>Waste Category</b>	<b>Typical Constituents</b>	<b>EPA Hazardous Waste Number</b>	<b>Hazardous Characteristics</b>	<b>Basis for Hazard Designation</b>
Oxidizers	Ammonium Nitrate Ammonium Perchlorate	D001* D001*	Oxidizer Oxidizer	Strong oxidizer Strong oxidizer
Reactive Metals	Magnesium powder Aluminum powder Zirconium/nickel	D003 D003 D003	Reactive Reactive Reactive	Water reactive Water reactive Explosive
PCBs	Polychlorinated Biphenyls	M001	Toxic	Bioaccumulative
Solvents	Acetone Ethyl Ether Heptane Hexane	U002 U117 D001 D001	Ignitable Ignitable Ignitable Ignitable	Flash Point - 15°F Flash Point - 49°F Flash Point - 25°F Flash Point - 9°F
Cyanides/Sulfides	Potassium Cyanate	F007	Toxic	
Halogenated Hydrocarbons	Methylene Chloride Perchloroethylene Trichloroethane	U080 U210 U227	Toxic Toxic Toxic	Narcotic in high concentration Skin/eye irritant Skin/eye irritant
Alcohols	Ethanol	D001	Ignitable	Flash Point = 55°F
Acids	Nitric Acid Sulfuric Acid Phosphoric Acid	D002 D002 D002	Corrosive Corrosive Corrosive	pH 2.0 pH 2.0 pH 2.0
Explosive/Explosive Contaminated Wastes	Nitroglycerine Nitrocellulose Nitroguanidine, RDX, HMX	D003 D003 D003	Reactive Ignitable, reactive Reactive	Heat/shock sensitive (explosive) Flash Point = 55°F Explosive

\*If Ammonium Perchlorate is less than 15 microns or any oxidizer is contaminated with a metal, a flammable, or an organic compound, the oxidizer is considered an explosive.

Appendix C.1 lists all the known hazardous wastes generated at the IHDIVNAVSURFWARCEN. Section XIV of the Hazardous Waste Permit Application (Part A) lists all known CHS that may be stored at IHDIVNAVSURFWARCEN.

## **C-2 Waste Analysis Plan**

### **C-2a Requirements for Ignitable, Reactive, or Incompatible Wastes**

The fundamental purpose of this WAP is to determine whether wastes are ignitable, reactive, or pose problems of compatibility with other wastes. Through proper characterization, wastes can be segregated and stored safely in accordance with applicable regulations.

This plan summarizes the analytical procedures necessary to characterize ignitable, incompatible, and reactive wastes. Explosive wastes must be further characterized and managed in accordance with NAVSEA Technical Manual OP-5, Ammunition and Explosive Ashore, a copy of which has been submitted to the Maryland Department of the Environment. NAVSEA OP-5 includes mandatory management practices (for example, limiting the mass of explosives that can be handled in a given class of facility) for explosive wastes at all Navy installations.

### **C-2b Waste Analysis Parameters and Rationale for Selection**

The IHDIVNAVSURFWARCEN generates many forms of CHS. Once generated, these wastes may be accumulated, when and if appropriate, at one of the many satellite and less-than-90-day sites that exist. They may also be transferred to Building 455 (non-explosive hazardous wastes), Building 1440 (PCBs), or Buildings 212 and 328 (explosive hazardous wastes). Economic factors and/or quantity or time limitations will determine when non-explosive hazardous waste will be transported to off-site disposal locations. All EHW will be thermally treated on-site.

### C. Waste Characteristics

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To safely manage and dispose of the waste, they must be properly characterized. This WAP serves the following purposes:

- To determine if wastes are hazardous, as defined by or listed, in regulations promulgated by the State of Maryland in implementing the Resource Conservation and Recovery Act (RCRA).
- To establish proper placement of CHS within a compatibility group to prevent mixing of incompatible wastes.
- To identify waste hazard classes as defined by the Department of Transportation (DOT), thereby ensuring proper labeling for waste shipped off-site.
- To provide the CHS identification needed by transporters and disposal operators to enable them to operate as prescribed by RCRA.

Most CHS generated or managed by the Activity are explosive or explosives-contaminated wastes. These wastes are identified by generating personnel on the basis of ingredients used as well as the processing procedures/conditions.

The majority of non-explosive-contaminated CHS generated by the Activity are used solvents or corrosives. These wastes are identified by generating personnel on the basis of the materials used and the processing procedures/conditions. CHS not identifiable in this manner are analyzed for the hazardous characteristics of ignitability, reactivity, corrosivity and toxicity using the Toxicity Characteristic Leaching Procedure (TCLP), and for the characteristics detailed in Subsection C-2c.

CHS designated for off-site treatment or disposal are collected and managed in DOT approved containers. Containers of CHS are characterized by the generating department on an internal manifest, DD Form 1348-1 (Figure C-1) and waste profile sheet (Figure C-2). EHW designated for on-site treatment are collected and managed in containers in good condition. Prior to treatment and/or storage in Buildings 212 and 328, a SATTP Scrap Sheet (Figure C-3) must be completed.





TOXICITY CHARACTERISTIC LIST

EFFECTIVE 75 SEP 90 LARGE QUANTITY GENERATORS  
29 MAR 91 SMALL QUANTITY GENERATORS

CONTAMINANT	EPA HW No	(HW#)	CONTAMINANT	EPA HW No	(HW#)
<input type="checkbox"/> ARSENIC	0004	_____	<input type="checkbox"/> HEXACHLORO 1,3 DIBADIENE	0033	_____
<input type="checkbox"/> BARIUM	0005	_____	<input type="checkbox"/> HEXACHLOROETHANE	0034	_____
<input type="checkbox"/> BENZENE	0018	_____	<input type="checkbox"/> LEAD	0008	_____
<input type="checkbox"/> CADMIUM	0006	_____	<input type="checkbox"/> LINDANE	0013	_____
<input type="checkbox"/> CARBON TETRACHLORIDE	0019	_____	<input type="checkbox"/> MERCURY	0009	_____
<input type="checkbox"/> CHLORDANE	0020	_____	<input type="checkbox"/> METHOXYCHLOR	0014	_____
<input type="checkbox"/> CHLOROBENZENE	0021	_____	<input type="checkbox"/> METHYL ETHYL KETONE	0035	_____
<input type="checkbox"/> CHLOROFORM	0022	_____	<input type="checkbox"/> NITROBENZENE	0036	_____
<input type="checkbox"/> CHROMIUM	0007	_____	<input type="checkbox"/> PENTACHLOROPHENOL	0037	_____
<input type="checkbox"/> O CRESOL	0023	_____	<input type="checkbox"/> PYRIDINE	0038	_____
<input type="checkbox"/> M CRESOL	0024	_____	<input type="checkbox"/> SELENIUM	0010	_____
<input type="checkbox"/> P CRESOL	0025	_____	<input type="checkbox"/> SILVER	0011	_____
<input type="checkbox"/> CRESOL	0026	_____	<input type="checkbox"/> TETRACHLOROETHYLENE	0039	_____
<input type="checkbox"/> 2,4-D	0016	_____	<input type="checkbox"/> TOXOPHENE	0015	_____
<input type="checkbox"/> 1,4-DICHLOROBENZENE	0027	_____	<input type="checkbox"/> TRICHLOROETHYLENE	0040	_____
<input type="checkbox"/> 1,2-DICHLOROETHANE	0028	_____	<input type="checkbox"/> 2,4,5 TRICHLOROPHENOL	0041	_____
<input type="checkbox"/> 1,1-DICHLOROETHYLENE	0029	_____	<input type="checkbox"/> 2,4,6 TRICHLOROPHENOL	0042	_____
<input type="checkbox"/> 2,4-DINITROTOLUENE	0030	_____	<input type="checkbox"/> 2,4,5 TRISILVERAL	0017	_____
<input type="checkbox"/> ENDRIN	0017	_____	<input type="checkbox"/> VINYL CHLORIDE	0043	_____
<input type="checkbox"/> HEPTACHLOR (AND ITS HYDROXIDE)	0031	_____			
<input type="checkbox"/> HEXACHLOROBENZENE	0032	_____			

PART III

FOR DRMO USE ONLY

DRMO VERIFICATION

DATE VERIFIED \_\_\_\_\_

2 RESULTS  ATTACHED

pH \_\_\_\_\_ FLASH POINT \_\_\_\_\_ SPECIFIC GRAVITY \_\_\_\_\_ HALIDES (TOX) \_\_\_\_\_

REACTIVITY WATER REACTIVITY \_\_\_\_\_ CYANIDES \_\_\_\_\_ SULFIDES \_\_\_\_\_

TCLP \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Once identified as a CHS, the waste is assigned a reaction group number (RGN) as described in the "Proposed Guide for Estimating the Incompatibility of Selected Hazardous Waste Based on Binary Chemical Reaction," D-34 Proposal P 168, ASTM, 1986 (see Appendix C.2). The RGN's are used to ensure compatibility of waste within a container. The compatibility chart (Figure C-4) reproduced from the ASTM guide is used as a general guide for compatibility of wastes. For those wastes which cannot be assigned an RGN from the Annexes of the ASTM guide, the test methods listed in Appendix C.3 will be used to characterize the wastes and assign it an appropriate RGN.

The IHDI VNAV SURFWARCEN is operated by highly trained personnel, and operations are conducted such that there is little question regarding the major components of any waste generated. In almost all cases, these wastes can be easily placed within the proper compatibility category for safe handling and disposal. The primary need for waste analysis is to categorize unlabeled reagents and reaction mixtures of unknown nature and, though very rare, of unknown origin.

### **C-2c Test Methods**

The following discussion describes the procedure by which chemical and physical information and data on unknown or unidentified CHS are obtained to ensure proper storage, transport, and disposal. These identification steps will be carried out by the IHDI VNAV SURFWARCEN laboratory as required to categorize the waste:

1. The tests for ignitability, corrosivity, reactivity, and toxicity, as defined and described in 40 CFR 261.21 through 261.24. On September 25, 1990, the EP toxicity test was replaced by the Toxicity Characteristic Leaching Procedure (TCLP).
2. Qualitative test for water reactivity and solubility of liquid waste.
3. Test for water in liquid waste.
4. Test for pH of liquid waste.

## C. Waste Characteristics

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Figure C-3

S.A.T.T.P. SCRAP SHEET

- 1) MATERIAL CLASSIFICATION: PROPELLANT (1.3) EXPLOSIVE (1.1) SLUM
- 2) MATERIAL NAME (AS IT APPEARS ON MASTER LIST): \_\_\_\_\_
- 3) EXPLOSIVE CONTAMINANT (IF APPLICABLE, AS IT APPEARS ON MASTER LIST): \_\_\_\_\_
- 4) FORM OF MATERIAL:   ENDFORMERS                   WHOLE GRAINS                   GRAIN FRAGMENTS                   SHAVINGS/CHIPS
- IGNITION DEVICE    PRODUCTION SCRAP (IN BOXES)    SLUM                   LIQUID                   PULL TUBES
- CARTRIDGE           POWDER                   PRESS HEELS           OTHER \_\_\_\_\_
- 5) SOLID MATERIAL
- A) QUANTITY OF MATERIAL \_\_\_\_\_ lbs. (LIMIT 75 POUNDS PER CONTAINER)
- B) NUMBER OF CONTAINERS \_\_\_\_\_
- 6) LIQUID MATERIAL
- A) QUANTITY OF MATERIAL \_\_\_\_\_ gal. (LIMIT OF 150 GALLONS TOTAL FOR SOLVENT TANK)
- B) QUANTITY OF SLUMMED MATERIAL \_\_\_\_\_ lbs. (LIMIT 75 POUNDS PER CONTAINER)
- C) NUMBER OF CONTAINERS \_\_\_\_\_
- 7) IGNITION DEVICES, CARTRIDGES, AND PULL TUBES (CIRCLE ONE)
- A) PROGRAM \_\_\_\_\_                   B) QUANTITY \_\_\_\_\_
- C) WEIGHT OF EACH \_\_\_\_\_ lbs.
- D) NUMBER OF CONTAINERS \_\_\_\_\_
- 8) SUB-COST CENTER OF SCRAP ORIGINATOR: \_\_\_\_\_
- 9) SIGNATURE OF SUPERVISOR: \_\_\_\_\_
- 10) CHARGE NUMBER (MUST BE INCLUDED): \_\_\_\_\_
- 11) DATE SENT TO SATTP: \_\_\_\_\_
- 12) MATERIAL DISPOSITION:
- A) ACCEPTED, MATERIAL BURN DATE: \_\_\_\_\_
- B) REJECTED, REASON: 1 2 3 4 5 6 7 8 9 OTHER \_\_\_\_\_



### C. Waste Characteristics

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5. Qualitative test for cyanide in liquid waste.
6. Qualitative test for sulfide in liquid waste.
7. Test for organic halogen in liquid waste.
8. Semi-quantitative determination of polychlorinated biphenyls in liquid waste.
9. Compatibility test for liquid waste (for possible use in bulking multiple liquid CHS).
10. Semi-quantitative determination of peroxides and other oxidizing agents in liquid waste.
11. Free liquid.

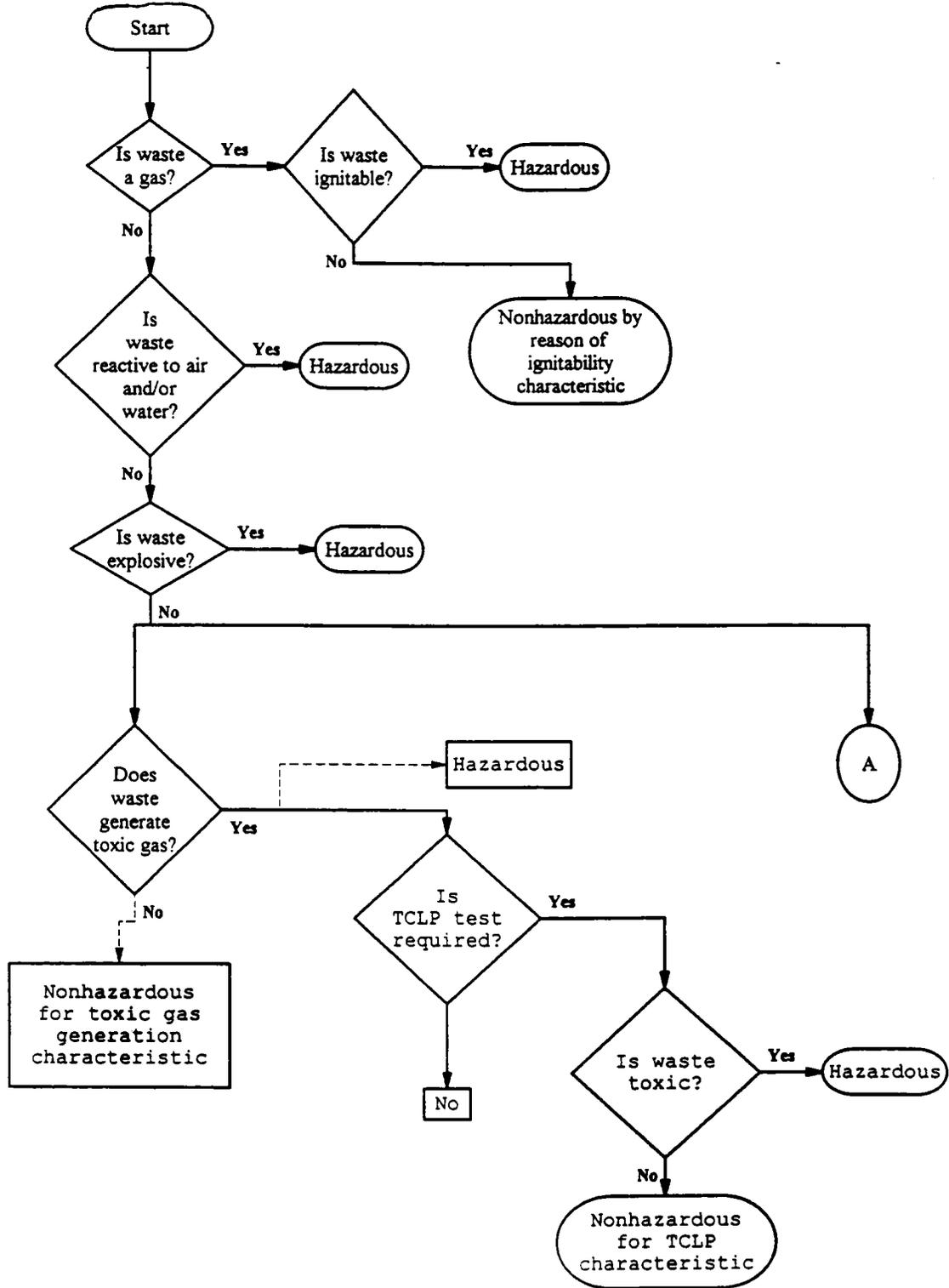
New and unknown energetic substances are examined according to the IHDIVNAVSURFWARCEN's Standard Operating Procedure (SOP) F20084, Unknown Materials Analysis, which states that, "Any new and unknown energetic material shall first be analyzed by Differential Scanning Calorimetry (DSC) to assess its thermal characteristics." For this reason, some explosive-contaminated wastes have DSC testing. If the type of material is known, this test may not be necessary; however, the information obtained by this test may be appropriate in the case of wastes that have been altered by testing on-site. SOP F20084 is available upon request.

The analytical methods used to categorize new and unknown explosive waste and test for ignitability, reactivity, corrosivity, and toxicity are described in Appendix C.3. Figure C-5 is a copy of the flow chart used to determine hazardous characteristics from Volume II of EPA SW-846 Test Methods for Evaluating Solid Waste. This flow-chart is used by the IHDIVNAVSURFWARCEN to characterize waste samples. Unknown wastes can be characterized by chemical analysis at the IHDIVNAVSURFWARCEN laboratory or a contractor lab or both in 30 days or less. There are a variety of tests that IHDIVNAVSURFWARCEN is capable of performing to determine if wastes are explosive hazards. Typically the hazardous wastes are analyzed initially by Differential Scanning

### C. Waste Characteristics

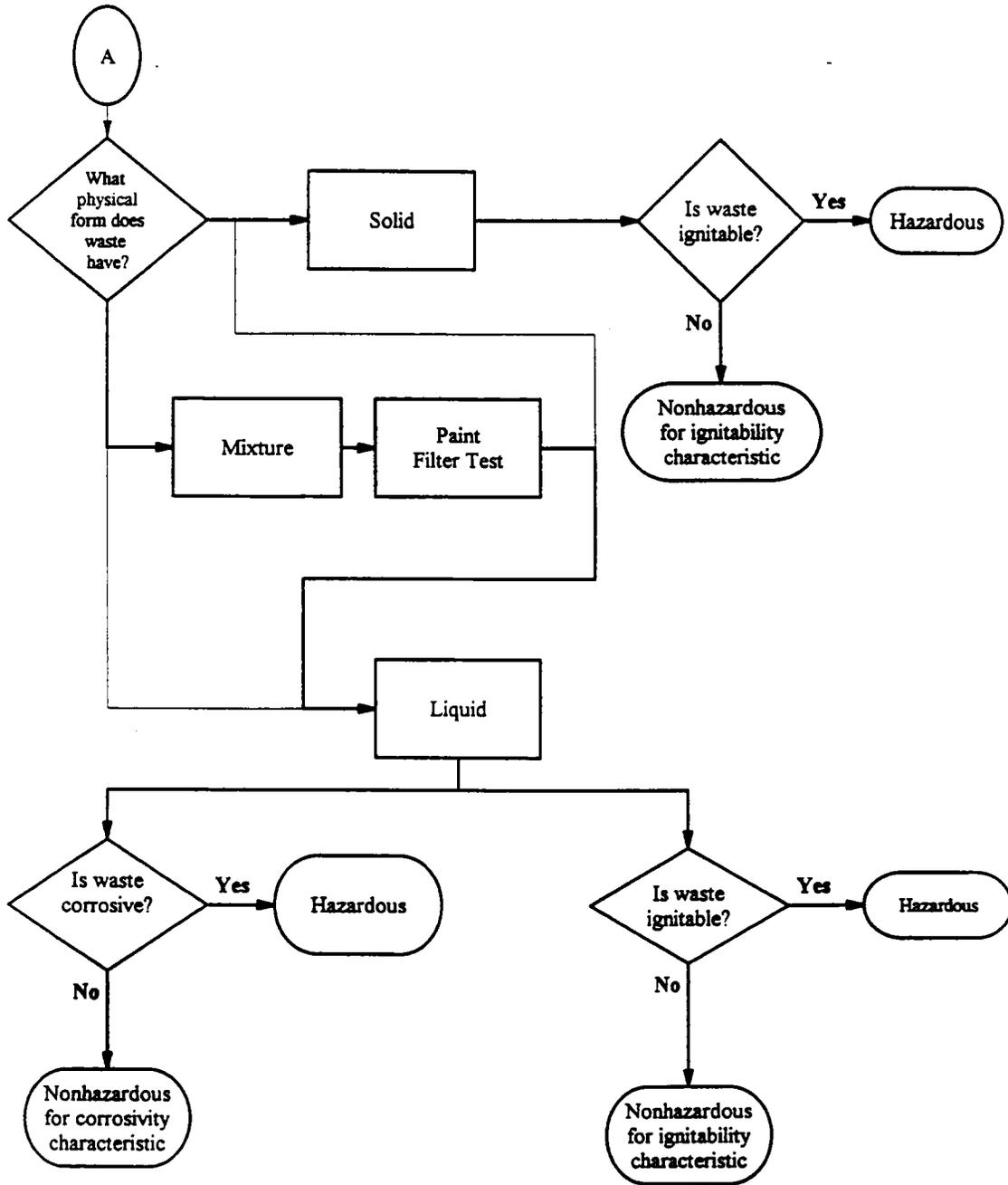
Figure C-5

Flow Chart for Determining Hazardous Waste Characteristics



C. Waste Characteristics

Figure C-5 (cont.)



### C. Waste Characteristics

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Calorimetry (DSC). This determines the thermal characteristics of the waste. Follow-up tests may include infrared spectroscopy, gas chromatography, and liquid chromatography.

In addition, reactivity tests such as card gap, cap, friction, impact, electrostatic discharge, and unconfined burn may be performed to further classify the wastes. These Department of Transportation (DOT) tests are routinely done to classify potentially reactive items prior to shipment. DOT classification authority has been delegated to IHDI VNAVSURFWARCEN.

#### **C-2d Sampling Methods**

For drums of liquid wastes, personnel experienced in sampling procedures determine whether the drummed material is homogeneous or layered. If homogeneous, a small glass tube or pipette is used to sample the portion of the liquid nearest the surface. For layered wastes, a Coliwasa sampler (as described by Test Methods for the Evaluation of Solid Waste Physical/Chemical Methods - EPA SW-846) is used to collect a sample from the entire liquid column.

For a drum with no free liquids, the appropriate personnel assess the degree of homogeneity of the wastes. Stainless steel spoons, spatulas, or a core sampler are used to collect grab samples from different portions of the drum, such that the composite sample represents the drum's contents.

Care is exercised to obtain samples which are representative of the total waste volume. If a reasonable degree of homogeneity cannot be assumed, multiple samples are obtained, analyzed, and compared for uniformity. In addition, due caution is exercised to minimize direct exposure of sampling personnel to the waste being sampled. The general hazardous characteristics of the waste should be known prior to sampling to determine appropriate sampling safeguards.

Table C-3 depicts sampling techniques employed as described in EPA SW-846 Testing Methods for Evaluating Solid Waste. Frequency of sampling will be conducted on a case-by-case basis.

### **C-2e Frequency of Analyses**

Wastes that cannot be positively identified by the generator are sampled for identification. Wastes from waste-generating processes will be reanalyzed whenever a change occurs in a process that is expected to alter waste composition.

### **C-2f Requirements for Wastes Generated Off-Site**

The IHDIVNAVSURFWARCEN will not accept unclassified wastes generated off-site. The IHDIVNAVSURFWARCEN will, in the future, be accepting spent fixer from photo finishing operations from DOD installations in Maryland for silver recovery and CHS from NAVSURFWARCENIHDIV Detachment, White Oak (EPA ID # MD0170023444) prior to closure of this installation. In addition, any CHS that is generated from off-site testing of IHDIVNAVSURFWARCEN products, may be brought back to IHDIVNAVSURFWARCEN for proper disposal. CHS generated off-site will typically be the same or very similar to wastes generated at the IHDIVNAVSURFWARCEN.

Only certified drivers are used to deliver the CHS to IHDIVNAVSURFWARCEN. The CHS is accompanied by a completed manifest, a Material Safety Data Sheet (MSDS), DD Form 1348-1 (Figure C-1), a Waste Profile Sheet (Figure C-2), and a Land Disposal Notification Form. Each container is identified by a number that matches it to the completed manifest, DD Form 1348-1, and the Waste Profile Sheet. The completed documentation is used to verify the contents of the containers.

**Table C-3**  
**Sampling Techniques for Solid Waste**

This table can be found in EPA SW-846 Testing Methods for Evaluating Solid Waste, Volume II. It is found in Chapter 9 - Sampling Plan on page NINE - 48 as Table 9-7, Examples of Sampling Equipment for Particular Waste Types. See SW-846, Chapter 9 for descriptions of the sampling equipment and methods.

**Waste Location or Container**

Waste Type	Drum	Tanks and bags	Open-bed truck	Closed-bed truck	Storage tanks or bins	Waste piles	Ponds, lagoons, & pits	Conveyer Belt	Pipe
Free-flowing liquids and slurries	Coliwasa	N/A	N/A	Coliwasa	Weighed bottle	N/A	Dipper	N/A	Dipper
Sludge	Trier	N/A	Trier	Trier	Trier	a	a		
Moist powders or granules	Trier	Trier	Trier	Trier	Trier	Trier	Trier	Above	Dipper
Dry powders or granules	Thief	Thief	Thief	Thief	a	Thief	Thief	Above	Dipper
Sand or packed powders and granules	Auger	Auger	Auger	Auger	Thief	Thief	a	Dipper	Dipper
Large grained solids	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Large Trier	Trier	Dipper

a - This type of sampling situation can present significant logistical sampling problems and sampling equipment must be specifically selected or designed based on site and waste conditions. No general statement about appropriate sampling equipment can be made.

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**C-2g IHDI VNAVSURFWARCEN Laboratory Capabilities**

The following equipment is available for lab analyses in support of the waste analysis plan:

**Chromatographs**

<b><u>Quantity</u></b>	<b><u>Type</u></b>	<b><u>Manufacturer</u></b>	<b><u>Accessories</u></b>
2	GS/MSD	Hewlett PACKARD	Purge & Trap
1	GPC	Waters	
2	LC	Waters	
1	LC/FTIR	Perkin-Elmer	
3	LC	Shimadzu	
2	IC	Dionex	

**Spectrophotometers**

<b><u>Quantity</u></b>	<b><u>Type</u></b>	<b><u>Manufacturer</u></b>	<b><u>Accessories</u></b>
1	ICAP	TJA	SSEA, HF Torch
1	XRD	Philips	
1	NMR	Varian	
1	UV/VIS	Varian	
1	FLAA	Perkin-Elmer Model 2380	MHS-10 Hydride Analyzer
1	FLAA	TJA Model 1000	

**Miscellaneous Equipment**

<b><u>Quantity</u></b>	<b><u>Type</u></b>	<b><u>Manufacturer</u></b>	<b><u>Accessories</u></b>
1	TA	Dupont	Autosampler
1	Microwave Digestor	CEM Model MD 80	
1	Sample Preparation Robotics	Zymark Robotics	

### C-3 Quality Assurance

IHDIVNAVSURFWARCEN utilizes commercial laboratories and other Department of the Navy laboratories as well as the laboratory facilities of our own Chemical and Physical Analysis Division to characterize and analyze waste. To ensure that the data generated using the analytical test procedures are accurate for storage and disposal of CHS, two documents will be followed. The two documents include the Quality Assurance guidelines contained in Chapter One, "Quality Control," of SW-846 Test Methods for Evaluating Solid Waste, and quality assurance procedures unique to IHDIVNAVSURFWARCEN contained in the "Test and Evaluation Department Quality Assurance Manual," IHSP 87-256, dated 31 March 1989. At a minimum, analyses contracted to commercial laboratories or other Department of the Navy laboratories will be required to pass quality control criteria described in Chapter One of SW-846.

All of the instruments used for analysis of CHS are calibrated or standardized in accordance with their manufacturers' specifications or SW-846, (both when applicable). Stock solution used for standardization is prepared when necessary from certified standard reference materials which are monitored by the branch manager of the laboratory.

**Appendix C.1  
List of All Hazardous Wastes  
Generated at the IHDIVNAVSURFWARCEN**

C. Waste Characteristics

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<b>ABBREVIATION</b>	<b>DEFINITION</b>
I	Ignitable
C	Corrosive
R	Reactive
E	TCLP
T	Toxic
H	Hazardous
CC FLASH	Closed Cup Flash Point
DSC	Differential Scanning Calorimetry
TCLP	Toxicity Characteristic Leaching Procedure
FLAA	Flame Atomic Absorption
GC	Gas Chromatography
GCMS	Gas Chromatography/Mass Spectrometry
GPC	Gel Permeation Chromatography
IC	Ion Chromatography
ICAP	Inductively Coupled Argon Plasma
IR	Infrared Spectroscopy
LC	Liquid Chromatography (High Performance)
pH	pH
XRAY DIFF	Xray Diffraction

Record#	chemname	epa	un
374	1.1 ASH BURN POINT	D006	3077
317	20% ACETONE/80% HEXANE	D001/F003	1993
319	20% ETHYL ACETATE,30% ACETIC ANHYDR	D001/F005	1993
257	3M "R" PROCESS GUM	PH-4	9189
321	40% ACETONE 45% ACETIC ANHYDIDE 10%	D001/F003,5	1993
423	45 CANS PAINT BEING ANALYZED	BEING ANALYZED	1263
107	5% Q1-6106 IN METHANOL	D001, F005	1993
101	6% COBALT NAP-ALL LIQUID	D001	1993
320	65%METHYLENE CHLORIDE 35% METHANOL	D001/F002,5	1993
316	80% HEXANE 20% ACETONE	D001/F003	1993
45	80% HEXANE,20% ACETONE	D001/F003	1993
217	80%HEXANE, 20%ACETONE	F003	1993
474	AAC G VARNISH MOISTURE & FUNGUS RES	D001	1263
23	ACETIC ANHYDRIDE	D002	1715
480	ACETONE	F003/D001	1993
12	ACETONE & WATER	F003	1993
310	ACETONE 90% WATER 10%	D001/F003	1993
305	ACETONE CONT W/LC-12-15	D001/F003	1993
314	ACETONE,ZINC CHROMATE CELLULOSE ACE	D001,7	1993
138	ACETONE/TOLUENE CONTAMINATED RAGS,P	F003,F005	1993
225	ACETONE97%,TOLUENE(2%) WATER(1%)	D001/F003	1993
170	ACID CONTAMINATED W/MERCURY	D002,9	2809
489	ACID WASTE CONT W/MERCURY	D002,9	2809
214	ADHESIVE	D001	9189
245	ADHESIVE SEALANT	D001	9189
246	ADHESIVE SEALANT	D001	9189
360	ADHESIVE SOLVENTS	D001/F003,5	1993
236	AEROSOL SPRAY PRIMER KRYLON	D001/F003,5	1954
143	AGED TDI TOLUENE DIISOCYANATE	F005	2078
30	AKLYD ENAMEL PAINT	D001	1263
233	AL IN HEPTANE	D001	1993
347	ALCOHOL ISOPRPYL	D001	1219
253	ALODINE CHROMIC ACID MIXTURE	D002	2924
415	ALUMINUM PHOSPHIDE FUMITOXIN	D003/F006	1397
55	ALUMINUM POWDER	D001	1309
66	ALUMINUM POWDER	D001	1309
205	ALUMINUM POWDER	D001	1309
231	ALUMINUM POWDER	D001	1309
402	ALUMINUM POWDER	D001	1309
417	ALUMINUM POWDER	D001	1309
318	ALUMINUM/HEPTANE	D001	1993
468	ALUMINUM/HEPTANE	D001	1993
447	AMMONIUM HYDROXIDE	D002	2672
292	AMMONIUM NITRATE	D001	2426
390	AMMONIUM NITRATE	D001	2426
391	AMMONIUM NITRATE	D001	2426
394	AMMONIUM NITRATE	D001	2426
399	AMMONIUM PERCHLORATE	D001	1442
395	AMMONIUM PERCHLORATE 90 MICRONS	D001	1442
274	AMMONIUM PERCHLORATE/200 MICRONS	D001	1442
389	ARSENIC/LEAD CONT SCRAP WOOD	D004,8	3077
192	ASH FROM HOG OUT PAN	D008	3077
191	ASH FROM IGNITER PAN	D006,8	3077
190	ASH FROM SLUM PAN DRUM 166,167	D008	3077
104	BAGS, RAGS, GLOVES CONT. W/TOLUENE	F005	1993
182	BARIUM	D005	1400
97	BARIUM CHROMATE	D002	9189
388	BARIUM HYDROXIDE	D005	1564

375	BASES ISOCYANATES AMINES	F003	1993
379	BASES ISOCYANATES AMINES	D038/F003,5	1993
218	BASES, ISOCYANATES, IMINES	F003,5	1993
410	BATTERY NON RECHARGEABLE MERCURY	D009	2809
87	BDNF/DNPBF (ACETAL/FORMAL)	D001	1993
32	BLACK ENAMEL-ALKYD LUSTERLESS	D001	1263
386	BLEACH FIXER	D002,11	1719
513	BLEACH FIXER	D011	1719
408	BORON	D001	9189
230	BRUCINE	P018	1570
373	BURN POINT DIRT 174	D008	3077
50	CADIUM & CADIUM COMPOUNDS	D006,8	9189
110	CADIUM CONT. SANDBLASTER GRIT	D006	3077
397	CALCIUM HYPOCHLORITE	D001	3101
68	CALCIUM SILICIDE	D001	1325
157	CATALYST FJOR EPOXY PRIMER COMP B	D001,F003	9189
40	CATALYST MIL-C83286 PART B	D001/F005	9189
328	CEILCOTE 682 TOP COAT	D001	1263
437	CEILCOTE ADHESIVE COMPONENT	D001,3	9189
147	CEILING TILE CONTAMINATED W/MERCURY	D009	2809
86	CEILOTE T-430 (ALCOHOL NAPHTHA MIXT	D001	1993
120	CHEMLOK 205 ELASTOMER ADHESIVE	D001,F003,5	9189
123	CHEMLOK 205A ELASTOMER ADHESIVE	D001,F005	9189
122	CHEMLOK 234B ELASTOMER ADHESIVE	D001,F002,F003	9189
121	CHEMLOK 250 ELASTOMER ADHESIVE	D001,F002,F003	9189
126	CHEMLOK 252 ELASTOMER ADHESIVE	F002,F005	9189
125	CHEMLOK 459 ELASTOMER ADHESIVE	F002	9189
127	CHEMLOK 7701 SURFACE TREATMENT	D001,F003	9189
124	CHEMLOK TS3320-19 ADHESIVE & COATIN	D001,F003	9189
358	CHOMERICS CATATLYST	D001/F003,5	1993
54	CHROMINUM: CHROMINUM COMPOUNDS	D006,7,8	9189
111	CHROMIUM (CONTAMINATED SOIL)	D007	9189
219	CHROMIUM LEAD CONT FILTERS	D007,8	9189
173	CHROMIUM TRIOXIDE MIXTURE PH-1	D002	1755
112	CHROMIUM/LEAD CONTAMINATED FILTER	D007/D008	9189
232	CHRONIUM/LEAD NITRATES	D001,7	9189
350	CLEANING COMPOUND SOLVENT	F002	1954
349	CLEANING LUBRICANT COMPOUND	F002	1954
458	CLEANING LUBRICANT COMPOUND	F002	9189
177	CLEANING, CMPD, SOLVENT, TRICHLOROT	F002	1993
499	COATING COMPOUND	D001	1263
103	COATING EPOXY - POLYAMIDE	D001,F005	9189
36	COATING EPOXY RESIN COMP A	D001/F005	9189
180	COATING, URETHANE MIL C 83286	D001,8	1263
141	COATING, URETHANE ORANGE 12197, MIL	D001,D008	1263
47	COBALT BETA RES/ACETONE/WATER	F003	1318
338	COMPOUND CLEANING	F002	1954
351	COMPOUND CORROSION PREVENTIVE	F002	1954
459	COMPOUND CORROSION PREVENTIVE	F002	1263
359	CONAP CONATHANE	D001/F003,5	1993
79	CONTAINS SOLVENT/PAINT RELATED MATE	D001,8 F002,3,5	1993
84	CONTAMINATED RAGS	D007,F003	9189
6	CORODEX #1	D002	1760
450	CORROSION INHIBITOR SEALING	D007	1263
329	CORROSION PREVENTIVE	D001	1263
486	CORROSION PREVENTIVE	D001	1263
400	CORROSION RESISTANT COATING	D002,7	1263
26	CSD PREMIX LOT #19	F002	1993
440	CYANOGEN IODIDE COMPLEXED W/SILVER	D011	2810
237	DATAKOAT PAINT SPRAY	D001/F002,5	1263

44	DECONTAMINATING AGENT STB	D001	1749
396	DECONTAMINATING AGENT STB	D001	1749
153	DEGREASOL CLEANING FLUID	D001	1993
449	DEVELOPER & REPLENISHER	D002	1719
7	DEVELOPER/REPLENISHER	D002	1719
134	DIETHYL PHTHALATE 99%	U088	2810
130	DIETHYLENETRIAMINE (DETAO	D002	2079
443	DIHYROXYBENZOIC ACID/SALICYALTE ACI	D001	1993
119	DOW CORNING 21 ADDITIVE	D001,F003	9189
485	DOW CORNING 281 CATALYST	F003/D001,8	9189
117	DOW CORNING Q1-6106 (ADHESION PROMO	D001	9189
118	DOW CORNING Z6075 SILANE	D002	2203
327	DRY FILM LUBRICANT	F002	1954
280	DUNKIT DEGREASER	D002/F001	3066
90	DUOMEEN T (N-TALLOW- 1,3 DIAMINOPRO	D002	9188
281	DUST CONT W/CADIUM	D006	9189
24	ECONBOND 787 EPOXY ADHESIVE PART A	D001	9189
497	ENAMEL ALKYD GLOSS BLACK PAINT	D001	1263
92	ENAMEL ALKYD GLOSS YELLOW 13538	D001,D008	1263
238	ENAMEL PAINT KRYLON 1809 SCHOOL BUS	D001/F005	1263
239	ENAMEL PAINT KRYLON BABY BLUE AEROS	D001/F005	1263
241	ENAMEL PAINT,KRYLON 2202 BRASS,AERO	F002,5	1954
240	ENAMEL PAINT,KRYLON AEROSOL SPRAY	D001/F005	1263
13	ENAMEL SILICONE SEMIGLOSS	D001	1263
156	ENAMEL, ALKYD SEMI GLOSS	D001,8	1263
34	EPOXY COATING	D001/F005	9189
168	EPOXY PRIMER COMP A	D001	9189
62	ETHANOL/METHYL VIOLET	D001	1993
105	ETHYL ALCOHOL	D001	1170
140	ETHYL ETHER	D001,F003	1155
199	FERRIC CHLORIDE 9002	D002	2582
94	FES #446H (SCOTCH GRIP RUBBER & GAS	D001,F005,F003	9189
429	FILLER WOOD LIGHT MAHOGANY	D001/F003,5	9189
209	FILTERS FOR PAINT BOOTH	D007,8/F003,5	3077
422	FILTERS FOR PAINT BOOTH	D007,8	3077
211	FIXER/BLEACHER FIXER	D009	1719
425	FLOURESCENT BULBS	D009	2809
463	FLOURESCENT BULBS	D009	RECY
61	FLY BURN PAN ASH	D008	3077
60	FLY BURN PAN ASH (NG/NC/ACETONE)	D008	3077
8	FORMIC ACID	D002	1779
22	FREIT=GHTLINER 910 EPOXY PART B	D001/F003,5	9189
355	FREON SOLVENT FLUX REMOVER	F002	1954
487	GALVANINZING COMPOUND	F003,5/D001	9189
142	GLYOXAL	D001	1325
167	GRAY ALKYD ENAMEL	D001	1263
63	HALOGENATED EPOXY'S	D001,22,38 F002,3,5	9189
220	HALOGENATED EPOXY'S	D001,38/F003,5	9189
377	HALOGENATED FLAMMABLE	D001,38/F003,5	1993
439	HALOGENATED FLAMMABLE	D001,19,22/F002,3,5	1993
295	HAVEG HARDENER	D002	1760
264	HEAT RESISTANT PAINT	D001	1263
301	HEAVY METALS	D002,5,8,9,11	2924
522	HEAVY METALS/INORGANIC ACIDS	D002,9	2924
304	HEAVY METALS/ORGANIC ACIDS	D002,8,9	2924
58	HEAVY METALS/POISON CORROSIVE LIQ.	D002,5,6,7,8,10,11	2924
115	HEAVY METALS/POISON CORROSIVE LIQUI	D002,6,5,7	2924
221	HEAVY METALS/POISON LIQUID (CORROSI	D002,9	2924
57	HEPTANE W/AMMONIUM PERCHLORATE	D001,38/F003,5	1993
65	HEPTANE W/AMMONIUM PERCHLORATE	D001,38 F003,5	1993

183	HEPTANE W/AMMONIUM PERCHLORATE	D001, D038, F003, F005	1993
174	HEXANE 80%/ ACETONE 20%	D001, F003	1993
91	HI-T 650 DRY FILM LUBRICANT	D001, F003, F005	1954
20	HX 686 COT #421 CURATIVE	F005	9189
300	HYDROCHLORIC ACID	D002	1789
303	HYDROCHLORIC ACID	D002	1789
516	HYDROCHLORIC ACID	D002	1789
294	HYDROCHLORIC ACID/METALS	D002	2924
16	HYDROGEN PEROXIDE 29% MIN.	D001	2014
384	HYDROMETER W/LEAD BSE MATERIAL	D008	2291
3	HYPO SOLUTION FROM SILVER RECOVERY	D011	3082
206	HYPO SOLUTION SILVER RECOVERY	D011	3082
385	HYPO SOLUTION/TO BE RECYCLED	D011	3082
64	IGNITABLE TCLP/TOXIC LIQUID FLAMMAB	D001, 38 F003, 5	1993
201	IGNITABLE/TOXIC LIQUID	D001, 038 F003, 5	1993
353	IGNITABLE/TOXIC LIQUID	D001/F003, 5	1263
202	IMINES, ISOCYANATES & BASES	D001, D038/F003, 5	1993
151	IMINES, ISOLYANATES & BASES	D001/D038/F003/F005	1993
200	INORGANIC ACID/ CONCENTRATE SULFURI	D002	1830
46	INORGANIC ACID/CONCENTRATED SULFURI	D002	1830
235	INORGANIC OXIDIZERS	D001, 38/F003, 5	1993
311	INORGANIC OXIDIZERS	D001, 38/F003, 5	2924
382	INORGANIC OXIDIZERS	D001/F003, 5	2924
470	INORGANIC OXIDIZERS IN HEPTANE	D001, 38/F003, 5	1993
203	INORGANIC OXIDIZERS PH-O	D002/F003, 5	2924
330	INTERNATIONAL ADHESION MODIFIER BAS	D001/F003	9189
333	INTERNATIONAL CURING AGENT	D001	1993
335	INTERNATIONAL ELASTOMER TIE COAT	D001/F003	9189
334	INTERNATIONAL ELASTOMER TOP COAT	D001/F003	9189
331	INTERNATIONAL ELASTOMERIC TIE COAT	D001/F003	9189
332	INTERNATIONAL HS UNIV EPOXY REACTOR	D001	9189
25	IRON CHLORIDE (FERRIC CHLORIDE SOLU	D002	2582
135	IRON OCTOATE	D001	1993
113	ISOCYANATES/AMINES	F003	2206
133	ISODECYL PELARGONATE/R45M/ ISOPHORO	F005	1993
184	ISOPAR-M WITH CADMIUM	D006	1993
213	KEROSENE CONT.W/PAINT SLUDGE	D001	1993
276	KEROSENE/PAINT SLUDGE	D001	1993
267	LACQUER GLOSS WHITE	D001/F003, 5	1954
161	LACQUER, GLOSS WHITE	D001, F005	1263
164	LACQUER, CELLULOSE NITRATE GLOSS	D001, F003, 5	1263
129	LC 12-15 (LEAD/COPPER RESORCYLATE)	D008	9189
49	LC-12-15 LEAD COPPER BETA RESORCYLA	D008	9189
114	LC-12-15/HEPTANE	D001	1993
483	LEAD 2 ETHYL OCTOATE MIL-L-17699	D008	9189
484	LEAD 2 ETHYL OCTOATE MIL-L-17699	D008	9189
299	LEAD BATTERIES	D002, 8	2794
77	LEAD CARBONATE	D008	2291
181	LEAD COMPOUND	D008	2291
228	LEAD CONT PAINT	D008	1263
69	LEAD DUST	D008	2291
52	LEAD SALICYLATE	D008	9189
71	LEAD: LEAD COMPOUNDS	D008	2291
31	LIGHT GRAY PAINT LACQUER	D001, F005	1263
243	LUBE COMPOUND, DIMETHYLSILICONE	D001/F002	9189
17	LUBRICATE SLYDE	D001	1954
428	LUBRICATING COMPOUND AEROSOL SILICA	F002	1954
393	LUPERSOL DDM-9	D001	3101
398	LUPERSOL DDM-9	D001	3101
158	LUSTERLESS GRAY LACQUER	D001, 5	1263

169	LUSTERLESS, LACQUER	D001, F005	1263
372	MACHINING COOLANT	D005, 8	1142
53	MAGNESIUM POWDER	D003	1869
73	MAGNESIUM POWDER	D003	1869
75	MAGNESIUM RIBBON	D003	1869
93	MALEIC ANHYDRIDE	D002	2215
74	MANGANESE/HEPTANE	D001	1993
420	MERCURY	D009	2809
512	MERCURY	D009	2809
404	MERCURY & MERCURY CONT WATER	D009	2809
409	MERCURY BOTTLE	D009	2809
234	MERCURY BOTTLES	D009	2809
418	MERCURY BOTTLES	D009	2809
421	MERCURY CONT CONTAINERS	D009	2809
227	MERCURY CONT DEBRIS	D009	2809
42	MERCURY CONT SWITCHES	D009	2809
72	MERCURY CONT. PAPER & PLASTIC	D009	2809
109	MERCURY CONT. SOIL	D009	2809
465	MERCURY CONTAMINATED CONTAINERS	D009	2809
273	MERCURY CONTAMINATED GLASS	D009	2809
419	MERCURY CONTAMINATED GLASS	D009	2809
171	MERCURY CONTAMINATED THERMOS BOTTLE	D009	2809
407	MERCURY CONTAMINATED W/GLASS	D009	2809
287	MERCURY CONTAMINATED WITH DIRT	D009	2809
405	MERCURY DIRTY W/WATER	D009	2809
179	MERCURY SWITCHES	D009	2809
523	MERCURY SWITCHES	D009	2809
268	MERCURY THERMOMETER	D009	2809
469	MERCURY W/HG ABSORB	D009	2809
56	MERCURY:MERCURY CONTAMINATED WASTE	D009	2809
376	METAL POWDER CONT W/HEPTANE	D001	1993
108	METHANOL	D001, F005	1230
14	METHANOL/KF REAGENT	D001/F005	1993
479	METHY CHLOROFORM	U226	1238
96	METHYL ACETATE	D001	1231
194	METHYL ACRYLATE	D001, 2	2924
29	METHYL ALCOHOL	D001/F005	1230
242	METHYL ETHYL KETONE	D001/F005	1193
149	METHYL ISOBUTYL KETONE 1 GAL GLASS	D001/F005	1245
272	METHYL VOILET/ETHANOL/WATER	D001	1993
27	METHYLENE CHLORIDE	F002	1593
160	METHYLENE CHLORIDE	F002	1593
154	METHYLENE CHLORIDE/ETHYL ACETATE	D001, F002, 3	1993
325	METHYLENE CHLORIDE/ETHYL ACETATE	D001/F002, 3	1993
282	MIXED SOLVENTS	D001/F003, 5	1993
283	MIXED SOLVNETS PH-O	D001, 2	1993
286	MK 103 LINER MIX W/TOLUENE	D001/F005	1993
136	MOLECULAR SEIVES WET W/ETHYL ACETAT	D001, F003	1993
196	MONOETHANOLAMINE #9003 STRIPPER	D002	1061
226	MONOMETER-Y14931 MERCURY	D009	2809
100	N-BUTYL ACETATE	D001	1993
11	NG KILLER	D001	1993
81	NG KILLER	D001, F003	1993
99	NG KILLER	D001, F003	1993
290	NG KILLER	D001	1993
454	NG KILLER	D001/F003	1993
256	NICKEL CADIUM RECHARGEABLE BATTERIE	D006	2796
431	NICKEL POWDER	D001	2881
426	NITROGUANIDINE	D001	1336
312	NON HALOGENATED FLAMMABLE	D001, 38/F003, 5	1993

380	NON HALOGENATED FLAMMABLE	D001,38/F003,5	1993
427	OIL 2 CYCLE LUBE	RECYLCE	1270
95	OXALIC ACID	D002	2449
378	OXIDIZERS/HEPTANE	D001,38/F003,5	1993
381	OXIDIZERS/HEPTANE	D001,38/F003,5	1993
383	OXIDIZERS/HEPTANE/SOLVENT	D001,8/F003,5	1993
162	PAINT ALUMINUM HEAT RESISTING	D001	1263
343	PAINT CONT.RAGS	D007/F003	1263
344	PAINT ENAMEL	D001,8/F003	1263
336	PAINT ENAMEL ALKYD GLOSS	D001,8	1263
348	PAINT ENAMEL GLASS RED	D001,8	1263
342	PAINT ENAMEL INT GLOSS WHITE	D001	1263
346	PAINT ENAMEL NON ELAMING	D001	1263
10	PAINT FILTERS	F003,5	3077
212	PAINT FILTERS	D001/F003,5	3077
254	PAINT FILTERS	F003,5	3077
412	PAINT FILTERS	D007,8/F003,5	3077
414	PAINT FILTERS	F003,5	3077
492	PAINT FILTERS	F003,5/D007,8,35	3077
496	PAINT FLAT BLACK LACQUER PAINT	F003,5/D001,35	1263
339	PAINT GLOSS WHITE LACQUER AEROSOL	D001,F002	1954
352	PAINT LACQUER AEROSOL BLUE	D001/F003,5	1954
340	PAINT LACQUER,AEROSOL,BLUE	D001/F002,3,5	1954
498	PAINT METALLIC ALUMINUM	D001	1263
436	PAINT OIL ALKYD	D001	1263
82	PAINT SLUDGE	D001,D007,F003	1263
223	PAINT SLUM	F005	1263
307	PAINT SLUM	F003,5/D001	1263
365	PAINT SLUM	D001,8	1263
85	PAINT SPRAY BOOTH FILTER	D007,F003,F005	3077
216	PAINT SPRAY BOOTH FILTER	F005	3077
265	PAINT SPRAY BOOTH FILTER	F003,5	3077
403	PAINT SPRAY BOOTH FILTER	F003,5	3077
471	PAINT SPRAY BOOTH FILTER	D007/F003,5	3077
411	PAINT SPRAY BOOTH FILTERS	F003,5	3077
413	PAINT SPRAY BOOTH FILTERS	D007/F003,5	3077
462	PAINT SPRAY BOOTH FILTERS	D007/F003,5	3077
488	PAINT SPRAY BOOTH FILTERS	F003,5/D007	3077
277	PAINT THINNER PAINT SLUDGE	D001/F003,5	1263
337	PAINT WHITE ENAMEL	D001	1263
163	PAINT, RUST INHIBITING	D001	1263
51	PH 2-ETHYLHEXOATE	D008	9189
148	PLANT GRADE ETHYL ALCOHOL	D001	1170
434	PLASTIC MEDIA W/ZINC CHROMATE DUST	D007/F005	9189
466	PLASTIC MEDIA W/ZINC CHROMATE DUST	D007/F005	3077
198	PLUTEK-COPPER PLATING SOL PL915	D002	1760
244	POLISH LIQUID	D001	9189
309	POLY DINITROPOPYL ACRYLATE	D001	1325
35	POLYAMIDE RESIN COMPONENT B	D001/F005	9189
451	POLYSULFIDE RUBBER COMPOUND	D001,8/F005	9189
432	POLYSULFIDE SEALANT	D001,8	1263
248	POLYURETHANE FOAM PT B	F002	1263
39	POLYURETHANE PART A	D001/F005	1263
88	POTASSIUM NITRATE	D001	1486
392	POTASSIUM PERCHLORATE	D001	1489
59	POWDERED ALUMINUM	D001	1309
289	PRETREATMENT COAITING,ACID COMP.	D001,2	2924
37	PRIMER COATING EPOXY	D001/F005	9189
38	PRIMER COATING EPOXY PT B	D001/F005	9189
159	PRIMER COATING, ZINC CHROMATE	D001,D007,F005	1263

33	PRIMER MIL-P-22332	D001,7/F003	1263
19	PRIMER SS4004	D001/F003,5	1263
460	PROCESSED HYPO SOLUTION	D011	3082
207	PROPYLAMINE	D001	1277
354	PROTECTIVE COATING, HUMISEAL 1A33	F005	1954
247	PSI-690 PRIMER FOR SEALANT	D001	1263
224	ROS6 ACETONE RINSATE	D001/F003	3077
322	RAGS & PLASTIC CONT W/TOLUENE & VER	F005	1993
195	RAGS CONT. W/PAINT THINNER	F003,F005	1993
9	RAGS CONT.W/PAINT THINNER	F003,F005	1993
102	RAGS CONTAMINATED W/IRON OCTOATE	F005	1993
269	RAGS CONTAMINATED W/TOLUENE & R-140	F005	1993
255	RAGS,GLOVES W/EC801/SIL. FLUID/LIQ.	F003,5	1993
152	RAGS,PAPER CONTW/EC80/ZINC CHROMATE	D007	1993
472	RAGS,PAPER,PLASTIC CONT W/INRT LOVA	F003	1993
473	RAGS,PAPER,PLASTIC CONT W/TOL. CKU	F005	1993
306	RAGS,PAPER,PLASTIC CONT W/TOLUENE &	F005	1993
313	RAGS,PAPER,PLASTIC CONTAMINATED W/T	F005	1993
270	RECOVERED METHYLENE CHLORIDE/METHAN	D001/F002,5	1993
495	RED GLOSS AKYLD ENAMEL PAINT	D001	1263
442	SALUCYLIC ACID/HEPTANE	D001	1993
210	SAND BLAST MEDIA PLASTIC	D007/F003,5	3077
368	SAND BLAST MEDIA PLASTIC	D007	3077
494	SANDING SEALER	F003,5/D001,35	9189
150	SEALING COMPOUND	F005 D001	1263
172	SEALING COMPOUND	D001,F005	1263
435	SEMI GLOSS ENAMEL RUST INHIB.	D001,8	1263
193	SILAPRENE INDUSTRIAL ADHESIVE	D001,F003,5	9189
430	SILICONE CURING AGENT	D001	9189
106	SILICONE SS4004 SILICONE PRIMER	D001,F003,5	1263
441	SILVER BETA RESORCYLATE IN HEPTANE	D001	1993
464	SILVER NITRATE	D001,11	1493
481	SLUM ASH 179	F005,2,3	3077
222	SLUM PAN ASH DRUM 168/169	D008	9189
424	SOAP PASTE TYPEII CLASS A	D002	1993
78	SODIUM & POTASSIUM NITRATE W/BARIUM	D001,5,8	2924
70	SODIUM HYDROXIDE	D002	1823
197	SODIUM HYDROXIDE LIQUID PHOTO RESIS	D002	1719
116	SODIUM METAL IN KEROSENE	D003,1	1993
229	SODIUM METAL/CADIUM NITRATE/SILVER	D001	2924
252	SODIUM NITRATE	D001	1498
401	SODIUM PERIODATE POWDER PILLOWS	D001	2924
204	SOIL SAMPLES CONT. W/SOLVENTS	F003,F005	1993
166	SOLVENT CEMENT	D001,F003,5	1993
288	SOLVENT CONT. RAGS	D007,8/F005	1993
366	SOLVENT CONTAMINATED RAGS	F002	1993
80	SOLVENT RAGS CONT. W/METHELENE CHLO	F002	1993
186	SOLVENT TANK WATER CONT. W/ACETONE	F003,5	1993
187	SOLVENT TANK WATER CONT. W/ACETONE	F003,5	1993
185	SOLVENT TANK WATER CONT. W/ALCOHOL	F003,5	1993
362	SOLVENTS FROM SCOTCH GRIP CPNTACT C	D001,35/F003,5	1993
189	SOLVNET TANK WATER CONT. W/ACETONE	F003,5	1993
188	SOLVNET TANK WATER CONT. W/ALCOHOL	F003,5	1993
89	SPENT ACETONE	D001, F003	1993
284	SPENT ACID SOLUTION	D002	1830
2	SPENT MACHINE COOLANT	D005,8	1142
258	SPENT MACHINE COOLANT	D005,8	1142
259	SPENT MACHINE COOLANT	D005,8	1142
260	SPENT MACHINE COOLANT	D005,8	1142
261	SPENT MACHINE COOLANT	D005,8	1142

262	SPENT MACHINE COOLANT	D005,8	1142
263	SPENT MACHINE COOLANT/WATER/OIL	D005,8	1142
370	SPENT MACHINING COOLANT CONT W/WATE	D005-8	1142
491	SPENT PAINT FILTERS	F003,5/D007,8	3077
387	SPENT PROCESSING SOLUTION	PH-10	3082
448	SPENT THERMAL BATTERIES	TCLP TOXIC SOLID	2794
279	SPENT TRICHLOROETHANE 111	F001	1993
291	STENCIL INK	D001	9189
21	STENCIL INK BLACK TT-I-1795	D001	1263
285	STILL BAG CONT TRICHLOROETHANE SLUR	F002	1993
28	SUBDUE 2F FUNGICIDE	D001	1993
296	SULFURIC ACID	D002	1830
297	SULFURIC ACID ELCTROLYTE BATT	D002	2794
293	SULFURIC ACID MIXTURE	D002	1830
302	SULFURIC ACID MIXTURE	D002	1830
482	SYL-OFF PAPER COATING	F003/D001	9189
326	THINNERF/COATING ACRYLIC	D001/F003,5	1263
457	THINNERF/COATING ACRYLIC	D001/F003,5	1993
298	TIN PLATING SOLUTION	D002	1760
41	TOLUENE W/MK 103 LINER MIX	F005	1993
361	TOLUENE WASTE	D001/F005	1993
531	TOLUENE/POTASS./PER./WATER	F005/D001	1993
139	TP 900, R-140 LINERS, TOLUENE, SR 1	F005	1993
249	TREE & LOG MARKING PAINT	D001	1263
250	TREE & LOG MARKING PAINT	D001,8/F005	1263
251	TREE & LOG MARKING PAINT	D001	1263
357	TRICHLOROETHANE MS-170	F002	1954
137	TRICHLOROETHANE/TOLUENE CONTAMINATE	F002,F005	1993
43	TRICHLOROFLOUROETHANE	F002	1082
356	TRICHLOROTRIFLUOROETHANE CLEANING C	F002	1082
266	TRIETHYLENETETRAMINE	D002	1760
18	TRIMEC BRAODLEAF HERBICIDE	D002	1993
433	TUBES CONT W/EC801 & LIQUID ENVEL	D005/F005	9189
308	UNLEADED GASOLINE	D001	1203
364	UNLEADED GASOLINE	D001	1203
323	UNSATURATED POLYESTER RESIN LAM 411	D001	1263
446	URETHANE ACETONITRILE, METHYLENE CH	D001/F002	1993
444	URETHANE IN METHANOL	D001/F005	1993
215	USED PAINT FILTER	F003,5	3077
145	USED PAINT FILTERS	D008/F003/F005	3077
144	USED PAINT FILTERS CONT. THINNER, E	D008/F003/F005	3077
83	USED PAINT FILTERS W/EPOXY PAINT 15	D007	3077
176	USED PAINT SLUDGE /THINNER	D001,F003,F005	1263
146	USED STILL BAG FORMERLY CONTAINING	F002	9189
275	USED THINNER/PAINT SLUDGE	D001/F003,5	1263
1	VAAR, 24%METHANOL, 75%WATER, POLYVINYL	F005	1993
345	VARNISH	D001	1263
155	VARNISH INSULATING	D001,F003	1263
175	VESTANAT T1890E POLYISOCYANATE ADDU	D001	1993
128	VITON A & FREON 113	F002	1993
131	VITON/HYCAR IN 1-PROPANOL	D001	1993
515	WAS TE SOLVENT DUNKIRT CARB	F002/D002	3066
537	WASTE ACETIC ANHYDRIDE	D001,2	1715
538	WASTE ACETIC ANHYDRIDE	D001,2	1715
504	WASTE ALUMINUM POWDER	D001	1309
521	WASTE ALUMINUM POWDER	D001	1309
508	WASTE AMMONIUM NITRATE	D001	2426
509	WASTE AMMONIUM PERCHLORATE	D001	1442
503	WASTE BARIUM NITRATE	D001,5	1446
490	WASTE BASES ISOCYANATES IMINES	F003,5/D001,38	1993

461	WASTE CHEMLOCK205 67% MEK 33%	D035/F003,5	9189
528	WASTE HALOGENATED FLAMMABLE	F003,5/D001,22	1993
511	WASTE HEAVY METALS MIXED ACIDS	D002	2924
529	WASTE HEAVY METALS/INORGAN ACIDS	D002,9	2924
527	WASTE INORGANIC OXIDIZERS	F003,5/D001,38	2924
501	WASTE KEROSENE PAINT SLUDGE	D001	1993
536	WASTE LACQUER C/N GLOSS WHITE	D001	1263
532	WASTE LACQUER CAMOUFLAGE	D001/F005	1263
363	WASTE LACQUER ELBA SOLVENT & EC FLA	D001	1993
271	WASTE LEAD GREASE OIL WATER	D008	9189
369	WASTE LEAD WATER	D008	9189
535	WASTE LUSTERLESS QUICK DRYING ENAME	F003,5/D001	1263
533	WASTE MACHINING COOLANT	D005,6,8	1142
507	WASTE MAGNESIUM POWDER	D003,1	1869
493	WASTE MERCURY	D009	2809
518	WASTE MERCURY	D009	2809
510	WASTE MERCURY CONT GLASS	D009	2809
406	WASTE MERCURY CONT SULFURIC	D002,9	2809
445	WASTE METHYLENE CHLORIDE	F002	1993
467	WASTE METHYLENE CHLORIDE	F002	1593
438	WASTE MIXTURE OF ACETONE & PAINT	D001/F003,5	1993
178	WASTE NATURAL ORANGE DETERGENT & WA	D007,8,9	9189
500	WASTE NG KILLER	F003/D001	1993
502	WASTE NON HALOGENATED FLAMMABLE	D001,8/F003,5	1993
477	WASTE PAINT & THINNER	D035/F003,5	1263
476	WASTE PAINT FILTERS	D035/F003,5	3077
524	WASTE PAINT FILTERS	F003,5	3077
525	WASTE PAINT SLUM	D001	1263
4	WASTE PETROLEUM NAPHTHA	D001	SAFE
456	WASTE PETROLEUM NAPHTHA	D001	SAFE
452	WASTE POTTING COMPOUND PART A	D001	9189
514	WASTE REMOVER PAINT	F002/D002	3066
478	WASTE RUST, CORODEX	D002	9189
519	WASTE SEALING COMPOUND PT A	F003/D001	9189
520	WASTE SEALING COMPOUND PT B	F003/D001	9189
526	WASTE SOLVENT CONT RAGS	F003,5	1993
315	WASTE STRYRENE MONOMER	D001	2055
539	WASTE SULFANILAMIDE SOLUTION	D002	1993
530	WASTE SULFURIC ACID	D002	1830
534	WASTE ZINC CHROMATE PRIMER	F003,5/D001,7	1263
505	WASTE ZINC POWDER	D001	1436
506	WASTE ZINC W/HYDROCARBON GREASE	D001	1325
475	WASTE, LEAD/GREASE/OIL/WATER	D008	9189
453	WASTE, SEALING COMPOUND CEMENT	D001	1263
455	WASTE, VARNISH	D001	1263
367	WASTE, LEAD/CADIUM/WATER	D006,8	9189
371	WASTE, LEAD/GREASE/OIL/WATER	D008	9189
208	WASTES LEAD/GREASE/OIL/WATER	D008	9189
15	WATE DPA SOLUTION	D002	1760
341	WATER DISPLACING COMPOUND	D001/F002	1954
98	WELDWOOD CONTACT CEMENT	D001,F003,F005	1263
517	WSTE MERCURY	D009	2809
5	YELLOW TRAFIIC PAINT	D001,8/F002,5	1263
324	ZINC CHROMATE CELLULOSE ACETATE WHI	D001	1263
48	ZINC CHROMATE PAINT RESIDUE	D007	1263
278	ZINC CHROMATE PRIMER	D001,7/F005	1263
416	ZINC CHROMATE, THINNER ENAMEL PAINT	D007/F005	1263
165	ZINC DUST PORTION ENAMEL	D006,8	1263
67	ZINC POWDER	D001	1436
132	ZINC POWDER	D001	1436

76 ZIRCONIUM CARBIDE

D001

1325

**Appendix C.2**  
**ASTM Compatibility Guide**

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## Proposed Guide for ESTIMATING THE INCOMPATIBILITY OF SELECTED HAZARDOUS WASTES BASED ON BINARY CHEMICAL REACTIONS<sup>1</sup>

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This proposed guide has no status as an ASTM standard and is published on behalf of the sponsoring committee for information only for a maximum of two years. Comments are solicited and should be addressed to ASTM, 1916 Race St., Philadelphia, PA 19103. When referencing this document, the word "Proposal" must precede the P designation.

### INTRODUCTION

The Resource Recovery and Conservation Act of 1976 (PL 94-580) defines hazardous waste or a combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause or contribute to an increase in serious irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed. The law also defines solid waste to mean not only solids but also liquids, semisolids, and contained gaseous materials.

The "combination of solid wastes" part of the definition often presents problems in many aspects of the management of hazardous wastes. In some instances, the combination or mixture of two or more types of the wastes produces undesirable or uncontrolled reactions resulting in adverse consequences. These reactions may cause any one or more of the following: (1) heat generation, (2) fire, (3) explosion, (4) formation of toxic fumes, (5) formation of flammable gases, (6) volatilization of toxic or flammable substances, (7) formation of substances of greater toxicity, (8) formation of shock and friction sensitive compounds, (9) pressurization in closed vessels, (10) solubilization of toxic substances, (11) dispersal of toxic dusts, mists, and particles, and (12) violent polymerization. In this guide, such reactions are called incompatible reactions and the reacting wastes are called

<sup>1</sup> This proposed guide is under the jurisdiction of ASTM Committee D-34 on Waste Disposal and is the direct responsibility of Subcommittee D34.04 on Contamination.

and Transportation.

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incompatible wastes.

In the review of the literature and surveys of hazardous waste management practices several adverse reaction consequences resulting from the mixing of incompatible hazardous wastes have been noted. These consequences have caused serious accidents involving extensive damage to property, equipment, vegetation, and environment or injury or death to man, or other living things, or any combination of these. This guide has been developed based upon case histories of accidents principally resulting from insufficient or inaccurate information concerning waste characteristics, handling, and disposal practices.

The method of determining waste compatibilities described in this guide was developed on the principal assumption that wastes interactions are due to the reactions produced by the pure chemicals in the wastes. Included in this assumption is the condition that the chemicals react at ambient temperature and pressure and that their reactivities are uninfluenced by concentration, synergistic, and antagonistic effects. In this assumption, the compatibility of a combination of wastes can be predicted by the reactivities of the chemical constituents in the respective wastes.

For convenience in referencing when using the incompatibility method, the pure chemicals known or expected to be present in hazardous wastes are classified under 41 different Reactivity Group Numbers (RGN) based on molecular functional groups or chemical reactivities.

Significant portions of this guide were published by EPA as "A Method for Determining Compatibility of Hazardous Wastes." The original work for the EPA publication was conducted by H. K. Hatayama, J. J. Chan, E. R. deVeras, R. D. Stephens, and D. L. Storm from the California Department of Health Services. The EPA has granted ASTM unconditional use of this document for development of an ASTM standard.

## 1. Scope

1.1 This guide provides a systematic method for determining the incompatibility of most binary combinations of hazardous wastes. Additionally, it provides a list of compounds known or expected to be present in hazardous wastes. Also, the guide classifies the compounds as well as the wastes into chemical reactivity groupings and lists the potential adverse reaction consequences of most incompatible binary combinations of the groupings.

NOTE 1—The guide reflects the results of a literature study conducted on case histories of accidents caused by the combination of incompatible wastes, industrial wastestream constituents, hazardous chemical data, and basic chemical reactions. Further literature studies and test data will be evaluated by ASTM and included in updated editions of this guide on a biannual basis.

1.2 This guide consists of a step-by-step procedure (Section 5) and an incompatibility chart to be used to predict the possible results of mixing. The chart is the key element. (Should this procedure indicate a compatible reaction, laboratory testing should be conducted to validate the actual compatibility.) As test data with incompatible results are evaluated, this informa-

tion will be included on the incompatibility chart.

### 1.3 Limitation of the Guide:

1.3.1 This guide cannot be used to predict all the potential incompatible reactions of any two given wastes, and neither can it furnish information on all hazardous wastestreams because of the tremendous variety of waste types, constituents, and characteristics. Additionally, the guide does not address ternary combinations of incompatible hazardous wastes.

1.3.2 The potential reaction consequences predicted by the chart are based on pure chemical reactions only at ambient temperature and pressure. Concentration, synergistic, and antagonistic effects have been assumed not to influence the reactions. The reactions have not as yet been validated on actual wastes containing the chemicals.

1.3.3 This chart must only be used in conjunction with its accompanying report and its annexes, and compatible mixtures should be considered so only after confirmational experiments especially with regard to mixtures having hazard potential.

1.4 This standard may involve hazardous ma-

materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 2. Terminology

2.1 *Description of Term Specific to This Standard:*

2.1.1 *incompatibility*—the potential for adverse reaction consequences listed in Table 1 when two of the chemicals listed are intentionally or inadvertently mixed together.

2.2 *Abbreviations:*

2.2.1 *RGN*—Reactivity Group Number.

2.2.2 *RC*—Reaction Codes.

## 3. Summary of Guide

3.1 This guide describes a method for determining the incompatibility of binary combinations of hazardous wastes. Using the step-by-step incompatibility analysis procedures, and the hazardous wastes incompatibility chart, candidate waste mixtures are first subjected through the compatibility procedures for identification and classification; and, next, the chart is used to predict the incompatibility of the wastes on mixing.

3.1.1 The chart consists of 41 reactivity groupings of hazardous wastes which are displayed in binary combinations on the chart.

3.1.2 The guide is applicable to four categories of wastes based on available compositional information: (1) compositions known specifically, (2) compositions known nonspecifically by chemical classes or reactivities, (3) compositions known nonspecifically by common or generic names of wastes, and (4) compositions unknown requiring chemical analysis.

## 4. Significance and Use

4.1 This guide is of particular value to generators, storers, treaters, transporters, and disposers of hazardous wastes and to regulators in identifying and segregating wastes for storage, transportation, and disposal; for segregating, combining, and proper containerization of wastes, or any combination of these; for determining co-burial of containerized wastes in the same cell or co-burial of bulk wastes; for determining suitability

of sites for disposal of certain wastes; and for purposes of detoxification or resource recovery to prevent possible uncontrolled reaction.

4.2 This guide should be used only by professional personnel trained or familiar with chemical reactivity and the nature of chemicals.

NOTE 2—The following literature references are cited for information only: (1-31).<sup>2</sup>

## 5. Procedure

5.1 *General*—This guide is used to determine the incompatibility reactions of most binary combinations of most hazardous wastes. The guide is applicable to four categories of wastes based on information available, namely: (1) compositions unknown, (2) compositions known specifically, (3) compositions known nonspecifically by chemical classes or reactivities, and (4) compositions known nonspecifically by common or generic names only. This guide starts with an incompatibility analysis flow chart (Fig. 1) indicating the analysis pathways for the four categories of wastes, followed by the incompatibility reaction criteria and the stepwise procedures for determining incompatibility.

5.2 *Incompatibility Reaction Criteria*—The reactions between binary combinations of wastes are *not compatible* according to this guide when the undesirable and hazardous consequences outlined in Table 1 are produced.

5.3 *Procedures for Determining Incompatibility*—Five main steps are required in the step-by-step procedures for determining the reaction incompatibility of any Wastes A and B. The procedures are conducted with reference to Figs. 1 and 2 (Note 3) and Annexes 1, 2, and 3.

NOTE 3—Figure 2 is available as an adjunct (wall-size color chart)<sup>3</sup> to this proposed guide.

5.3.1 Obtain as much information as possible about the history and compositions of the wastes. Such information can usually be obtained from the records of the waste producers, the manifests that accompany the wastes and examination of the processes that produced the wastes. When no information is available, collect representative samples of the wastes and submit them for anal-

<sup>2</sup>The boldface numbers in parentheses refer to the list of references at the end of this proposed guide.

<sup>3</sup>Available from ASTM Headquarters. Order PCN 12-001680-48.

ysis. The analysis should provide information on the specific chemical constituents or classes of compounds in the wastes.

5.3.2 Starting with Waste A, list on the worksheet (Fig. 3) on the column for Waste A, the chemical names or classes of compounds in the waste or the generic names of the waste. The composition of the waste is *known specifically* when the constituents are listed by chemical names such as ethylene glycol, sodium nitrate, etc.; *known nonspecifically* by classes when the constituents are identified only by chemical classes or reactivities such as alcohols, caustics, mercaptans, etc. The waste is *known nonspecifically* by generic names when classified as spent caustic, tanning sludge, copper plating waste, etc.

5.3.3 When the composition of Waste A is *known specifically* by chemical names, consult Annex A1. Find the chemicals in the list and note their respective Reactivity Group Numbers (RGN) on the worksheet. If a chemical component is not listed in Annex A1 look for its synonym(s) (32 to 43) and note its RGN (see 5.5.1 Example 1, Note 4). Alternatively, when no synonym can be found, the RGN of the component may be determined based on its chemical class or reactivity (5.5.1, Example 1, Note 6).

5.3.4 When the composition of the waste is *known nonspecifically* by chemical classes or reactivities only, consult Annex A2 and note the corresponding RGN on the worksheet (5.5.2, Example 2).

5.3.5 When the composition of the waste is *known nonspecifically* but classified by common or generic names, consult Annex A3 and note the RGN on the worksheet (5.5.3, Example 3).

5.3.6 Repeat the above procedure for Waste B and list the information on the column for Waste B on the worksheet (Fig. 3).

5.3.7 Consult the Hazardous Wastes Incompatibility Chart<sup>3</sup> in Fig. 2 and determine the RC between any binary combinations of RGN of Wastes A against B. Note all RC on the worksheet. If no RC is listed, Wastes A and B are compatible and vice versa.

5.4 Procedures for using the hazardous wastes incompatibility chart.

5.4.1 The chart<sup>3</sup> (Fig. 2) is a quick and ready reference for determining the incompatibility reactions of most binary combinations of hazardous wastes. (See Note 3.)

5.4.2 *Description of the Chart.*<sup>3</sup>

5.4.2.1 The chart consists of 41 reactive groupings of hazardous wastes which are displayed in binary combinations on the chart.

5.4.2.2 The first column of the chart lists the reactivity groups by RGN. The first 34 RGN which are based on chemical classes or molecular functional groups are listed consecutively from 101 to 34. The last 7 RGN which are based on general chemical reactivities are listed consecutively from 101 to 107. The second column lists the corresponding reactivity group names. Each group name is followed by a number of reaction squares. A terminal square of each row is labelled with its RGN and together serve as headings for the columns of squares. An additional bottom row of squares is labelled correspondingly as the diagonal row of squares.

5.4.2.3 The rest of the squares on the chart are either blank or filled in with RC. Any RC on the squares indicate potential incompatible reactions that can result from the combination of the wastes reactivity groups represented by the individual squares. The predicted reactions are based on the combinations of the most reactive chemicals in the respective reactivity groups. All the binary wastes combinations designated with RC are described in greater detail in Annex A4. Where waste combinations are believed to be incompatible but insufficient supporting data have been found in the literature, incompatible reactions are also noted and marked on the chart with "U." The RC are identified in the legend on the upper right hand corner of the chart and described in detail in 5.2. The multiple RC are explained in 5.4.4.

5.4.3 *Steps for Using the Chart:*

5.4.3.1 For the binary combination of any reactivity groups, first find the RGN of the first group on the first column of the chart.

5.4.3.2 Find the RGN of the second group from the bottom squares of RGN.

5.4.3.3 Find the intersecting reaction square for the two RGN.

5.4.3.4 Note the RC in the square.

5.4.3.5 Refer to the legend on the chart or in 5.4 for the explanation of the RC.

5.4.3.6 When no RC is found on the reaction square, the two groups of wastes are compatible. When any RC are noted on the square, the wastes are incompatible when mixed or allowed to come in contact with one another.

5.4.4 *Explanation of the Multiple RC-*

many binary combinations, multiple RC are used to denote the reaction consequence. The order in which these letter codes appear in the squares corresponds to the order in which the consequences can occur. For example, in RC (<sup>H</sup>F<sub>E</sub>), the first letter denotes the initial or primary hazardous consequence of a binary reaction which in this case is *heat* generation. The second and third letters denote the resulting secondary consequences of the production of *fire* and *explosion* from the heat generated by the primary reaction. In some cases the third letter code refers to a resulting tertiary consequence such as the evolution of a toxic gas from a *fire* caused by excessive *heat* generation (<sup>H</sup>F<sub>G</sub>). Where the codes GT<sub>GF</sub> appear, the gases evolved are *toxic* and *flammable* such as hydrogen sulfide, hydrogen cyanide, or carbon disulfide. The relative positions of the letter codes to one another in this case bear no significance. The codes can also be written as GF<sub>GT</sub>.

5.5 *Specific Examples*—The following examples illustrate the stepwise procedures for determining the incompatibility of hazardous wastes.

5.5.1 *Example 1—Composition known specifically.*

5.5.1.1 The manifests identify the constituents of the wastes specifically as follows:

(a) Waste A contains ethylene glycol, chlorobenzene, and hydrochloric acid.

(b) Waste B contains isooctane and sodium sulfide.

5.5.1.2 List the components of Waste A on the column for Waste A on the worksheet (Fig. 3). Consult Fig. 1 and follow the incompatibility flow diagram for *composition known specifically*.

5.5.1.3 Find the RGN of the components ethylene glycol, chlorobenzene and hydrochloric acid in Annex A4 (Note 4). Thus, the RGN for the components are: ethylene glycol -4, chlorobenzene -17, and hydrochloric acid -1.

NOTE 4—If a chemical constituent is not listed in Annex A1, its synonym(s) can be obtained from chemical references (for example, Refs 32 to 34) and used to determine its RGN. For example, Pyranton is a chemical not listed in Annex A1. In the Merck Index (39), the synonym for this chemical is diacetone alcohol which is listed in Annex A1 with RGN of 4 and 19. Thus, the incompatibility of this compound with other waste constituents can be established in the same way Example 1.

5.5.1.3 Record the RGN of the components on the worksheet.

5.5.1.4 List the components of Waste B on the column for Waste B on the worksheet. Repeat this procedure for Waste B. Thus, the RGN of the components of Waste B are as follows: isooctane-29, and sodium sulfide 24, 33, and 105.

NOTE 5—If Waste A contains a water reactive constituent (RGN 107) and Waste B contains an aqueous component, then water (RGN 106) should be listed as one of the hazardous components for Waste B.

5.5.1.5 Pair up each listed RGN of Waste A against that of Waste B. Hence the following pairs are possible: 4 and 29, 4 and 33, 17 and 29, 17 and 33, 1 and 29, 1 and 33. For each pair, find the RC in the Hazardous Wastes Incompatibility Chart<sup>3</sup> (Fig. 2). Record the corresponding RC for each pair on the worksheet. The completed worksheet is shown in Fig. 4.

5.5.1.6 *Conclusion*—Waste A is incompatible with Waste B. Potential hazard of toxic (GT) and flammable (GF) gas formation generates heat by chemical reaction (H), ignition of reaction mixtures (F), explosion due to rigorous reactive (E), and solubilizing of toxic substances (S) are indicated if the wastes are mixed.

NOTE 6—When a synonym for an unlisted compound cannot be found, the RGN under which it is listed may be derived by molecular functional groups or chemical reactivity. For example, isobutyl carbinol is not listed in Annex A1. The Merck Index (39), however, lists the compound as an isopentylalcohol. Therefore, by consulting Annex A2, isobutyl carbinol may be classified under RGN 4. When the compound contains more than one functional group, all applicable RGN must be identified. A compound like peroxosulfuric acid is not listed in Annex A1. The functional groups of this chemical are those of a strong mineral acid and a very powerful oxidizing agent. Therefore, the compound may be classified under RGN 2.

5.5.2 *Example 2—Composition known nonspecifically by chemical classes for activities.*

5.5.2.1 The manifests identify the wastes constituents as follows:

(a) Waste A contains toxic metals, aldehydes, and alcohols.

(b) Waste B contains toxic metals and oxidizing agents.

5.5.2.2 List the components of Waste A in the column for Waste A on the worksheet (Fig. 3). Consult Fig. 1 and follow the incompatibility flow diagram for *composition known nonspecifically by chemical classes or reactivities*.

5.5.2.3 Find the RGN for toxic metals, aldehydes, and alcohols in Annex A2. Thus, the RGN for the components are: toxic metals—24, alde-

hydrides—5, and alcohols—4.

5.5.2.4 Record the RGN of the components on the worksheet.

5.5.2.5 List the components of Waste B in the column for Waste B on the worksheet. Repeat the procedure for Waste B. Thus, the RGN for the components of Waste B are: toxic metals—24 and oxidizing agents—104.

5.5.2.6 Determine the incompatibility of Waste A and B in the same manner as in 5.4.3. The completed worksheet for this example is shown in Fig. 5.

5.5.2.7 *Conclusion*—Waste A is incompatible with Waste B. Potential for heat and fire generations (H<sub>F</sub>) are indicated if the wastes are mixed.

5.5.3 *Example 3—Composition known nonspecifically by common or generic names of wastes.*

5.5.3.1 The manifests describe the wastes as follows:

(a) Waste A is a metal plating waste.

(b) Waste B is a pectin waste from the production of citrus products.

5.5.3.2 List the generic name of Waste A in the column for Waste A on the worksheet (Fig. 3). Consult Fig. 1 and follow the incompatibility flow diagram for composition *known nonspecifically*

*ally* by common or generic names of waste.

5.5.3.3 Find the RGN of "metal plating waste" in accordance with Annex A3. The RGNs for this generic waste are 11 and 24.

5.5.3.4 Enter the RGN of Waste A on the worksheet.

5.5.3.5 Enter the waste generic name of "Citrus Pectin Waste" in the column for Waste B on the worksheet. Repeat steps in 5.5.3.3 and 5.5.3.4 for Waste B. Thus, the most likely RGN for this generic waste are 1 and 4.

5.5.3.6 Determine the incompatibility of Wastes A and B in the same manner as in 5.5.1.5. The completed worksheet for this example is shown in Fig. 6.

5.5.3.7 *Conclusion*—Waste A is incompatible with Waste B. Potential hazards of toxic and flammable gas formation (GTGF) are indicated if the wastes are mixed. Also solubilization (S) of metals may occur.

## 6. Precision and Bias

6.1 No statement is made about either the precision or the bias of the information provided by this guide or the accompanying chart since the results cannot predict all potential incompatible chemical reactions of any two given wa

TABLE 1 Reaction Codes and Consequences

NOTE—The RC is used in the incompatibility chart (Fig. 2) to denote the potential hazardous reaction consequences that can result from the binary combinations of the wastes.

Reaction Codes (RC)	Reaction Consequences
H	generates heat by chemical reactions
F	produces fire from extremely exothermic reactions, ignition of reaction mixtures or of the reaction products
G	generates innocuous gases such as nitrogen gas (N <sub>2</sub> ), carbon dioxide (CO <sub>2</sub> ), etc. but can cause pressurization and rupture of closed containers
GT	generates toxic gases such as hydrogen cyanide (HCN), hydrogen sulfide (H <sub>2</sub> S), etc.
GF	generates flammable gases such as hydrogen gas (H <sub>2</sub> ), acetylene (C <sub>2</sub> H <sub>2</sub> ), etc.
E	produces explosion due to extremely vigorous reactions or reactions producing enough heat to detonate unstable reactants or reaction products
P	produces violent polymerization resulting in the generation of extreme heat and sometimes toxic and flammable gases
S	solubilizes toxic substances such as metals

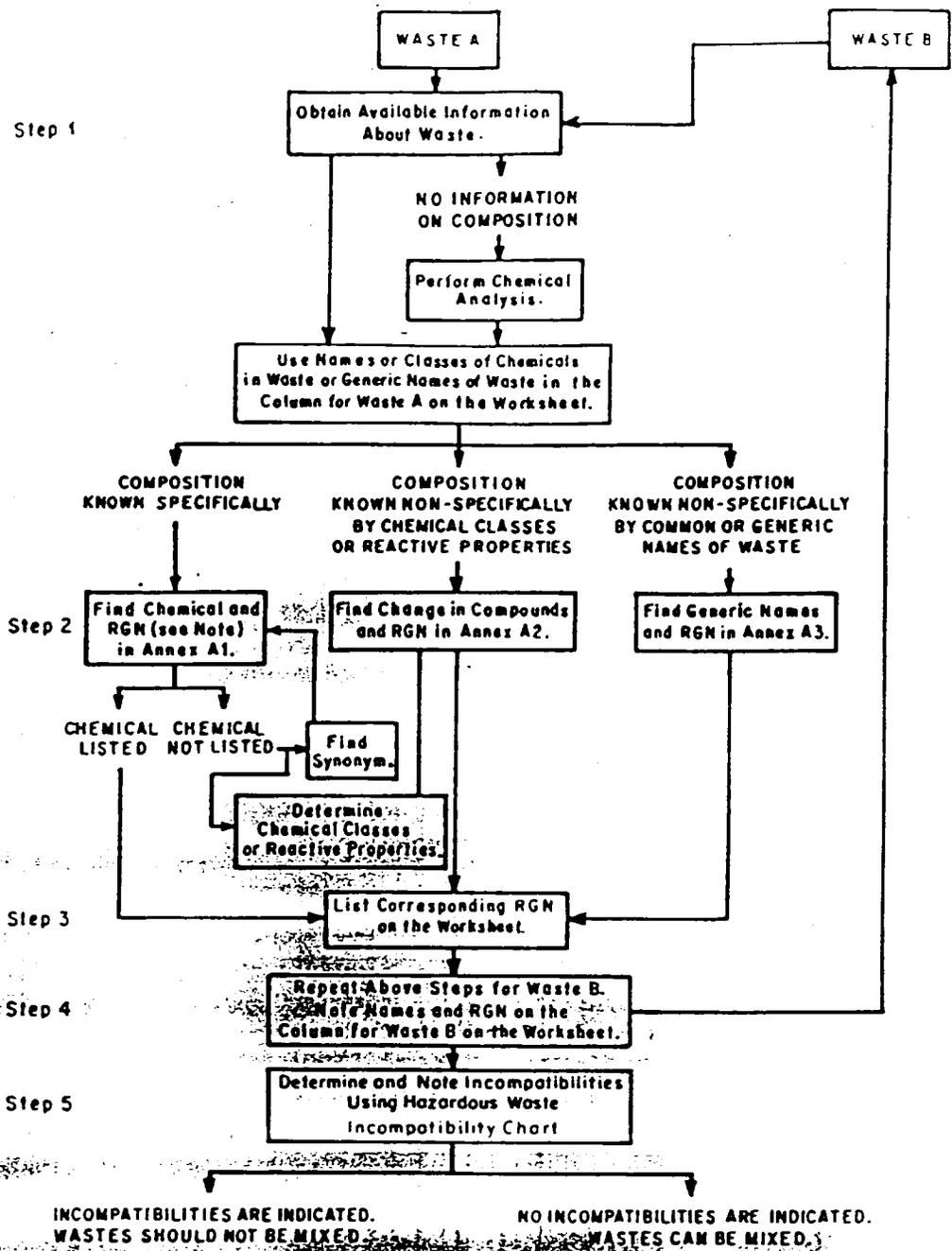


FIG. 1 Flow Diagram for Determining Hazardous Waste Incompatibility



EXAMPLE 1

Waste A \_\_\_\_\_ Source \_\_\_\_\_

Waste B \_\_\_\_\_ Source \_\_\_\_\_

Name of Waste Evaluation \_\_\_\_\_ Date \_\_\_\_\_

WASTE A \ WASTE B Name      Reactivity Group Number		Reactivity Group Number	Name							
		29	33	24						
		Isocitane	Sodium Sulfide	Sodium Sulfide	Sodium Sulfide					
Ethylene Glycol	4				N	CF				
Chlorobenzene	17				H	E				
Hydrochloric Acid	1		GT	S	H	CF				
			GF							

NOTE—Refer to Fig. 2 for the definitions of the Reaction Code entered on the squares of this worksheet.  
 FIG. 4 Completed Worksheet for Determining Hazardous Waste Incompatibility When Wastestream Compositions Are Known Specifically

EXAMPLE 2

Waste A \_\_\_\_\_ Source \_\_\_\_\_

Waste B \_\_\_\_\_ Source \_\_\_\_\_

Name of Waste Evaluation \_\_\_\_\_ Date \_\_\_\_\_

WASTE A \ WASTE B Name      Reactivity Group Number		Reactivity Group Number	Name									
		24	Toxic Metals	104	Oxidizing Agent							
Toxic Metals	24											
Aldehydes	5			H <sub>F</sub>								
Alcohols	4			H <sub>F</sub>								

NOTE—Refer to Fig. 2 for the definitions of the Reaction Code entered on the squares of this worksheet.

FIG. 5 Completed Worksheet for Determining Hazardous Waste Incompatibility When Wastestream Compositions Are Known Nonspecifically by Chemical Classes

EXAMPLE 3

Waste A \_\_\_\_\_ Source \_\_\_\_\_  
 Waste B \_\_\_\_\_ Source \_\_\_\_\_  
 Name of Waste \_\_\_\_\_ Date \_\_\_\_\_  
 Evaluation \_\_\_\_\_

Name	Reactivity Group Number	Reactivity Group Number									
		4	1								
Metal Plating Waste	11		GT								
	24		GF								
			S								

NOTE—Refer to Fig. 2 for the definitions of the Reaction Code entered on the squares of this worksheet.  
 FIG. 6 Completed Worksheet for Determining Hazardous Waste Incompatibility When Wastestream Compositions Are Known Nonspecifically by Generic Names

## ANNEXES

## (Mandatory Information)

## A1. LIST OF CHEMICAL SUBSTANCES, COMPOUNDS, AND CLASSES

A1.1 This annex lists the chemical substances that may be found in hazardous wastestreams. The list is not inclusive but represents the data compiled through a literature survey and examination of hazardous waste management practices.

A1.2 The list consists of three columns. The first column lists the chemical or trade names in alphabetical order. The trade names are denoted by the asterisks (\*). The second column lists the synonyms or common names of the chemical substances when available. The third column lists the reactivity group numbers (RGN) assigned to the substances as derived in Annex A2. A compound may be assigned more than one RGN.

A1.3 This annex is used to obtain the RGN of waste constituents when known specifically. The RGN is used to determine the incompatibility of the combinations

of wastes according to the incompatibility guide in Section 5.

A1.4 The chemical substances listed were compiled from several sources. The list of Hazardous Wastes and Hazardous Materials and List of Extremely Hazardous Wastes and Extremely Hazardous Materials in California's Industrial Waste Law of 1972 (44) served as the starting reference. The primary sources of information consisted of published reports (32, 33, 36, 45-48) identifying the hazardous chemical substances in industrial wastestreams. Additional chemical entries were abstracted from the California Waste Haulers Record files (49), California Extremely Hazardous Waste Disposal permit files (50), and the TRW Systems' Report on Recommended Methods of Reduction, Neutralization, Recovery, and Disposal of Hazardous Wastes (51).

TABLE A1.1 Possible Chemical Constituents of Hazardous Wastestreams

Name	Synonym	RGN
Atate*		32
Acenaphthene		16
Acetamide		6
Acetaldehyde	ethanol	5
Acetic acid		3
Acetic anhydride	acetyloxyde, 2-propanone	107
Acetone	dimethyl ketone	19
Acetone cyanohydrin	hydroxyisobutyronitrile	4, 26
Acetonitrile	methyl cyanide	26
Acetophenone	phenylmethyl ketone	19
Acetoxybutane	butyl acetate	13
Acetoxypentane	amyl acetate	13
Acetyl acetone	2, 4-pentanedione	19
Acetyl azide	acetozone	102
Acetyl benzoyl peroxide		30
Acetyl bromide		17, 107
Acetyl chloride		17, 107
Acetylene	ethyne	28
Acetyl nitrate		27, 102
Acetyl peroxide		30
Acrolein	aqualin	5, 103
Acrylic acid	2-propenoic acid	3, 103
Acrylonitrile	vinyl cyanide	26, 103
Adipic acid	hexanedioic acid	3
Adiponitrile	1, 4-dicyanobutane	26
Agallol	methoxyethylmercuric chloride	24
Agaloretan	methoxyethylmercuric chloride	24
Aldicarb	Temik*	9, 20
Aldrin		17
Alkyl aluminum chloride		107
Alkyl resins		101

TABLE A1.1 *Continued*

Name	Synonym	RGN
Allene	propadiene	
Allyl alcohol	2-propen-1-ol	
Allyl bromide	3-bromopropene	1
Allyl chloride	3-chloropropene	1
Allyl chlorocarbonate	allyl chloroformate	13, 1
Allyl chloroformate	allyl chloroformate	13, 1
Allyl trichlorosilane		10
Aluminum		22, 2
Aluminum aminoborohydride		10
Aluminum borohydride		105, 10
Aluminum bromide		10
Aluminum carbide		10
Aluminum chloride		10
Aluminum diethyl monochloride	diethylaluminum chloride	105, 10
Aluminum fluoride		15, 10
Aluminum hydride		10
Aluminum hypophosphide		10
Aluminum phosphide		10
Aluminum tetraazidoborate		8
Aminobenzene	aniline	7
Aminobutane	butylamine	7
Aminochlorotoluene	chlorotoluidine	7, 17
Aminodiphenyl		7
Aminoethane	ethylamine	7
Aminoethanol		4, 7
Aminoethanolamine		7
Aminohexane	hexylamine	7
Aminomethane	methylamine	7
Aminopentane	amylamine	7
Aminophenol	hydroxyaniline	7, 31
Aminopropane	isopropyl amine	7
Amino propionitrile		7, 26
Aminothiazole		7, 8
Aminotoluene	toluidine	7
Ammonia		10
Ammonium arsenate		24
Ammonium azide		102
Ammonium bifluoride		15
Ammonium chlorate		102, 104
Ammonium dichromate		24, 102
Ammonium fluoride		15
Ammonium hexanitrocobaltate		24, 102
Ammonium hydroxide		10
Ammonium hypophosphide		105
Ammonium molybdate		24
Ammonium nitrate		102
Ammonium nitridoosmate		24, 104
Ammonium nitrate		102
Ammonium perchlorate		104
Ammonium periodate		102, 104
Ammonium permanganate		24, 102, 104
Ammonium persulfate		104
Ammonium picrate		102
Ammonium sulfide		33, 105
Ammonium tetrachromate		24, 104
Ammonium tetraperoxychromate		24, 102, 104
Ammonium trichromate		24, 104
Amyl acetate	acetoxy pentane	13
Amyl alcohol	pentanol	4
Amyl chloride	chloropentane	17
Amyl cyanide	capronitrile	26
Amylamine	aminopentane	7
Amylene	pentene	28
Amyl mercaptan	pentanethiol	20
Aniline	benzenamine	7

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TABLE A1.1 *Continued*

Name	Synonym	RGN
Acetone V-101	tetrasul	20
Anisole	methoxybenzene	14
Anisole chloride	anisoy chloride	107
Anthracene		16
Antimony		23, 24
Antimony chloride	antimony trichloride	24, 107
Antimony fluoride	antimony trifluoride	24, 107
Antimony nitride		24, 25
Antimony oxychloride		24
Antimony oxide	antimony trioxide	24
Antimony pentachloride		24
Antimony pentasulfide		24, 33, 105
Antimony perchlorate		24, 104
Antimony potassium tartrate		24
Antimony sulfate	antimony insulfate	24
Antimony sulfide	antimony trisulfide	24, 33, 105
Antimony tribromide		24, 107
Antimony trichloride	antimony chloride	24, 107
Antimony trifluoride	antimony fluoride	24, 107
Antimony triiodide		24, 107
Antimony trioxide	antimony oxide	24
Antimony trisulfate	antimony sulfate	24
Antimony trisulfide	antimony sulfide	24, 33
Antimony trivinyl		24, 107
Aqualin	acrolein	5, 103
Aqueous solutions and mixtures		106
Aretan*	methoxyethylmercuric chloride	24
Aroclor*	polychlorinated biphenyl	17
Arsenic		24
arsenic bromide	arsenic tribromide	24, 107
arsenic chloride	arsenic trichloride	24, 107
arsenic disulfide	arsenic sulfide	24, 33, 105
arsenic iodide	arsenic triiodide	24, 107
arsenic oxide	arsenic pentoxide	24
arsenic pentaselenide		24
arsenic pentasulfide		24, 33
arsenic pentoxide	arsenic oxide	24
arsenic sulfide	arsenic disulfide	24, 33, 105
arsenic tribromide	arsenic bromide	24, 107
arsenic trichloride	arsenic chloride	14, 107
arsenic trifluoride		24
arsenic triiodide	arsenic iodide	24, 107
arsenic trisulfide		24, 33, 105
Arsine		24, 105
Askarel	polychlorinated biphenyl	17
Asphalt		101
Azidocarbonyl guanidine		8, 102
Azido-s-triazole		8
Azinphos ethyl	Ethyl guthion*	32
Azirdine	ethyleneimine	7, 103
<i>o, o'</i> -Azodiisobutyronitrile		8, 26
Azodrin*	monocrotophos	32
Bakelite*		101
Banol	carbonolate	9
Barium		21, 24, 107
Barium azide		24, 102
Barium bromate		24, 104
Barium carbide		24, 105, 107
Barium chlorate		24, 104
Barium chloride		24
barium chromate		24, 104
barium fluoride		15, 24
barium fluosilicate		24
Barium hydride		24, 105

TABLE A1.1 Continued

Name	Synonym	RGN
Barium hydroxide		10, 24
Barium hypophosphide		24, 105
Barium iodate		24, 104
Barium iodide		24
Barium monoxide	barium oxide	10, 24, 107
Barium nitrate		24, 104
Barium oxide	barium monoxide	10, 24, 107
Barium perchlorate		24, 104
Barium permanganate		24, 104
Barium peroxide		24, 104
Barium phosphate		24
Barium stearate		24
Barium sulfide		24, 33, 105, 107
Barium sulfite		24
Bassa*	BPMC	9
Bayer 25/141	fensulfothion	32
Baygon*		9
Benzadox	Topcide*	6
Benzal bromide		17
Benzal chloride		17
Benzaldehyde		5
Benz-a-pyrene		16
Benzene		16
Benzene diazonium chloride		8, 102
Benzene phosphorus dichloride		107
Benzidine		7
Benzoic acid		3
Benzonitrile		26
Benzophenone		19
Benzoquinone	quinone	19
Benzotriazole		8, 102
Benzotribromide		17
Benzotrifluoride	trifluoromethylbenzene	17
Benzoyl chloride		107
Benzoyl peroxide	dibenzoyl peroxide	30, 102
Benzyl alcohol		4
Benzylamine		7
Benzyl benzene	diphenylmethane	16
Benzyl bromide		17
Benzyl chloride	chlorotoluene	17
Benzyl chlorocarbonate	benzyl chloroformate	17
Benzyl chloroformate	benzyl chlorocarbonate	17
Benzyl silane		105, 107
Benzyl sodium		105
Beryllium		24
Beryllium copper alloy		24
Beryllium fluoride		15, 24
Beryllium hydride		24, 105, 197
Beryllium hydroxide		10, 24
Beryllium oxide		24
Beryllium sulfide		33, 105
Beryllium tetrahydroborate		24, 105, 107
Bidrin*		32
Bismuth		22, 23, 24
Bismuth chromate		24
Bismuthic acid		24
Bismuth nitride		24
Bismuth pentafluoride		24, 25, 102
Bismuth pentoxide		24, 107
Bismuth sulfide		24
Bismuth tribromide		24, 33, 105
Bismuth trichloride		24
Bismuth triiodide		24
Bismuth trioxide		24

TABLE A1.1 Continued

Name	Synonym	RGN
Bismuth trisulfide		24, 33, 105
Blada-fum*	sulfotepp	32
Blue vitriol	copper sulfate	24
Bomyl		32
Borane		24, 107
Bordeaux arsenites		24
Boric acid		1
Boron arsenotribromide		24, 105
Boron bromodiodide		24, 107
Boron dibromiodide		24, 107
Boron nitride		24, 25
Boron phosphide		24, 107
Boron triazide		24, 102
Boron tribromide		24, 107
Boron trichloride		24, 107
Boron trifluoride		24, 107
Boron triiodide		24, 107
Boron trisulfide		24, 33, 105
BPMC	Bassa*	9
Brass		23
Bromic acid		2
Bromine		104
Bromine azide		102
Bromine cyanide	cyanogen bromide	11
Bromine monofluoride		104, 107
Bromine pentafluoride		104, 107
Bromine trifluoride		104, 107
Bromacetylene		17
Bromobenzoyl acetanilide		6, 19
Bromobenzyl trifluoride		17
Bromodiborane		105
Bromodiethylaluminum		107
Bromodimethoxyaniline		14
Bromoform	tribromomethane	17
Bromomethane	methyl bromide	17
Bromophenol		17, 31
Bromopropene	allyl bromide	17
Bromopropyne		17
Bromosilane		105
Bromotoluene		17
Bromotrichloromethane		17
Bromotrifluoromethane		17
Bromoxynil	3,5-dibromo-4-hydroxy benzonitrile	17, 26, 31
Bronze		23
Buna-N*		101
Bunker fuel oil		101
Butacarb		9
Butadiene		28, 103
Butadiyne	diacetylene	28
Butanal	butyraldehyde	5
Butane		29
Butanediol		4
Butanethiol	butyl mercaptan	20
Butanetriol trinitrate		102
Butanol	butyl alcohol	4
Butanone	methyl ethyl ketone	19
Butenal	crotonaldehyde	5
Butene		28
Butene-2-one	methyl vinyl ketone	19
Butyl acetate	acetoxybutane	13
n-Butyl acrylate		13, 103
Butylamine	aminobutane	7
Butyl alcohol	butanol	4
t-Butyl azidoformate		8
Butyl benzene	phenylbutane	16

TABLE A1.1 Continued

Name	Synonym	RGN
Butyl benzyl phthalate		13
Butyl cellosolve*		4
Butyl dichloroborane		105
Butyl ether	dibutyl ether	14
Butyl formate		13
Butyl fluoride		17
Butyl glycidyl ether		34
Butyl hydroperoxide		30
<i>i</i> -Butyl hypochlorite		102, 104
<i>n</i> -butyl lithium		105, 107
Butyl mercaptan	butanethiol	20
Butyl peroxide		30
Butyl peroxyacetate	<i>i</i> -butyl perbenzoate	30
Butyl peroxybenzoate		30
Butyl peroxyvalerate		30
<i>i</i> -Butyl perbenzoate	butyl peroxyacetate	30
<i>i</i> -Butyl-3-phenyl oxazirane		34
Butyl trichlorosilane		107
Butyramide		6
Butyraldehyde	butanol	5
Butyric acid		3
Butyronitrile		26
Bux*		9
Cacodylic acid	dimethylarsenic acid	24
Cadmium		23, 24
Cadmium acetylide		24, 105, 107
Cadmium amide		24, 10, 107
Cadmium azide		24, 102
Cadmium bromide		24
Cadmium chlorate		24, 104
Cadmium chloride		24
Cadmium cyanide		11, 24
Cadmium fluoride		15, 24
Cadmium hexamine chlorate		24, 102
Cadmium hexamine perchlorate		24, 102
Cadmium iodide		24
Cadmium nitrate		24, 102, 104
Cadmium nitride		24, 25, 102
Cadmium oxide		24
Cadmium phosphate		24
Cadmium sulfide		24, 33, 105
Cadmium trihydrazine chlorate		24, 102
Cadmium trihydrazine perchlorate		24, 102
Calcium		24, 102
Calcium arsenate		24, 102
Calcium arsenite		24
Calcium bromate		104
Calcium carbide		105, 107
Calcium chlorate		104
Calcium chlorite		104
Calcium fluoride		15
Calcium hexammoniate		105
Calcium hydride		105, 107
Calcium hydroxide	hydrated lime	10
Calcium hypochlorite	calcium oxychloride	104
Calcium hypophosphide		105
Calcium iodate		104
Calcium-manganese-silicon alloy		23
Calcium nitrate	lime nitrate, nitrocalcite	104
Calcium oxide	salked lime	10, 107
Calcium oxychloride	calcium hypochlorite	104
Calcium perchromate		104
Calcium permanganate		104
Calcium peroxide		104
Calcium phosphide		107

TABLE A.I.1 Continued

Name	Synonym	RGN
Calcium sulfide		33, 105
Camphor oil		101
Capric acid		3
Caproic acid	hexanoic acid	3
Caprylic acid		3
Caprylyl peroxide	octyl peroxide	30
Carbacrol		31
Carbaryl		9
Carbetamide		6
Carbonolate	hanol	9
Carbofuran	Furadan*	9
Carboic acid	phenol	31
Carbolic oil		31
Carbon, activated, spent		101
Carbon bisulfide	carbon disulfide	20
Carbon disulfide	carbon bisulfide	20
Carbon tetrachloride	tetrachloromethane	17
Carbon tetrafluoride		17
Carbon tetraiodide		17
Castrix	crimidine	7
Catechol		31
Caustic potash	potassium hydroxide	10
Caustic soda	sodium hydroxide	10
CDEC		12
Cellulose		101
Cellulose nitrate	nitro cellulose	27, 102
Cerium		22
Cerium hydride		105
Cerium trisulfide		33, 105
Cerous phosphide		105
Cesium		21, 104, 107
Cesium amide		107
Cesium azide		102
Cesium carbide		105
Cesium fluoride		15
Cesium hexahydroaluminat		105
Cesium hydride		105, 107
Cesium phosphide		107
Cesium sulfide		33, 105
Chloral hydrate	trichloroacetaldehyde	5
Chlordane		17
Chlorestol	polychlorinated biphenyl	17
Chlorfenvinphos		32
Chloric acid		2, 104
Chlorine		104
Chlorine azide		102
Chlorine dioxide		102, 104, 107
Chlorine fluoroxide		102, 104
Chlorine monofluoride		104, 107
Chlorine monoxide		104
Chlorine pentafluoride		104, 107
Chlorine trifluoride		104, 107
Chlorine trioxide		102, 104
Chloroacetaldehyde		5, 17
Chloroacetic acid	monochloroacetic acid	3, 17
Chloroacetone	monochloroacetone	17, 19
Chloroacetophenone	phenyl chloromethyl ketone	17, 19
Chloroacetyl chloride		107
Chloroacetylene		102
Chloroacrylonitrile		17, 26
Chlorazodin		8, 17
Chlorobenzene		17
Chlorobenzotriazole		8, 17
Chlorobenzoyl peroxide		17, 30
Chlorobenzylidene malononitrile		17, 26

TABLE A.II Continued

Name	Synonym	RGN
Chlorobutyrinitrile		17, 26
Chloro chromic anhydride	chromyl chloride	24, 104, 107
Chloroacresol		17, 31
Chlorodiborane		105
Chlorodisobutyl aluminum		105, 107
Chlorodimethylamine diborane		105
Chlorodinitrobenzene	dinitrochlorobenzene	17, 27
Chlorodinitrotoluene		17, 27
Chlorodipropyl borane		105
Chloroethane	ethyl chloride	17
Chloroethanol		4, 7
Chloroethylenimine		17
Chloroform	trichloromethane	17
Chlorohydrin		17
Chloromethane	methyl chloride	17
Chloromethyl methyl ether		17
Chloromethyl phenoxyacetic acid		3, 17
Chloronitroaniline		17, 27
Chloronitrobenzene	nitrochlorobenzene	17, 27
Chloropentane	amyl chloride	17
Chlorophenol		31
Chlorophenyl isocyanate		17, 18, 107
Chloropicrin	chloropicrin, trichloronitromethane	17, 27, 102
Chloropropane	isopropyl chloride	17
Chloropropene	allyl chloride	17
Chloropropylene oxide	epichlorohydrin	17, 34
Chlorosilane		105
Chlorosulfonic acid		1
Chlorothion*		17, 32
Chlorotoluene	benzyl chloride	17
Chlorotoluidine		7, 17
Chlorotrinitrobenzene	picryl chloride	17, 27, 102
B-Chlorovinyl dichloroarsine	lewisite	24
Chromic acid	chromic anhydride, chromium trioxide	2, 24, 104
Chromic anhydride	chromium trioxide, chromic acid	2, 24, 104
Chromic chloride	chromium trichloride	24
Chromic fluoride	chromium trifluoride	15, 24
Chromic oxide		24
Chromic sulfate	chromium sulfate	24
Chromium		23, 24
Chromium sulfate	chromic sulfate	24
Chromic sulfide		24, 33, 105
Chromium trichloride	chromic chloride	24
Chromium trifluoride	chromic fluoride	15, 24
Chromium trioxide	chromic acid, chromic anhydride	2, 24, 104
Chromyl chloride	chloro chromic anhydride	24, 104, 107
Chrysene		16
CMME	methyl chloromethyl ether	14, 17
Coal oil		101
Coal tar		31
Cobalt		22, 23, 24
Cobalt bromide	cobaltous bromide	24
Cobalt chloride	cobaltous chloride	24
Cobalt nitrate	cobaltous nitrate	24, 104
Cobaltous bromide	cobalt bromide	24
Cobaltous chloride	cobalt chloride	24
Cobaltous nitrate	cobalt nitrate	24, 104
Cobaltous resinate	cobalt resinate	24
Cobaltous sulfate	cobalt sulfate	24
Cobalt resinate	cobaltous resinate	24
Cobalt sulfate	cobaltous sulfate	24
Collodion	pyroxylin	27
Compound 1836	diethyl chlorovinyl phosphate	17, 32
Copper		23, 24
Copper acetoarsenite	Pans green	24

TABLE A1.1 *Continued*

Name	Synonym	RGN
Copper acetylide		24, 102, 105, 107
Copper arsenate	cupric arsenate	24
Copper arsenite	cupric arsenite	24
Copper chloride	cupric chloride	24
Copper chlorotetrazole		24
Copper cyanide	cupric cyanide	11, 24
Copper nitrate	cupric nitrate	24, 104
Copper nitride		24, 25
Copper sulfate	cupric sulfate, blue vitriol	24
Copper sulfide		24, 33, 105
Coroxon*		32
Coumafuryl	fumann	19
Coumatetraly		19
Cresol		31
Cresol glydicyl ether		34
Cresote		31
Crimidine	castrix	7
Crotonaldehyde	butenal	5
Crotyl alcohol		4
Crotyl bromide		17
Crotyl chloride		17
Cumene	isopropyl benzene	16
Cumene hydroperoxide	dimethylbenzyl hydroperoxide	30
Cupric arsenate	copper arsenate	24
Cupric arsenite	copper arsenite	24
Cupric chloride	copper chloride	24
Cupric cyanide	copper cyanide	11, 24
Cupric nitrate	copper nitrate	24, 104
Cupric sulfate	copper sulfate	24
Cupriethylenediamine		7, 24
Cyanoacetic acid	malonic nitric	3, 26
Cyanochloropentane		17, 26
Cyanogen		26
Cyanogen bromide	bromine cyanide	11
Cyanophenphos	Surecide*	26, 32
Cyanuric triazide		102
Cycloheptane		29
Cyclohexane		29
Cyclohexanol		4
Cyclohexanone		19
Cyclohexanone peroxide		30
Cyclohexylamine		7
Cyclohexenyl trichlorosilane		107
Cyclohexyl phenol		31
Cyclohexyl trichlorosilane		107
Cyclopentane		39
Cyclopentanol		4
Cyclopentene		28
Cyclopropane		29
Cyclotrimethylene trinitraamine	RDX	27, 102
Cymene		16
Cyolan*	phospholan	20, 32
2,4-D	dichlorophenoxyacetic acid	3, 17
Dasanit*	fensulfothioh	32
DBCP	dibromochloropropane	17
DCB	Dichlorobenzene	17
DDD		17
DDNP	diazodinitrophenol	8, 27, 102
DDT		17
DDVP	Dichlorovos, Vapona*	17, 32
DEAC	diethylaluminum chloride	105, 107
Decaborane		107
Decahydronaphthalene	decalin	29
Decalin	decahydronaphthalene	29
Decane		29

TABLE A1.1 Continued

Name	Synonym	RGN
Decanol		
Decene		4
Decyl benzene		28
Delnav*		16
Demeton-s-methyl sulfoxid	dioxathion	32
Diacetone alcohol	Metasystox R*	32
Diacetyl		4, 19
Diacetylene	butadiyne	19
Diamine	hydrazine	28
Diaminobenzene	phenylene diamine	8, 105
Diaminohexane	hexamethylenediamine	7
Diazidoethane		7
Diazinon*		8, 102
Diazodinitrophenol	ddnp	32
Dibenzoyl peroxide	benzoyl peroxide	27, 102
Diborane	diboron hexahydride	30, 102
Diboron hexahydride	diborane	105, 107
Dibutyl ether	butyl ether	105, 107
Dibutyl phthalate		14
3,5-Dibromo-4-hydroxybenzonitrile	Bromoxynil	13
Dibromochloropropane	DBCP, Funazone*, Nemagon	17, 26, 31
Dibromoethane	ethylene dibromide	17
Dichloroacetone		17
Dichloroamine		17, 19
Dichlorobenzene	DCB	104
Dichlorobenzidine		17
Dichlorodimethylsilane	dimethyl dichlorosilane	7, 17
Dichloroethane	ethylene dichloride	107
Dichloroethene	dichloroethylene	17
Dichloroether	dichloroethyl ether	17
Dichloroethylarsine		14, 17
Dichloroisocyanuric acid	dichloro-s-triazine-2,4,5-trione	24, 107
Dichloromethane	methylene chloride	105
Dichlorophene		17
Dichlorophenol		17
Dichlorophenoxyacetic acid	2,4-D	17, 31
Dichloropropane	propylene dichloride	3, 17
Dichloropropanol		17
Dichloropropene	dichloropropylene	4, 17
Dichloropropylene	dichloropropene	17
Dichloro-s-triazine-2,4,5-trione	dichloroisocyanuric acid	17
Dichlorovos	DDVP	104
Dicumyl peroxide		17, 32
Dicyclopentadiene		30
Dieldrin		28
Diethanolamine		17
Diethyl aluminum chloride	aluminum diethylmonochloride, DEAL	4, 7
Diethylamine		105, 107
Diethyl benzene		7
Diethyl chlorovinyl phosphate	Compound 1836	16
Diethyl dichlorosilane		17, 32
Diethyl dioxide		107
Diethylene glycol dimurate	dioxane	14
Diethylene glycol monobutyl ether acetate		27, 102
Diethylene triamine		13
Diethyl ether		7
Diethyl ketone		14
Diethyltoluamide		19
Diethyl zinc	zinc ethyl	6
Diesel oil		24, 105, 107
Difluorophosphoric		301
Diglycidyl ether	bis(2,3-epoxypropyl) ether	1
Diisobutylene		34
Diisobutyl ketone		28
Diisopropanolamine		19
		4, 17

TABLE A1.1 *Continued*

Name	Synonym	RGN
Diisopropylbenzene hydroperoxide		30
Diisopropyl beryllium		24, 104, 107
Diisopropyl ether	isopropyl ether	14
Diisopropyl peroxydicarbonate	isopropyl percarbonate	30
Dimecron*	phosphamidon	32
Dimefox	Hanane*	6, 31
Dimethyl acetylene		28
Dimethyl amine		7
Dimethylamino azobenzene	methyl yellow	7, 8
Dimethyl arsenic acid	cacodylic acid	24
Dimethylbenzyl hydroperoxide	cumene hydroperoxide	30
Dimethyl butane	neohehexane	29
Dimethyl butyne		28
Dimethyl dichlorosilane	dichlorodimethylsilane	107
Dimethyldithiophosphoric acid		32
Dimethyl ether		14
Dimethyl formal		19
Dimethyl formamide		6
Dimethylhexane dihydroperoxide		30
Dimethyl hydrazine	UDMH	8
Dimethyl ketone	acetone	19
Dimethyl magnesium		105, 107
Dimethylnitrobenzene	nitroxylen	27
Dimethylnitrosoamine	<i>n</i> -nitrosodimethyl amine	7, 27
Dimethyl sulfide	methyl sulfide	20
Dimeton		32
Dinitrobenzene		27
Dinitrochlorobenzene	chlorodinitrobenzene	17, 27
2,4-Dinitro-6- <i>sec</i> -butyl phenol	dinoseb	27, 31
Dinitrocresol	DNOC, Elgetol 30	27, 31
Dinitrophenol		27, 31
Dinitrophenyl hydrazine		8, 27
Dinitrotoluene		27
Dinoseb	2,4-dinitro-6- <i>sec</i> -butylphenol	27, 31
Dioxacarb		9
Dioxane	diethylene dioxide	14
Dioxathion	Delnav*	32
Dipentaerythritol hexanitrate		27, 102
Dipentene		28
Diphenamide		6
Diphenyl	phenylbenzene	16
Diphenyl acetylene		16
Diphenylamine		7
Diphenylamine chloroarsine	phenarsazine chloride	7, 24
Diphenyl ethane		16
Diphenyl ethylene	stilbene	16
Diphenyl methane	benzylbenzene	16
Diphenylmethane diisocyanate		18, 107
Diphenyl oxide		14
Dipicryl amine	hexamethyldiphenylamine	7, 27, 102
Dipropyl amine		7
Disulfoton	Disyston*	32
Disulfuric acid		1
Disulfur		25, 102
Disulfuryl chloride		107
Disyston*	disulfoton	32
Dithane* M-45		12
Dithione*	sulfotepp	32
DNOC	dinitrocresol	27, 31
Dodecene		28
Dodecyl benzene		16
Dodecyl trichlorosilane		107
Dowco-139*	mexacarbate	9
Dowicide I	<i>o</i> -phenyl phenol	31
Dowtherm		16

TABLE A1.1 *Continued*

Name	Synonym	RGN
Durene		
Dyfonate*		
Dynes Thinner	fonofos	
Elgetol 30		
Endosulfan	dinitrocresol	1
Endothall	Thiodan*	27.
Endothion		17.
Endrin	exothion	
EPN		
Epichlorohydrin		
Epoxybutane	chloropropylene oxide	17.
Epoxybutene		
Epoxyethane		
Epoxyethylbenzene	ethylene oxide	34, 10
Bis(2-3-Epoxypropyl) ether		3
Ethane	diglycidyl ether	3
Ethanethiol		2
Ethanol	ethyl mercaptan	2
Ethion*	ethyl alcohol	
Ethoxyethanol	nialate	3.
Ethyl acetate		4, 14
Ethyl acetylene		1.
Ethylacrylate		28
Ethyl alcohol		13, 103
Ethylamine	ethanol	4
Ethyl benzene	aminoethane	7
Ethyl butanoate	phenylethane	16
Ethyl butyrate	ethyl butyrate	13
Ethyl chloride	ethyl butanoate	13
Ethyl chloroformate	chloroethane	17
Ethyl dichloroarsine		13, 17
Ethyl dichlorosilane	dichloroethylarsine	24, 107
Ethyl ether		107
Ethylene	diethyl ether, dichloroether	14, 17
Ethylene chromic oxide		28
Ethylene chlorohydrin		24, 104
Ethylene cyanohydrin		4, 17
Ethylene diamine	hydroxypropionitrile	4, 26
Ethylene dibromide		7
Ethylene dichloride	dibromoethane	17
21-Ethylene glycol	dichloroethane	17
Ethylene glycol dinitrate		4
Ethylene glycol monomethyl ether	glycol dinitrate	27, 102
Ethyleneimine		4, 14, 17
Ethylene oxide	aziridine	7, 103
Ethyl formate	epoxyethane	34, 103
2-Ethylhexyl acrylate		13
Ethyl mercaptan		13, 103
Ethyl nitrate	ethanethiol	20
Ethyl nitrite		27, 102
Ethyl propionate		27, 102
Ethyl trichlorosilane		13
Exothion	endothion	107
Eugenol		32
Fensulfothion		31
Ferbam	Bayer 25141, Dasanit*	32
Ferric arsenate		12
Ferric sulfide		24
Ferrous arsenate		33
Ferrous sulfide	iron arsenate	24
Fluoranthrene		33, 105
Fluorence		16
Fluorine		16
Fluorine azide		104, 107
Fluorine monoxide	oxygen difluoride	102
		104, 107

TABLE A1.1 *Continued*

Name	Synonym	RGN
Fluoroacetanilide		6. 17
Fluoroacetic acid		3
Fluoroboric acid		1. 15
Fluorosulfonic acid	fluosulfonic acid	1. 107
Fluosulfonic acid	fluorosulfonic acid	1. 107
Fluosilicic acid		1. 15
Fonofos*	Dyfonate*	32
Formaldehyde	methanal	5
Formamide		6
Formetanate hydrochloride		6
Formic acid	methanoic acid	3
Fostion*	prothate	32
Freon*		17
Fumaric acid		3
Fumarin	coumafuryl	19
Fumazone*	dibromochloropropane	17
Furadan*	carbofuran	9
Furan	furfuran	14
Furfural		5
Furfuran		14
Gas oil, cracked		101
Gasoline		101
Germanium sulfide		33. 105
Glutaraldehyde		5
Glycerin		4
Glycidol		34
Glycol diacetate		13
Glycol dinitrate	ethylene glycol dinitrate	27. 102
Glycol ether		14
Glycolic acid		3
Glycol monolactate trinitrate		27. 102
Glycolonitrile		26
Gold acetylide		105. 107
Gold cyanate	gold fulminate	102
Gold fulminate	gold cyanate	102
Gold sulfide		33. 105
Grease		101
Guajacol		31
Guanyl nitrosaminoguanilydene hydrazine		8. 102
Guanidine nitrate		27. 104
Gun cotton	nitrocellulos	27. 102
Guthion*		32
Hafnium		22
Hanane*	dimefox	6. 32
Hemimellitene		16
Heptachlor		17
Heptane		29
Heptanal		5
Heptanol		4
Heptanone		19
Heptene		28
Hexaborane		105
Hexachlorobenzene		17
Hexadecyl trichlorosilane		107
Hexaethyl tetraphosphate		32
Hexafluorophosphoric acid		1. 15
Hexahydride diborane	diborane	105. 107
Hexamethyl benzene		16
Hexamethylenediamine	diaminohexane	7
Hexamethylenetetraamine		7
Hexanal		5
Hexanitrodiphenylamine	dipicrylamine	7. 27. 102
Hexanol		4
Hexanoic acid	caproic acid	3
Hexene		28

TABLE A1.1 *Continued*

Name	Synonym	RGN
Hexylamine	aminohexane	7
Hexyl trichlorosilane		107
Hexyne		28
HMX		102
Hopxide*		9
Hydrated lime	calcium hydroxide	10
Hydrazine	diamine	8, 105
Hydrazine azide		8, 102
Hydrazoic acid	hydrogen azide	102
Hydroiodic acid	hydrogen iodide	1
Hydrobromic acid	hydrogen bromide	1, 107
Hydrochloric acid	muatic acid	1
Hydrocyanic acid	hydrogen cyanide	1, 11
Hydrofluoric acid	hydrogen fluonide	1, 15
Hydrogen azide	hydrazoic acid	102
Hydrogen bromide	hydrobromic acid	1, 107
Hydrogen cyanide	hydrocyanic acid	1, 11
Hydrogen fluoride	hydrofluoric acid	1, 15
Hydrogen iodide	hydroiodic acid	1
Hydrogen peroxide		104
Hydrogen phosphide	phospine	105
Hydrogen selenide		24, 105
Hydrogen sulfide		33, 105
Hydroquinone		31
Hydroxyacetophenone		19, 31
Hydroxydibromobenzoic acid		3, 17
Hydroxydiphenol		31
Hydroxyhydroquinone		31
Hydroxyacetophenone		19, 31
Hydroxyisobutyronitrile	acetone cyanohydrin	4, 26
Hydroxyl amine		105
Hydroxypropionitrile	ethylene cyanohydrin	4, 26
Hypochlorous acid		2
Indene		16
Indium		22, 23, 24
Inerteen	polychlorinated biphenyl	17
Iodine monochloride		107
Iodine pentoxide		104
Iron		23
Iron arsenate	ferrous arsenate	24
Isobutane		29
Isobutanol		4
Isobutyl acetate		13
Isobutyl acrylate		13, 103
Isobutylene		28
Isodecyl acrylate		13
Isodurene		16
Isoeugenol		31
Isohexane		29
Isooctane	trimethylpentane	29
Isooctene		28
Isopentane	methylbutane	29
Isophorone		19
Isoprene	methyl butadiene	28, 103
Isopropanol		4
Isopropyl acetate		13
Isopropyl acetylene		28
Isopropylamine	aminopropane	7
Isopropyl benzene	cumene	16
Isopropyl chloride	chloropropane	17
Isopropyl ether	diisopropyl ether	14
Isopropyl mercaptan		20
<i>n</i> -Isopropylmethylcarbamate		9
<i>o</i> -Isopropyl methylphosphoryl fluoride		17, 32
Isopropyl percarbonate	diisopropyl peroxydicarbonate	30

TABLE A1.1 *Continued*

Name	Synonym	RGN
Isotactic propylene		101
J-100		101
Jet oil		101
Kerosene		101
Lacquer thinner		101
Landrin*		9
Lannate*	methomyl	9, 20
Lauroyl peroxide		30
Lead		23, 24
Lead acetate		24
Lead arsenate	lead orthoarsenate	24
Lead arsenite		24
Lead azide		24, 102
Lead carbonate		24
Lead chlorite		24, 104
Lead cyanide		11, 24
Lead dinitroresorcinate		24, 27, 102
Lead mononitroresorcinate		24, 27, 102
Lead nitrate		24, 104
Lead orthoarsenate	lead arsenate	24
Lead oxide		24
Lead styphnate	lead trinitroresorcinate	24, 27, 102
Lead sulfide		24, 33, 104
Lead trinitroresorcinate	lead styphnate	24, 27, 102
Lewisite	As-chlorovinyl-dichloroarsine	24
Lime nitrate	calcium nitrate	104
Lindane		17
Lithium		21, 107
Lithium aluminum hydride		105, 107
Lithium amide		10, 107
Lithium ferrosilicon		107
Lithium hydride		105, 107
Lithium hydroxide		10
Lithium hypochlorite		104
Lithium nitride		25
Lithium peroxide		104, 107
Lithium silicon		107
Lithium sulfide		33, 105
London purple		24
Lye	sodium hydroxide	10
Magnesium		21, 22
Magnesium arsenate		24
Magnesium arsenite		24
Magnesium chlorate		104
Magnesium fluoride		15
Magnesium nitrate		104
Magnesium perchlorate		104
Magnesium peroxide		104
Magnesium sulfide		33, 105
Malathion		32
Maleic acid		3
Malonic nit ile	cyanoacetic acid	3, 26
Maneb		12
Manganese		22, 23, 24
Manganese acetate		24
Manganese arsenate	manganous arsenate	24
Manganese bromide	manganous bromide	24
Manganese chloride	manganous chloride	24
Manganese methylecyclopentadienyltricarbonyl		24
Manganese nitrate	manganous nitrate	24, 104
Manganese sulfide		24, 33, 105
Manganous arsenate	manganese arsenate	24
Manganous bromide	manganese bromide	24
Manganous chloride	manganese chloride	24
Manganous nitrate	manganese nitrate	104

TABLE A1.1 *Continued*

Name	Synonym	RGN
Mannitol hexanitrate	nitromannite	27, 102
Matacil*		9
Mayer's reagent	mercuric potassium iodide	24
Medinoterb acetate		13, 27
Meobal		9
Mercaptobenzothiazol		8, 20
Mercatoethanol		4, 20
Mercarbam		32
Mercunc acetate		24
Mercunc ammonium chloride	mercury ammonium chloride	24
Mercunc benzoate	mercury benzoate	24
Mercunc bromide		24
Mercunc chloride	mercury chloride	24
Mercunc cyanide	mercury cyanide	11, 24
Mercunc dioxysulfate	mercuric subsulfate	24
Mercunc iodide	mercury iodide	24
Mercunc nitrate	mercury nitrate	24, 104
Mercunc oleate	mercury oleate	24
Mercunc oxide		24
Mercunc oxycyanide		11, 24, 102
Mercunc potassium iodide	Mayer's reagent	24
Mercunc salicylate	salicylated mercury	24
Mercunc subsulfate	mercuric dioxysulfate	24
Mercunc sulfate	mercury sulfate	24
Mercunc sulfide		24, 33, 105
Mercunc thiocyanate	mercury thiocyanide	24
Mercunc thiocyanide	mercury thiocyanate	24
Mercuriol	mercury nucleate	24
Mercurous bromide		24
Mercurous gluconate		24
Mercurous iodide		24
Mercurous nitrate		24, 104
Mercurous oxide		24
Mercurous sulfide		24
Mercury		24
Mercury (vapor)		22, 24
Mercury acetate	mercuric acetate	24
Mercury ammonium chloride	mercuric ammonium chloride	24
Mercury benzoate	mercuric benzoate	24
Mercury bisulfate	mercurous sulfate	24
Mercury chloride	mercuric chloride	24
Mercury cyanide	mercuric cyanide	11, 24
Mercury fulminate		24, 102
Mercury iodide	mercuric iodide	24
Mercury nitrate	mercuric nitrate	24, 104
Mercury nucleate	mercuriol	24
Mercury oleate	mercuric oleate	24
Mercury sulfate	mercuric sulfate	24
Mesitylene	1,3,5-trimethylbenzene	16
Mesityl oxide		19
Mesuroil*		9
Metasystox-R	demeton-S-methyl sulfoxid	32
Metham		12
Methanal	formaldehyde	5
Methane		29
Methanethiol	methyl mercaptan	20
Methanoic acid	formic acid	3
Methanol	methyl alcohol	4
Methomyl	Lannate*	9, 20
Methoxyethylmercuric chloride	Aggalolaretan*	24
Methyl acetate		13
Methyl acetone		101
Methyl acetylene	methyl butyne	28
Methyl acrylate		13, 103
Methyl alcohol	methanol	4

TABLE A1.1 *Continued*

Name	Synonym	RGN
Methyl aluminum sesquibromide		105, 107
Methyl aluminum sesquichloride		105, 107
Methylamine	aminomethane	7
Methyl amyl acetate		13
<i>n</i> -Methyl aniline		7
Methyl azirdine	propyleneimine	7
Methyl benzene	toluene	16
Methyl bromide	bromomethane	17
Methyl butadiene	isoprene	28, 103
Methyl butane	isopentane	29
Methyl butene		28
Methyl butyl ether		14
Methyl <i>t</i> -butyl ketone		19
Methyl butyne	isopropyl acetylene	28
Methyl butyrate		13
Methyl chloride	chloromethane	17
Methyl chlorocarbonate	methyl chloroformate	13, 17
Methyl chloroform		17
Methyl chloroformate	methyl chlorocarbonate	13, 17
Methyl chloromethyl ether	cumene	14, 17
Methyl cyanide	acetonitrile	26
Methyl cyclohexane		29
Methyl dichloroarsine		24
Methyl dichlorosilane		107
Methylene chloride	dichloromethane	17
Methylene diisocyanate	MDI	18, 107
4,4-Methylene bis(2-chloroniline)		7, 17
Methyl ethyl chloride		17
Methyl ethyl ether		14
Methyl ethyl ketone	butanone, MEK	19
Methyl ethyl ketone peroxide		30
Methyl ethyl pyridine		7
Methyl formate		13
Methyl hydrazine	monomethyl hydrazine	8
Methyl iodide		17
Methyl isobutyl ketone	MIBK	19
Methyl isocyanate		18, 107
Methyl isopropenyl ketone		19
Methyl magnesium bromide		105, 107
Methyl magnesium chloride		105, 107
Methyl magnesium iodide		105, 107
Methyl mercaptan		20
Methyl methacrylate		13, 103
Methyl naphthalene		16
Methyl parathion		32
Methyl pentanoate	methyl valerate	13
Methyl propionate		13
Methyl <i>n</i> -propyl ketone		19
Methyl styrene		28, 103
Methyl sulfide	dimethyl sulfide	20
Methyl trichlorosilane		107
Methyl valerate	methyl pentanoate	13
Methyl vinyl ketone	butene-2-one	19
Methyl yellow	dimethylamino azobenzene	7, 8
Mevinphos	Phosdrin*	32
Mexacarbate	Dowco-139*	9
Mineral spirits		101
Mintacol*	paraoxon	32
Mipcin*		9
Mobam		9
Mocap*		32
Molybdenum	molybdenum anhydride	22, 23, 24
Molybdenum anhydride	molybdenum trioxide	24
Molybdenum sulfide		24, 33, 105
Molybdic acid		24

TABLE A1.1 *Continued*

Name	Synonym	RGN
Monochloroacetone	chloroacetone	17, 19
Monochloroacetic acid	chloroacetic acid	3, 17
Monocrotophos	Azodinn*	32
Monoethanol amine		4, 7
Monofluorophosphonic acid		1
Monoisopropanolamine		4, 7
Monomethyl hydrazine	methyl hydrazine	8
Morpholine		7
Municipal solid waste	refuse	101
Muratic acid	hydrochloric acid	1
Nabam		12
Nack	sodium-potassium alloy	21, 107
Nak	sodium-potassium alloy	21, 107
Naphtha		101
Naphthalene		16
Naphthol		31
Naphthylamine		7
Naphthyl mercaptan		20
Naphitic	trinitronaphthalene	27, 102
Nemagon*	dibromochloropropane	17
Neohexane	dimethyl butane	29
4-NBP	nitrobiphenyl	27
Niacide*		12
Nialate	ethion	32
Nickel		22, 24
Nickel acetate		24
Nickel antimonide		24, 107
Nickel arsenate	nickelous arsenate	24
Nickel arsenite	nickelous arsenite	24
Nickel carbonyl	nickel tetracarbonyl	24
Nickel chloride	nickelous chloride	24
Nickel cyanide		11, 24
Nickel nitrate	nickelous nitrate	24, 104
Nickelous arsenate	nickel arsenate	24
Nickelous arsenite	nickel arsenite	24
Nickelous chloride	nickel chloride	24
Nickelous nitrate	nickel nitrate	24, 104
Nickel selenide		24
Nickel subsulfide		24, 33, 105
Nickel sulfate		24
Nickel tetracarbonyl	nickel carbonyl	24
Nitraniline	nitroniline	7, 27
Nitric acid < 70%		2
Nitric acid ≥ 70%		104
Nitroaniline	nitraniline	7, 27
Nitrobenzene	nitrobenzol	27
Nitrobenzol	nitrobenzene	27
Nitrobiphenyl	4-NBP	27
Nitrocalcic	calcium nitrate	104
Nitrocellulose	cellulose nitrate, gun cotton	27, 102
Nitrochlorobenzene	chloronitrobenzene	17, 27
Nitrogen dioxide		104
Nitromannite	mannitol hexanitrate	27, 102
Nitrogen mustard		7, 17
Nitrogen tetroxide		104
Nitroglycerin	trinitroglycerin	27, 102
Nitrohydrochloric acid		2
Nitrophenol		27, 31
Nitropropane		27
Nitrosodimethylamine	dimethylnitrosamine	7, 27
Nitrosoguanidine		27, 102
Nitrostarch	starch nitrate	27, 102
Nitroxylene	nitroxylol, dimethylnitrobenzene	27
Nitroxylol	nitroxylene, dimethylnitrobenzene	27
Nitrosodimethylamine	dimethylnitrosoamine	7, 27

TABLE A1.1 *Continued*

Name	Synonym	RGN
Phenyl phenol		31
Phenyl trichlorosilane		107
Nonane		29
Nonene		28
Nonanone		19
Nonanal		5
Nonanol		4
Octadecyl trichlorosilane		107
Octadecyne		28
Octamethylpyrophosphoramide	schradan	6, 32
Octanal		5
Octane		29
Octanone		19
Octanol		4
Octene		28
Octyl peroxide	caprylyl peroxide	30
Octyl trichlorosilane		107
Oil of bergamot		101
Oil of vitriol	sulfuric acid	1
Oleum	sulfuric acid	2, 24
Orris root		101
Orthozenol	o-phenyl phenol	31
Osmium		23, 24
Osmium amine nitrate		24, 104
Osmium amine perchlorate		24, 104
Oxamyl		9
Oxalic acid		3
Oxygen difluoride		104, 107
PCB	polychlorinated biphenyl	17
Paper		101
Paraoxon	Mintacol*	32
Parathion		32
Paris green	copper acetoarsenite	24
PETD	Polyram combi*	12
PETN	pentaerythrityl tetranitrate, pentaerythritol tetra- nitrate	27, 102
Pentaborane		105
Pentachlorophenol		17, 31
Pentaerythritol tetranitrate	pentaerythrityl tetranitrate, PETN	27, 102
Pentamethyl benzene		16
Pentane		29
Pentanethiol	amyl mercaptan	20
Pentanal	valeraldehyde	5
Pentanone		19
Pentene	amylene	28
Pentylamine		7
Pentyne		28
Peracetic acid	peroxyacetic acid	3, 30
Perbromic acid		2
Perchloric acid		2
Perchloroethylene	tetrachloroethylene	17
Perchloromethyl mercaptan	trichloromethylsulfenylchloride	17, 20
Perchlorous acid		2
Perchloryl fluoride		104
Periodic acid		2
Permonosulfuric acid		1
Peroxyacetic acid	peroxyacetic acid	3, 30
PETD	Polyram combi*	12
Petroleum naptha		101
Petroleum oil		101
Phenanthrene		16
Phenarszine chloride	diphenylamine chlorosarsine	7, 24
Phenol	carbolic acid	31
Phenyl acetic acid		3
Phenyl acetonitrile		26
Phenyl acetylene		16

TABLE A1.1 Continued

Name	Synonym	RGN
Phenylaniline	diphenylamine	7
Phenylbenzene	diphenyl	16
Phenylbutane	butylbenzene	16
Phenylchloromethyl ketone	chloroacetophenone	17, 19
Phenyl dichloroarsine		24
Phenyl diamine	diaminobenzene	7
Phenylethane	ethylbenzene	16
Phenyl hydrazine hydrochloride		8
o-Phenyl phenol	orthozenol. Dovicide 1	31
Phenyl trichlorosilane		107
Phenyl valerylinitrile		26
Phenylpropane	propylbenzene	16
Phloroglucinol		31
Phorate	Thimet*	32
Phosdrin*	mevinphos	32
Phosphamidon	Dimectron*	32
Phosphine	hydrogen phosphide	105
Phospholan	Cyolan*	20, 32
Phosphonium iodide		105, 107
Phosphonic acid		1
Phosphonic anhydride	phosphorus pentoxide	107
Phosphonic sulfide	phosphorus pentasulfide	33, 105, 107
Phosphorus (amorphous red)		105, 107
Phosphorus (white-yellow)		105
Phosphorus heptasulfide		33, 105
Phosphorus oxybromide	phosphoryl bromide	104, 107
Phosphorus oxychloride	phosphoryl chloride	104, 107
Phosphorus pentachloride	phosphonic chloride	107
Phosphorus pentasulfide	phosphonic sulfide	33, 105, 107
Phosphorus pentoxide	phosphonic anhydride	107
Phosphorus sesquisulfide	tetraphosphorus trisulfide	33, 105, 107
Phosphorus tribromide		107
Phosphorus trichloride		107
Phosphorus trisulfide		33, 105, 107
Phosphoryl bromide	phosphorus oxybromide	104, 107
Phosphoryl chloride	phosphorus oxychloride	104, 107
Phthalic acid		3
Picramide	trinitroaniline	7, 27, 102
Picric acid	trinitrophenol	27, 31, 102
Picndine		7
Picryl chloride	chlorotrinitrobenzene	17, 27, 102
Piperidine		7
Pinmicarb		9
Polyamide resin		101
Polybrominated biphenyl		17
Polybutene		28
Polychlorinated biphenyls	PCB, Askarel, Arochlor*, Chlorextok, Inerteen	17
Polychlorinated triphenyls		17
Polyethylene		101
Polyester resin		101
Polyglycol ether		14
Polymenc oil		101
Polyphenyl polymethylisocyanate		18, 107
Polypropylene		28, 101
Polyram combi*	PETD	12
Polysulfide polymer		20, 101
Polystyrene		101
Polyurethane		101
Polyvinyl acetate		101
Polyvinyl chloride		101
Polyvinyl nitrate		27, 102
Potasan		32
Potassium		21, 107
Potassium acid fluoride	potassium fluoride	15
Potassium aluminate		10

TABLE A1.1 *Continued*

Name	Synonym	RGN
Potassium arsenate		24
Potassium arsenite		24
Potassium bifluoride	potassium fluoride	15
Potassium bichromate	potassium dichromate	24, 104
Potassium bromate		104
Potassium butoxide		10
Potassium cyanide		11
Potassium dichloroisocyanurate		104
Potassium dichromate	potassium bichromate	24, 104
Potassium dinitrobenzofuroxan		27, 102
Potassium fluoride	potassium acid fluoride	15
Potassium hydride		105, 107
Potassium hydroxide	caustic potash	10
Potassium nitrate	saltpeter	102, 104
Potassium nitride		25
Potassium nitrite		104
Potassium oxide		107
Potassium perchlorate		104
Potassium permanganate		24, 104
Potassium peroxide		104, 107
Potassium sulfide		33, 105
Promecarb		9
Propanal	propionaldehyde	5
Propane		29
Propanethiol	propyl mercaptan	20
Propanoic acid	propionic acid	3
Propanol	propyl alcohol	4
Propargyl bromide		17
Propargyl chloride		17
2-Propen-1-ol	allyl alcohol	4
Propiolactone		13
Propionaldehyde	propanal	5
Propionamide		6
Propionic acid	propanoic acid	3
Propionitrile		26
Propyl acetate		13
Propyl alcohol	propanol	4
Propylamine		7
Propyl benzene	phenyl propane	16
Propylene dichloride	dichloropropane	17
Propylene glycol		4
Propylene glycol monomethyl ether		4, 14
Propylene oxide		34, 103
Propyleneimine	methyl aziridine	7
Propyl ether		14
Propyl formate		13
Propyl mercaptan	propanethiol	20
Propyl trichlorosilane		107
Prothate	Foston*	32
Pseudocumene	1,2,4-trimethylbenzene	16
Pyridine		5
Pyrogallol		31
Pyrosulfuryl chloride	disulfuryl chloride	107
Pyroxylin	collodion	27
Quinone	benzoquinone	19
Raney nickel		22
RDX	cyclotrimethylene trinitramine	27, 102
Refuse	Municipal solid waste	101
Resins		101
Resorcinol		31
Rubidium		21, 105, 107
Salicylated mercury	mercuric salicylate	24
Saligenin		31
Saltpeter	potassium nitrate	102, 104
Shradan	octamethyl pyrophosphoramide OMPA	6, 32

TABLE A1.1 *Continued*

Name	Synonym	RGN
Selenious acid	selenious acid	1, 24
Selenium		22, 23, 24
Selenium diethyldithiocarbamate		12, 24
Selenous acid	selenous acid	15, 24
Silicocchloroform	trichlorosilane	1, 24
Silicon tetrachloride		107
Silicon tetrafluoride		107
Silver acetylide		15, 107
Silver azide		24, 102, 105, 107
Silver cyanide		24, 102
Silver nitrate		11, 24
Silver nitride		24, 104
Silver styphnate		24, 25, 102
Silver sulfide	silver trinitroresorcinate	24, 27, 102
Silver tetrazene		24, 33, 105
Silver trinitroresorcinate	silver styphnate	24, 102
Slaked lime	calcium oxide	24, 27, 102
Smokeless powder		10, 107
Sodamide		102
Soda niter	sodium amide	10, 107
Sodium	sodium nitrate	104
Sodium acid fluoride	sodium fluoride	21, 105, 107
Sodium aluminate		15
Sodium aluminum hydride		10, 105
Sodium amide	sodamide	105, 107
Sodium arsenate		10, 107
Sodium arsenite		24
Sodium azide		24
Sodium bichromate		102
Sodium bifluoride	sodium dichromate	24, 104
Sodium bromate	sodium fluoride	15
Sodium cacodylate		104
Sodium carbonate	sodium dimethylarsenate	24
Sodium carbonate peroxide		10
Sodium chlorate		104
Sodium chlorite		104
Sodium chromate		104
Sodium cyanide		24
Sodium dichloroisocyanurate		11
Sodium dichromate		104
Sodium dimethylarsenate	sodium bichromate	24, 104
Sodium fluoride	sodium cacodylate	24
Sodium hydride	sodium acid fluoride	15
Sodium hydroxide	caustic soda, lye	105, 107
Sodium hypochlorite		10
Sodium hyposulfite		10, 104
Sodium methylate	sodium thiosulfate	105
Sodium methoxide	sodium methoxide	10, 107
Sodium molybdate	sodium methylate	10, 107
Sodium monoxide		24
Sodium nitrate	sodium oxide	10, 107
Sodium nitride	soda niter	104
Sodium nitrite		25
Sodium oxide		104
Sodium pentachlorophenate	sodium monoxide	10, 107
Sodium perchlorate		31
Sodium permanganate		104
Sodium peroxide		24, 104
Sodium phenolsulfonate		104, 107
Sodium picramate		31
Sodium polysulfide		27, 102
Sodium potassium alloy		101
Sodium selenate	nak, nack	21, 105, 107
Sodium sulfide		24
		24, 33, 105

TABLE A11 *Continued*

Name	Synonym	RGN
Sodium thiosulfate		105
Stannic chloride	tin tetrachloride	24, 107
Stannic sulfide		33, 105
Starch nitrate	nitrostarch	27, 102
Stilbene	diphenyl thylene	16
Stoddard solvent		101
Strontium		24
Strontium arsenate		24
Strontium dioxide	strontium peroxide	24, 104
Strontium monosulfide		24, 33, 105
Strontium nitrate		24, 104
Strontium peroxide	strontium dioxide	104
Strontium tetrasulfide		24, 33, 105
Styphnic acid	trinitroresorcinol	27, 31, 102
Styrene	vinylbenzene	16, 28, 103
Succinic acid		3
Succinic acid peroxide		30
Sulfonyl chloride	sulfuryl chloride	107
Sulfonyl fluoride		107
Sulfotepp	Dithione*, Blada-Fum*	32
Sulfur chloride	sulfur monochloride	107
Sulfur (elemental)		101
Sulfuric acid	oil of vitriol, oleum	2, 107
Sulfuric anhydride	sulfur trioxide	104, 107
Sulfur monochloride	sulfur chloride	107
Sulfur mustard		20
Sulfur oxychloride	thionyl chloride	107
Sulfur pentafluoride		15, 107
Sulfur trioxide	sulfuric anhydride	104, 107
Sulfuryl chloride	sulfonyl chloride	107
Sulfuryl fluoride	sulfonyl fluoride	107
Supracide*	Ultracide*	32
Surecide*	cyanophenphos	32
Synthetic rubber		101
TCDD	tetrachlorodibenzo- <i>p</i> -dioxin	14, 17
TEDP	tetraethyl dithionopyrophosphate	32
TEL	tetraethyl lead	24
TEPA	tris-(1-aziridinyl) phosphate oxide	6, 32
TEPP	tetraethyl pyrophosphate	32
THF	tetrahydrofuran	14
TMA	trimethylamine	7
TML	tetramethyl lead	24
TNB	trinitrobenzene	27, 102
TNT	trinitrotoluene	27, 102
Tall oil		101
Tallow		101
Tar		101
Tellurium hexafluoride		15, 24
Temik*	aldicarb	9, 20
Tetaborane		105
Tetrachlorodibenzo- <i>p</i> -dioxin	TCDD	14, 17
Tetrachloroethane		17
Tetrachloroethylene	perchloroethylene	17
Tetrachloromethane	carbon tetrachloride	17
Tetrachlorophenol		17, 31
Tetrachloropropyl ether		14, 17
Tetradecene		28
Tetraethyl dithionopyrophosphate	TEDP	32
Tetraethyl lead	TEL	24
Tetraethyl pyrophosphate	TEPP	32
Tetrahydrofuran	THF	14
Tetramethylenediamine		7
Tetramethyl lead	TML	24
Tetramethyl succionitric		26
Tetranitromethane		27, 102

TABLE A1.1 Continued

Name	Synonym	RGN
Tetraphenyl ethylene		16
Tetraphosphorus trisulfide	phosphorus sesquisulfide	23, 105, 107
Tetraselenium tetranitride		24, 25, 102
Tetrasul	Animer <sup>®</sup> V-101	20
Tetrasulfur tetranitride		25, 102
Tetrazene		8, 102
Thallium		24
Thallium nitride		24, 25, 102
Thallium sulfide		24, 33, 105
Thallos sulfate		24
Thimet <sup>®</sup>	phorate	32
Thionyl chloride	sulfur oxychloride	107
Thiocarbonyl chloride	thiophosgene	107
Thiodan <sup>®</sup>	endosulfan	17, 20
Thionazin	Zinophos <sup>®</sup>	32
Thionyl chloride	sulfur oxychloride	107
Thiophosgene	thiocarbonyl chloride	107
Thiophosphoryl chloride		107
Thiram		12
Thorium		22, 23, 24
Tin tetrachloride	stannic chloride	24, 107
Titanic chloride	titanium tetrachloride	24, 107
Titanium		22, 23, 24
Titanium sesquisulfide		24, 33, 105
Titanium sulfate		24
Titanium sulfide		24, 33, 105
Titanium tetrachloride	titanic chloride	24, 107
TMA	trimethylamine	7
TNB	trinitrobenzene	27, 102
TNT	trinitrotoluene	27, 102
Tolualdehyde		5
Toluene	toluol, methylbenzene	16
Toluene diisocyanate	TDI, tolyenediisocyanate	18, 107
Toluic acid		3
Toluidine	aminotoluene	7
Toluol	toluene, methylbenzene	16
Topcide <sup>®</sup>	benzadox	6
Tranid <sup>®</sup>		9, 26
Triamphos	Wepsyn <sup>®</sup> 155	6, 32
Tribromomethane	bromoform	17
Tri- <i>n</i> -butylaluminum		107
Tricadmium dinitride		24, 25
Tricalcium dinitride		25
Tracesium nitride		24, 25
Trichloroacetaldehyde	chloral hydrate	5, 17
Trichloroborane		107
Trichloroethane		17
Trichloroethene	trichloroethylene	17
Trichloroisocyanuric acid		104
Trichloromethane	chloroform	17
Trichloromethyl sulfenyl chloride	perchloromethyl mercaptan	17, 20
Trichloronitromethane	chloropicrin	17, 27, 102
Trichlorophenoxyacetic acid		3, 17
Trichloropropane		17
Trichlorosilane	silicocchloroform	107
Tridecene		28
Triethanotamine		4, 7
Triethyl aluminum		105, 107
Triethyl antimony	triethylstibine	24, 105, 107
Triethyl arsine		24, 107
Triethyl bismuthine		24
Triethylamine		7
Triethylene phosphoramidate	tris (1-aziridinyl) phosphine oxide	6, 32
Triethylene tetramine		7
Triethyl stibine	triethyl antimony	24, 105, 107

TABLE A1.1 *Continued*

Name	Synonym	RGN
Trifluoroethane		17
Trifluoromethylamine	hexafluoride	17
Trisobutyl aluminum		105, 107
Trilead dinitride		24, 25, 102
Trimercury dinitride		24, 25, 102
Trimethyl aluminum		105, 107
Trimethylamine	TMA	7
Trimethyl antimony	trimethylstibine	24, 105
Trimethyl arsine		24, 107
1,2,4-Trimethylbenzene	pseudocumene	16
1,3,5-Trimethylbenzene	mesitylene	16
Trimethyl bismuthine		24
Trimethyl pentane	isooctane	29
Trimethylstibine	trimethyl antimony	24, 105, 107
Tri- <i>n</i> -butylborane		105, 107
Trinitroaniline	picramide	-7, 27, 102
Trinitroanisole	trinitrophenylmethyl ether	14, 27
Trinitrobenzene	TNB	27, 102
Trinitrobenzoic acid		3, 27, 102
Trinitroglycerin	nitroglycerin	27, 102
Trinitronaphthalene	naphthite	27, 102
Trinitrophenol	picric acid	27, 31, 102
Trinitrophenyl methyl ether	trinitroanisole	14, 27
Trinitroresorcinol	styphnic acid	27, 31, 102
Trinitrotoluene	TNT	27, 102
Trioctyl aluminum		105, 107
Triphenyl ethylene		16
Triphenyl methane		16
Tripropylamine		7
Tripropyl stibine		24, 107
Trisilyl arsine		24, 107
Tris-(1-aziridinyl) phosphate oxide	TEPA, triethylene phosphoramidate	6, 32
Trithion		32
Trithorium tetranitride		24, 25
Trivinyl stibine		24, 107
Tsumacide*		9
Tungstic acid		24
Turpentine		101
UDMH	dimethyl hydrazine	8
Ultracide*	Supracide*	32
Undecene		28
Unisolve		101
Uranium nitrate	uranyl nitrate	24, 104
Uranium sulfide		24, 33, 105
Uranyl nitrate	uranium nitrate	24, 104
Urea formaldehyde		5
Urea nitrate		27, 102, 104
VC	vinylidene chloride	17, 103
Valeraldehyde	pentanal	5
Valeramide		6
Valeric acid		3
Vanadic acid anhydride	vanadium pentoxide	24
Vanadium oxytrichloride		24
Vanadium pentoxide	vanadic acid anhydride	24
Vanadium sulfate	vanadyl sulfate	24
Vanadium tetroxide		24
Vanadium trichloride		24, 107
Vanadium trioxide		24
Vanadyl sulfate	vanadium sulfate	24
Vapona*	DDVP	32
Vinyl acetate		13, 103
Vinyl azide		102
Vinylbenzene	styrene	16, 28, 103
Vinyl chloride		17, 103
Vinyl cyanide		26, 103

TABLE A1.1 *Continued*

Name	Synonym	RGN
Vinyl ethyl ether		14
Vinylidene chloride	VC	17
Vinyl toluene		17, 103
Vinyl trichlorosilane		28, 103
VX		107
Water		20, 32
Waxes		106
Wepsyn* 135	Inamiphos	101
Wood		6, 32
Zectran*	Dowco 139*	101
Zinc		9
Zinc acetylde		22, 23, 24
Zinc ammonium nitrate		24, 105, 107
Zinc arsenate		24, 104
Zinc arsenite		24
Zinc chloride		24
Zinc cyanide		24
Zinc dioxide		11, 24
Zinc ethyl	zinc peroxide	24, 102, 104, 107
Zinc fluoborate	diethyl zinc	24, 105, 107
Zinc nitrate		15, 24
Zinc permanganate		24, 104
Zinc peroxide		24, 104
Zinc phosphide	zinc dioxide	24, 102, 104, 107
Zinc salts of dimethyl dithiocarbamic acid		24, 107
Zinc sulfate		12, 24
Zinc sulfide		24
Zincb*		24, 33, 105
Zinophos*		12, 24
Ziram*	thioazin	20
Zirconium		12, 24
Zirconium chloride		22, 23, 24
Zirconium picramate	zirconium tetrachloride	24
Zirconium tetrachloride	zirconium chloride	24, 104
		24

## A2. LIST OF WASTE CONSTITUENTS BY CHEMICAL CLASS AND REACTIVITY

A2.1 This annex categorizes the chemical substances in Annex A1 into reactivity groups according to molecular functional groups, chemical classes, or chemical reactivities. The substances are divided in 41 Reactivity Group Numbers (RGN) and listed consecutively in the first two pages of this annex. RGN 1 to 34 are categorized based on molecular functional groups, 101 to 107 on chemical reactivities. The reactivity groupings here are identical to those depicted in the Hazardous Wastes Incompatibility Chart (Fig. 2).

A2.2 The succeeding pages of this annex contain the tabulations of the chemical substances in Annex A1 under their respective RGN. All trade names in the tables are denoted by asterisks (\*) consistent with the

notations used in Annex A1.

A2.3 This annex is used to obtain the RGN of hazardous wastes when the waste constituents are known only by chemical classes, molecular functional groups, or chemical reactivities. The information is used to determine the incompatibility of the combinations of the wastes according to the incompatibility method in Section 5 of this guide.

A2.4 The listing was developed from the same primary references used in Annex A1 (32, 33, 36, and 45-52). The reactivity groupings of waste constituents presented here are not inclusive. Additions or deletions will be made in the future when more information is available from the management of hazardous wastes.

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TABLE A.2.1 Waste Constituents by Class and Reactivity

Reactivity Group Num.	Group Name
1	Acids, mineral, nonoxidizing
2	Acids, mineral, oxidizing
3	Acids, organic
4	Alcohols and glycols
5	Aldehydes
6	Amides
7	Amines, aliphatic and aromatic
8	Azo compounds, diazo compounds, and hydrazines
9	Carbamates
10	Caustics
11	Cyanides
12	Dithiocarbamates
13	Esters
14	Ethers
15	Fluorides, inorganic
16	Hydrocarbons, aromatic
17	Halogenated organics
18	Isocyanates
19	Ketones
20	Mercaptans and other organic sulfides
21	Metals, alkali and alkaline earth, elemental and alloys
22	Metals, other elemental and alloys in the form of powders, vapor or sponges
23	Metals, other elemental and alloys, as sheets, rods, moldings, drops, etc.
24	Metals and metal compounds, toxic
25	Nitrides
26	Nitriles
27	Nitro compounds
28	Hydrocarbon, aliphatic, unsaturated
29	Hydrocarbon, aliphatic, saturated
30	Peroxides and hydroperoxides, organic
31	Phenols and creosols
32	Organophosphates, phosphothioates and phosphodithioates
33	Sulfides, inorganic
34	Epoxides
101	Combustible and flammable materials, miscellaneous
102	Explosives
103	Polymerizable compounds
104	Oxidizing agents, strong
105	Reducing agents, strong
106	Water and mixtures containing water
107	Water reactive substances

Group 1 Acids, Mineral, Nonoxidizing

Boric acid	Fluorosilicic acid	Hydrofluoric acid
Chlorosulfonic acid	Hexafluorophosphoric acid	Monofluorophosphoric acid
Difluorophosphoric acid	Iodic acid	Permonosulfuric acid
Disulfuric acid	Hydrobromic acid	Phosphoric acid
Fluoroboric acid	Hydrochloric acid	Selenous acid
Fluorosulfonic acid	Hydrocyanic acid	

Group 2 Acids, Mineral, Oxidizing

Bromic acid	Nitrohydrochloric acid	Perchlorous acid
Chloric acid	Oleum	Periodic acid
Chromic acid	Cyclopentanone	Sulfuric acid
Hypochlorous acid	Perbromic acid	
Nitric acid 70 %	Perchloric acid	

Group 3 Acids, Organic (All Isomers)		
Acetic acid	Dichlorophenoxyacetic acid	Peracetic acid
Acrylic acid	Endothal	Phenyl acetic acid
Adipic acid	Fluoroacetic acid	Phthalic acid
Benzoic acid	Formic acid	Propionic acid
Butyric acid	Fumaric acid	Succinic acid
Capric acid	Glycolic acid	Trichlorophenoxyacetic acid
Caproic acid	Hydroxydibromobenzoic acid	Trinitrobenzoic acid
Caprylic acid	Malic acid	Toluic acid
Chloromethylphenoxyacetic acid	Monochloroacetic acid	Valeric acid
Cyanoacetic acid	Oxalic acid	
Group 4 Alcohols and Glycols (All Isomers)		
Acetone cyanohydrin	Dichloropropanol	Isopropanol
Allyl alcohol	Dicthanol amine	Mercaptoethanol
Aminoethanol	Diisopropanolamine	Methanol
Amyl alcohol	Ethanol	Monoethanol amine
Benzyl alcohol	Ethoxyethanol	Monoisopropanol amine
Butanediol	Ethylene chlorohydrin	Monisopropanol amine
Butyl alcohol	Ethylene cyanohydrin	Nonanol
Butyl cellosolve*	Ethylene glycol	Octanol
Chloroethanol	Ethylene glycol monomethyl ether	Propanol
Crotyl alcohol	Glycerin	Propylene glycol
Cyclohexanol	Heptanol	Propylene glycol monomethyl ether
Decanol	Hexanol	Triethanolamine
Diacetron alcohol	Isobutanol	
Group 5 Aldehydes (All Isomers)		
Acetaldehyde	Crtonaldehyde	Nonanal
Acrolein	Formaldehyde	Octanal
Benzaldehyde	Furfural	Propionaldehyde
Butyraldehyde	Glutaraldehyde	Tolualdehyde
Chloral hydrate	Heptanal	Urea formaldehyde
Chloroacetaldehyde	Hexanal	Valeraldehyde
Group 6 Amides (All Isomers)		
Acetamide	Dimethylformamide	Propionamide
Benzadox	Dimefox	Schradan
Bromobenzoyl acetanilide	Diphenamide	Tris-(1-azirdinyl) phosphate oxide
Butyramide	Fluoroacetanilide	Wepsyn* 155
Carbetamide	Formamide	Valeramide
Diethyltoluamide		
Group 7 Amines, Aliphatic and Aromatic (All Isomers)		
Aminodiphenyl	Dimethylamine	Naphthylamine
Aminoethanol	Dimethylaminozobenzene	Nitroaniline
Aminoethanolamine	Diphenylamine	Nitrogen mustard
Aminophenol	Diphenylamine chloroarsine	Nitrosodimethylamine
Aminopropionitrile	Dipicrylamine	Pentylamine
Amylamine	Dipropylamine	Phenylene diamine
Aminothiazole	Ethylamine	Picramide
Aniline	Ethylenediamine	Picridine
Benzidine	Ethylencimine	Piperidine
Benzylamine	Hexamethylenediamine	Propylamine
Butylamine	Hexamethylenetetraamine	Propylencimine
Chlorotoluidine	Hexylamine	Pyridine
Crimidine	Isopropylamine	Tetramethylenediamine
Cupriethylenediamine	Methylamine	Toluidine
Cyclohexylamine	n-Methyl aniline	Triethanolamine
Dichlorobenzidine	4,4-Methylene bis(2-chloroaniline)	Triethylamine
Diethanolamine	Methyl ethy pyridine	Triethylenetetraamine
Diethylamine	Monoethanolamine	Trimethylamine
Diethylenetriamine	Monoisopropanolamine	Tripopylamine
Diisopropanolamine	Morpholine	

## Group 8 Azo Compounds Diazo Compounds and Hydrazines (All Isomers)

Aluminum tetraazidoborate	Chloroazodin	Guanyl nitrosoaminoguanylidene hydrazine
Aminothiazole	Chlorobenzotriazole	Hydrazine
Azidocarbonyl guanidine	Diazodinitrophenol	Hydrazine azide
Azidothiazole	Diazidoethane	Methyl hydrazine
<i>o,o'</i> -Azodisobutyronitrile	Dimethylamino azobenzene	Mercaptobenzothiazole
Benzene diazonium chloride	Dimethyl hydrazine	Phenyl hydrazine hydrochloride
Benzotriazole	Dinitrophenyl hydrazine	Tetrazene
<i>n</i> -Butyl azidoformate		

## Group 9 Carbamates

Aldicarb	Formetanate hydrochloride	Methomyl
Bassa*	Furadan*	Mipcin*
Baygon*	Hopcide*	Mobam*
Butacarb	<i>n</i> -Isopropylmethylcarbamate	Oxamyl
Bux*	Landrin*	Prmicarb
Carbaryl	Matacil*	Promecarb
Carbanolate	Meobal	Tranid*
Dioxacarb	Mesurof*	Tsumacide*
Dowco* 139		

## Group 10 Caustics

Ammonia	Calcium oxide	Sodium amide
Ammonium hydroxide	Lithium amide	Sodium carbonate
Barium hydroxide	Lithium hydroxide	Sodium hydroxide
Barium oxide	Potassium aluminate	Sodium hypochlorite
Beryllium hydroxide	Potassium butoxide	Sodium methylate
Cadmium amide	Potassium hydroxide	Sodium oxide
Calcium hydroxide	Sodium aluminate	

## Group 11 Cyanides

Cadmium cyanide	Lead cyanide	Potassium cyanide
Copper cyanide	Mercuric cyanide	Silver cyanide
Cyanogen bromide	Mercuric oxycyanide	Sodium cyanide
Hydrocyanic acid	Nickel cyanide	Zinc cyanide

## Group 12 Dithiocarbamates

CDEC	Nabam	Zinc salts of dimethyl dithiocarbamic acid
Diethane* M-45	Niacide*	Zineb
Ferbam	Polyram-combi*	Ziram
Maneb	Selenium diethyl dithiocarbamate	
Metham	Thiram	

## Group 13 Esters (All Isomers)

Allyl chlorocarbonate	Ethyl chloroformate	Methyl amyl acetate
Amyl acetate	Ethyl formate	Methyl butyrate
Butyl acetate	2-Ethyl hexylacrylate	Methyl chloroformate
Butyl acrylate	Ethyl propionate	Methyl formate
Butyl benzyl phthalate	Glycol diacetate	Methyl methacrylate
Butyl formate	Isobutyl acetate	Methyl propionate
Dibutyl phthalate	Isobutyl acrylate	Methyl valerate
Diethylene glycol monobutyl ether acetate	Isodecyl acrylate	Propiolactone
Ethyl acetate	Medinoterb acetate	Propyl acetate
Ethyl acrylate	Methyl acetate	Propyl formate
Ethyl butyrate	Methyl acrylate	Vinyl acetate

## Group 14 Ethers (All Isomers)

Anisole	Ethoxyethanol	Propyl ether
Butyl cellosolve*	Ethyl ether	Propylene glycol monomethyl ether
Bromodimethoxyaniline	Ethylene glycol monomethyl ether	TCDD
Dibutyl ether	Furan	Tetrachloropropyl ether
Dichloroethyl ether	Glycol ether	Tetrahydrofuranic
Dimethyl ether	Isopropyl ether	Trinitroanisole
Dimethyl formal	Methyl butyl ether	Vinyl ethyl ether
Dioxane	Methyl chloromethyl ether	Vinyl isopropyl ether
Diphenyl oxide	Methyl ethyl ether	

TABLE A2.1 *Continued*

Group 15 Fluorides, Inorganic		
Aluminum fluoride	Cesium fluoride	Potassium fluoride
Ammonium bifluoride	Chromic fluoride	Selenium fluoride
Ammonium fluoride	Fluoroboric acid	Silicon tetrafluoride
Barium fluoride	Fluorosilicic acid	Sodium fluoride
Beryllium fluoride	Hexafluorophosphoric acid	Sulfur pentafluoride
Cadmium fluoride	Hydrofluoric acid	Tellurium hexafluoride
Calcium fluoride	Magnesium fluoride	Zinc fluoroborate
Group 16 Hydrocarbons, Aromatic (All Isomers)		
Acenaphthene	Diphenyl ethylene	Methyl naphthalene
Anthracene	Diphenyl methane	Naphthalene
Benz- <i>a</i> -pyrene	Dodecyl benzene	Pentamethyl benzene
Benzene	Dowtherm	Phenanthrene
<i>n</i> -Butyl benzene	Durene	Phenyl acetylene
Chrysene	Ethyl benzene	Propyl benzene
Cumene	Fluoranthrene	Pseudocumene
Cymene	Fluorene	Styrene
Decyl benzene	Hemimellitene	Tetraphenyl ethylene
Diethyl benzene	Hexamethyl benzene	Toluene
Diphenyl	Indene	Stilbene
Diphenyl acetylene	Isodurene	Triphenylethylene
Diphenyl ethane	Mesitylene	Triphenylmethane
Group 17 Halogenated Organics (All Isomers)		
Acetyl bromide	Chloroethanol	Ethylene dibromide
Acetyl chloride	Chloroethylenimine	Ethylene dichloride
Aldrin	Chloroform	Fluoroacetanilide
Allyl bromide	Chlorohydrin	Freons*
Allyl chloride	Chloromethyl methyl ether	Heptachlor
Allyl chlorocarbonate	Chloromethyl phenoxyacetic acid	Hexachlorobenzene
Amyl chloride	Chloronitroaniline	Hydroxydibromobenzoic acid
Benzal bromide	Chlorophenol	Isopropyl chloride
Benzal chloride	Chlorophenyl isocyanate	<i>o</i> -Isopropyl methyl phosphoryl fluoride
Benzotribromide	Chloropicrin	Lindane
Benzotrifluoride	Chlorothion	Methyl bromide
Benzyl bromide	Chlorotoluidine	Methyl chloride
Benzyl chloride	C MEE	Methyl chloroform
Benzyl chlorocarbonate	Crotyl bromide	Methyl chloroformate
Bromoacetylene	Crotyl chloride	Methyl ethyl chloride
Bromobenzyl trifluoride	DDD	Methyl iodide
Bromoform	DDT	Monochloroacetone
Bromophenol	DDVP	Nitrochlorobenzene
Bromopropyne	Dibromochloropropane	Nitrogen mustard
Bromotrifluoromethane	Dichloroacetone	Pentachlorophenol
Bromotrifluoromethane	Dichlorobenzene	Perchloroethylene
Bromoxynil	Dichlorobenzidine	Pechloromethylmercaptan
Butyl fluoride	Dichloroethane	Picryl chloride
Carbon tetrachloride	Dichloroethylene	Polybrominated biphenyls
Carbon tetrafluoride	Dichloroethyl ether	Polychlorinated biphenyls
Carbon tetraiodide	Dichloromethane	Polychlorinated triphenyls
Chloral hydrate	Dichlorophenol	Propargyl bromide
Chlordane	Dichlorophenoxy acetic acid	Propargyl chloride
Chloroacetaldehyde	Dichloropropane	TCDD
Chloroacetic acid	Dichloropropanol	Tetrachloroethane
Chloroacetophenone	Dichloropropylene	Tetrachlorophenol
Chloroacrylonitrile	Dieldrin	Tetrachloropropyl ether
Chloroazodin	Diethyl chloro vinyl phosphate	Trichloroethane
Chlorobenzene	Dichlorophene	Trichloroethylene
Chlorobenzotriazole	Dinitrochlorobenzene	Trichlorophenoxyacetic acid
Chlorobenzoyl peroxide	Endosulfan	Trichloropropane
Chlorobenzylidene malononitrile	Endrin	Trifluoroethane
Chlorobutyronitrile	Epichlorohydrin	Vinyl chloride
Chlorocresol	Ethyl chloroformate	Vinylidene chloride
Chlorodinitrotoluene	Ethylene chlorohydrin	

TABLE A2.1 *Continued*

Group 18 Isocyanates (All Isomers)		
Chlorophenyl isocyanate	Methyl isocyanate	Polyphenyl polymethylisocyanate
Diphenylmethane diisocyanate	Methylene diisocyanate	Toluene diisocyanate
Group 19 Ketones (All Isomers)		
Acetone	Diacetyl	Methyl isobutyl ketone
Acetophenone	Dichloroacetone	Methyl isopropenyl ketone
Acetyl acetone	Diethyl ketone	Methyl <i>n</i> -propyl ketone
Benzophenone	Diisobutyl ketone	Methyl vinyl ketone
Bromobenzoyl acetanilide	Heptanone	Monochloroacetone
Chloroacetophenone	Hydroxyacetophenone	Nonanone
Coumafuryl	Mesityl oxide	Octanone
Coumatetraalyl	Methyl <i>t</i> -butyl ketone	Pentanone
Cyclohexanone	Methyl ethyl ketone	Quinone
Diacetone alcohol		
Group 20 Mercaptans and Other Organic Sulfides (All Isomers)		
Aldicarb	Mercaptobenzothiazole	Polysulfide polymer
Amyl mercaptan	Mercaptoethanol	Propyl mercaptan
Butyl mercaptan	Methomyl	Sulfur mustard
Carbon disulfide	Methyl mercaptan	Tetrasul
Dimethyl sulfide	Naphthyl mercaptan	Thionazin
Endosulfan	Perchloromethyl mercaptan	VX
Ethyl mercaptan	Phospholan	
Group 21 Metals, Alkali and Alkaline Earth, Elemental		
Barium	Magnesium	Sodium
Calcium	Potassium	Sodium-potassium alloy
Cesium	Rubidium	Strontium
Lithium		
Group 22 Metals, Other Elemental and Alloys in the Form of Powders, Vapors or Sponges		
Aluminum	Magnesium	Selenium
Bismuth	Manganese	Titanium
Cerium	Mercury (vapor)	Thorium
Cobalt	Molybdenum	Zinc
Hafnium	Nickel	Zirconium
Indium	Raney nickel	
Group 23 Metals, Other Elemental and Alloys as Sheets, Rods Moldings, Drops, etc.		
Aluminum	Chromium	Molybdenum
Antimony	Cobalt	Osmium
Bismuth	Copper	Selenium
Brass	Indium	Titanium
Bronze	Iron	Thorium
Cadmium	Lead	Zinc
Calcium-manganese-silicon alloy	Manganese	Zirconium
Group 24 Metals and Metal Compounds, Toxic		
Ammonium arsenate	Antimony sulfate	Arsenic trisulfide
Ammonium dichromate	Antimony tribromide	Arsines
Ammonium hexanitrocobaltate	Antimony trichloride	Barium
Ammonium molybdate	Antimony triiodide	Barium azide
Ammonium nitrosomate	Antimony trifluoride	Barium carbide
Ammonium permanganate	Antimony trioxide	Barium chlorate
Ammonium tetrachloromate	Antimony trisulfide	Barium chloride
Ammonium tetraperoxychromate	Antimony trivinyl	Barium chromate
Ammonium trichromate	Arsenic	Barium fluoride
Antimony	Arsenic pentaselenide	Barium fluosilicate
Antimony nitride	Arsenic pentoxide	Barium hydride
Antimony oxychloride	Arsenic pentasulfide	Barium hydroxide
Antimony pentachloride	Arsenic sulfide	Barium hypophosphide
Antimony pentafluoride	Arsenic tribromide	Barium iodate
Antimony pentasulfide	Arsenic trichloride	Barium iodide
Antimony perchlorate	Arsenic trifluoride	Barium nitrate
Antimony potassium tartrate	Arsenic triiodide	Barium oxide

TABLE A2.1 *Continued*Group 24 Metals and Metal Compounds, Toxic *Continued*

Barium perchlorate	Chromium sulfide	Mercuric iodide
Barium permanganate	Chromium trioxide	Mercuric nitrate
Barium peroxide	Chromyl chloride	Mercuric oleate
Barium phosphate	Cobalt	Mercuric oxide
Barium stearate	Cobaltous bromide	Mercuric oxycyanide
Barium sulfide	Cobaltous chloride	Mercuric potassium iodide
Barium sulfite	Cobaltous nitrate	Mercuric salicylate
Beryllium	Cobaltous sulfate	Mercuric subsulfate
Beryllium-copper alloy	Cobaltous resinate	Mercuric sulfate
Beryllium fluoride	Copper	Mercuric sulfide
Beryllium hydride	Copper acetarsenite	Mercuric thiocyanide
Beryllium hydroxide	Copper acetylide	Mercuriol
Beryllium oxide	Copper arsenate	Mercurous bromide
Beryllium tetrahydroborate	Copper arsenite	Mercurous gluconate
Bismuth	Copper chloride	Mercurous iodide
Bismuth chromate	Copper chlorotetrazole	Mercurous nitrate
Bismuthic acid	Copper cyanide	Mercurous oxide
Bismuth nitride	Copper nitrate	Mercurous sulfate
Bismuth pentafluoride	Copper nitride	Mercury
Bismuth pentoxide	Copper sulfate	Mercury fulminate
Bismuth sulfide	Copper sulfide	Methoxyethylmercuric chloride
Bismuth tribromide	Cupriethylene diamine	Methyl dichloroarsine
Bismuth trichloride	Cyanochloropentane	Molybdenum
Bismuth triiodide	Diethyl zinc	Molybdenum sulfide
Bismuth trioxide	Diisopropyl beryllium	Molybdenum trioxide
Borane	Diphenylamine chloroarsine	Molybdic acid
Bordeaux arsenites	Ethyl dichloroarsine	Nickel
Boron arsenotribromide	Ethylene chromic oxide	Nickel acetate
Boron bromodiodide	Ferric arsenate	Nickel antimonide
Boron dibromiodide	Ferrous arsenate	Nickel arsenate
Boron nitride	Hydrogen selenide	Nickel arsenite
Boron phosphide	Indium	Nickel carbonyl
Boron triazide	Lead	Nickel chloride
Boron tribromide	Lead acetate	Nickel cyanide
Boron triiodide	Lead arsenate	Nickel nitrate
Boron trisulfide	Lead arsenite	Nickel selenide
Boron trichloride	Lead azide	Nickel subsulfide
Boron trifluoride	Lead carbonate	Nickel sulfate
Cacodylic acid	Lead chloride	Osmium
Cadmium	Lead cyanide	Osmium amine nitrate
Cadmium acetylide	Lead dinitroresorcinate	Osmium amine perchlorate
Cadmium amide	Lead mononitroresorcinate	Phenyl dichloroarsine
Cadmium azide	Lead nitrate	Potassium arsenate
Cadmium bromide	Lead oxide	Potassium arsenite
Cadmium chlorate	Lead styphnate	Potassium dichromate
Cadmium chloride	Lead sulfide	Potassium permanganate
Cadmium cyanide	Lewisite	Selenium
Cadmium fluoride	London purple	Selenium fluoride
Cadmium hexamine chlorate	Magnesium arsenate	Selenium diethyl dithiocarbamate
Cadmium hexamine perchlorate	Magnesium arsenite	Selenous acid
Cadmium iodide	Manganese	Silver acetylide
Cadmium nitrate	Manganese acetate	Silver azide
Cadmium nitride	Manganese arsenate	Silver cyanide
Cadmium oxide	Manganese bromide	Silver nitrate
Cadmium phosphate	Manganese chloride	Silver nitride
Cadmium sulfide	Manganese methylclopentadienyl tri-carbonyl	Silver styphnate
Cadmium trihydrazine chlorate	Manganese nitrate	Silver sulfide
Cadmium trihydrazine perchlorate	Manganese sulfide	Silver tetrazene
Calcium arsenate	Mercuric acetate	Sodium arsenate
Calcium arsenite	Mercuric ammonium chloride	Sodium arsenite
Chromic chloride	Mercuric benzoate	Sodium cacodylate
Chromic fluoride	Mercuric bromide	Sodium chromate
Chromic oxide	Mercuric chloride	Sodium dichromate
Chromic sulfate	Mercuric cyanide	Sodium molybdate
Chromium		Sodium permanganate

TABLE A2.1 *Continued*Group 24 Metals and Metal Compounds. Toxic *Continued*

Sodium selenate	Tricadmium dinitride	Vanadium trichloride
Stannic chloride	Tricesium nitride	Vanadyl sulfate
Stannic sulfide	Triethyl arsine	Zinc
Strontium arsenate	Triethyl bismuthine	Zinc acetylide
Strontium monosulfide	Triethyl stibine	Zinc ammonium nitrate
Strontium nitrate	Trilead dinitride	Zinc arsenate
Strontium peroxide	Trimercury dinitride	Zinc arsenite
Strontium tetrasulfide	Trimethyl arsine	Zinc chloride
Tellurium hexafluoride	Trimethyl bismuthine	Zinc cyanide
Tetraethyl lead	Trimethyl stibine	Zinc fluoroborate
Tetramethyl lead	Tripropyl stibine	Zinc nitrate
Tetraselenium tetranitride	Trisilyl arsine	Zinc permanganate
Thallium	Trithorium tetranitride	Zinc peroxide
Thallium nitride	Trivinyl stibine	Zinc phosphate
Thallium sulfide	Tungstic acid	Zinc salts of dimethyldithio carbamate acid
Thallosulfate	Uranium sulfide	Zinc sulfate
Thorium	Uranyl nitrate	Zinc sulfide
Titanium	Vanadic acid anhydride	Zirconium
Titanium sulfate	Vanadium oxytrichloride	Zirconium chloride
Titanium sesquisulfide	Vanadium tetroxide	Zirconium picramate
Titanium tetrachloride	Vanadium trioxide	
Titanium sulfide		

## Group 25 Nitrides

Antimony nitride	Potassium nitride	Tricadmium dinitride
Bismuth nitride	Silver nitride	Tricalcium dinitride
Boron nitride	Sodium nitride	Tricesium nitride
Copper nitride	Tetraselenium tetranitride	Trilead dinitride
Disulfur dinitride	Tetrasulfur tetranitride	Trimercury dinitride
Lithium nitride	Thallium nitride	Trithorium tetranitride

## Group 26 Nitriles (All Isomers)

Acetone cyanohydrin	Butyronitrile	Glycolonitrile
Acetonitrile	Chloroacrylonitrile	Phenyl acetonitrile
Acrylonitrile	Chlorobenzylidene malonitrile	Phenyl valerylnitrile
Adiponitrile	Chlorobutyronitrile	Propionitrile
Aminopropionitrile	Cyanoacetic acid	Surecide*
Amyl cyanide	Cyanochloropentane	Tetramethyl succinonitrile
<i>u,a</i> -Azodiisobutyronitrile	Cyanogen	Tranid*
Benzonitrile	Ethylene cyanohydrin	Vinyl cyanide
Bromoxynil		

## Group 27 Nitro Compounds (All Isomers)

Acetyl nitrate	Glycol monolactate trinitrate	Nitroxykene
Chlorodinitrofluorene	Guanidine nitrate	Pentaerythritol tetranitrate
Chloronitroaniline	Lead dinitroresorcinate	Picramide
Chloropicrin	Lead mononitroresorcinate	Picric acid
Collodion	Lead styphnate	Picryl chloride
Diazodinitrophenol	Mannitol hexanitrate	Polyvinyl nitrate
Diethylene glycol dinitrate	Medinoterb acetate	Potassium dinitrobenzofuroxan
Dinitrobenzene	Nitroaniline	RDX
Dinitrochlorobenzene	Nitrobenzene	Silver styphnate
Dinitrocresol	Nitrophenyl	Sodium picramate
Dinitrophenol	Nitrocellulose	Tetrahydro methane
Dinitrophenyl hydrazine	Nitrochlorobenzene	Trinitroanisole
Dinitrotoluene	Nitroglycerin	Trinitrobenzene
Dinoseb	Nitrophenol	Trinitrobenzoic acid
Dipentaerythritol hexanitrate	Nitropropane	Trinitronaphthalene
Dipicryl amine	<i>n</i> -Nitrosodiummethylamine	Trinitroresorcinol
Ethyl nitrate	Nitrosoguanidine	Trinitrotoluene
Ethyl nitrite	Nitrostarch	Urea nitrate
Glycol dinitrate		

TABLE A2.1 *Continued*

Group 28 Hydrocarbons, Aliphatic, Unsaturated (All Isomers)		
Acetylc	Ethyl acetylene	Nonene
Allene	Ethylene	Octadecyne
Amylene	Heptene	Octene
Butadiene	Hexene	Pentene
Butadiyne	Hexyne	Pentyne
Butene	Isobutylene	Polybutene
Cyclopentane	Isocetane	Polypropylene
Decene	Isoprene	Propylene
Dicyclopentadiene	Isopropyl acetylene	Styrene
Diisobutylene	Methyl acetylene	Tetradecene
Dimethyl acetylene	Methyl butene	Tridecene
Dimethyl butyne	Methyl butyne	Undecene
Dipentene	Methyl styrene	Vinyl toluene
Dodecene		
Group 29 Hydrocarbons, Aliphatic, Saturated		
Butane	Ethane	Methane
Cycloheptane	Heptane	Methyl cyclohexane
Cyclohexane	Hexane	Neohexane
Cyclopentane	<i>Isobutane</i>	Nonane
Cyclopropane	<i>Isohexane</i>	Octane
Decalin	<i>Isooctane</i>	Pentane
Decane	<i>Isopentane</i>	Propane
Group 30 Peroxides and Hydroperoxides Organic (All Isomers)		
Acetyl benzoyl peroxide	Butyl peroxyvalate	Diisopropyl peroxydicarbonate
Acetyl peroxide	Caprylyl peroxide	Dimethylhexane dihydroperoxide
Benzoyl peroxide	Chlorobenzoyl peroxide	Isopropyl percarbonate
Butyl hydroperoxide	Cumene hydroperoxide	Lauroyl peroxide
Butyl peroxide	Cyclohexanone peroxide	Methyl ethyl ketone peroxide
Butyl peroxyacetate	Dicumyl peroxide	Peracetic acid
Butyl peroxybenzoate	Diisopropylbenzene hydroperoxide	Succinic acid peroxide
Group 31 Phenols, Cresols (All Isomers)		
Amino phenol	Dinitrophenol	Phenol
Bromophenol	Dinoseb	<i>p</i> -Phenyl phenol
Bromoxynil	Eugenol	Phloroglucinol
Carbacrol	Guaiacol	Picric acid
Carbolic oil	Hydroquinone	Pyrogallol
Catecol	Hydroxyacetophenone	Resorcinol
Chlorocresol	Hydroxidiphenol	Saligenin
Chlorophenol	Hydroxyhydroquinone	Sodium pentachlorophenate
Coal tar	Isocugenol	Sodium phenolsulfonate
Cresol	Naphthol	Tetrachlorophenol
Cresote	Nitrophenol	Thymol
Cyclohexyl phenol	Nonyl phenol	Trichlorophenol
Dichlorophenol	Pentachlorophenol	Trinitroresorcinol
Dinitrocresol		
Group 32 Organophosphates, Phosphothiates, and Phosphodithioates		
Abate*	Disulfoton	Phorate
Azinphos ethyl	Dyfonate*	Phosphamidon
Azodrin*	Endothion	Phospholan
Bidrin*	EPN	Potasan
Bomyl*	Ethion*	Prothoate
Chlorofenvinphos	Fensulothion	Schradan
Chlorothion*	Guthion*	Sulfotepp
Coroxon*	Hexaethyl tetraphosphate	Supracide*
DDVP	Malathion	Surecide*
Demeton	Mecarbam	Tetraethyl dithionopyrophosphate
Demeton-s-methyl sulfoxide	Methyl parathion	Tetraethyl pyrophosphate
Diazinon*	Mevinphos	Thionazin
Diethyl chlorovinyl phosphate	Mocap*	<i>Tri</i> (1-aziridinyl) phosphine oxide
Dimethyldithiophosphoric acid	<i>o</i> -Isopropyl methylphosphoryl fluoride	VX
Dimcfox	Paraoxon	Wepsyn* 155
Dioxathion	Parathion	

TABLE A2.1 *Continued*

## Group 33 Sulfides, Inorganic

Ammonium sulfide	Chromium sulfide	Phosphorous pentasulfide
Antimony pentasulfide	Copper sulfide	Phosphorous sesquisulfide
Antimony trisulfide	Ferri sulfide	Phosphorous trisulfide
Arsenic pentasulfide	Ferrous sulfide	Potassium sulfide
Arsenic sulfide	Germanium sulfide	Silver sulfide
Arsenic trisulfide	Gold sulfide	Sodium sulfide
Barium sulfide	Hydrogen sulfide	Stannic sulfide
Beryllium sulfide	Lead sulfide	Strontium monosulfide
Bismuth sulfide	Lithium sulfide	Strontium tetrasulfide
Bismuth trisulfide	Magnesium sulfide	Thallium sulfide
Boron trisulfide	Manganese sulfide	Titanium sesquisulfide
Cadmium sulfide	Mercuric sulfide	Titanium sulfide
Calcium sulfide	Molybdenum sulfide	Uranium sulfide
Cerium trisulfide	Nickel subsulfide	Zinc sulfide
Cesium sulfide	Phosphorous heptasulfide	

## Group 34 Epoxides

Butyl glycidyl ether	Epichlorohydrin	Ethylene oxide
<i>t</i> -Butyl- $\beta$ -phenyl oxazirane	Epoxybutane	Glycidol
Cresol glycidyl ether	Epoxybutene	Phenyl glycidyl ether
Diglycidyl ether	Epoxyethylbenzene	Propylene oxide

## Group 101 Combustible and Flammable Materials, Miscellaneous

Alkyl resins	Kerosene	Polyurethane
Asphalt	Lacquer	Polyvinyl acetate
Bakelite*	Methyl acetone	Polyvinyl chloride
Buna-N*	Mineral spirits	Refuse
Bunker fuel oil	Naphtha	Resins
Camphor oil	Oil of bergamot	Sodium polysulfide
Carbon, activated, spent	Orris root	Stoddard solvent
Cellulose	Paper	Sulfur (elemental)
Coal oil	Petroleum naphtha	Synthetic rubber
Diesel oil	Petroleum oil	Tall oil
Ethyls thinner	Polyamide resin	Tallow
Gas oil, cracked	Polyester resin	Tar
Gasoline	Polyethylene	Turpentine
Grease	Polymeric oil	Unisolve
Isotactic propylene	Polypropylene	Waxes
J-100	Polystyrene	Wood
Jet oil	Polysulfide polymer	

## Group 102 Explosives

Acetyl azide	Cadmium azide	Disulfur dinitride
Acetyl nitrate	Cadmium hexamine chlorate	Ethyl nitrate
Ammonium azide	Cadmium hexamine perchlorate	Ethyl nitrite
Ammonium chlorate	Cadmium nitrate	Fluorine azide
Ammonium hexanitrocobaltate	Cadmium nitride	Glycol dinitrate
Ammonium nitrate	Cadmium trihydrazine chlorate	Glycol monolactate trinitrate
Ammonium nitrite	Calcium nitrate	Gold fulminate
Ammonium periodate	Cesium azide	Guanyl nitrosaminoguanylidene hydrazine
Ammonium permanganate	Chlorine azide	HMX
Ammonium picrate	Chlorine dioxide	Hydrazine azide
Ammonium tetrahydroxochromate	Chlorine fluoroxide	Hydrozoic acid
Azidocarbonyl guanidine	Chlorine trioxide	Lead azide
Barium azide	Chloroacetylene	Lead dinitroresorcinate
Benzene diazonium chloride	Chloropicrin	Lead mononitroresorcinate
Benzotriazole	Copper acetylide	Lead styphnate
Benzoyl peroxide	Cyanuric triazide	Mannitol hexanitrate
Bismuth nitride	Diazidoethane	Mercuric oxycyanide
Boron triazide	Diazodinitrophenol	Mercury fulminate
Bromine azide	Diethylene glycol dinitrate	Nitrocarbonitrate
Butanetroil trinitrate	Dipentaerithritol hexanitrate	Nitrocellulose
<i>t</i> -Butyl hypochlorite	Dipicryl amine	

TABLE A2.1 *Continued*

Group 102 Explosives <i>Continued</i>		
Nitroglycenn	Silver acetylide	Thallium nitride
Nitrosoguanidine	Silver azide	Thylead dinitride
Nitrostarch	Silver nitride	Trimercury dinitride
Pentaerythritol tetranitrate	Silver styphnate	Trinitrobenzene
Picramide	Silver tetrazene	Trinitrobenzoic acid
Picric acid	Smokeless powder	Trinitronaphthalene
Picryl chloride	Sodium azide	Trinitroresorcinol
Polyvinyl nitrate	Sodium picramate	Trinitrotoluene
Potassium dinitrobenzofuroxan	Tetranitromethane	Urea nitrate
Potassium nitrate	Tetraselenium tetranitride	Vinyl azide
RDX	Tetrazene	Zinc peroxide
Group 103 Polymerizable Compounds		
Acrolein	Ethylenimine	Propylene oxide
Acrylic acid	2-Ethylhexyl acrylate	Styrene
Acrylonitrile	Isobutyl acrylate	Vinyl acetate
Butadiene	Isoprene	Vinyl chloride
n-Butyl acrylate	Methyl acrylate	Vinyl cyanide
Ethyl acrylate	Methyl methacrylate	Vinylidene chloride
Ethylene oxide	2-Methyl styrene	Vinyl toluene
Group 104 Oxidizing Agents, Strong		
Ammonium chlorate	Chlorine	Oxygen difluoride
Ammonium dichromate	Chlorine dioxide	Perchloryl fluoride
Ammonium nitridoosmate	Chlorine fluoroxide	Phosphorus oxybromide
Ammonium perchlorate	Chlorine monofluoride	Phosphorus oxychloride
Ammonium periodate	Chlorine monoxide	Potassium bromate
Ammonium permanganate	Chlorine pentafluoride	Potassium dichloroisocyanurate
Ammonium persulfate	Chlorine trifluoride	Potassium dichromate
Ammonium tetrachromate	Chlorine trioxide	Potassium nitrate
Ammonium tetraperoxychromate	Chromic acid	Potassium perchlorate
Ammonium trichromate	Chromyl chloride	Potassium permanganate
Antimony perchlorate	Cobaltous nitrate	Potassium peroxide
Barium bromate	Copper nitrate	Silver nitrate
Barium chlorate	Dichloroamine	Sodium bromate
Barium iodate	Dichloroisocyanuric acid	Sodium carbonate peroxide
Barium nitrate	Ethylene chromic oxide	Sodium chlorate
Barium perchlorate	Fluorine	Sodium chlorite
Barium permanganate	Fluorine monoxide	Sodium dichloroisocyanurate
Barium peroxide	Guanidine nitrate	Sodium dochromate
Bromic acid	Hydrogen peroxide	Sodium hypochlorite
Bromine	Iodine pentoxide	Sodium nitrate
Bromine monofluoride	Lead chlorite	Sodium nitrite
Bromine pentafluoride	Lead nitrate	Sodium perchlorate
Bromine trifluoride	Lithium hypochlorite	Sodium permanganate
n-Butyl hypochlorite	Lithium peroxide	Sodium peroxide
Cadmium chlorate	Magnesium chlorate	Strontium nitrate
Cadmium nitrate	Magnesium nitrate	Strontium peroxide
Calcium bromate	Magnesium perchlorate	Sulfur trioxide
Calcium chlorate	Magnesium peroxide	Trichloroisocyanuric acid
Calcium chlorite	Manganese nitrate	Uranyl nitrate
Calcium hypochlorite	Mercure nitrate	Urea nitrate
Calcium iodate	Mercurous nitrate	Zinc ammonium nitrate
Calcium nitrate	Nitric Acid 70 %	Zinc nitrate
Calcium perchromate	Nickel nitrate	Zinc permanganate
Calcium permanganate	Nitrogen dioxide	Zinc peroxide
Calcium peroxide	Osmium amine nitrate	Zirconium picramate
Chloric acid	Osmium amine perchlorate	

TABLE A2.1 *Continued*

## Group 105 Reducing Agents, Strong

Aluminum borohydride	Cesium carbide	Molybdenum sulfide
Aluminum carbide	Cesium hexahydroaluminate	Nickel subsulfide
Aluminum hydride	Cesium hydride	Pentaborane
Aluminum hypophosphide	Cesium sulfide	Phosphine
Ammonium hypophosphide	Chlorodiborane	Phosphonium iodide
Ammonium sulfide	Chlorodiisobutyl aluminum	Phosphorus (red amorphous)
Antimony pentasulfide	Chlorodimethylamine diborane	Phosphorus (white or yellow)
Antimony trisulfide	Chlorodipropyl borane	Phosphorus heptasulfide
Arsenic sulfide	Chlorosilane	Phosphorus pentasulfide
Arsenic trisulfide	Chromium sulfide	Phosphorus sesquisulfide
Arsine	Copper acetylide	Phosphorus trisulfide
Barium carbide	Copper sulfide	Potassium hydride
Barium hydride	Diborane	Potassium sulfide
Barium hypophosphide	Diethyl aluminum chloride	Silver acetylide
Barium sulfide	Diethyl zinc	Silver sulfide
Benzyl silane	Diisopropyl beryllium	Sodium
Benzyl sodium	Dimethyl magnesium	Sodium aluminate
Beryllium hydride	Ferrous sulfide	Sodium aluminum hydride
Beryllium sulfide	Germanium sulfide	Sodium hydride
Beryllium tetrahydroborate	Gold acetylide	Sodium hyposulfite
Bismuth sulfide	Gold sulfide	Sodium sulfide
Boron arsenotribromide	Hexaborane	Stannic sulfide
Boron trisulfide	Hydrazine	Strontium monosulfide
Bromodiborane	Hydrogen selenide	Strontium tetrasulfide
Bromosilane	Hydrogen sulfide	Tetaborane
Butyl dichloroborane	Hydroxyl amine	Thallium sulfide
<i>n</i> -Butyl lithium	Lead sulfide	Titanium sesquisulfide
Cadmium acetylide	Lithium aluminum hydride	Titanium sulfide
Cadmium sulfide	Lithium hydride	Triethyl aluminum
Sodium dichromate	Lithium sulfide	Triethyl stibine
Calcium	Magnesium sulfide	Trisobutyl aluminum
Calcium carbide	Manganese sulfide	Trimethyl aluminum
Calcium hexammoniate	Mercuric sulfide	Trimethyl stibine
Calcium hydride	Methyl aluminum sesquibromide	Tri- <i>n</i> -butyl borane
Calcium hypophosphide	Methyl aluminum sesquichloride	Triocetyl aluminum
Calcium sulfide	Methyl magnesium bromide	Uranium sulfide
Cerium hydride	Methyl magnesium chloride	Zinc acetylide
Cerium trisulfide	Methyl magnesium iodide	Zinc sulfide
Cerous phosphide		

## Group 106 Water and Mixtures Containing Water

Aqueous solutions and mixtures  
Water

## Group 107 Water Reactive Substances

Acetic anhydride	Antimony triiodide	Boron dibromiodide
Acetyl bromide	Antimony triviny	Boron phosphide
Acetyl chloride	Arsenic tribromide	Boron tribromide
Alkyl aluminum chloride	Arsenic trichloride	Boron trichloride
Alkyl trichlorosilane	Arsenic triiodide	Boron trifluoride
Aluminum aminoborohydride	Barium	Boron triiodide
Aluminum borohydride	Barium carbide	Bromine monofluoride
Aluminum bromide	Barium oxide	Bromine pentafluoride
Aluminum chloride	Barium sulfide	Bromine trifluoride
Aluminum fluoride	Benzene phosphorus dichloride	Bromo diethylaluminum
Aluminum hypophosphide	Benzoyl chloride	<i>n</i> -Butyl lithium
Aluminum phosphide	Benzyl silane	<i>n</i> -Butyl trichlorosilane
Aluminum tetrahydroborate	Benzyl sodium	Cadmium acetylide
Amyl trichlorosilane	Beryllium hydride	Cadmium amide
Anisoyl chloride	Beryllium tetrahydroborate	Calcium
Antimony tribromide	Bismuth pentafluoride	Calcium carbide
Antimony trichloride	Borane	Calcium hydride
Antimony trifluoride	Boron bromodiodide	Calcium oxide

TABLE A2.1 *Continued*

Group 107 Water Reactive Substances <i>Continued</i>		
Calcium phosphide	Lithium amide	Sodium
Cesium amide	Lithium ferrosilicon	Sodium aluminum hydride
Cesium hydride	Lithium hydride	Sodium amide
Cesium phosphide	Lithium peroxide	Sodium hydride
Chlorine dioxide	Lithium silicon	Sodium methyate
Chlorine monofluoride	Methyl aluminum sesquibromide	Sodium oxide
Chlorine pentafluoride	Methyl aluminum sesquichloride	Sodium peroxide
Chlorine trifluoride	Methyl dichlorosilane	Sodium-potassium alloy
Chloroacetyl chloride	Methylene diisocyanate	Stannic chloride
Chlorodiisobutyl aluminum	Methyl isocyanate	Sulfonyl fluoride
Chlorophenyl isocyanate	Methyl trichlorosilane	Sulfuric acid (70 %)
Chromyl chloride	Methyl magnesium bromide	Sulfur chloride
Copper acetylide	Methyl magnesium chloride	Sulfur pentafluoride
Cyclohexenyl trichlorosilane	Methyl magnesium iodide	Sulfur trioxide
Cyclohexyl trichlorosilane	Nickel antimonide	Sulfuryl chloride
Decaborane	Nonyl trichlorosilane	Thiocarbonyl chloride
Diborane	Octadecyl trichlorosilane	Thionyl chloride
Diethyl aluminum chloride	Octyl trichlorosilane	Thiophosphoryl chloride
Diethyl dichlorosilane	Phenyl trichlorosilane	Titanium tetrachloride
Diethyl zinc	Phosphonium iodide	Toluene diisocyanate
Diisopropyl beryllium	Phosphoric anhydride	Trichlorosilane
Dimethyl dichlorosilane	Phosphorous oxychloride	Triethyl aluminum
Dimethyl magnesium	Phosphorus pentasulfide	Triisobutyl aluminum
Diphenyl dichlorosilane	Phosphorus trisulfide	Trimethyl aluminum
Diphenylmethane diisocyanate	Phosphorus (amorphous red)	Tri- <i>n</i> -butyl aluminum
Disulfuryl chloride	Phosphorus oxybromide	Tri- <i>n</i> -butyl borane
Dodecyl trichlorosilane	Phosphorus oxychloride	Trioctyl aluminum
Ethyl dichloroarsine	Phosphorus pentachloride	Trichloroborane
Ethyl dichlorosilane	Phosphorus sesquisulfide	Triethyl arsine
Ethyl trichlorosilane	Phosphorus tribromide	Triethyl stibine
Fluorine	Phosphorus trichloride	Trimethyl arsine
Fluorine monoxide	Polyphenyl polymethyl isovanate	Trimethyl stibine
Fluorosulfonic acid	Potassium	Tripropyl stibine
Gold acetylide	Potassium hydride	Trisilyl arsine
Hexadecyl trichlorosilane	Potassium oxide	Trivinyl stibine
Hexyl trichlorosilane	Potassium peroxide	Vanadium trichloride
Hydrobromic acid	Propyl trichlorosilane	Vinyl trichlorosilane
Iodine monochloride	Pyrosulfuryl chloride	Zinc acetylide
Lithium	Silicon tetrachloride	Zinc phosphide
Lithium aluminum hydride	Silver acetylide	Zinc peroxide

### A3. INDUSTRY INDEX AND LIST OF GENERIC NAMES AND REACTIVITY

A3.1 This annex consists of two separate but related tables. Table A3.1 is the Industry Index which lists names of industries alphabetically with their corresponding Standard Industrial Classification (SIC) code numbers. Table A3.2 is the list of Generic Names of Wastestreams.

A3.2 This annex is used to determine the RGN of wastestreams when their compositions are not known specifically but are identified by their generic or common names. The SIC code number of one wastestream produced by a given industry is obtained from the Industry Index table (Table A3.1). This number is located in the List of Generic Names of Wastestreams

(Table A3.2). Then the corresponding industry source, generic name of the waste, and its RGN are noted from the table. The process is repeated for the second waste. The RGN for the two types of wastes are entered in the incompatibility worksheet (Fig. 3) and the incompatibility method in Section 5.

A3.3 The primary references used in the compilation of the following tables are the same ones used in Annex A1. The lists are in no way complete nor are the assignments of RGN to particular wastestreams absolute. Changes in manufacturing processes and practices may change the waste compositions thus resulting in different generic types of wastes.

TABLE A3.1 Industry Index Table

Industry	SIC Code	Industry	SIC Code
Chemical products, miscellaneous	289	Mining, bituminous coal and lignite	12
Chemicals, agricultural	287	Mining, metal	10
Chemicals, industrial inorganic	281	Paints, varnishes, lacquers, enamels and allied products	285
Chemicals, industrial organic	286	Paper and allied products	26
Drugs	283	Petroleum refining and related industries	29
Food and kindred products	20	Plastic materials and synthetic resins	282
Furniture and fixtures	25	Printing, publishing and allied industries	27
Instruments, measuring, analyzing, and control	38	Services, business	73
Leather and leather	31	Services, electrical, gas and sanitary	49
Lumber and wood products	24	Soap, detergents and cleaning preparations	284
Machinery, except electrical	35	Stone, clay, glass and concrete	
Machinery, equipment and supplies electrical and electronic	36	Textile mill products	22
Metal industries, primary	33	Transportation equipment	37
Metal products, fabricated	34		

TABLE A3.2 Generic Names of Wastestreams

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group Numbers
10	Metal mining	ore extraction wastes	1, 24
12	Bituminous coal and lignite mining	ore flotation, leach and electrolysis wastes	10, 24
20	Food and kindred products	coal processing wastes	24, 31, 101
		coffee, caffeine extraction chaff	17
		citrus pectin wastes	1, 4
22	Textile mill products	cotton processing	1, 10, 24
		orlon production wastes	24, 31
		wool processing wastes	1, 3, 24
		textile dyeing and finishing wastewater sludge	17, 24
24	Lumber and wood products	plywood production phenolic resin wastes	31
		wood preserving spent liquors	15, 17, 24, 27, 31
25	Furniture and fixtures	softwood anti-stain process wastes	7, 17, 31
26	Paper and allied products	furniture paint stripping wastes	10, 24, 101
		wood processing wastes	13, 16, 28, 29, 101
		chemical pulping wastes	1, 101
		dimethyl sulfate still bottoms	1
		paperboard production wastes	24, 31
		paperboard caustic sludge	10, 33
		paper making and printing wastes	16, 24
27	Printing, publishing and allied industry	newspaper printing and equipment cleaning wastes	4, 14, 16, 29
		packaging materials paint sludge and solvent	4, 13, 24
		photofinishing wastes	10
		chromate printing wastes	24, 104
281	Industrial inorganic chemicals	nitrous oxide manufacturing wastes	10, 104
		titanium dioxide manufacturing—chloride	1, 24
		acetylene manufacturing sludge	10
		industrial gas scrubber wastes	10
		antimony oxide manufacturing wastes	24, 33
		antimony pentafluoride production wastes	15, 24
		chrome and zinc pigments manufacturing wastes	11, 24
		hydrogen chloride manufacturing wastes	1
		chlorine fume control wastes	1
		fluoride salt production wastes	15
		mercuric cyanide manufacturing wastes	11, 24
		barium compounds manufacturing wastes	11, 24, 33
		dichromate production wastes	24
		fluorine manufacturing wastes	15, 104

TABLE A3.2 *Continued*

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group Numbers		
282	Plastics materials and synthetics	adhesives and coating manufacturing wastes	10, 17, 19, 29		
		polyvinyl acetate emulsion sludge	101, 103		
		plywood liquid resin plant wastes	4, 5, 10, 31		
		organic peroxide catalyst production wastes	3, 101		
		latex manufacturing wastes	13, 101, 103		
		acrylic resine production wastes	3, 13, 26, 28, 103		
		cellulose ester production wastes	1, 3, 4, 13, 14, 24, 103		
		ethylene and vinyl chloride manufacturing residue	17, 24, 29		
		urea and melanine resin manufacturing wastes	6, 10, 24		
		vinyl resin manufacturing wastes	17, 31		
		adiponitrile production wastes	11, 26, 101, 103		
		urethane manufacturing wastes	16, 24		
		synthetic rubber manufacturing wastes	14, 16, 17, 27		
		rayon fiber manufacturing wastes	24		
		283	Drugs	arsenic pharmaceutical wastes	24
				blood plasma fractions production wastes	4
				alkaloids extraction wastes	4, 16, 17, 19, 29, 101
mercurial pharmaceutical wastes	16, 24				
antibiotic manufacturing wastes	4, 13, 14, 19				
284	Soaps and detergents	chemical cleaning compounds manufacturing wastes	24, 104		
		bleach and detergent manufacturing wastes	10		
285	Paints, varnishes, lacquers	paint wash solvent wastes	101		
		glycerin sludge	4		
		solvent-based paint sludge	11, 13, 16, 17, 19, 24, 101		
		water-based paint sludge	24, 101, 103		
		lacquer paints manufacturing wastes	13, 16, 19, 24		
		putty and miscellaneous paint products manufacturing wastes	24, 101		
286	Industrial organic chemicals	benzene sulfonate phenol production waste	1, 16		
		phenol production wastes from cumene oxidation	17, 101		
		phenol production wastes from chlorination benzene	17, 31		
		organic dye manufacturing wastes	1, 7, 24, 31		
		chromate pigments and dye wastes	7, 24, 27, 33		
		cadmium-selenium pigment wastes	24		
		nitrobenzene production wastes	27		
		toluene diisocyanate production wastes	18, 24, 101		
		pitch and creosote equipment cleaning wastes	10		
		chlorinated solvents refining wastes	4, 16, 17, 19		
		transformer oil manufacturing wastes	17, 28		
		ethylene manufacturing wastes by thermal pyrolysis	17, 31		
		ethylene chloride manufacturing wastes from oxychlorination of ethylene	17		
		ethylene glycol manufacturing wastes	4, 14, 17		
		freon manufacturing wastes	1, 24		
		formaldehyde manufacturing wastes	17, 24		
		epichlorohydrin manufacturing wastes	4, 14, 17		
		manufacturing wastes from <i>n</i> -butane dehydrogenation	17, 24, 33		
		acetaldehyde still bottoms from ethylene oxide	5, 17		
		acetone manufacturing wastes	17, 31		
		methanol manufacturing wastes-carbon monoxide synthesis	17, 24		
		methyl methacrylate resin manufacturing wastes	3, 13, 16, 26, 28, 103		
		maleic anhydride production wastes	3, 4, 28, 103		
lead alkyl production wastes	24				

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TABLE A3.2 *Continued*

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group Numbers
		perchloroethylene production wastes	17, 28, 31
		propylene glycol manufacturing wastes	14, 17, 28
		acrylonitrile production wastes	26, 101, 103
		adipic acid production wastes—cyclohexane oxide	3, 24
287	Agricultural chemicals	vinyl chloride manufacturing wastes	17, 31
		buctril production caustic wash	3, 10, 16, 17, 31
		DCP tar	17, 31
		MCP production wastes	1, 3, 13, 17, 31
		DDT formulation wastes	10, 16, 17
		arsenic pesticide formulation wastes	24
		atracine production wastes	3, 10, 11
		malathion production wastes	16, 32
		parathion production wastes	1, 32
		trifluralin manufacturing wastes	16, 17, 27
289	Miscellaneous chemical products	phosphoric acid production wastes	1, 24
		TNT production wastes	8, 16, 24, 27, 102
		TNT red water wastes	3, 27, 102
		penite production wastes	24
		acidic cleaning compounds	1
29	Petroleum refining and related industry	coke product wastes	24, 101
		catalyst wastes	24, 101
		alkane production wastes	4, 7, 10, 16
		wastewater treatment air flotation unit flocculent	10
		spent caustic	10, 20, 24, 31, 33
		dissolved air flotation emulsion	16, 24, 31, 33, 101
		catacarb rinse water	24
		catalyst sludge	10, 24
		API separator sludge	11, 16, 24, 31, 33, 101
		liquified petroleum gas processing wastes	16, 101
		VLE alkylation sludge	10, 15
		fluid catalytic cracker fines	11, 16, 24, 31
		spent lime from boiler feed water treatment	10, 24, 31
		HF alkylation sludge, neutralized	15, 24, 31, 101
		non-lead gasoline tank bottoms	16, 24, 31, 101
		lead gasoline tank bottoms	16, 24, 31, 101
		refinery storm water run off silt	11, 16, 24, 31, 101
		waste biodegradation sludge	11, 24, 31
		coke fines	24, 31
		lube oil filter clays	16, 24, 31
		kerosene filter clays	16, 24, 31, 101
		cooling tower sludge	11, 16, 24, 31, 101
		slop oil emulsion solids	16, 24, 31, 101
		exchange bundle cleaning sludge	16, 24, 31, 101
		once through cooling water sludge	24, 31, 101
		crude tank bottoms	16, 24, 31, 101
		sour refinery waste	10, 11, 20, 31, 33
		still bottoms	24
		waste brine sludge	24
		gasoline blending wastes	24, 101
		soda ash alkaline solution	10
		acid sludge	1
		caustic cleaning solution	10
		alky spend caustic	10
		lime sludge from raw water treatment	10
		lube oil and grease reclaimers residue	24
		waste lube oil and grease	24
		recycled oil spend sulfuric acid	1
		recycled oil acid sludge	1, 16, 28
		recycled oil caustic sludge	10, 24
		recycled oil spend clays	101
		recycled oil still bottoms	31
		recycled oil wastewater	31

TABLE A3.2 *Continued*

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group Numbers		
30	Rubber and miscellaneous plastic products	tires and inner tube mixing process wastes	17, 24, 101		
		tires and inner tube mixing preparation wastes	18		
		tires and inner tube cleaning process wastes	17		
		tires and inner tube manufacturing wastes	5, 16, 17, 24, 28		
		medical product washings	4		
31	Leather and leather products	medical product dispersion casting	16		
		tanning solvents	4, 19		
		sulfide dehairing sludges	33		
		tanning wastes	10, 13, 24, 101		
		chrome tan liquor	24, 33		
32	Stone clay, glass and concrete products	glass etching wastes	1, 4		
		mirror production wastes	24		
		piezoelectric ceramics compounding process wastes	24		
		piezoelectric ceramics calcining process wastes	24		
		piezoelectric ceramics grinding wastes	24		
		piezoelectric ceramics pressing wastes	24		
		piezoelectric ceramics polarization wastes	24		
		steel manufacturing waste oil	24, 101		
		stainless steel pickling liquor	1, 2, 24		
		pig iron production wastes	10, 11, 31		
33	Primary metal industries	steel finishing wastes	11, 24		
		steel manufacturing wastes	1, 24, 31		
		coke plant raw waste sludge	7, 11, 16, 31		
		carbon tubing undercoating process wastes	3, 24		
		metal smelting and refining wastes	1, 24		
		spent battery acid	1		
		barium compounds smelting and refining wastes	24		
		aluminum scrap melting wastes	23, 25, 107		
		metal reclaiming wastes	1, 2, 24		
		brass mill wastes	1, 24, 104		
		aluminum extrusion solvents	4		
		aluminum degreasing solvents	19		
		aluminum fluidizing process wastes	1		
		aluminum extrusion equipment cleaning wastes	10, 101		
		aluminum foundry wastes	15, 101		
		wire and cable fiber spinning wash	1		
		wire and cable spent scrubber solution	15		
		34	Fabricated metal products	metal cleaning wastes	1, 2, 3, 24
				can manufacturing wastes	1, 29, 101
				steel pickling bath wastes	1
metal drum reconditioning wastes	10, 24				
submerged burnishing wastes	11, 24				
acid plating solution	2				
programate sludge	10, 11, 24				
metal stripping wastes	11, 24				
plating rack stripping wastes	2				
oxidizing sludge	24				
plating wastes	11, 24				
steel fabrication waste oil	101				
metal plating degreasing solvents	19, 101				
copper plating wastes	11, 24				
brass plating wastes	11, 24				
aluminum anodizing wastes	1, 24				
chrome plating wastes	11, 24				
metal coating phosphate sludge	24, 101				
aluminum pickling bath	1, 2				
nickel stripping wastes	11				
anodizing tank wastes	1				
chemical milling spent caustic	10, 24, 33				
galvanizing pickling bath	10				

TABLE A3.2 *Continued*

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group Numbers		
35	Machinery except electrical	galvanizing wastes	1		
		wire products metal milling wastes	1, 2, 24		
		rolling mill solvents	24, 101		
		rotogravure printing plate wastes	10, 24		
		duplicating and photoequipment manufacturing wastes	10, 24		
		electric circuits manufacturing acid solution	1, 2, 24		
		electric circuits manufacturing solvents			
		chromic acid bath	1, 24, 104		
		electric computer metal plating wastes	1, 2, 24		
		computer manufacturing wastes	11, 15, 17, 24, 101		
		machinery chemical milling acids	1, 2, 24		
		36	Electrical and electronic equipment and supplies	electronic equipment dip and cleaning wastes	10, 17, 24, 101
electronic components plating wastes	1, 2, 24				
fiberglass form manufacturing wastes	17, 19, 101				
electronic components manufacturing solvents	4, 13, 16, 17, 19, 101				
machine parts cleaning solvents	4, 17, 19				
electronic components etching solution	10, 15				
copper plating cyanide stripping solution	11				
TV picture tube manufacturing wastes	1, 2				
miniature equipment chemical milling wastes	10, 16				
telephone answering device manufacturing wastes	4, 17				
electronic tube production wastes	1, 24				
metal finishing wastewater treatment sludge	10, 24				
semi-conductor manufacturing wastes	1, 2, 24, 104				
silicon etching solution	1, 2				
electronic components paint sludge	4, 16, 19, 101, 107				
ceramic capacitor production waste solvent	16, 17, 19				
magnetic tape manufacturing wastes	24, 104				
magnetic recorder head laminating processing wastes	4, 14, 17, 19				
battery reclamation wastes	4				
storage battery manufacturing wastes	10, 24				
37	Transportation equipment			automobile paint application and clean up wastes	24, 31
				automobile electro deposition primer paint wastes	19, 24, 31
		automobile paint sludge	10, 24, 31		
		automobile manufacturing wastewater treatment residue	24, 31		
		aircraft alkaline cleaning solution	10, 104		
		aircraft aluminum etching wastes	10, 33		
		aircraft parts acid plating wastes	1, 24, 104		
		aircraft parts anodizing wastes	1		
		chrome plating wastes	24, 104		
		aluminum hot-seal wastes	24, 104		
		chrome district sludge	10, 24		
		rail car metal cleaning wastes	1, 24, 101		
38	Measuring, analysis and controlling instruments	chlorinated cleaning solvents	17		
		microfilm production wastes	4, 14, 19		
49	Electric gas and sanitary service	graphic arts adhesive manufacturing wastes	16, 28, 101		
73	Business services	askarel liquid	17		
		printed circuit board laboratory wastes	27		
		photographic fixing solution	10, 11		
		film processing acid wastes	3, 5		
		ship line flush wastes	4, 10, 13, 16		
		equipment and floor cleaning caustic wastes	10		

TABLE A3.2 Continued

SIC Code	Industry Source	Generic Name of Wastes	Reactivity Group No.
		acidic chemical cleaning solution	
		railroad equipment cleaning caustic wastes	
		boiler wash	
		solvent recovery tank bottoms	4, 19, 27
		solvent recovery sludge	4, 17, 19, 27
		chlorinated solvent recovery still bottoms	17, 24

**A4. LIST OF INCOMPATIBLE BINARY COMBINATIONS OF HAZARDOUS WASTES BY REACTIVITY GROUPS AND POTENTIAL ADVERSE REACTION CONSEQUENCES**

A4.1 This annex describes in detail the potential adverse reaction consequences predicted in the Hazardous Wastes Incompatibility Chart (Fig. 2). The list of reactions do not in any way represent all the possible incompatible reactions that can occur between any two given types of wastes.

A4.2 The first column of the list identifies the binary combinations of the wastes by Reactivity Group Numbers (RGN). The second column lists the corresponding adverse reaction consequences. For every reaction, supporting references are given for the users information.

TABLE A4.1 Incompatible Combinations of Hazardous Wastes by Reactivity Groups and Reaction Consequences

Reactivity Group No. Combination	Adverse Reaction and Consequences
1 + 4	<i>Mineral Acids + Alcohols and Glycols</i> Dehydration reactions and displacement with the halide result in heat generation (53).
1 + 5	<i>Mineral Acids + Aldehydes</i> Condensation reactions cause heat generation. Acrolein and other B-unsaturated aldehydes polymerize readily (36, 44).
1 + 6	<i>Mineral Acids + Amide</i> Hydrolysis of amide to the corresponding carboxylic acid results in an exotherm (36, 44).
1 + 7	<i>Mineral Acids + Amines</i> The acid base reaction between these two types of compounds forming the ammonium salts may be sufficiently exothermic to cause a hazard (36, 54).
1 + 8	<i>Mineral Acids + Azo Compounds</i> Amyl azo and diazo compounds decompose exothermically upon mixing with strong mineral acids to yield nitrogen gas and the corresponding amyl cation. Aliphatic azo and diazo compounds, particularly diazoalkanes, can polymerize violently with heat generation. Organo azides can also decompose exothermically with strong acid to form nitrogen gas and the respective cations. An exotherm also results from the acid-base reaction of hydrazines with mineral acids as hydrazines are comparable in base to strength to ammonia. Diazomethane is a particularly reactive compound in this group (55, 56).
1 + 9	<i>Mineral Acids + Carbamates</i> Carbamates can undergo hydrolysis as well as decarboxylation upon mixing with strong mineral acids. Both reactions are exothermic and the latter can generate pressure if it occurs in a closed container (57, 58).
1 + 10	<i>Mineral Acids + Caustics</i> The acid-base reaction between strong mineral acids and strong caustics is extremely exothermic and many times violent. Fires can result if the caustic substance is an alkoxide.
1 + 11	<i>Mineral Acids + Cyanide</i> Inorganic cyanides rapidly form extremely toxic and flammable hydrogen cyanide gas upon contact with mineral acids (41).
1 + 12	<i>Mineral Acids + Dithiocarbamates</i> Acid hydrolysis of dithiocarbamate heavy metal salts with strong mineral acids yields extremely flammable and toxic carbon disulfide gas. An exotherm can be expected from the reaction.
1 + 13	<i>Mineral Acids + Esters</i> Strong mineral acids in excess will cause hydrolysis and decomposition of esters with heat generation.
1 + 14	<i>Mineral Acids + Ethers</i> Either may undergo hydrolysis with strong acids exothermically (53, 58).
1 + 15	<i>Mineral Acids + Fluorides</i> Most inorganic fluorides yield toxic and corrosive hydrogen fluoride gas upon reaction with strong mineral acids (39, 41).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
1 + 17	<i>Mineral Acids + Halogenated Organics</i> Strong mineral acids in excess may cause decomposition with generation of heat and toxic fumes of hydrogen halides (41).
1 + 18	<i>Mineral Acids + Isocyanates</i> Acid catalyzed decarboxylation as well as vigorous decomposition can occur upon mixing of isocyanates with strong mineral acids (58).
1 + 19	<i>Mineral Acids + Ketone</i> Acid catalyzed aldol condensation occurs exothermically (58).
1 + 20	<i>Mineral Acids + Mercaptans</i> Alkyl mercaptans are particularly reactive with mineral acids yielding extremely toxic and flammable hydrogen sulfide gas. Other mercaptans can yield hydrogen sulfide with excess strong acids. Excess strong acid can also result in decomposition and generation of toxic fumes of sulfur oxides (41).
1 + 21	<i>Mineral Acids + Alkali and Alkaline Earth Metals</i> The reaction of strong mineral acids with alkali and alkaline earth metals in any form will result in a vigorous exothermic generation of flammable hydrogen gas. Usually fire and the generation of toxic metal oxide particulates.
1 + 22	<i>Mineral Acids + Metal Powders, Vapors, or Sponges</i> Reactions of strong mineral acids with finely divided metals or metals in a form with high surface area will result in vigorous generation of flammable hydrogen gas and possible explosion caused by the heat of reaction (41).
1 + 23	<i>Mineral Acids + Metal Sheets, Rods, Drops, etc.</i> Strong mineral acids will form flammable hydrogen gas upon contact with metals in the form of plates, sheets, chunks, and other bulk forms. The heat of reaction may ignite the gas formed (41).
1 + 24	<i>Mineral Acids + Toxic Metals</i> Mineral acids tend to solubilize toxic metals and metal compounds releasing previously fixed toxic constituents to the environment (41, 59).
1 + 25	<i>Mineral Acids + Nitrides</i> The aqueous fraction of strong mineral acids will react with nitrides evolving caustic and flammable ammonia gas. The acid base reaction of mineral acids and nitrides can also evolve much heat and ammonia (32, 41).
1 + 26	<i>Mineral Acids + Nitriles</i> Exothermic hydrolysis of nitriles to the corresponding carboxylic acid and ammonium ion is known to occur with mineral acids. Extremely toxic and flammable hydrogen cyanide gas may be evolved with such compounds as acetone, cyanohydrin and propionitriles (39, 41).
1 + 28	<i>Mineral Acids + Unsaturated Aliphatics</i> Addition of mineral acids to alkenes usually results in exothermic acid catalyzed hydration and partial addition of the hydrogen halide or sulfates. Acetylenes are also susceptible to exothermic acid catalyzed hydration forming the corresponding aldehyde or ketone, with possible addition of the hydrogen halide in the case of halogen acids (58, 60).
1 + 30	<i>Mineral Acids + Organic Peroxides</i> Strong mineral acids can react with organic peroxides and hydro-peroxides with enough heat generated to cause explosive decomposition in the more unstable compounds. Oxygen can also be generated (32, 33).
1 + 31	<i>Mineral Acids + Phenols and Cresols</i> Exothermic sulfonation reactions can occur with addition of sulfonic acid to phenols and cresols. Substitution of the hydroxyl with a halide can occur with addition of the halogen acids. Excess strong acid can decompose phenols and cresols with heat generation (58, 61).
1 + 32	<i>Mineral Acids + Organophosphates</i> Excess strong mineral acid can cause decomposition of organophosphates, phosphothioate, and phosphodithioates with heat generation and possibly toxic gas formation (41).
1 + 33	<i>Mineral Acids + Sulfides</i> Extremely toxic and flammable hydrogen sulfide gas results from the combination of mineral acids and sulfides (41).
1 + 34	<i>Mineral Acids + Epoxides</i> Acid catalyzed cleavage can occur initiating polymerization with much heat generated (58).
1 + 101	<i>Mineral Acids + Combustible Materials</i> Many explosives are extremely heat sensitive and can be detonated by heat generated from the action of strong mineral acids on these compounds (41, 42).
1 + 102	<i>Mineral Acids + Polymerizable Compounds</i> Strong mineral acids can act as initiators in the polymerization of these compounds. The reactions are exothermic and can occur violently (62).
1 + 104	<i>Mineral Acids + Strong Oxidizing Agents</i> Many combinations of strong mineral acids and strong oxidizing agents are sensitive to heat and shock and may decompose violently. The halogen acids may be oxidized yielding highly toxic and corrosive halogen gases, accompanied by heat generation (32, 39, 41, 43, 55, 63).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
1 + 105	<i>Mineral Acids + Strong Reducing Agents</i> Many reducing agents form flammable hydrogen gas on contact with mineral acids. The heat generated can cause spontaneous ignition. Some reducing agents such as metal phosphides and inorganic sulfides evolve extremely toxic and flammable fumes of phosphine and hydrogen sulfides, respectively (32, 39, 41, 43, 55, 63).
1 + 106	<i>Mineral Acids + Waste and Miscellaneous Aqueous Mixtures</i> Much heat can be evolved upon solubilization and hydrolysis of these acids.
1 + 107	<i>Mineral Acids + Water Reactives</i> Group 107 compounds not only share the characteristic that hazardous consequences can result from their contact with water; they are also generally extremely reactive with most of the other compounds listed. In many cases much heat is generated along with toxic or flammable gases, or both. Explosions may occur, or highly unstable mixtures may result. For this reason, it is recommended that Group 107 compounds be completely isolated from the other compounds. Many of these Group 107 compounds are also pyrophoric, especially those which are also classed as strong reducing agents (32, 39, 41, 43, 55, 63).
2 + 3	<i>Oxidizing Mineral Acids + Organic Acids</i> These mineral acids can oxidize the hydrocarbon moiety of organic acids with resulting heat and gas formation.
2 + 4	<i>Oxidizing Mineral Acids + Alcohols and Glycols</i> Oxidation of the hydrocarbon moiety can occur resulting in heat and gas formation. Nitration with nitric acid can take place in the presence of sulfuric acid forming extremely unstable nitro compounds (41, 58).
2 + 5	<i>Oxidizing Mineral Acids + Aldehydes</i> Oxidation of the hydrocarbon moiety can occur resulting in heat and gas formation (41).
2 + 6	<i>Oxidizing Mineral Acids + Amides</i> The acid-base reaction produces much heat and exhaustive oxidation results in generation of heat and toxic fumes of nitrogen oxide (41, 58).
2 + 7	<i>Oxidizing Mineral Acids + Amines</i> The acid-base reaction produces much heat and exhaustive oxidation results in generation of heat and toxic fumes of nitrogen oxide (41, 58).
2 + 8	<i>Oxidizing Mineral Acids + Azo Compounds</i> Azo compounds and diazo compounds are easily decomposed by strong acids evolving much heat and nitrogen gas. They are very susceptible to oxidation and can evolve toxic fumes of nitrogen oxides upon exhaustive oxidation. Hydrazines are especially susceptible to oxidation and inflame upon contact with oxidizing agents. Many of the compounds in this group such as diazomethane and the azides are very unstable and can decompose explosively upon heating (32, 39, 41).
2 + 9	<i>Oxidizing Mineral Acids + Carbamates</i> Carbamates can undergo exothermic hydrolysis and decarboxylation upon mixing with these acids. Exhaustive oxidation can also result in formation of toxic fumes of nitrogen oxides, and sulfur oxides in the case of thiocarbamates (39, 41, 57).
2 + 10	<i>Oxidizing Mineral Acids + Caustics</i> The neutralization reaction can be violent with evolution of much heat (41).
2 + 11	<i>Oxidizing Mineral Acids + Cyanides</i> Evolution of extremely toxic and flammable hydrogen cyanide gas will occur before oxidation (41).
2 + 12	<i>Oxidizing Mineral Acids + Dithiocarbamates</i> Acids will cause decomposition of dithiocarbamates with evolution of extremely flammable carbon disulfide. Significant heat may be generated by the oxidation and decomposition to ignite the carbon disulfide (64).
2 + 13	<i>Oxidizing Mineral Acids + Esters</i> Exhaustive oxidation of esters can cause decomposition with heat and possible ignition of the more flammable esters. Conversion to the organic acid and decarboxylation can also occur.
2 + 14	<i>Oxidizing Mineral Acids + Ethers</i> Heat generated from the exhaustive oxidation of ethers can ignite the more flammable ethers. These compounds can also undergo exothermic acid catalyzed cleavage (41, 58).
2 + 15	<i>Oxidizing Mineral Acids + Fluorides</i> Gaseous hydrogen fluoride can result from a combination of inorganic fluorides and these acids. Hydrogen fluoride is extremely corrosive and toxic. Some heat can also be evolved (41).
2 + 16	<i>Oxidizing Mineral Acids + Aromatic Hydrocarbons</i> Oxidation of the hydrocarbon may produce enough heat to ignite the mixture (41).
2 + 17	<i>Oxidizing Mineral Acids + Halogenated Organics</i> These acids can cause oxidation and decomposition of halogenated organics resulting in heat and generation of extremely toxic fumes of hydrogen chloride, phosgene, and other gaseous halogenated compounds (41).
2 + 18	<i>Oxidizing Mineral Acids + Isocyanates</i> Isocyanates may be hydrolyzed by the water in concentrated acids to yield heat and carbon dioxide. They may also be oxidized by these acids to yield heat and toxic nitrogen oxides (41, 63).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
2 + 19	<i>Oxidizing Mineral Acids + Ketones</i> Ketones can undergo exothermic aldol condensation under acidic conditions. Oxidizing acids can cleave the ketone to give a mixture of acids. Excess acid can cause complete decomposition yielding much heat and gas. Fire can also result (41, 58).
2 + 20	<i>Oxidizing Mineral Acids + Mercaptans</i> Extremely toxic and flammable hydrogen sulfide gas can be formed by the action of the acid on mercaptans. Oxidation of mercaptans and other sulfur compounds can result in formation of toxic sulfur dioxide and heat (41).
2 + 21	<i>Oxidizing Mineral Acids + Alkali and Alkaline Earth Metals</i> Extremely flammable hydrogen gas can be generated upon contact of acids and these metals. The reaction of such a strong oxidizing agent and strong reducing agents can be so violent as to cause a fire and possibly an explosion (41).
2 + 22	<i>Oxidizing Mineral Acids + Metal Powders, Vapors, and Sponges</i> The action of acid on these metals produces hydrogen gas and heat. Due to the large surface area of these forms of metals, the reaction can occur with explosive violence (32, 41).
2 + 23	<i>Oxidizing Mineral Acids + Metal Sheets, Rods, Drums, etc.</i> The reaction of acids on metals as sheets, plates, and other bulk forms can evolve hydrogen gas and some heat. Although the reaction proceeds much slower than in the case of powders, a definite fire hazard exists. Of the metals listed in Group 23, only zirconium is not attacked by nitric acid (39).
2 + 24	<i>Oxidizing Mineral Acids + Toxic Metals</i> Many of the compounds in Group 24 are very easily solubilized by strong acids, consequently, the toxic metal compounds are converted into forms which are more easily transported and assimilated. Some of these compounds have other hazardous properties and are classified elsewhere (39, 41).
2 + 25	<i>Oxidizing Mineral Acids + Nitrides</i> Nitrides are extremely strong bases and will participate in an acid-base reaction evolving much heat. This reaction can proceed with explosive violence due to the instability of metal nitrides and the generation of flammable ammonia gas (32, 41).
2 + 26	<i>Oxidizing Mineral Acids + Nitriles</i> The primary hazard in mixing these types of compounds appears to be oxidation of the nitriles with generation of heat and toxic fumes of nitrogen oxides. In some cases such as acetone cyanohydrin and propionitrile, extremely toxic hydrogen cyanide gas is known to result from mixing with strong acids. These fumes are also flammable. Mixtures of nitric acid and acetonitrile are high explosives (32, 39, 41).
2 + 27	<i>Oxidizing Mineral Acids + Nitro Compounds</i> These acids can decompose nitro compounds to produce heat and toxic fumes of nitrogen oxide. This oxidation can be extremely violent. Mixtures of nitric acid and nitroaromatics are known to exhibit explosive properties. Mixtures of some nitroalkanes (nitromethane) with nitric acid can also be detonated (32, 41).
2 + 28	<i>Oxidizing Mineral Acids + Unsaturated Aliphatics</i> Aliphatic unsaturated hydrocarbons are extremely susceptible to oxidation resulting in heat generation and fire (41, 58).
2 + 29	<i>Oxidizing Mineral Acids + Saturated Aliphatics</i> Aliphatic saturated hydrocarbons are easily oxidized by these acids yielding heat and carbon dioxide (41, 53).
2 + 30	<i>Oxidizing Mineral Acids + Organic Peroxides</i> The lower molecular weight organic peroxides and hydroperoxides are very sensitive to heat and shock. Mixing of oxidizing mineral acids with such unstable compounds can cause heat generation due to the oxidizing capacity of the acids and acid catalyzed hydrolysis. These reactions can cause explosive decomposition (32, 65).
2 + 31	<i>Oxidizing Mineral Acids + Phenols and Cresols</i> Phenols and cresols are easily oxidized and excess oxidizing acids can result in much heat generation (41, 58).
2 + 32	<i>Oxidizing Mineral Acids + Organophosphates</i> Excess oxidizing acid can decompose these compounds to yield heat and toxic fumes of nitrogen oxides, sulfur oxides, and phosphorous oxides (41).
2 + 33	<i>Oxidizing Mineral Acids + Sulfides</i> Toxic and flammable hydrogen sulfide gas can be generated by the action of these acids on inorganic sulfides. These sulfides can also be oxidized exothermically to sulfur dioxide, also a toxic gas. This reaction can occur very violently (41).
2 + 34	<i>Oxidizing Mineral Acids + Epoxides</i> Epoxides are very easily cleaved by acids with heat generation. This ring opening can be the initiating step in the formation of epoxy resins, and uncontrolled polymerization can result in extreme heat generation. The oxidation capacity of these acids can cause ignition of the epoxides (58, 62).
2 + 101	<i>Oxidizing Mineral Acids + Combustible Materials</i> Oxidizing mineral acids can decompose substances in Group 101 with heat generation and possible fire. Toxic gases may also be formed as combustion products, but the type of gas will depend upon the composition of these miscellaneous substances (41).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
2 + 102	<i>Oxidizing Mineral Acids + Explosives</i> Such strong acids can easily detonate compounds in this group of explosives due to the heat generated upon mixing. The oxidizing character of these acids merely enhances the possibility of detonation (41, 42).
2 + 103	<i>Oxidizing Mineral Acids + Polymerizable Compounds</i> As in Combination 1 + 102, these acids can act as initiators in the polymerization of many compounds. These reactions are exothermic and can occur violently. In addition, these acids can oxidize the compounds of Group 103, producing more heat and possible toxic fumes (41, 43, 62).
2 + 105	<i>Oxidizing Mineral Acids + Strong Reducing Agents</i> Mixing of compounds in these two groups can result in violent, extremely exothermic reactions. Fires and explosions can result (41, 59).
2 + 106	<i>Oxidizing Mineral Acids + Water and Water Mixtures</i> Much heat can be evolved from the dissolution of these acids by water (41).
3 + 4	<i>Organic Acids + Alcohols and Glycols</i> The organic acids of primary concern in this combination are those with <i>α</i> -substituted halogens such as chloroacetic acid, and <i>α</i> - and <i>β</i> -substituted carboxyl groups such as oxalic acid and malonic acid. These acids are comparable in strength to strong mineral acids and can catalyze dehydration and esterification in alcohols and glycols with heat generation. Polyhydric alcohols and polybasic acids can polymerize by esterification with much heat evolved. Due to their acid strength, these halo organic acids would be more accurately compared to acids of Group 1 in terms of reactivity. Hereafter, refer to Group 1 to find the reactivity of these acids. The non-substituted monobasic aliphatic and aromatic acids are relatively nonreactive with alcohols and glycols and esterify only with strong mineral acids or other catalysts present.
3 + 5	<i>Organic Acids + Aldehydes</i> Exothermic condensation reactions can occur between these two types of compounds. The acidic character of the organic acids may be sufficient to catalyze the reaction. Polybasic and unsaturated acids are susceptible to polymerization under these conditions, resulting in much heat generated (53).
3 + 7	<i>Organic Acids + Amines</i> An acid-base reaction between the stronger acids and amines can generate some heat. Dicarboxylic acids and diamines can copolymerize with heat generation (66, 67).
3 + 8	<i>Organic Acids + Azo Compounds</i> Aliphatic and aromatic diazo compounds are readily decomposed by organic acids releasing heat and nitrogen gas as reaction products. Azo compounds are not sensitive to such decomposition. Hydrazine azide is extremely sensitive to heat or shock. An acid-base reaction with hydrazine can produce some heat (55, 63).
3 + 10	<i>Organic Acids + Caustics</i> Acid-base reactions produce heat (58).
3 + 11	<i>Organic Acids + Cyanides</i> Hydrogen cyanide, an extremely toxic and flammable gas, is generated upon mixing (41).
3 + 12	<i>Organic Acids + Dithiocarbamates</i> Toxic and flammable carbon disulfide can be formed upon contact of dithiocarbamate with the stronger organic acids. Although CS <sub>2</sub> is a liquid at room temperature, it has a very high vapor pressure. Some heat can be generated from the hydrolysis of the dithiocarbamate salts (64).
3 + 15	<i>Organic Acids + Fluorides</i> Toxic and corrosive hydrogen fluoride fumes can be generated by the action of strong organic acids upon metal fluoride salts. Alkali metal fluorides are especially susceptible to decomposition in this manner (41, 55).
3 + 18	<i>Organic Acids + Isocyanates</i> Some water is normally associated with organic acids, and this can cause hydrolysis of isocyanates to carbon dioxide and amines with some heat generated (58).
3 + 21	<i>Organic Acids + Alkali and Alkaline Earth Metals</i> Reaction of organic acids with these metals in any form can result in exothermic generation of flammable hydrogen gas and possible fire (61).
3 + 22	<i>Organic Acids + Metal Powders, Vapors, and Sponges</i> The stronger organic acids can liberate flammable hydrogen gas upon contact with metals in these forms. The heat of reaction can cause explosions (41).
3 + 24	<i>Organic Acids + Metals</i> The stronger organic acids can solubilize some of these metal compounds and complex with the metal (58).
3 + 25	<i>Organic Acids + Nitrides</i> An acid-base reaction can occur resulting in heat and possible evolution of flammable ammonia gas. Many of these nitrides are explosively unstable and can be detonated by the heat of reaction.
3 + 26	<i>Organic Acids + Nitriles</i> Strong organic acids can convert nitriles to their corresponding organic acid with some heat generation (61).
3 + 33	<i>Organic Acids + Sulfides</i> Extremely toxic and flammable hydrogen sulfide and some heat can be generated (41).
3 + 34	<i>Organic Acids + Epoxides</i> Acid catalyzed cleavage of the epoxide ring can initiate violent polymerization with much heat generated.

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
3 + 102	<i>Organic Acids + Explosives</i>
3 + 103	<i>Organic Acids + Polymerizable Compounds</i>
3 + 104	<i>Organic Acids + Oxidizing Agents</i>
3 + 105	<i>Organic Acids + Reducing Agents</i>
4 + 8	<i>Alcohols and Glycols + Azo Compounds</i>
4 + 10	<i>Alcohols and Glycols + Isocyanates</i>
4 + 21	<i>Alcohols and Glycols + Alkali and Alkaline Earth Metals</i>
4 + 25	<i>Alcohols and Glycols + Nitrides</i>
4 + 30	<i>Alcohols and Glycols + Organic Peroxides</i>
4 + 34	<i>Alcohols and Glycols + Epoxides</i>
4 + 104	<i>Alcohols and Glycols + Oxidizing Agents</i>
4 + 105	<i>Alcohols and Glycols + Reducing Agents</i>
4 + 107	<i>Alcohols and Glycols + Water Reactives</i>
5 + 7	<i>Aldehydes + Amines</i>
5 + 8	<i>Aldehydes + Azo Compounds</i>
5 + 10	<i>Aldehydes + Caustics</i>
5 + 12	<i>Aldehydes + Dithiocarbamates</i>
5 + 21	<i>Aldehydes + Alkali and Alkaline Earth Metals</i>
5 + 25	<i>Aldehydes + Nitrides</i>

*Organic Acids + Explosives*

Strong organic acids can decompose compounds in this group resulting in enough heat to cause detonation (41).

*Organic Acids + Polymerizable Compounds*

Strong organic acids can initiate cationic polymerization. Dicarboxylic acids can copolymerize with diamines as in the reaction of adipic acid and hexamethylene diamine to form nylon 6, 6 (42, 62, 66).

*Organic Acids + Oxidizing Agents*

The hydrocarbon moiety of the organic acids are susceptible to decomposition by strong oxidizing agents releasing heat and gas. The gas produced can be toxic if the acid contains halogens such as dichlorophenoxy acetic acid, or if it contains other hetero atoms (41).

*Organic Acids + Reducing Agents*

Carboxylic acids are easily reduced by lithium aluminum hydride to the corresponding alcohols with some heat generation. Other reducing agents require more vigorous reaction conditions. Flammable hydrogen gas can be produced from the extractions of the hydroxyl proton and the  $\alpha$ -hydrogens.

*Alcohols and Glycols + Azo Compounds*

Alkyl and aryl diazo compounds are susceptible to replacement by alkoxy groups yielding nitrogen gas and various ether compounds. Literature indicates that organic azides and hydrazines are generally immiscible with alcohols and glycols and do not react violently (39, 63).

*Alcohols and Glycols + Isocyanates*

Polyhydric alcohols and polyisocyanates polymerize very readily due to the ease of addition reactions at the isocyanate group. Much heat can be evolved. Monohydric alcohols form carbamates with isocyanates with some evolution of heat.

*Alcohols and Glycols + Alkali and Alkaline Earth Metals*

Alcohols and glycols decompose these active metals yielding flammable hydrogen gas and the corresponding metal alkoxides. The reaction with alkali metals can be violent with much heat generated and fire. These metal alkoxides are strongly caustic and easily hydrolyzed by water and acids yielding heat (39, 58, 60).

*Alcohols and Glycols + Nitrides*

Flammable ammonia gas is generated by the action of alcohols and glycols on nitrides. Most nitrides are very unstable and may be detonated by the heat of reaction.

*Alcohols and Glycols + Organic Peroxides*

Alcohols and glycols may be oxidized by these organic peroxides and hydroperoxides to yield heat and possibly fire (43).

*Alcohols and Glycols + Epoxides*

Traces of acid or base can catalyze polymerization of these compounds with heat (58).

*Alcohols and Glycols + Oxidizing Agents*

Oxidizing of alcohols and glycols with these strong oxidizing agents can produce heat and inflame or can form explosively unstable compounds (36).

*Alcohols and Glycols + Reducing Agents*

The hydroxyl proton is easily extracted by these strong reducing agents to yield flammable hydrogen gas. In many cases, ignition occurs and sometimes explosions may also occur (32, 36, 39, 43).

*Alcohols and Glycols + Water Reactives*

See Combination 1 + 107.

*Aldehydes + Amines*

Exothermic condensation to form amines can occur. The reaction can be catalyzed by acid (58).

*Aldehydes + Azo Compounds*

Aliphatic diazo compounds, especially diazomethane, react with aldehydes to give ketones, ethylene oxide derivatives, and nitrogen gas. Aromatic diazo compounds can effect an electrophilic substitution on an aldehyde with heat and generation of nitrogen gas. Aldehydes and hydrazines can condense exothermically to form hydrazones (44, 63).

*Aldehydes + Caustics*

Aldehydes undergo self-condensation in combination with caustics and, in the case of acrolein, can result in violent polymerization. Much heat is evolved (44, 61).

*Aldehydes + Dithiocarbamates*

Not much is known about this combination. If these compounds do react, an amide and toxic and flammable carbon disulfide can result. This reaction may be acid catalyzed (64).

*Aldehydes + Alkali and Alkaline Earth Metals*

Owing to the extreme reactivity of these metals and the carbonyl functionality of aldehydes, attack of the metal radical can occur at a number of sites including the oxygen and the  $\alpha$ -hydrogen. Extraction of the  $\alpha$ -hydrogens can result in generation of flammable hydrogen gas. Various other condensation reactions can be initiated by this substitution resulting in heat generation (68).

*Aldehydes + Nitrides*

Nitrides are known to be extremely strong bases and can consequently catalyze condensation reactions liberating heat. With acrolein, uncontrolled self-polymerization can result. The labile  $\alpha$ -hydrogens of aldehydes may be extracted forming flammable ammonia gas (39, 43).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
5 + 27	<i>Aldehydes + Nitro Compounds</i> The aliphatic nitro compounds are somewhat susceptible to condensation with aldehydes resulting in some heat generation. Formaldehyde and nitromethane can react readily in this manner (53).
5 + 28	<i>Aldehydes + Unsaturated Aliphatics</i> At elevated temperatures, a Diels-Alder type reaction can take place between acrolein and 1, 3-butadiene and may be exothermic (58).
5 + 30	<i>Aldehydes + Organic Peroxides</i> A mixture of aldehydes and hydroperoxides results in formation of $\alpha$ -hydroxy peroxides which are unstable to heat and shock. Acyl peroxides such as diacetyl peroxide can decompose with slight heating resulting in formation of CO <sub>2</sub> and methyl radicals. These radicals can abstract hydrogen from aldehydes and initiate a chain reaction and produce much heat. Alkyl and acyl peroxides can decompose in the same manner and initiate free radical reactions involving aldehydes to yield heat. Peroxy acids are very strong oxidizers in themselves and can react violently with aldehydes (36, 65).
5 + 33	<i>Aldehydes + Sulfides</i> Aqueous sulfides can react readily with aldehydes to form gemhydroxythiols with much heat generated (69).
5 + 34	<i>Aldehydes + Epoxides</i> An electrophilic ring opening is possible, but information is very scarce on this type of reaction.
5 + 104	<i>Aldehydes + Oxidizing Agents</i> Aldehydes are very easily oxidized by these compounds resulting in formation of the corresponding carboxylic acid or complete decomposition. In both cases, heat is evolved, and fires can result (41, 58).
5 + 105	<i>Aldehydes + Reducing Agents</i> The labile $\alpha$ -hydrogens of the aldehydes may be extracted by some reducing agents to yield flammable hydrogen gas with some heat (44, 58).
6 + 21	<i>Amides + Alkali and Alkaline Earth Metals</i> Alkali and alkaline earth metals can abstract an <i>N</i> -hydrogen forming flammable hydrogen gas. Some heat may be generated (61).
6 + 24	<i>Amides + Toxic Metals</i> Lower molecular weight amides which are liquid at room temperature are used as ionizing solvents and can solubilize salts of many toxic metal compounds (39).
6 + 104	<i>Amides + Oxidizing Agents</i> Exhaustive oxidation of amides can result in heat generation and evolution of toxic nitrogen-oxide fumes (41).
6 + 105	<i>Amides + Reducing Agents</i> The <i>N</i> -hydrogen can be easily extracted by these reducing agents to yield heat and flammable hydrogen gas (61).
7 + 12	<i>Amines + Dithiocarbamates</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous consequences. It is recommended that mixing be avoided pending laboratory assessment of safety.
7 + 17	<i>Amines + Halogenated Organics</i> Amines are particularly susceptible to alkylation by alkyl halides resulting in formation of secondary and tertiary amines and some heat (54).
7 + 18	<i>Amines + Isocyanates</i> Amines act as organic bases in catalyzing the polymerization of isocyanates. The uncontrolled reaction can be violent and produce much heat (43).
7 + 21	<i>Amines + Alkali and Alkaline Earth Metals</i> These metals can dissolve in amines yielding strongly reducing metal amide solutions and flammable hydrogen gas (55).
7 + 24	<i>Amines + Toxic Metals</i> Amines act as surfactants in increasing the solubility of toxic metal compounds in water (67).
7 + 30	<i>Amines + Organic Peroxides</i> Upon exhaustive oxidation with peroxy acids, amines can yield heat and toxic fumes of nitrogen oxides. Treatment of amines with peroxides and hydroperoxides can result in hydrogen abstraction and initiation of polymerization reactions with heat generated (65).
7 + 34	<i>Amines + Epoxides</i> Condensation and ring opening can generate heat. Such a reaction can initiate polymerizations which, if uncontrolled, can generate much heat (70).
7 + 104	<i>Amines + Oxidizing Agents</i> Exhaustive oxidation of amines with these oxidizing agents can result in heat generation and evolution of toxic nitrogen oxide fumes (41).
7 + 105	<i>Amines + Reducing Agents</i> Alkyl metal halides can undergo a Grignard reaction with primary and secondary amines forming the corresponding alkanes. Enough heat may be evolved to cause a fire hazard. See Combination 7 + 21 for the combination of amines and alkali and alkaline earth metals. Other reducing agents may also react with amines in a similar manner yielding heat and hydrogen gas (63, 71).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
8 + 9	<p><i>Azo Compounds + Carbamates</i></p> <p>Diazo alkanes could add to the carbonyl group of the carbamate with liberation of N<sub>2</sub>. Aryl diazonium compounds can react with the nitrogen of the carbamate group, also yielding nitrogen. Azo compounds appear to be relatively inert towards reaction with carbamates while hydrazines may form hydrazones with carbonyl with heat generated. Information regarding these reactions, however, is very scarce (58, 63).</p>
8 + 11	<p><i>Azo Compounds + Cyanides</i></p> <p>Aryl diazonium salts can react with metallic cyanides to form the corresponding nitric, an inorganic salt, and gaseous nitrogen. Diazo alkanes, however, are much less subject to addition of a base like cyanide. Azo alkanes, azo aromatic compounds, and hydrazine and its derivatives do not appear to react with metallic cyanides (56, 61, 63).</p>
8 + 12	<p><i>Azo Compounds + Dithiocarbamates</i></p> <p>Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.</p>
8 + 13	<p><i>Azo Compounds + Esters</i></p> <p>Aliphatic diazo compounds, especially diazomethane, are extremely reactive as alkylating agents and may react with esters in some manner to yield heat. The reaction, however, is not substantiated in the literature reviewed. Aromatic diazo and azo compounds do not appear to undergo potentially hazardous reactions with ester (56, 63).</p>
8 + 17	<p><i>Azo Compounds + Halogenated Organics</i></p> <p>Aliphatic diazo compounds can act as nucleophiles in substituting for the halogen in aliphatic halogenated organics. Nitrogen gas is evolved from such a reaction. Although hydrazines are relatively weak nucleophiles, they can react with primary and some secondary halides with some heat generated (44, 63).</p>
8 + 18	<p><i>Azo Compounds + Isocyanates</i></p> <p>Isocyanates are susceptible to nucleophilic attack at the carbon and can consequently react with diazo alkanes in this manner. Gaseous nitrogen can result. Hydrazines may also attack the carbon but with less vigor (63).</p>
8 + 19	<p><i>Azo Compounds + Ketones</i></p> <p>Although ketones are not as reactive as aldehydes with diazo alkanes, alkylation can occur with water as a catalyst releasing nitrogen gas. Electrophilic substitution of quinones can occur with aromatic dizonium cations yielding nitrogen gas. Although hydrazines form hydrazines with ketones, the reaction requires heating (44, 63).</p>
8 + 20	<p><i>Azo Compounds + Mercaptans</i></p> <p>Aromatic diazonium salts can form thioethers with mercaptans resulting in evolution of nitrogen gas. Aliphatic diazo compounds may undergo the same reaction (56, 63).</p>
8 + 21	<p><i>Azo Compounds + Alkali and Alkaline Earth Metals</i></p> <p>Molecules which react with these metals are characterized by having centers of high electron density which can induce a localized positive charge in the metal. The subsequent electron transfer is highly exothermic. The compounds in Group 8 all have centers of high electron density in the nitrogen and in the <math>\alpha</math>-carbon in the case of diazo alkanes. The reaction of these compounds with the active metals of Group 21 can thus be very exothermic and may produce hydrogen or nitrogen, or both (68).</p>
8 + 22	<p><i>Azo Compounds + Metal Powders</i></p> <p>Due to the high surface area of these forms of metals and the high flammability of hydrazine and some of its organic derivatives, a combination of these substances in air can result in spontaneous ignition. Toxic nitrogen oxide fumes can be formed. Diazo alkanes polymerize very readily in the presence of copper and other metal powders releasing much heat (36, 56).</p>
8 + 23	<p><i>Azo Compounds + Metal Sheets, Rods, Drops, etc.</i></p> <p>Hydrazine and some of its organic derivatives can inflame on contact with surfaces of metals in forms of sheets, rods, drops, etc. (36).</p>
8 + 25	<p><i>Azo Compounds + Nitrides</i></p> <p>Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.</p>
8 + 30	<p><i>Azo Compounds + Organic Peroxides</i></p> <p>Hydrazones are explosively oxidized by organic peroxides and hydroperoxides yielding toxic nitrogen oxide fumes. Diazo compounds may form more unstable peroxides with hydroperoxides. Organic peroxides and azo compounds are both relatively sensitive to homolytic fission by heat or light. Any situation where either factor is applied to this mixture might result in extremely fast and exothermic free radical reactions (44, 56, 63).</p>
8 + 31	<p><i>Azo Compounds + Phenols and Cresols</i></p> <p>Aromatic and aliphatic diazo compounds react readily with phenols and cresols forming ethers and nitrogen gas and releasing heat (63).</p>
8 + 32	<p><i>Azo Compounds + Organophosphates</i></p> <p>Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.</p>

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
8 + 33	<i>Azo Compounds + Sulfides</i> Addition of diazonium salts to solutions of sodium sulfides, bisulfides, and polysulfides results in explosions even at 8°C.
8 + 34	<i>Azo Compounds + Epoxides</i> Since epoxides are very susceptible to ring cleavage and polymerization by acidic or basic reagents, such reactions are possible with diazonium compounds and hydrazines. In the case of the diazonium compounds, attack of the aryl cation could occur on the oxygen with evolution of nitrogen gas and heat. Hydrazines can act as bases in attacking one of the ring carbons releasing heat. Being strong nucleophiles, diazo alkanes may also cleave the ring at a carbon with generation of heat and nitrogen gas (56, 63).
8 + 102	<i>Azo Compounds + Explosives</i> Aliphatic and aromatic diazo compounds and hydrazines are extremely reactive and can undergo numerous interactions with explosives. Any heat or shock generated can detonate the mixture (41).
8 + 103	<i>Azo Compounds + Polymerizable Compounds</i> The diazonium ion can act as a Lewis acid in catalyzing various cationic polymerization. Diazo alkanes are very strong nucleophiles and may add to double bond systems to initiate polymerization. All of the monomers listed in Group 103 may be susceptible to polymerization in combination with diazo alkanes. Hydrazines may be basic enough to catalyze anionic polymerization in combination with diazo alkanes. Hydrazines may be basic enough to catalyze anionic polymerization (39, 43, 62).
8 + 104	<i>Azo Compounds + Oxidizing Agents</i> Exhaustive oxidation of azo, diazo, and hydrazines with these strong oxidizing agents can result in extreme heat generation and evolution of toxic nitrogen oxide fumes. Hydrazines can react with explosive (41).
8 + 105	<i>Azo Compounds + Reducing Agents</i> Various reactions producing much heat and evolving nitrogen gas can result from a combination of diazonium compounds and these strong reducing agents. Diazo alkanes are so reactive that they may produce any number of products upon reaction with these compounds. Extreme heat evolution is very probable (63).
8 + 106	<i>Azo Compounds + Water and Miscellaneous Aqueous Mixtures</i> Both diazo alkanes and diazo aromatic liberate nitrogen gas upon reaction with water (63).
8 + 107	<i>Azo Compounds + Water Reactives</i> See Combination 1 + 107.
9 + 10	<i>Carbamates + Caustics</i> Alkaline hydrolysis of carbamates generally yield heat, amines, and carbon dioxide by spontaneous decomposition of <i>N</i> -alkyl or <i>N</i> -aryl carbamic acid (57).
9 + 21	<i>Carbamates + Alkali and Alkaline Earth Metals</i> These metals are very susceptible to reaction with compounds containing centers of high electron density. An oxidizing reaction can occur by an induced positive charge on the metal. The electron transfer is very energetic and may result in fire from formation of hydrogen gas (68).
9 + 22	<i>Carbamates + Metal Powders, Vapors, or Sponges</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
9 + 25	<i>Carbamates + Nitrides</i> Since nitrides are extremely strong bases, they can easily extract the <i>N</i> -protons from carbamates forming flammable ammonia gas and initiating decomposition to various nitrogen containing products (55).
9 + 30	<i>Carbamates + Organic Peroxides</i> Selective oxidation may occur at double bonded nitrogen sites with some heat generated. Exhaustive oxidation, however, can liberate toxic nitrogen oxide fumes with much heat. Initial reaction may cause decomposition of the more unstable peroxides (41).
9 + 104	<i>Carbamates + Acidizing Agents</i> Exhaustive oxidation of carbamates can result in extreme heat generation and formation of toxic nitrogen oxide fumes (41).
10 + 13	<i>Caustics + Esters</i> Esters are easily hydrolyzed by caustics to a salt and alcohol with heat generation (58).
10 + 17	<i>Caustics + Halogenated Organics</i> Aliphatic halides can undergo substitution or dehydrohalogenation upon treatment with strong caustics. Both processes involve some heat generation while the second evolves flammable olefins and acetylenes especially with the lower molecular weight compounds. Halogenated aromatics, however, are relatively stable to strong caustics (49, 58).
10 + 18	<i>Caustics + Isocyanates</i> Caustics catalyze the polymerization of diisocyanates yielding much heat. The mono isocyanates decompose to amines and carbon dioxide (56, 63).
10 + 19	<i>Caustics + Ketones</i> Caustics can catalyze the self-condensation of ketones yielding heat (58).
10 + 21	<i>Caustics + Alkali and Alkaline Earth Metals</i> Heat and flammable hydrogen gas can be generated due to the aqueous nature of most caustics (36, 39).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
10 + 22	<i>Caustics + Metal Powders, Vapors, and Sponges</i> Heat and flammable hydrogen gas may be generated with some metals such as aluminum, magnesium, zinc, and beryllium. Explosions may also occur due to the high surface area of these forms (32, 55).
10 + 23	<i>Caustics + Metal Sheets, Rods, Drops, etc.</i> Heat and flammable hydrogen gas are liberated upon dissolution of these metals in caustics. The reaction, however, is much slower than those in Combination 10 + 22 (55).
10 + 24	<i>Caustics + Toxic Metals</i> Many toxic metals and metal compounds are soluble in caustics, that is, $PbCO_3$ , $PbCrO_4$ , $Cd(CN)_2$ , $As_2O_3$ , $AsF_5$ , $AgCrO_4$ , $ZuCO_3$ , $Zn(CN)_2$ (59).
10 + 25	<i>Caustics + Nitrides</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
10 + 26	<i>Caustics + Nitriles</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
10 + 27	<i>Caustics + Nitro Compounds</i> Nitro alkanes and caustics from salts in the presence of water. The dry salts are explosive (36).
10 + 32	<i>Caustics + Organophosphates</i> Alkaline hydrolysis of phosphorothioates can generate enough heat to cause explosive rearrangement from the thiono to the thio form. Hydrolysis of other organophosphates can generate heat (64).
10 + 34	<i>Caustics + Epoxides</i> Base catalyzed cleavage can result in polymerization with much heat (58).
10 + 102	<i>Caustics + Explosives</i> Alkaline hydrolysis of other reactions can generate enough heat to detonate these compounds (41).
10 + 103	<i>Caustics + Polymerizable Compounds</i> These compounds can undergo anionic polymerization with caustics as initiators yielding much heat (43, 62).
10 + 107	<i>Caustics + Water Reactives</i> See Combination 1 + 107.
11 + 17	<i>Cyanides + Halogenated Organics</i> Nucleophilic substitution can result in some heat with formation of nitriles (58).
11 + 18	<i>Cyanides + Isocyanates</i> Cyanide solution can cause decomposition of isocyanates yielding heat and carbon dioxide. This decomposition is due to the water as well as the basic character of cyanide anion (63).
11 + 19	<i>Cyanides + Ketones</i> Some heat may be evolved from the formation of cyanohydrins with alkaline cyanide solution (63).
11 + 21	<i>Cyanides + Alkali and Alkaline Earth Metals</i> Hydrogen cyanide can react with these metals to yield heat and flammable hydrogen gas (55).
11 + 25	<i>Cyanides + Nitrides</i> Hydrogen cyanides and nitrides may react to form flammable ammonia gas (55).
11 + 30	<i>Cyanides + Organic Peroxides</i> Metal cyanides and hydrogen cyanide are readily oxidized and may react explosively with these organic peroxides, and hydroperoxides. Toxic nitrogen oxide fumes can result (32, 43).
11 + 34	<i>Cyanides + Epoxides</i> Due to its basicity in aqueous solution, ring cleavage can occur with heat generation and possible polymerization of the epoxides (58).
11 + 104	<i>Cyanides + Oxidizing Agents</i> Metal cyanides and hydrogen cyanides are readily oxidized. Toxic nitrogen oxide fumes may be produced (32, 63).
11 + 107	<i>Cyanides + Water Reactives</i> See Combination 1 + 107.
12 + 18	<i>Dithiocarbamates + Isocyanates</i> A reaction involving the disulfide group and the isocyanate group may be possible. However, there is little evidence in the literature reviewed to substantiate this reaction.
12 + 21	<i>Dithiocarbamates + Alkali and Alkaline Earth Metals</i> Due to the high electron density about the disulfide group a reaction may occur between these two groups of compounds yielding heat and toxic fumes. However, substantiation is scarce in the literature reviewed (68).
12 + 30	<i>Dithiocarbamates + Peroxides</i> Oxidation can result in heat generation and formation of toxic oxides of nitrogen and sulfur (41).
12 + 34	<i>Dithiocarbamates + Polymerizable Compounds</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
12 + 104	<i>Dithiocarbamates + Strong Oxidizing Agents</i> Oxidation can result in heat generation and formation of toxic nitrogen oxides and sulfur oxides (41).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
12 + 106	<i>Dithiocarbamates + Water</i> Extremely flammable and toxic carbon disulfide may be generated (64).
12 + 107	<i>Dithiocarbamates + Water Reactives</i> See Combination 1 + 107.
13 + 21	<i>Esters + Alkali and Alkaline Earth Metals</i> The <i>a</i> -hydrogens can be easily scavenged by these metals yielding hydrogen gas and heat (68).
13 + 25	<i>Esters + Nitrides</i> Nitrides can attack the <i>a</i> -hydrogens forming flammable ammonia gas and generating heat. The transition metal nitrides, however, are chemically very inert (55).
13 + 102	<i>Esters + Explosives</i> Esters may form highly oxygenated compounds with some of these explosives (metal nitrates) to form even more unstable compounds. They may react exothermically with others to cause explosive decomposition and yield extremely toxic fumes (32, 41).
13 + 104	<i>Esters + Strong Oxidizers</i> Vigorous oxidation of the hydrocarbon moiety can occur yielding much heat (41).
13 + 105	<i>Esters + Strong Reducing Agents</i> See Combination 13 + 21.
14 + 104	<i>Ethers + Strong Oxidizers</i> These compounds can react violently upon contact yielding much heat and causing ignition and explosions (32).
14 + 107	<i>Ethers + Water Reactives</i> See Combination 1 + 107.
15 + 107	<i>Fluorides + Water Reactives</i> See Combination 1 + 107.
16 + 104	<i>Aromatic Hydrocarbons + Strong Oxidizing Agents</i> Violent reactions can occur between these types of compounds resulting in heat and fire (41).
17 + 20	<i>Halogenated Organics + Mercaptans</i> Alkyl halides and mercaptans can react to form thioethers with some heat generation (44).
17 + 21	<i>Halogenated Organics + Alkali and Alkaline Earth Metals</i> Halogenated organics, especially alkyl halides form explosive mixtures with alkali and alkaline earth metals (32).
17 + 22	<i>Halogenated Organics + Metal Powders, Vapors, or Sponges</i> Metals in these forms are highly reactive and can result in violent reactions on contact with halogenated hydrocarbons. Explosions can occur with aluminum, magnesium, zinc, zirconium, and their alloys in combination with alkyl halides (32).
17 + 23	<i>Halogenated Organics + Metal Sheets, Rods, Drops, etc.</i> Aluminum and magnesium in bulk forms are especially reactive with halogenated hydrocarbons releasing much heat. The formation of the metal halide catalyzes further decomposition of the metals. Fire and explosions may occur (32).
17 + 25	<i>Halogenated Organics + Nitrides</i> Substitution can occur yielding heat. However, generation of ammonia gas will be more likely (44, 55).
17 + 30	<i>Halogenated Organics + Organic Peroxides</i> Peroxides and hydroperoxides generate radicals which can initiate chain decomposition of alkyl halides. Such a reaction can be explosively violent with the more reactive peroxides (65).
17 + 104	<i>Halogenated Organics + Oxidizing Agents</i> Halogenated organics can be easily oxidized by these compounds yielding heat and toxic and corrosive hydrocarbon halide fumes (41).
17 + 105	<i>Halogenated Organics + Reducing Agents</i> Boranes are known to form explosive mixtures with alkyl halides. See also Combination 17 + 21 (36).
17 + 107	<i>Halogenated Organics + Water Reactives</i> See Combination 1 + 107.
18 + 20	<i>Isocyanates + Mercaptans</i> Mercaptans may add to isocyanates yielding some heat. Diisocyanates and dimercaptans may polymerize with much heat generated (63, 72).
18 + 21	<i>Isocyanates + Alkali and Alkaline Earth Metals</i> These metals can abstract the <i>a</i> -hydrogens from aliphatic isocyanates to yield hydrogen gas. The isocyanate group may also induce sufficient charge separation in the metals to cause exothermic transfer of electrons (32).
18 + 22	<i>Isocyanates + Metal Powders, Vapors and Sponges</i> The most highly reactive of these metals such as aluminum, magnesium, zinc, zirconium, and their alloys abstract the labile <i>a</i> -hydrogens from the alkyl isocyanates to yield hydrogen gas. Decomposition of the isocyanate group is also possible.
18 + 25	<i>Isocyanates + Nitrides</i> Little information is available in the literature reviewed. Reaction of these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
18 + 30	<i>Isocyanates + Organic Peroxides</i> Isocyanates may form peroxy carbamates with hydroperoxides which in turn can decompose yielding carbon dioxide and free radicals upon slight heating. Peroxides may form carbamates with slight heating. Peroxides may form carbamates with isocyanates yielding some heat. In both cases, the radicals have to be generated pyrolytically or by metal catalysts for these reactions to occur. Contaminants and heat of solution may be sufficient to generate radicals in wastes (65).
18 + 31	<i>Isocyanates + Phenols and Cresols</i> Isocyanates and phenols can combine to form carbamic esters yielding some heat. With multifunctional isocyanates and phenols, polymerization can result yielding much heat. This reaction is especially catalyzed by metal compounds (63).
18 + 33	<i>Isocyanates + Sulfides</i> If sulfide salts are soluble in isocyanates, attack may occur at the carbonyl forming a thiocarbamate and yielding heat. If the sulfides are in aqueous solution, the isocyanates will react preferentially with the water and decompose yielding carbon dioxide (63).
18 + 104	<i>Isocyanates + Oxidizing Agents</i> Exhaustive oxidation of isocyanates can yield heat, fire, and toxic fumes of nitrogen oxides (41).
18 + 105	<i>Isocyanates + Strong Reducing Agents</i> See Combinations 18 + 21 and 18 + 33. Other reducing agents may react in a similar manner.
18 + 106	<i>Isocyanates + Water</i> Isocyanates form carbamic acid with water which decompose immediately to carbon dioxides yielding some heat.
18 + 107	<i>Isocyanates + Water Reactives</i> See Combination 1 + 107.
19 + 20	<i>Ketones + Mercaptans</i> Ketones and mercaptans can form gem-hydroxy thioethers yielding some heat (73).
19 + 21	<i>Ketones + Alkali and Alkaline Earth Metals</i> These metals can readily abstract the labile $\alpha$ -hydrogens forming flammable hydrogen gas and heat (68).
19 + 25	<i>Ketones + Nitrides</i> Nitrides which are somewhat soluble in ketones, may generate flammable ammonia gas upon reaction with the labile $\alpha$ -hydrogens of the ketones. Various other reactions can also generate heat (55).
19 + 30	<i>Ketones + Peroxides and Hydroperoxides</i> Peroxides and ketones may form diperoxides which can decompose with slight increase in temperature or in the presence of water. Hydroperoxides are also formed by this interaction. Hydroperoxides form hydroperoxides and diperoxides with ketones. Many of the reaction products as well as the peroxy reactants are extremely sensitive to heat and shock (65).
19 + 104	<i>Ketones + Strong Oxidizing Agents</i> Exhaustive oxidation can generate much heat and ignite the mixture (41).
19 + 105	<i>Ketones + Strong Reducing Agents</i> See Combination 19 + 21. Other reducing agents may also react with ketones in the same manner.
19 + 107	<i>Ketones + Water Reactives</i> See Combination 1 + 107.
20 + 21	<i>Mercaptans + Alkali and Alkaline Earth Metals</i> These active metals can easily abstract the sulfhydryl hydrogen to form flammable hydrogen gas and the mercaptide with heat (62).
20 + 22	<i>Mercaptans + Metal Powders, Vapors or Spumes</i> Metals in these forms can react with mercaptans to form flammable hydrogen gas, and mercaptides with heat. Aluminum, beryllium, magnesium, zinc, and zirconium are especially reactive in this manner (32, 61).
20 + 25	<i>Mercaptans + Nitrides</i> Nitrides which are soluble in mercaptans, may form ammonia gas with heat generation (55, 73).
20 + 30	<i>Mercaptans + Organic Peroxides</i> The sulfhydryl hydrogen can be easily abstracted by radicals produced from the decomposition of peroxides and hydroperoxides. The resulting chain reaction can be highly exothermic. The lower molecular weight peroxy compounds are extremely unstable and explosions can occur (57, 61).
20 + 34	<i>Mercaptans + Epoxides</i> Mercaptans may cleave epoxides with heat generation. Difunctional mercaptans may polymerize with epoxides in this manner yielding much heat (58).
20 + 104	<i>Mercaptans + Oxidizing Agents</i> Exhaustive oxidation can result in much heat generation and formation of toxic sulfur oxide fumes (41).
20 + 105	<i>Mercaptans + Reducing Agents</i> See Combination 20 + 21. Other strong reducing agents may react in the same manner generating hydrogen.
20 + 107	<i>Mercaptans + Water Reactives</i> See Combination 1 + 107.

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
21 + 25	<i>Alkali and Alkaline Earth Metals + Nitrides</i> Many nitrides are explosively unstable and may react violently with these extremely reactive metals (32).
21 + 26	<i>Alkali and Alkaline Earth Metals + Nitriles</i> These metals can abstract the labile $\alpha$ -hydrogen to yield flammable hydrogen gas and heat. Polymerization may be initiated in this manner yielding much heat (68).
21 + 27	<i>Alkali and Alkaline Earth Metals + Nitro Compounds</i> Aliphatic nitro compounds have labile $\alpha$ -hydrogens which can easily be extracted by these active metals. The resulting alkali or alkaline earth metal salts are highly unstable to heat and shock and may be detonated by the heat of reaction. The redox reaction between aromatic nitro compounds and these metals can be highly exothermic (63).
21 + 30	<i>Alkali and Alkaline Earth Metals + Organic Peroxides</i> The redox reaction can be explosively exothermic (36, 41).
21 + 31	<i>Alkali and Alkaline Earth Metals + Phenols and Cresols</i> Flammable hydrogen gas can be liberated by abstraction of the phenolic hydrogen. The heat of reaction may ignite the gas (58).
21 + 32	<i>Alkali and Alkaline Earth Metals + Organophosphates</i> The high electron density of the organophosphate group can initiate a reaction with these active metals resulting in exothermic transfer of electrons from the metals. In the case of phosphorothioates and phosphorodithioate this heat of reaction may be sufficient to cause explosive rearrangement from the thiono to the thio form. Parathion and methyl parathion are especially sensitive to heat (64, 68).
21 + 101	<i>Alkali and Alkaline Earth Metals + Combustible Materials</i> Many of these miscellaneous materials may contain various substances such as water which are extremely reactive with the active metals. Heat and various hazardous gases may be evolved. Enough heat may be evolved to ignite the materials if air or some other source of oxygen is present.
21 + 102	<i>Alkali and Alkaline Earth Metals + Explosives</i> Many explosives are highly oxygenated and will react on contact with these active metals with explosive violence. These active metals can also react exothermically with the other unstable compounds to cause detonation.
21 + 103	<i>Alkali and Alkaline Earth Metals + Polymers</i> Radicals from these metals readily attack unsaturated carbons and can initiate polymerization of many of the compounds in Group 103 (74).
21 + 104	<i>Alkali and Alkaline Earth Metals + Oxidizing Agents</i> Alkali and alkaline earth metals are extremely effective reducing agents. They will react violently with oxidizing agents evolving much heat, and resulting in fires and explosions (41).
21 + 106	<i>Alkali and Alkaline Earth Metals + Water</i> These metals and alloys of these metals react violently (explosively for Rb and Cs) with water evolving flammable hydrogen gas and resulting in formation of strong caustics. Enough heat can be generated to cause ignition (41).
21 + 107	<i>Alkali and Alkaline Earth Metals + Water Reactives</i> See Combination 1 + 107.
22 + 28	<i>Metal Powders + Unsaturated Aliphatics</i> Finely divided metals, especially copper and silver, can form acetylides with acetylenes. These acetylides are very sensitive to shock and heat and can regenerate flammable acetylene upon contact with water (41).
22 + 30	<i>Metal Powders + Organic Peroxides</i> Diacyl peroxides and ozonides are particularly reactive with metals in these forms. They can decompose violently yielding heat and various gases. The peroxy acids are especially strong oxidizing agents and can produce much heat upon reaction with these metals. Other peroxy compounds may decompose violently upon contact yielding oxygen (39, 65).
22 + 34	<i>Metal Powders + Epoxides</i> The metal oxide coating of these finely divided particles can catalyze ring opening and polymerization with much heat evolved (74).
22 + 102	<i>Metal Powders + Explosives</i> Many of these unstable compounds are extremely vigorous oxidizing agents and can react explosively with the metals (41).
22 + 103	<i>Metal Powders + Polymerizable Compounds</i> The oxide coatings of these metals can catalyze the polymerization of the monomers in Group 102. See also Combination 22 + 30. Much heat can be evolved (74).
22 + 104	<i>Metal Powders + Oxidizing Agents</i> These metals are readily oxidized by the substances in Group 104 yielding much heat. Fires and explosions can also result (41).
22 + 106	<i>Metal Powders + Water</i> Some of these metals evolve flammable hydrogen gas with some heat on contact with water. In enclosed areas explosions can occur (43).
22 + 107	<i>Metal Powders + Water Reactives</i> See Combination 1 + 107.

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
23 + 103	<i>Metal Sheets, etc. + Polymerizable Compounds</i> Polymerization may be catalyzed by these metal surfaces yielding much heat. Although not as reactive as Group 22, chunks or containers made of these metals may be reactive enough to initiate polymerization (36).
23 + 104	<i>Metal Sheets, etc. + Oxidizing Agents</i> These metals can react vigorously with oxidizing agents generating heat and possible resulting in fires (36).
23 + 107	<i>Metal Sheets, etc. + Water Reactives</i> See Combination 1 + 107.
24 + 26	<i>Toxic Metals + Nitriles</i> Acetonitrile and ethylene cyanohydrin are used as nonaqueous solvents for many inorganic salts (39).
24 + 30	<i>Toxic Metals + Organic Peroxides</i> Many metal salts can catalyze the decomposition of organic peroxides and hydroperoxides yielding heat and various gases such as oxygen and carbon dioxide. Diacyl peroxides are especially susceptible to explosive decomposition in the presence of heavy metals and metal salts. Hydroperoxides are more stable than diacyl peroxides but do undergo similar reactions with these metals (65, 74).
24 + 34	<i>Toxic Metals + Epoxides</i> Polymerization of epoxides, especially ethylene oxide and propylene oxide, can be initiated by Lewis acids such as SnCl <sub>4</sub> , ZnCl <sub>2</sub> , SbCl <sub>5</sub> , ZrCl <sub>4</sub> , CrCl <sub>3</sub> , CoCl <sub>2</sub> , and HgCl <sub>2</sub> . Organometallic zinc compounds can also initiate much heat (74).
24 + 102	<i>Toxic Metals + Explosives</i> These various metal salts may react exothermically with explosives to cause detonation. Much of this reactivity is associated with the anion rather than the metal cation.
24 + 103	<i>Toxic Metals + Polymers</i> See Combination 24 + 34. Vinyl monomers and dienes are susceptible to cationic polymerization by Lewis acid catalysts such as SnCl <sub>4</sub> , SnBr <sub>4</sub> , SbCl <sub>5</sub> , and AlCl <sub>3</sub> . Although a co-catalyst such as H <sub>2</sub> O, or HCl is required, only trace amounts need be present (62, 74).
24 + 106	<i>Toxic Metals + Water</i> Some of these compounds are very soluble in water. See the specific compounds for solubilities (59).
24 + 107	<i>Toxic Metals + Water Reactives</i> See Combination 1 + 107.
25 + 26	<i>Nitrides + Nitriles</i> If the ionic nitrides are soluble in aliphatic nitriles, they can extract the $\alpha$ -hydrogens from the nitriles to form flammable ammonia gas. Some heat can be evolved (55, 63).
25 + 27	<i>Nitrides + Nitro Compounds</i> If soluble, nitrides can extract a hydrogen from aliphatic nitro compounds to yield flammable ammonia gas and heat. Many polynitrated aromatics and ionic nitrides are unstable to heat and shock. However, the nitrides are much more unstable and may initiate the explosive decomposition of such nitro compounds (36, 63).
25 + 30	<i>Nitrides + Organic Peroxides</i> On combination with hydroperoxides, nitrides can abstract the peroxy hydrogen and initiate the decomposition with generation of ammonia. The anion formed can further decompose upon reaction with more hydroperoxides to yield oxygen gas. This decomposition can proceed with fire and explosions. Some hydroperoxides may form relatively stable salts, however, these salts can decompose violently upon heating. Ammonia gas can also be formed with peroxides due to abstraction of hydrogen on the peroxy carbon. The peroxide then undergoes homolytic fission with some heat evolved. Nitrides and the lower molecular weight peroxides are both extremely unstable (65).
25 + 31	<i>Nitrides + Phenols and Cresols</i> Flammable ammonia gas can be formed from the acid-base reaction of the aromatic hydroxy group and ionic nitrides also yielding heat (55).
25 + 34	<i>Nitrides + Epoxides</i> Base catalyzed ring opening initiating polymerization of epoxides can occur with nitrides. Much heat can be evolved (58).
25 + 101	<i>Nitrides + Combustible Materials</i> Many of these miscellaneous mixtures may also contain water which will form ammonia gas with nitrides. Moreover, since nitrides are also pyrophoric, any air present can initiate combustion (36, 55).
25 + 102	<i>Nitrides + Explosives</i> Ionic nitrides are pyrophoric and extremely sensitive to shock and heat. They can act as initiating explosives for many of the high explosives listed in Group 102.
25 + 103	<i>Nitrides + Polymerizable Compounds</i> Ionic nitrides may initiate anionic polymerization of vinyl monomers and dienes yielding much heat. See also Combination 25 + 34.
25 + 104	<i>Nitrides + Oxidizing Agents</i> Ionic nitrides are pyrophoric and can inflame or explode on contact with strong oxidizing agents (36, 41).
25 + 106	<i>Nitrides + Water</i> Ionic nitrides are easily hydrolyzed to caustic and flammable ammonia gas (55).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
25 + 107	<i>Nitriles + Water Reactives</i> See Combination 1 + 107.
26 + 30	<i>Nitriles + Organic Peroxides</i> Amyl nitriles such as phenyl acetonitrile are converted to peroxyesters and hydrogen cyanide gas upon treatment with hydroperoxides. The polymerization of acrylonitriles can be initiated by organic peroxides. Dibenzoyl peroxide is widely used for this purpose. Upon exhaustive oxidation with peroxy acids, much heat and toxic nitrogen oxide fumes can be evolved (41, 65, 74).
26 + 104	<i>Nitriles + Oxidizing Agents</i> Exhaustive oxidation can result in evolution of heat and toxic fumes of nitrogen oxides, and ignition (36, 41).
26 + 105	<i>Nitriles + Reducing Agents</i> Nitriles are readily reduced by metal hydrides, especially $\text{LiAlH}_4$ , yielding much heat. Hydrogen gas can also be evolved from the abstraction of the labile $\alpha$ -hydrogens.
26 + 107	<i>Nitriles + Water Reactives</i> See Combination 1 + 107.
27 + 104	<i>Nitro Compounds + Oxidizing Agents</i> Many nitro compounds can decompose explosively. Strong oxidizing agents can catalyze this decomposition by oxidizing the hydrocarbon moiety. Shock-sensitive salts can also form, which when dry, can decompose explosively (36, 41).
27 + 105	<i>Nitro Compounds + Reducing Agents</i> The labile $\alpha$ -hydrogens of nitro aliphates can be extracted and evolved as flammable hydrogen gas with some heat (63, 68).
27 + 107	<i>Nitro Compounds + Water Reactives</i> See Combination 1 + 107.
28 + 30	<i>Unsaturated Aliphatics + Organic Peroxides</i> Olefinic hydrocarbons are susceptible to oxidation by peroxy acids to epoxides and glycol ester. The reaction may evolve some heat. Alkyl and aryl peroxides attack olefins by a free radical mechanism sometimes resulting in highly exothermic polymerizations. Aryl peroxides also participate in a free radical reaction with olefins, but attack can occur at the allylic methylene or the double bond. In either case, polymeric hydrocarbons result. Acetylenic hydrocarbons undergo similar reactions, but rates are much slower (65).
28 + 104	<i>Unsaturated Aliphatics + Strong Oxidizer</i> Exhaustive oxidation can result in ignition of the hydrocarbons (41).
28 + 107	<i>Unsaturated Hydrocarbons + Water Reactive</i> See Combination 1 + 107.
29 + 104	<i>Saturated Aliphatics + Oxidizing Agents</i> These hydrocarbons can be easily oxidized to yield heat and may ignite (41).
29 + 107	<i>Saturated Aliphatics + Water Reactives</i> See Combination 1 + 107.
30 + 31	<i>Organic Peroxides + Phenols and Cresols</i> Some heat may be evolved from the oxidation of phenols and cresols to quinones and from free radical substitution on the aromatic ring. These oxidations are greatly enhanced by the presence of metal ions (65, 75).
30 + 32	<i>Organic Peroxides + Organophosphates</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
30 + 33	<i>Organic Peroxides + Sulfides</i> Inorganic sulfides may be oxidized to toxic sulfur dioxide by these organic peroxides. The metal ions may also catalyze the decomposition of the more unstable peroxides and hydroperoxides yielding gas and heat (41, 65).
30 + 34	<i>Organic Peroxides + Epoxides</i> Hydroperoxides are known to cleave epoxide rings by nucleophilic attack of the peroxy anion. Some heat may be evolved, but there is no evidence of polymerization. Polymerization can occur with a combination of peroxides and allylic epoxides by a free radical mechanism (65, 76).
30 + 101	<i>Organic Peroxides + Combustible Materials</i> Many of these materials are susceptible to oxidation by organic peroxides and can evolve toxic gases. Heat and fire can also result (41).
30 + 102	<i>Organic Peroxides + Explosives</i> If these explosives are not detonated upon contact with organic peroxides, the mixture can be extremely unstable and sensitive to any shock or slight heating (41).
30 + 103	<i>Organic Peroxides + Polymerizable Compounds</i> Olefinic bonds are particularly susceptible to attack by free radicals generated from organic peroxides and hydroperoxides. The polymerization of vinyl, acrylic, and olefinic monomers listed in Group 103 can be initiated by these radicals with heat generated (74).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
30 + 104	<i>Organic Peroxides + Oxidizing Agents</i> Strong oxidizing agents can cause violent decomposition of organic peroxides and hydroperoxides yielding heat and oxygen or carbon dioxide. The decomposition can be catalyzed by the metallic character as well as the oxidizing properties of these compounds (41, 65).
30 + 105	<i>Organic Peroxides + Reducing Agents</i> These compounds can react explosively (41).
30 + 107	<i>Organic Peroxides + Water Reactives</i> See Combination 1 + 107.
31 + 34	<i>Phenols and Cresols + Epoxides</i> Epoxides may be cleaved by phenols and cresols in the presence of traces of acid or base. Some heat can be evolved. Polymerization is possible (58).
31 + 103	<i>Phenols and Cresols + Polymerizable Compounds</i> See Combinations 18 + 31 and 31 + 34.
31 + 104	<i>Phenols and Cresols + Oxidizing Agents</i> Mild oxidation can yield ketones, carboxylic acids, and carbon dioxide with some heat. Exhaustive oxidation can yield much more heat and possibly fire (41, 77).
31 + 105	<i>Phenols and Cresols + Reducing Agents</i> See Combination 21 + 31. The phenolic hydrogen is readily extracted by reducing agents, especially hydrides to yield flammable hydrogen gas and heat (78).
31 + 107	<i>Phenols and Cresols + Water Reactives</i> See Combination 1 + 107.
32 + 34	<i>Organophosphates + Epoxides</i> Little information is available in the literature reviewed. Reaction between these two groups may produce hazardous conditions. It is recommended that mixing be avoided pending laboratory assessment of safety.
32 + 104	<i>Organophosphates + Oxidizing Agents</i> Exhaustive oxidation of these organophosphorous compounds can yield toxic and corrosive fumes of oxides of phosphorous, sulfur, and nitrogen with heat (41, 79).
32 + 105	<i>Organophosphates + Reducing Agents</i> The phosphothioates and phosphodithioates can evolve toxic and flammable hydrogen sulfide upon reduction. See Combination 21 + 32 (79).
32 + 107	<i>Organophosphates + Water Reactives</i> See Combination 1 + 107.
33 + 34	<i>Sulfides + Epoxides</i> Soluble sulfides can cleave epoxides by a nucleophilic attack, possibly initiating polymerization and yielding much heat (39, 58).
33 + 102	<i>Sulfides + Explosives</i> Sulfides are strong reducing agents and can react explosively with the highly oxygenated compounds in Group 102.
33 + 103	<i>Sulfides + Polymerizable Compounds</i> Soluble sulfides may initiate anionic polymerization with some heat generated. See Combination 33 + 34.
33 + 104	<i>Sulfides + Oxidizing Agents</i> Sulfides are strong reducing agents and can react violently with oxidizing agents yielding toxic fumes of sulfur dioxide and heat (41).
33 + 106	<i>Sulfides + Water</i> Toxic and flammable hydrogen sulfide gas can be generated (41).
33 + 107	<i>Sulfides + Water Reactives</i> See Combination 1 + 107.
34 + 102	<i>Epoxides + Explosives</i> The lower molecular weight epoxides are extremely flammable and can react explosively with the highly oxygenated members of Group 102 (41).
34 + 104	<i>Epoxides + Oxidizing Agents</i> Exhaustive oxidation can result in heat and ignition of the flammable epoxides (41).
34 + 105	<i>Epoxides + Reducing Agents</i> Reductive cleavage of epoxides occurs readily with metal hydrides and other agents yielding much heat. See Combination 21 + 34 (80).
34 + 107	<i>Epoxides + Water Reactives</i> See Combination 1 + 107.
101 + 102	<i>Combustibles + Explosives</i> Many of these explosives are very strong oxidizing agents and can react violently with these combustibles. If they do not react immediately, these mixtures may be unstable (41, 42).
101 + 104	<i>Combustibles + Oxidizing Agents</i> Heat, fire, and possibly explosions can result from this combination. Toxic gases can result if the combustible material contains compounds of nitrogen, sulfur, or phosphorous (41).

TABLE A4.1 *Continued*

Reactivity Group No. Combination	Adverse Reaction and Consequences
101 + 105	<i>Combustibles + Reducing Agents</i> These miscellaneous combustibles may contact water which can react with many reducing agents to form flammable hydrogen gas. The reducing agents are also pyrophoric and can ignite the combustibles in the presence of air (41).
101 + 107	<i>Combustibles + Water Reactives</i> See Combination 1 + 107.
102 + 103	<i>Explosives + Polymerizable Compounds</i> Many explosives are strong oxidizing agents and can react explosively with these organic compounds. Many of these monomers such as ethylene oxide, vinyl chloride, butadiene, and others are extremely flammable (36).
102 + 104	<i>Explosives + Oxidizing Agents</i> Extremely sensitive mixtures can result from this combination. The presence of another oxidizing agent can catalyze the decomposition of many of the highly oxygenated explosives. Others such as the nitrides, azides, and carbides are easily oxidized and can react explosively (36, 41).
102 + 105	<i>Explosives + Reducing Agents</i> Since many explosives are strong oxidizing agents, their reaction with reducing agents can be extremely violent (36, 41).
102 + 107	<i>Explosives + Water Reactives</i> See Combination 1 + 107.
103 + 104	<i>Polymerizable Compounds + Oxidizing Agents</i> These monomers are readily combustible organic compounds and can react violently with strong oxidizing agents to yield heat and fire. The halogenated monomers or those containing nitrogen can evolve toxic fumes (36, 41).
103 + 105	<i>Polymerizable Compounds + Reducing Agents</i> Many reducing agents are also widely used as initiators for anionic polymerization. The reaction can yield much heat. Competing reactions may also produce flammable hydrogen gas (41, 62).
103 + 107	<i>Polymerizable Compounds + Water Reactives</i> See Combination 1 + 107.
104 + 105	<i>Oxidizing Agents + Reducing Agents</i> These compounds can react with explosive violence upon contact (41).
104 + 107	<i>Oxidizing Agents + Water Reactives</i> See Combination 1 + 107.
105 + 106	<i>Reducing Agents + Water</i> These strong reducing agents can liberate extremely flammable or toxic gases, or both, such as phosphine, hydrogen sulfide, ammonia, hydrogen, and acetylene upon contact with water. The heat generated can ignite these gases (36, 39, 41).
105 + 107	<i>Reducing Agents + Water Reactives</i> See Combination 1 + 107.
106 + 107	<i>Water + Water Reactives</i> This combination can result in violent reactions evolving flammable or toxic gases, or both, with heat. Often fires and explosions result (36, 39, 41).

## APPENDIX

## (Nonmandatory Information)

## XI. MAJORITY REPORT

X1.1 The thrust of the proposed guide is to identify known incompatibilities. The lack of an incompatible annotation does *not* connote a safe or compatible situation.

X1.2 The proposed guide is a living document. The current information is recognized as being incomplete; and the addition of new data will be accomplished on a biannual basis, as stated in the scope of the document. It is hoped that reviewers and users of this proposed

guide will provide updated information on incompatibilities they have encountered, so that the proposed guide may be updated into a more useful document.

X1.3 The proposed guide is a collation of published data and does not represent the results of round-robin testing. The development of standard test methods was *not* a part of the scope of this proposed guide. Test procedures presented in the referenced literature may vary.

## X2. MINORITY REPORT

X2.1 Reservations about this proposed guide have been expressed in three general areas: (1) Accuracy, (2) Ease of Use, and (3) Lack of Accompanying Experimental Methods.

X2.1.1 *Accuracy*—This proposed guide has predicted no hazard whatsoever for over 50 binary chemical combinations and about a dozen classes of chemicals that were known to be hazardous. All appropriate reference material may not have been thoroughly researched in preparation of this proposed guide.

X2.1.2 *Ease of Use*—This proposed guide is more difficult to use than other charts available due to its classification of chemicals or wastes into as many as seven incompatibility groups. This introduces the possibility of an incompatibility matrix as large as 7 x 7

or 49 separate determinations for one case. This is so cumbersome that human error in manipulating this many pieces of data comes into consideration.

X2.1.3 *Experimental Confirmation*—It is recommended that any estimation of chemical hazard be accompanied by appropriate experimental confirmation. The current U.S. Coast Guard Compatibility Chart\* provides such a procedure, whereas this proposed guide does not.

\*"U.S. Coast Guard Compatibility Chart." *Code of Federal Regulations*, 46 CFR Parts 140-150, revised 50 FR 33019 Aug 16, 1985. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402

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**Appendix C.3**  
**Analytical Methods**

## TESTS AND TEST METHODS FOR HAZARDOUS WASTE

## Inductively Coupled Argon Plasma Spectroscopy/Spectroscopy/6010/A

Abbreviation	Test Name	Test Method	Method Number	Reference
CC Flash	Closed Cup Flash Point	Pensky-Martin Closed Cup Tester	1010	A
		Setaflash Closed Cup Tester	1000	A
DSC	Differential Scanning Calorimetry	Thermal Analysis	Internal procedure	IHDIVNAVSURFWAR CEN/Procedure 3340.52
TCLP	Toxicity Characteristic Leaching Procedure	Extraction procedure	1311	A
FLAA ICAP	Flame Atomic Absorption	Spectroscopy	Internal procedure	7000
GC	Gas Chromatography	Halogenated volatile organics	8010	A
		Nonhalogenated volatile organics	8010	A
		Aromatic volatile organics	8010	A
		Acrolein, acrylonitrile, acetonitrile	8030	A
		Phenols	8040	A
		Phthalate esters	8060	A
		Organochlorine pesticides & PCB's	8080	A
Nitroaromatics & cyclic ketones	8090	A		

## TESTS AND TEST METHODS FOR HAZARDOUS WASTE

## Inductively Coupled Argon Plasma Spectroscopy/Spectroscopy/6010/A

Abbreviation	Test Name	Test Method	Method Number	Reference
		Polynuclear aromatic hydrocarbon	8100	A
		Chlorinated hydrocarbons	8120	A
ICAP	Inductively Coupled Argon Plasma Spectroscopy	Spectroscopy	6010	A

A. Methods listed under Method Number refer to Methods in "Test Methods for Evaluating Solid Waste, SW-846, USEPA II, November 1990."

## ANALYTICAL METHODS

1. The tests for ignitability, corrosivity, reactivity, and TCLP toxicity as defined and described in 40 CFR 261.21 through 261.24.
2. Qualitative test for water reactivity and solubility of liquid wastes:

- a. Scope and application

This method is designed as a qualitative test for the reactivity and solubility of an unknown liquid waste in water. It is designed to be a screening procedure to determine, on a qualitative basis, the reactivity of an unknown waste with water.

- b. Summary of method

A small volume of liquid waste is added to water and the mixture observed for water miscibility, temperature exotherm, precipitation, and gas formation.

- c. Sample handling and preservation

The sample collected for this test should be tested as soon as possible after being collected. The sample should be kept in a closed container to prevent reaction with atmospheric moisture.

- d. Interferences

Certain water-reactive materials may require an induction time, catalyst, or heat before reactions occur.

- e. Apparatus

- Heavy-walled glass test tubes, calibrated at 10 and 20 ml.
- Liquid thermometer or digital thermometers and thermocouple.
- Disposable pipettes, 10-ml volume.

f. Reagents

Distilled water or low turbidity tap water.

g. Procedure

- Pipette 10 ml of water into a test tube. The test tube should be clamped to a support and tilted at a 45° angle.
- The temperature of the water and test solution should be approximately the same. If not, allow both to equilibrate to ambient temperature.
- Slowly add 10 ml of the test sample to the test tube. The liquid should drain down the inside of the test tube and the addition stopped if an immediate reaction occurs.
- Mix the sample with a glass stirring rod and measure the temperature of the mixture.
- Turn the test tube to a vertical position.
- Observe the mixture for liquid/liquid phase separation, gas or solids formation, color, and temperature changes.

h. Report

The report should contain, at a minimum, the following information. Additional comments or other unusual observations should be included.

- Temperature change \_\_\_ °C.
- Gas formation \_\_\_ (yes or no).
- Solubility with water \_\_\_ (complete, partial, insoluble).
- Precipitation \_\_\_ (yes or no).
- Waste density \_\_\_ (>water, <water).
- Other observations \_\_\_\_\_.

3. Test for water in liquid waste by Karl Fischer analysis:

a. Scope and application

This method is for the determination of water in liquid waste. The purpose of the method is to screen liquid samples that may contain high concentrations of water-soluble organic compounds, such as low molecular weight alcohols, ketones, and organic acids. An alternative to the Karl Fischer analysis would be to check the head space of the drum with a portable organic vapor detector for significant quantities of organic vapors.

b. Summary of method

A small aliquot of waste liquid is titrated with Karl Fischer reagent. The concentration of water is calculated and reported as percent water.

c. Sample handling and preservation

The samples should be stored in closed containers prior to testing.

d. Interferences

There are several known compounds and classes of compounds that will interfere with the test by reacting with one or more of the components in the Karl Fischer reagent. High concentrations of certain reducing and oxidizing agents will bias the test results.

e. Apparatus

- Karl Fischer test apparatus are available from several manufacturers. Most laboratory supply houses stock automated, semiautomated, and manual instruments. The instrument selected should have an electrometric end point detector, since highly colored samples would interfere with a colorimetric end point detection.

- Syringes -- 50 ml.

f. Reagents

- Karl Fischer reagent (methanol solution 1 ml to 5 ml H<sub>2</sub>O).
- Methanol -- water-free.

g. Procedure

The procedure used will be determined by the apparatus selected. The manufacturer's instructions should be used where applicable. Generally, the sample size used should be 50 ml.

h. Calibration

The Karl Fischer reagent is standardized by titrating 50 ml of water with the reagent. The standardization factor is calculated using the following equation:

$$\text{Standard factor } K = \frac{B}{A} \times 100$$

Where: B = ml of water (normally 50 ml).  
A = Volume of Karl Fischer reagent, ml.

i. Calculations

Calculate the percentage of water in the sample using the following equation:

$$\% \text{ water} = \frac{A \times K}{B}$$

Where: A = ml of Karl Fischer reagent.  
B = ml of sample.  
K = Standard factor.

j. Report

Report as apparent percent water.

4. Test for pH in liquid wastes:

a. Scope and application

This test method is applicable to wastes that are primarily aqueous.

b. Summary of method

- The pH of a sample that is known to be primarily aqueous is measured with an electronic pH meter.
- The pH of a sample is determined by using pH test strips.

c. Interferences

- The pH of a solution normally refers to the hydrogen ion activity in aqueous samples. High concentrations of organic matter may yield results that will lead to erroneous interpretation of the true sample acidity.
- Indicator papers are available that may be used as spot tests. Highly colored matter in the sample can interfere with this test. The presence of strong oxidizing or reducing agents may also cause interferences.

d. Sample handling and preservation

The pH is normally determined directly on aqueous samples in the field.

e. Apparatus

- An electronic pH meter with temperature compensation adjustment and appropriate electrodes.
- Indicator strips are available from several commercial sources which cover the pH range of interest.

f. Procedure

- Electronic pH measurements -- The unit is calibrated using the manufacturer's instructions. The electrode is immersed in the sample and the pH reading read directly from a meter or digital display.
- Indicator papers -- The indicator strip is either immersed in the sampled or a drop of the sample is placed on the test strip. The color developed is compared to a standard color chart supplied with the test package.

g. Report

Report as pH and specify the method used.

5. Qualitative test for cyanide in liquid wastes:

a. Scope and application

This test method is a qualitative test for the determination of cyanide in liquid waste.

b. Summary of method

Samples are neutralized and treated with Chloramine-T to convert cyanide to cyanogen chloride. A pyridine-barbituric acid reagent reacts with the cyanogen chloride to produce a pink to red color.

c. Interferences

Oxidizing agents destroy most of the cyanide during storage. Iron-based cyanide complexes will not be detected by this test. Thiocyanate will give a positive interference.

d. Sample handling and preservation

The sample pH should be adjusted to greater than 12 with NaOH to prevent loss of HCN gas.

e. Apparatus

- Porcelain spot plate with 6 to 12 cavities.
- Dropping pipettes.
- Glass stirring rods.

f. Reagents

- Chloramine-T solution -- Dissolve 1.0 g white, water-soluble pyridine-barbituric in 100 ml distilled water. Prepare weekly and store in a refrigerator.
- Pyridine-barbituric acid reagent -- Place 15 g white, water-soluble pyridine-barbituric powder in 100 ml distilled water. Prepare weekly and store in a refrigerator.
- Hydrochloric acid, HCl, 1 + 9 -- Add 10 ml of concentrated HCl to 50 ml distilled water and mix. Add an additional 40 ml water to make a total of 100 ml.
- Sodium carbonate,  $\text{Na}_2\text{CO}_3$ , anhydrous.
- Phenolphthalein indicator solution.

g. Procedure

- Dilute 1 ml of the solution to 10 ml with distilled water. Add approximately 100 mg  $\text{Na}_2\text{CO}_3$  to the solution and swirl to dissolve.
- Add one drop of phenolphthalein indicator, then add HCl 1 + 9 dropwise with constant swirling until the solution becomes colorless.
- Place three drops of the sample and three drops of distilled water in separate cavities of a white spot plate.
- To each cavity, add one drop of Chloramine-T solution and mix with a clean stirring rod.
- Add one drop of pyridine-barbituric acid solution to each cavity and again mix.
- After 1 minute, the sample spot will turn pink to red if 0.5 mg/L or more of CN is present. The blank spot should be faint yellow.

h. Calculations

No calculations are required.

i. Report

Report the results as positive or negative CN.

6. Qualitative test for sulfide in liquid wastes:

a. Scope and application

This method is for the qualitative determination of sulfide in liquid wastes.

b. Summary of method

- Potassium antimony tartrate is added to an acidified waste sample. Yellow  $Sb_2S_3$  is formed if sulfide is present.

- Lead acetate paper is suspended above an acidified sample of waste. The paper becomes blackened by the formation of PbS if sulfide is present.

c. Sample handling and preservation

The sample should be kept in a closed container prior to testing.

d. Interferences

Lead sulfide and other metallic sulfides may not dissolve sufficiently in the acid solution to release  $H_2S$ .

e. Apparatus

- Glassware, such as test tubes or small glass beakers, should be used as a reaction vessel.

- pH meter or pH test strips.

f. Reagents

- Potassium antimony tartrate -- Prepare a saturated solution of potassium tartrate by mixing 10 g of the salt with 100 ml of distilled water.
- Hydrochloric acid -- Concentrated.
- Lead acetate paper test strips.

g. Procedure

- Antimony test.
  - . Add 20 ml of distilled water to test tube (or beaker), then add 1 ml of the test sample and mix.
  - . Adjust the pH of the mixture to 7 using NaOH, then add 0.5 ml of concentrated HCl.
  - . Add potassium antimony tartrate dropwise (5 to 10 drops). A yellow precipitate of  $Sb_2S_3$  indicates the presence of sulfide.
- Lead acetate test.
  - . Add 20 ml of distilled water to a test tube (or beaker), then add 1 ml of the test sample and mix.
  - . Adjust the pH of the mixture to 7 using NaOH, then add 0.5 ml of concentrated HCl.
  - . Suspend a lead acetate test strip above the liquid and cover the reaction vessel. A slotted stopper may be used if the reaction vessel is a test tube or a watch glass if a beaker is used; allow 30 minutes for the color to develop.
  - . The test strip will turn brown or black as the lead reacts with  $H_2S$  to form  $PbS$ .

h. Calculations

This test is a qualitative test for sulfide. No calculations are required.

i. Report

Report positive or negative sulfide.

7. Test for organic halogen in liquid wastes:

a. Scope and application

This method is for the determination of organic halogen in liquid waste samples after reduction to the halide ion by sodium biphenyl reagent. The halide ion is determined by potentiometric titration.

b. Summary of method

A sample of waste is added to a known volume of toluene. The toluene solution is extracted with 3N nitric acid to remove ionic halides. An aliquot of the solution is transferred to a separatory funnel and reacted with sodium biphenyl reagent to reduce the organic halogen to the halide ion. The halide ion is titrated with standard silver nitrate.

c. Sample handling and preservation

The samples should be stored in a closed container prior to testing.

d. Interferences

- Organic halogens subject to hydrolysis may react with the 3N nitric extraction.
- Halogenated organic compounds that are insoluble in toluene cannot be quantitatively determined.

e. Apparatus

- 125 ml separatory funnels, pipettes, and other glassware normally used in an analytical laboratory.
- Electronic voltmeter, to measure the potential difference between the electrodes. A pH meter may be converted to this use by substitution of the appropriate electrodes.

f. Reagents

- Sodium biphenyl reagent -- Sodium biphenyl reagent may be purchased from a specialty chemical supplier.
- Toluene -- Reagent grade, halogen free.
- Silver nitrate, 0.01N -- Dissolve 1.7 g  $\text{AgNO}_3$  in 1,000 ml of distilled water. Standardize this solution against a standard NaCl solution.
- Stock sodium chloride solution, 0.1N -- Dissolve 5.845 g NaCl in 1,000 ml of distilled water.
- Standard sodium chloride solution, 0.01N -- Dilute 10 ml of the 0.1N NaCl standard to 100 ml in a 100-ml volumetric flask.

g. Procedure

- Sodium biphenyl reaction.
  - Add 50 ml of toluene to a 125-ml separatory funnel.
  - Add a small volume of the waste sample to the toluene. A 5 ml aliquot of sample usually will be sufficient. If the sample is suspected of containing a high concentration of organic halogen, 1 ml of sample should be used.

- Add 20 ml of 3N  $\text{HNO}_3$  to the sample and shake. Allow the water layer to separate, then drain off and discard the aqueous liquid. Repeat this extraction a second time and discard the aqueous liquid.
- Transfer an aliquot of the toluene to another 125 ml separatory funnel. A 25-ml aliquot should be transferred if the sample is expected to contain less than 1 percent halogen. Smaller volumes should be selected for samples containing greater than 1 percent halogen. Add sufficient reagent grade toluene to the separatory funnel to allow mixing of the biphenyl reagent.
- Add sodium biphenyl reagent in 10-ml increments and mix until a dark blue/green color remains in the solution.
- Add 20 ml of distilled water to the separatory funnel. An exothermic reaction may occur at this point as the excess sodium biphenyl reacts with water. Mix the contents of the separatory funnel without capping, until the green color disappears.
- Drain the aqueous layer into a glass beaker.
- Add 20 ml of 3N nitric acid to the separatory funnel and shake for approximately 30 seconds. Combine the aqueous layer with the sample drawn in the third step in item "g." Repeat the nitric acid extraction.
- Titrate the three combined extracts using 0.01N silver nitrate.

- Titration

- The various instruments that can be used in this determination differ in operating details. The manufacturer's instructions should be used if an automatic recording titrator is available. A pH meter may be used to follow a manual titration.

- . Add 2 ml of concentrated HNO<sub>3</sub> to the test solution. Place a magnetic stirring rod and electrodes in the solution and start the stirrer.
- . Set the instrument to the desired range of mV or pH units.
- . Add standard AgNO<sub>3</sub> titrant, recording the instrument scale reading after each addition. Smaller increments of titrant should be added when large changes in scale readings are noted.
- . Plot the differential titration curve if the exact end point cannot be determined by inspection of the data. Plot the change in instrument reading against the volume of AgNO<sub>3</sub> added. The end point of the titration is the point of greatest change in instrument reading per unit volume of AgNO<sub>3</sub> added.

- Standardization of Titrant

- . Pipette 25 ml of 0.01N NaCl into a beaker. Add distilled water to bring the volume to approximately 75 ml.
- . Titrate the sample with 0.01N AgNO<sub>3</sub> using the same procedures outlined in item 7g, under "Titration," of this method.
- . Calculate the normality of the AgNO<sub>3</sub> titrant as follows:

$$N(\text{AgNO}_3) = \frac{0.25}{V(\text{AgNO}_3)}$$

h. Calculations

Calculate the organic halogen content as follows:

$$\frac{V_T \times N_T \times \text{eq. wgt} \times 0.1}{V_S} \left( \frac{V_T + V_S}{V_A} \right) = \text{percent halide as Cl}$$

$V_T$  = Volume of 0.01N  $\text{AgNO}_3$  titrant.

$N_T$  = Normality of  $\text{NO}_3$  titrant.

Eq. wgt. = 35.45 for Cl.

$V_T$  = Volume of toluene (item 7g, under "Sodium biphenyl reaction.")

$V_S$  = Volume of waste sample (item 7g, under "Sodium biphenyl reaction.")

$V_A$  = Volume of toluene aliquot reduced (item 7g, under "Sodium biphenyl reaction.")

i. Report

Report as weight/volume percent halide as chloride.

8. Semi-quantitative determination of polychlorinated biphenyls (PCB's) in liquid wastes:

a. Scope and application

This method is for the semi-quantitative determination of polychlorinated biphenyls (PCB's) in liquid waste samples by gas chromatography.

The purpose of this method is to serve as a general guide for the development of analytical techniques that can be used in a mobile laboratory for the determination of PCB blends. The methodology should be tested prior to field use and modification made to accommodate the equipment available and the qualifications of the analytical personnel responsible for the analysis.

b. Summary of method

A sample of liquid waste is quantitatively diluted in hexane. The diluted sample is dried and filtered by passing it through a disposable pipette containing sodium sulfate. The concentrations of PCB's are determined by gas chromatographic analysis.

c. Interferences

Contamination of glassware and reagents is the main source of interference. Method blanks should be run in order to identify the source and magnitude of interferences detected.

d. Apparatus and materials

- Gas chromatograph -- A gas chromatograph suitable for on-column injection and related hardware including an electron capture or halogen specific detector, column supplies, recorder, gases, and syringes.
- Column and packing --
  - Supelcoport 100/120 mesh coated with 1.5 percent SP-2250 (1.95 percent SP-2401) packed in a 180 cm x 4 mm I.D. glass column with 5 percent methane/95 percent argon carrier gas. Column temperature is approximately 200°C.
  - Sample preparation of column -- Insert a small plug of glass wool or cotton into a disposable Pasteur pipette, add approximately 5 cm of granulated anhydrous sodium sulfate, then add a second plug of glass wool or cotton to retain the packing. This column is used to remove moisture and suspended matter.
  - Supelcoport 100/120 mesh coated with 3 percent OV-1 in a 180 cm x 4 mm ID glass column with 5 percent methane/95 percent argon carrier gas at 60 ml/minute flow rate. Column temperature is approximately 200°C.

e. Reagents

- Sodium sulfate -- ACS, granular, anhydrous, purified by heating at 400°C for 4 hours in a shallow tray.
- Hexane -- Pesticide residue analysis grade.
- Standard solutions -- Prepare standard solutions containing 0.5 mg/L of each of the following PCB isomers: PCB-1016, -1221, -1232, -1242, -1248, -1254, and -1260.

f. Procedure

- Pipette 1 ml of the waste sample into a 100-ml volumetric flask and dilute to the mark with hexane.
- Filter a portion of the sample through the disposable pipette containing sodium sulfate. Discard the first 3 to 4 ml of sample and collect the sample in a vial that can be sealed with a septum closure.
- Inject 5 ul of sample using the solvent flush technique. Record the volume injected.
- If the peak heights are off-scale, dilute the sample and repeat the analysis.

g. Calculation

Compare the chromatogram generated to chromatograms of 0.5 mg/L PCB standards. Select the chromatogram with the closest retention time match and compare peak heights. Since the waste sample was diluted 1:100 in the first item of step 8.f, the peak heights of 0.5 mg/L standard will be equivalent to a 50 mg/L concentration in a diluted waste sample.

h. Report

This method is designed as a semi-quantitative method for the determination of PCB's. Report as >50 mg/L, or none detected.

9. Compatibility test for liquid wastes:

a. Scope and application

- This method is a qualitative test designed to determine the compatibility of liquids of unknown composition at ambient and elevated temperatures. The test method is designed for use in a field laboratory using relatively inexpensive testing devices.
- This method is applicable to both organic and aqueous wastes. The standard test temperature at 75°C must be modified for liquids with boiling points of 75°C.
- All wastes tested by this method should have been tested for water reactivity prior to testing by this method.

b. Summary of method

- Samples of liquid waste are tested in batches of 10 at ambient temperature. If waste incompatibility is detected at ambient temperature, the reactive waste is marked as reactive and incompatible with the batch.
- Samples that are not reactive are individually preheated to 75°C. The heated samples are then blended in an adiabatic test device.

c. Sample handling and preservation

The samples should be stored in closed containers prior to testing.

d. Interferences

Certain reactions may require a catalyst or higher temperature before exothermic reactions occur. The test conditions outlined in this method may not adequately evaluate interactions that could occur when larger quantities of waste are mixed.

e. Apparatus

- A heavy-wall beaker or Dewar flask sized to contain approximately 1.5 to 2.0 times the final test volume is used for the ambient temperature testing.
- A heater block (Figure C.3-1) consisting of a rectangular metal block with cylindrical holes in the top surface large enough to hold test tubes containing 10 ml of sample is used to preheat samples. The block is made from copper or aluminum for good heat conduction. A series of cartridge heaters are placed in horizontal holes drilled into the block. Insulation is placed on the bottom and sides of the block to maintain a uniform temperature throughout the block. A thermocouple and controller are used to regulate the heat supply to the block.
- The adiabatic test device (Figure C.3-2) consists of a glass reaction vessel surrounded by insulation and a heating jacket. A stirrer is mounted on the top cover. A thermocouple, preferable in glass, is immersed in the liquid sample in the reaction vessel. The output of this measuring thermocouple is connected to a recorder. A second thermocouple is attached to the inner wall of the heater surface and is used to maintain the reactor at a constant temperature of 75°C.

f. Reagents

No special reagents are required for this test.

g. Procedure

- Pipette 1 ml of the first sample into a reaction vessel. Place a thermometer or thermocouple in the liquid.
- Add the remaining waste in 1-ml aliquots, stirring after each addition. Record the temperature and other observations (such as gas formation, immiscibility, etc.). If a reaction occurs after the addition of a waste sample, repeat the test for binary combinations of the last sample tested and each of the previous samples tested.

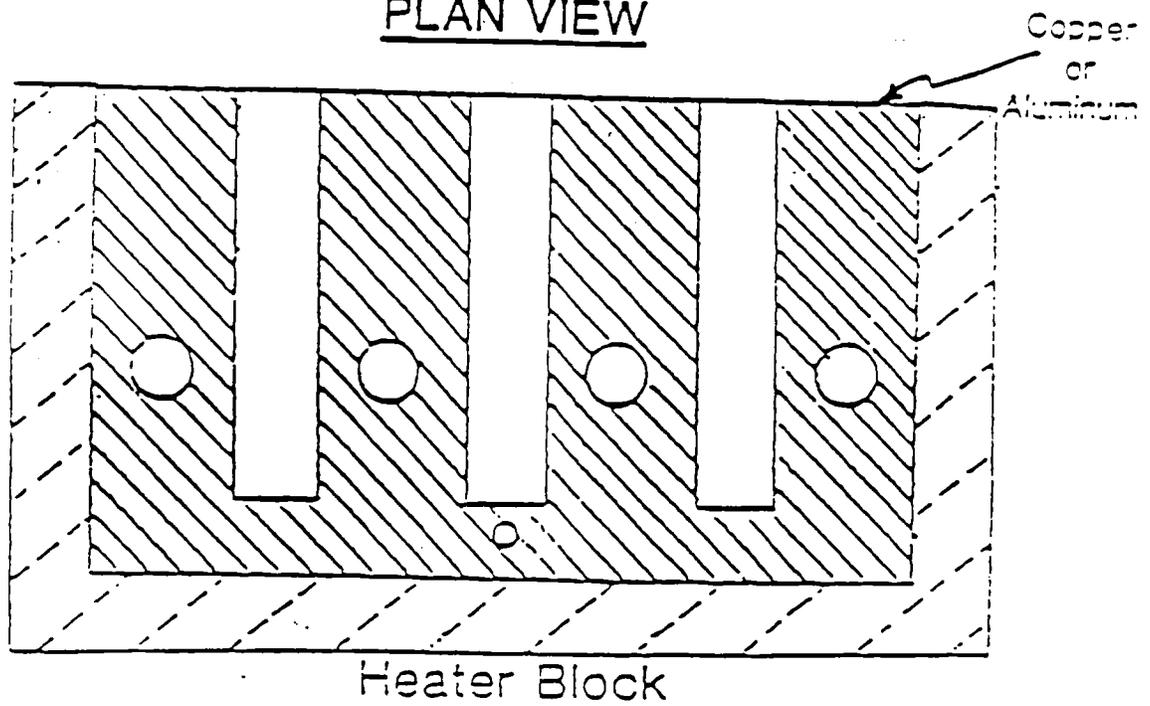
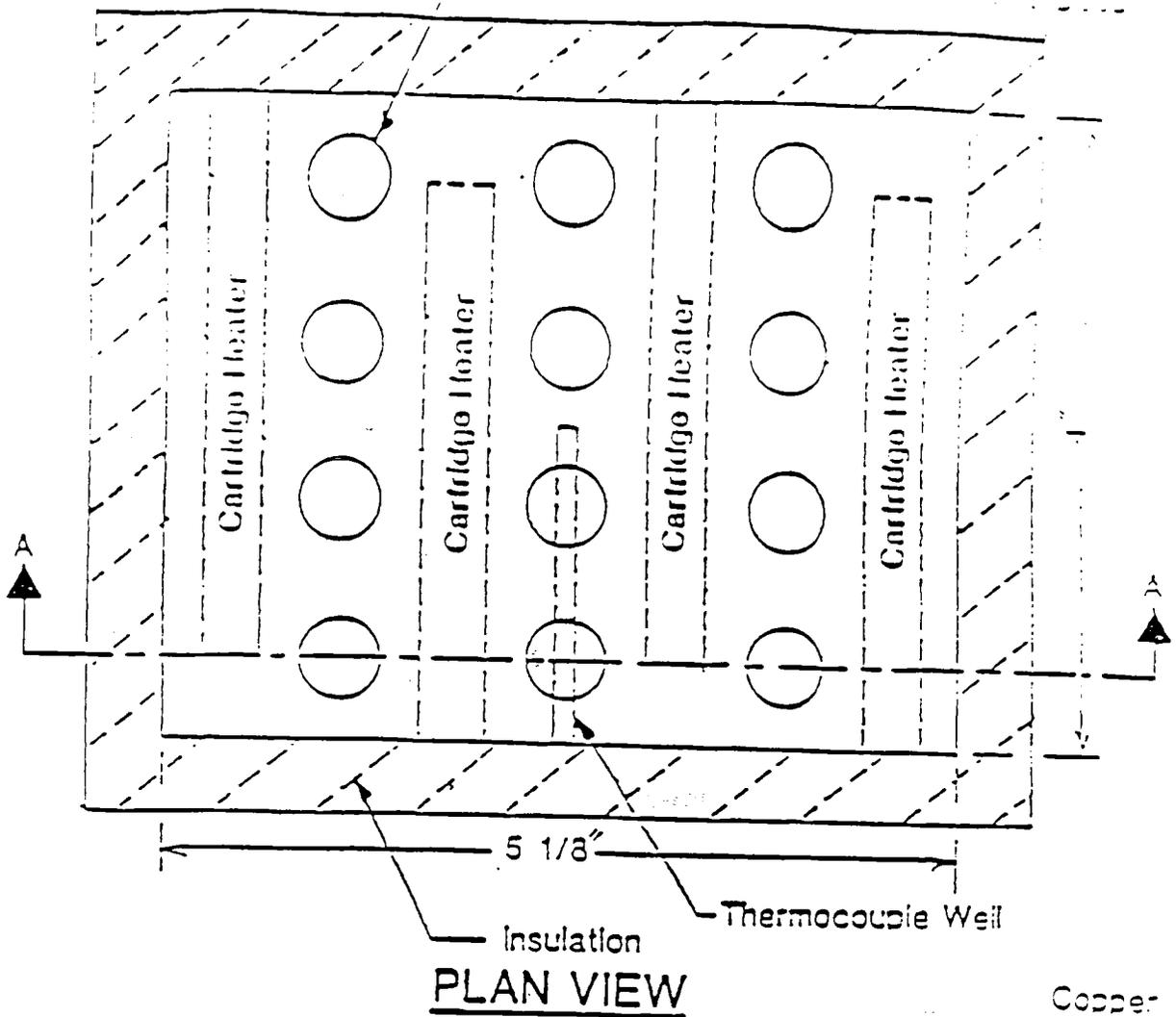
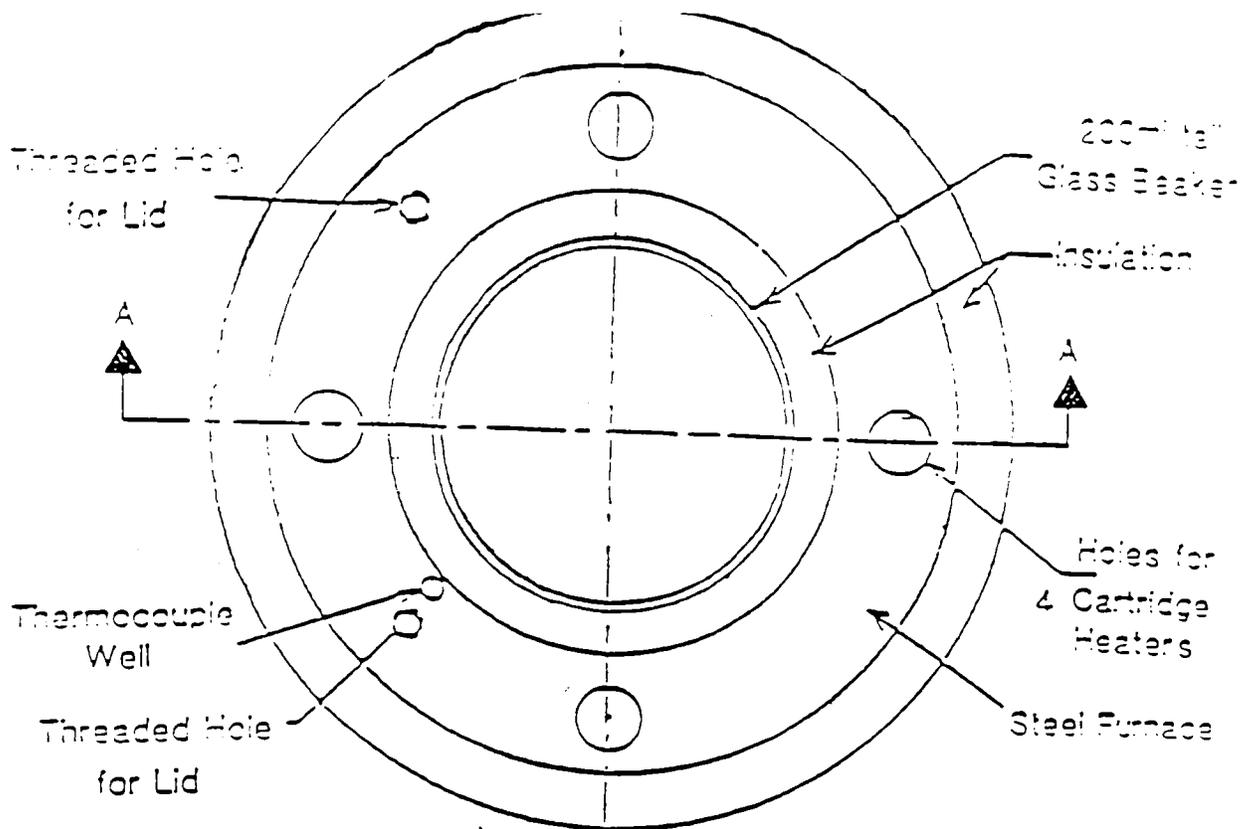
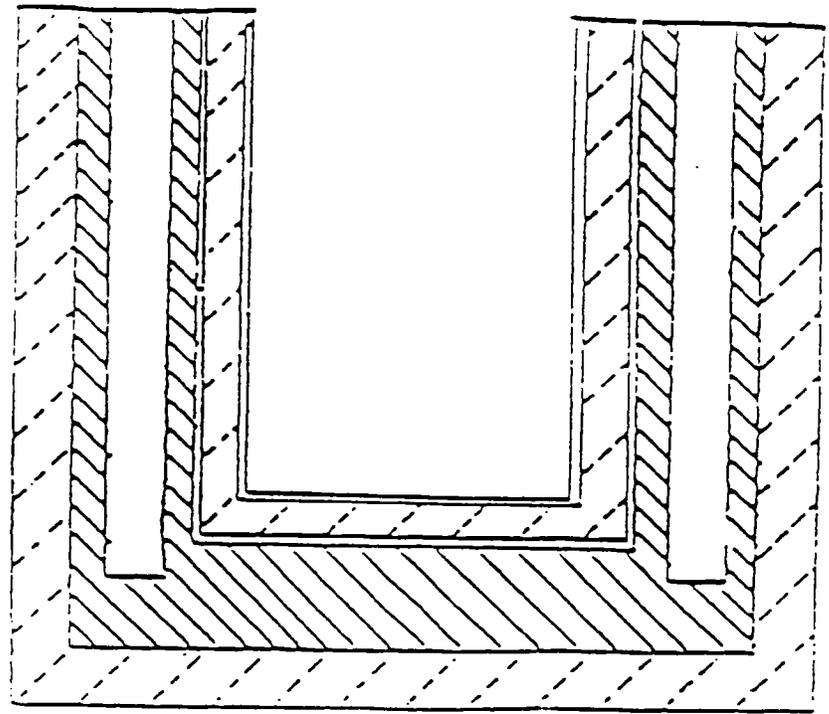


FIGURE C.3-1 HEATER BLOCK



PLAN VIEW



Adiabatic Test Device

CROSS SECTION A-A

FIGURE C.3-2 ADIABATIC TEST DEVICE

- Place approximately 0.5 ml of sample in a test tube. Place the test tube in the heater block, which has been preheated to 75°C. Observe the sample for approximately 30 seconds. If no reaction or boiling occurs, remove the test tube from the heater block. Repeat this procedure for all samples that are to be blended in the adiabatic test device.
- Check the temperature of the samples using a thermocouple or glass thermometer to confirm they are at 75°C. Observe all samples for reactions such as gas formation or exothermic reactions. Any sample that is reactive under these conditions should not be blended with other wastes.
- Preheat the adiabatic test device to 75°C. Transfer 5 ml of the first sample to the device. Add 5 ml of the second sample to the device and mix. Observe the temperature recording device for 5 minutes. If no exothermic reaction occurs, continue to add the remaining samples at 5-minute intervals.
- If any reaction occurs, a binary composite of the last sample tested and each of the previous samples tested are mixed in the reaction vessel to determine which materials in the blend are reactive. Both samples are marked reactive.
- If no reactions occur, 5 to 10 ml of the final mixture is taken and placed in the heater block. This composite sample will serve as the first sample for the next series of samples being tested for compatibility. Reserve the remaining final mixture for binary testing.

h. Report

The report should contain, at a minimum, the following information. Additional comments should be made if unusual or unexpected reactions occur.

- Identification number of each waste added.
- Temperature after each addition.

- Miscibility of the material after each addition.
  - Formation of precipitates after each addition.
  - Gas formation after each addition.
  - The exact order of addition of each waste.
  - Other comments, such as color and viscosity, of the final mixture.
10. Semi-quantitative determination of peroxides and other oxidizing agents in liquid wastes:

a. Scope and application

This method is for the semi-quantitation of active oxygen in liquid waste. Active oxygen is defined as the oxidizing potential present in a waste that will oxidize iodide to iodine under acidic conditions.

b. Summary of method

- An organic waste is dissolved in a mixture of methylene chloride and acetic acid. A saturated solution of sodium iodide is added and the mixture is allowed to react in the dark at room temperature for 15 minutes. The liberated iodine is then titrated with standard sodium thiosulfate solution.

- An aqueous waste is diluted with distilled water and treated with concentrated sulfuric acid to reduce the pH to  $<2$ . A saturated solution of sodium iodide is added, and the mixture is allowed to react in the dark at room temperature for 15 minutes. The liberated iodine is titrated with standard sodium thiosulfate solution.

c. Interferences

- Conjugated diolefins interfere by absorbing iodine.
- Highly-colored samples may interfere with the colorimetric end point detection.

d. Apparatus

Laboratory glassware, including burettes, pipettes, Erlenmeyer flasks, volumetric flasks, and beakers.

e. Reagents

- Acetic acid, glacial.
- Methylene chloride.
- Sodium iodide -- Prepare a saturated solution of sodium iodide (NaI) in deaerated water.
- Sodium thiosulfate, standard solution (0.1N) -- Prepare and standardize a 0.1N solution of sodium thiosulfate ( $\text{Na}_2\text{S}_2\text{O}_3$ ) in accordance with the appropriate sections of ASTM Method E-200.
- Starch indicator solution -- Titrate 1 g of soluble starch with a few ml of cold water, and slowly pour into 100 ml of boiling water while stirring.
- Water, deaerated -- Deaerate distilled water by boiling for 5 to 10 minutes prior to use.
- Sulfuric acid -- Concentrated  $\text{H}_2\text{SO}_4$ .

f. Procedure

- Organic waste
  - Add 20 ml of acetic acid to a 250-ml flask.
  - Pipette 1 ml of sample into the acetic acid.
  - Add 10 ml of methylene chloride and mix.
  - Add 5 ml of freshly prepared saturated NaI solution. Stopper the flask and swirl. Allow the sample to stand in the dark for 15 minutes.

- Add 50 ml of deaerated water and titrate with 0.1N  $\text{Na}_2\text{S}_2\text{O}_3$  solution until the solution is a pale straw color. Add 1 to 2 ml of starch solution and continue the titration to the sharp disappearance of the blue color. Record the number of milliliters required for the titration.

- Aqueous waste

- Add 50 ml of deaerated water to a 250-ml flask.
- Pipette 1 ml of sample into the water.
- Add concentrated  $\text{H}_2\text{SO}_4$  to adjust the pH of the solution to  $<2$ .
- Pipette 10 ml of freshly prepared saturated NaI solution. Stopper the flask and swirl. Allow the sample to stand in the dark for 15 minutes.
- Titrate with a 0.1N  $\text{Na}_2\text{S}_2\text{O}_3$  solution until the solution is a pale straw color. Add 1 to 2 ml of starch indicator and continue titration to the sharp disappearance of the blue color. Record the number of milliliters required for the titration.

- General

- Prepare a reagent blank in the same manner as the samples. Titrate and record the milliliters of titrant required for the blank.
- The volume of sample used can be adjusted as required. Larger samples can be used if milligrams per liter (parts per million) accuracy is required. Smaller volumes can be used if the waste contains high (percent level) concentrations of reactive oxygen.

g. Calculations

Calculate the concentration (mg/L) of active oxygen as follows:

$$\text{Active oxygen (mg/L)} = \frac{(A - B) \times N \times 8,000}{V}$$

Where: A = ml sodium thiosulfate solution required for titration of the sample.

B = ml sodium thiosulfate solution required for the blank.

N = Normality of the thiosulfate solution.

V = ml of waste sample.

h. Report

Report as active oxygen, mg/L.

11. Free liquid determination using the paint filter test:

The paint filter test described by the U.S. EPA (50 FR 18370) as specified in Method 9095 in EPA publication SW-846 is used to determine the presence of free liquids in sludges, semisolids, slurries, and other containerized wastes destined for landfill disposal.

12. Differential Scanning Calorimetry (DSC) of Sieved Burn Pan Ash Samples

PROPOSED DIVISION 330 STANDARD METHOD

Procedure NO: 3340.52

5 Aug 91

Author: JOHN M. CORBETT, 3340H

Technique: Differential Scanning Calorimetry (DSC)  
of Sieved Burn Pan Ash Samples

1. Initially, a brief visual examination of the ash and dirt samples is made to ensure there is not an obvious contamination of the sample with energetic materials. If this is negative, the sample is gently agitated in an attempt to homogenize the sample thus eliminating settling that may have occurred after the sample was collected. Approximately 100 grams of sample is then placed in a nest of sieves made up of a US #14 sieve and US #35 sieve and is shaken for 20 minutes on a remote shaker. The fractions retained on and passing through each of the sieve are then collected and weighed. Note that the samples are not dried before shaking and contain varying amounts of water and kerosene. This often has a significant effect on how much material passes through each of the sieves.
2. At least two samples of the material passing thru the US #35 sieve are examined by Differential Scanning Calorimetry (DSC). Likewise, at least two samples from the material retained on the US #35 sieve are examined by DSC. It may be necessary to increase the number of samples taken from either or both of these two sieved fractions if a significant inhomogeneity is observed in these fractions. The material retained on the US #14 sieve often contains a significant

fraction of rocky and other obviously non-energetic material. Samples from this fraction are subjected to a DSC test only if a visual examination finds material which is suspected of being an energetic.

3. The DSC test itself is performed by placing the sample in an aluminum sample pan, covering it with an aluminum sample cover, and then hermetically sealing the pan. Typically, 1 to 7 mg of sample are used depending upon the density of the material. The hermetically sealed sample pan containing the sample is placed in a TA Instruments 910 single DSC cell and heated at a rate of 10°C/min from 30°C to 550°C while subjected to 250 ml/min nitrogen purge. The heat flow from the sample is measured and then plotted as a function of temperature. Any exothermic reactions that occur are noted. The nitrogen purge is used to vent any corrosive gasses that may be released if an energetic event were to occur rupturing the sample pan.

4. If any exothermic reactions are noted in a DSC test, additional DSC testing is conducted on the fraction in which the sample was taken. This is done in a much more selected fashion. The fraction is examined under a 10x microscope and suspect particles are removed. Each particle is then divided into two parts. Half of the sample is subjected to a DSC test and the other half is set aside. If the DSC test indicates an exothermic reaction, additional testing is conducted on the second half of the sample in an attempt to identify the energetic material. Methods commonly utilized

include liquid chromatography (LC), Fourier transform infrared spectroscopy (FTIR), or X-ray diffractometry (XRD). Test results are then forwarded to the current coordinating engineer to determine if additional testing is required or if the sample is to be returned for retreatment.

5. All burn pan ash samples which are not to be re-treated, should be submitted to the ICAP analyst in 3340 for determination of toxicity characteristics by TCLP.

*John M. Corbett*  
JOHN M. CORBETT

Copy to:  
330  
Standard Method File

## REFERENCES

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2. 15th Edition, Standard Methods for the Examination of Water and Wastewater.
3. EPA SW-846, Test Methods for Evaluating Solid Waste, July 1982.
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8. MIL STD 286B, Military Standard, "Propellants Solid; Sampling, Examination, and Testing."

### Section D Process Information

The IHDIVNAVSURFWARCEN maintains two long-term container storage areas for non-explosive hazardous wastes; these storage areas are located in Buildings 455 and 1440. The materials stored in Building 455 are non-explosive hazardous wastes that do not contain Poly-Chlorinated Biphenyls (PCBs). Building 1440 is reserved for the storage of PCBs and PCB-contaminated equipment (e.g., light ballasts, capacitors).

In addition to the two non-explosive container storage buildings, two additional buildings are being proposed to manage explosive hazardous wastes. These storage sites are located in Buildings 212 and 328. The explosive hazardous waste stored at these sites are wastes that will be scheduled for thermal treatment at the Strauss Avenue Thermal Treatment Point. The establishment of Buildings 212 and 328 ensures proper management of explosive hazardous wastes when the wastes must be stored over 90 days. Building 212 will be used to store Class 1 Division 3 explosive hazardous wastes and Building 328 will be used to store Class 1 Division 1 explosive hazardous wastes.

Topographic maps (Figures D-1 to D-6) on the scale of 1 inch = 100 feet show the locations of Buildings 455, 1440, 212, and 328 in relation to land surface details. Building 455 is located in panel K-vertical scale, 36-horizontal scale of map areas 8 and 12 (Figures D-1 and D-2, respectively). Building 1440 is located in panel J-vertical scale, 8-horizontal scale of map area 11 (Figure D-3). Building 212 is located in panel I-vertical scale, 29-horizontal scale of map area 9 (Figure D-4) and Building 328 is located in panel M-vertical scale, 26-horizontal scale of map area 13 (Figure D-5). Map area 15 (Figure D-6) has been included to meet the requirements of COMAR 26.13.07.02D(35) for a topographic map showing a distance of 1,000 feet around the facility.

As Figure D-7 illustrates, Building 455 is divided into eight individual bays. The bays are separated by impermeable walls and each bay serves as a storage area for different types of hazardous waste (Figure D-8). Table D-1 contains a description of the contents of each bay, along with capacities and other significant features.

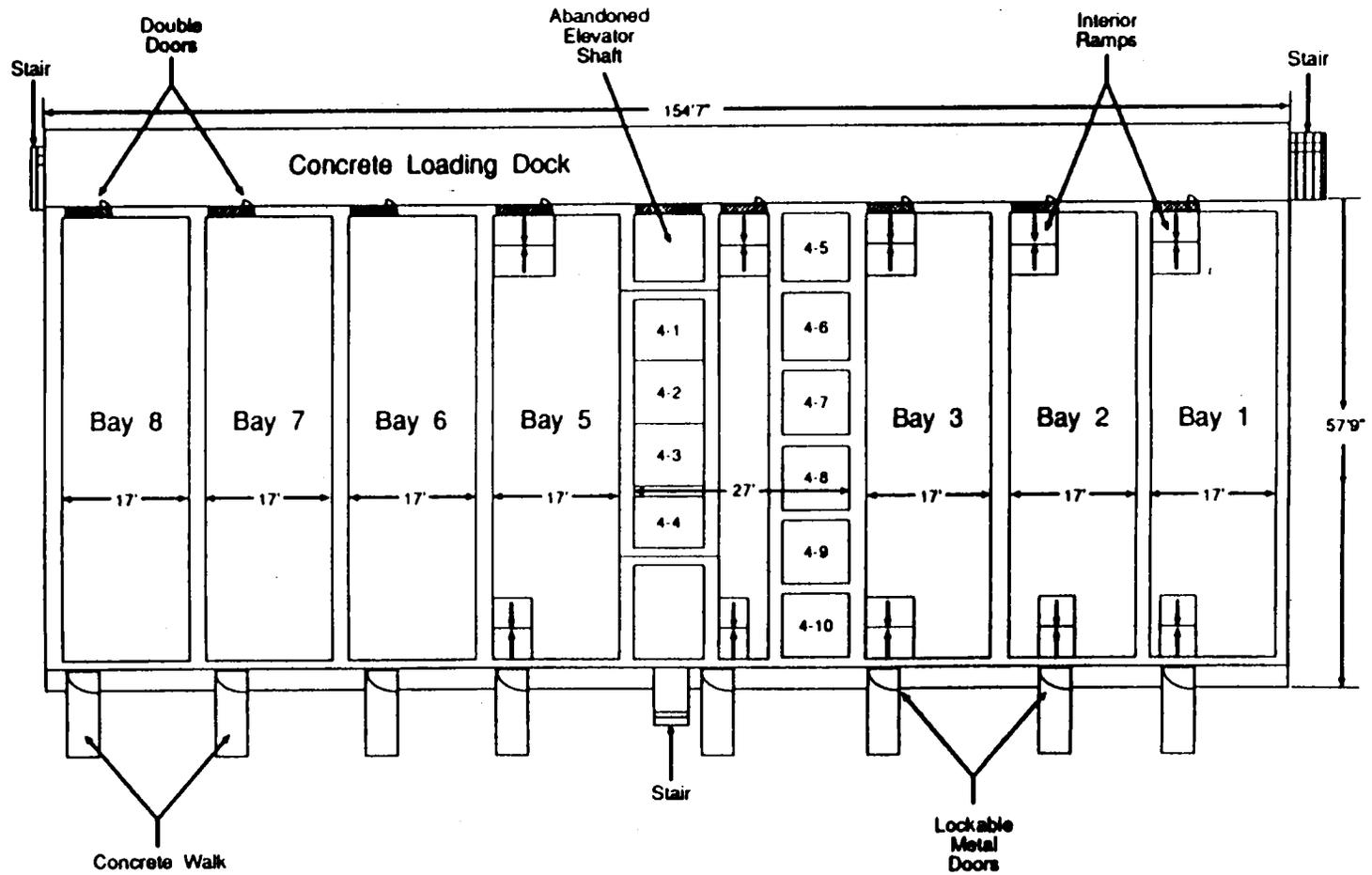
Details of the minor changes to the storage areas of Building 455 are shown in Table D-2. A wet pipe sprinkler system will be installed in Bay 1. Figure D-9 is a photograph that depicts the exterior of Building 455. Fire protection for Building 455 is enhanced by a fire hydrant (No. 231-8) located 150 feet east of the southeast corner. Its flow rate is 987 gpm.

Building 1440 is constructed of steel-frame paneling with a concrete floor. The overall dimensions are 31 feet by 36 feet or 1,116 square feet. Table D-3 outlines the storage and containment capacities. Figure D-10 contains a general floor plan for Building 1440. Storage Area 4, identified on Figure D-10, has never been used to store PCB or PCB-contaminated equipment. However, Storage Area 4 will be used for the storage of CHS on an as-needed basis. Only one type of CHS (i.e., all corrosives, all flammables, or all toxics, etc.) will be managed at one time. In addition, there are no plans to use this area in the future for PCB storage. Figure D-11 is a photograph depicting the exterior and surroundings. Fire protection for Building 1440 is supported by a fire hydrant located approximately 100 feet due east on Olson Road.

Hazardous waste in both Building 455 and Building 1440 are removed and disposed of by a licensed disposal contractor. The contractor is responsible for providing all services for final treatment/disposal of hazardous waste in accordance with all local, state, and federal solid and hazardous waste laws and regulations. Services include all necessary personnel, labor, transportation, packaging, detailed analysis equipment, and reports. Hazardous waste is properly manifested and documented. Containers receive all necessary marking and labeling in accordance with DOT, OSHA, and EPA requirements.

Figure D-7

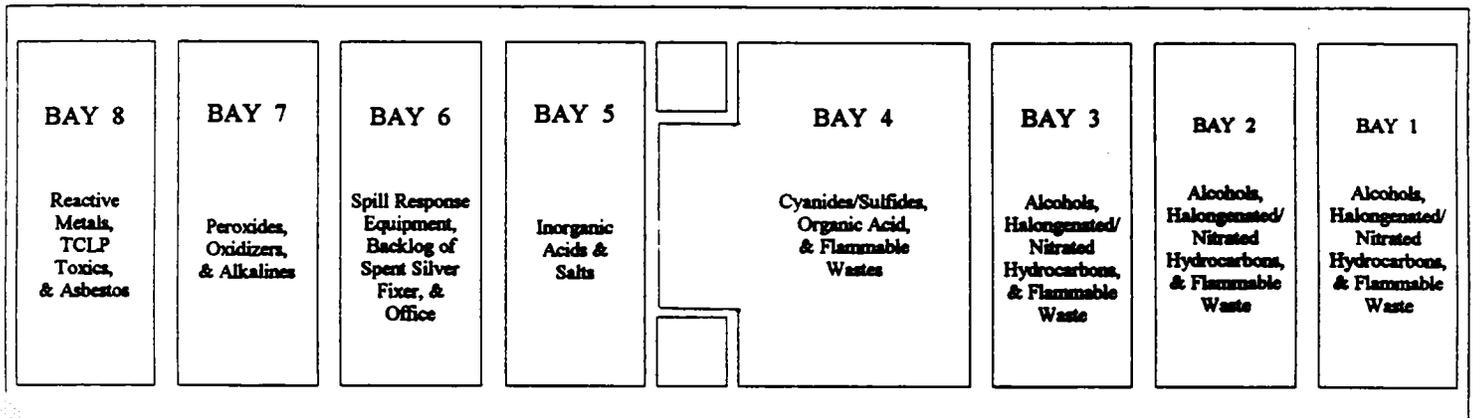
General Floor Plan for Building 455



**D. Process Information**

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**Figure D-8  
Container Storage Bays in Building 455**



**Table D-1**

**Storage and Containment Capacities for Building 455**

Bay	Categories	Maximum Inventory Allowed (gal.)	Secondary Containment Capacity (gal.)	Ventilation	Temperature Control	Electrical	Sprinkler System	Fire Alarms
1	Inorganic Acids and Salts	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes
2	Alcohols, Halogenated/ Nitrated Hydrocarbons & Flammable Waste	35,400	3,540	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
3	Alcohols, Halogenated/Nitrated Hydrocarbons & Flammable Waste	35,400	3,540	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
4**	Cyanides/ Sulfides, Organic Acid, & Flammable Wastes	46,700	4,670	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
5	Alkalines	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes
6	Spill Response Equipment	---	---	Fans & Louvers	No	NEMA 12	No	Yes
7***	Peroxides & Oxidizers	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes
8	Reactive Metals & TCLP Toxics	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes

\* Maximum Inventory allowed by regulations is equal to 10 times the available secondary containment capacity. This inventory only applies to liquids.  
 \*\* Bay 4 has 10 sub-diked areas. Periodically used to store waste awaiting complete analysis results.  
 \*\*\* Bay 7 is used to store empty drums periodically.

**Table D-2**  
**New Storage and Containment Capacities for Building 455**

<b>Bay</b>	<b>Categories</b>	<b>Maximum Inventory Allowed (gal.)</b>	<b>Secondary Containment Capacity (gal.)</b>	<b>Ventilation</b>	<b>Temperature Control</b>	<b>Electrical</b>	<b>Sprinkler System</b>	<b>Fire Alarms</b>
1	Alcohols, Halogenated/ Nitrated Hydrocarbons, & Flammable Waste	35,400	3,540	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
2	Alcohols, Halogenated/ Nitrated Hydrocarbons, & Flammable Waste	35,400	3,540	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
3	Alcohols, Halogenated/ Nitrated Hydrocarbons, & Flammable Waste	35,400	3,540	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
4**	Cyanides/Sulfides, Organic Acid, & Flammable Wastes	46,700	4,670	Fans & Louvers	Steam Heated	Class I Div. I Group E, F, & G	Wet Pipe	Yes
5	Inorganic Acids & Salts	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes
6	Spill Response Equipment, Backlog of Spent Silver Fixer, & Office	---	---	Fans & Louvers	No	NEMA 12	No	Yes
7***	Peroxides, Oxidizers, & Alkalines	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes
8	Reactive Metals, TCLP Toxics, & Asbestos	35,400	3,540	Fans & Louvers	No	NEMA 12	No	Yes

\* Maximum Inventory allowed by regulations is equal to 10 times the available secondary containment capacity. This inventory only applies to liquids.

\*\* Bay 4 has 10 sub-diked areas. Periodically used to store waste awaiting complete analysis results.

\*\*\* Bay 7 is used to store empty drums periodically.

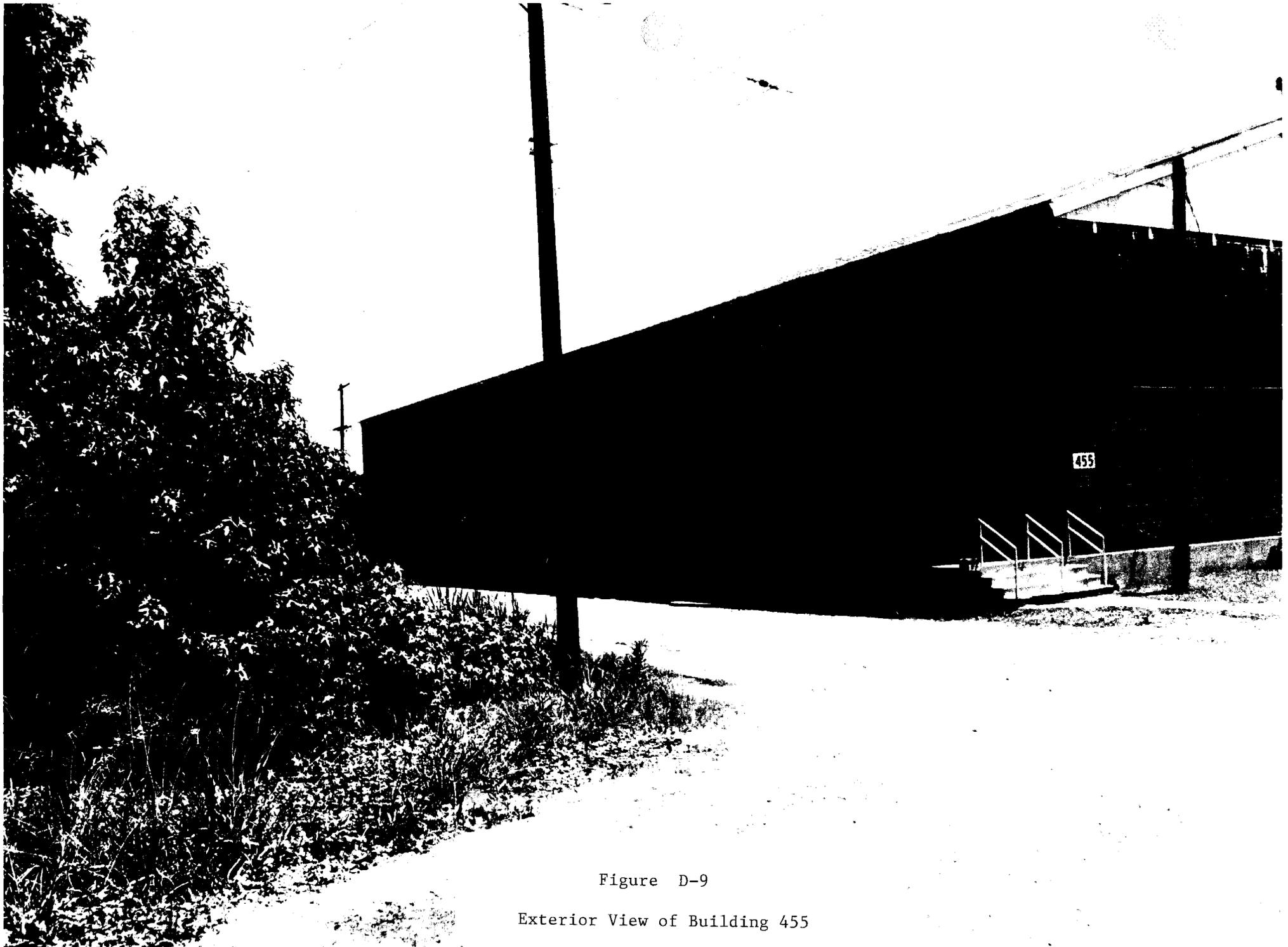


Figure D-9

Exterior View of Building 455

Table D-3

## Maximum PCB Inventory for Building 1440

Storage Area	Dimensions (feet)	Secondary Containment Capacity		Maximum Allowable PCB Storage Capacity* (gal.)	Maximum Container (gal.)
		(cubic ft.)	(gal.)		
1	22.5 x 19 x .5	213.75	1,599	6,396	799
2	9.25 x 12 x .5	55.5	415	1,660	207
3	9.25 x 12 x .5	55.5	415	1,660	207
4	35 x 10 x .5	175	1,309	**	**
Totals		499.75	3,738	9,716	

\* Maximum storage capacity as established under TSCA regulations, 40 CFR 761.65(b)(1)(ii).

\*\* Storage Area 4 has never been used to store PCB or PCB-contaminated equipment. There are no plans to use this area in the future for PCB storage. This area will be used for storage of CHS.

D. Process Information

Figure D-10  
Floor Plan for Building 1440

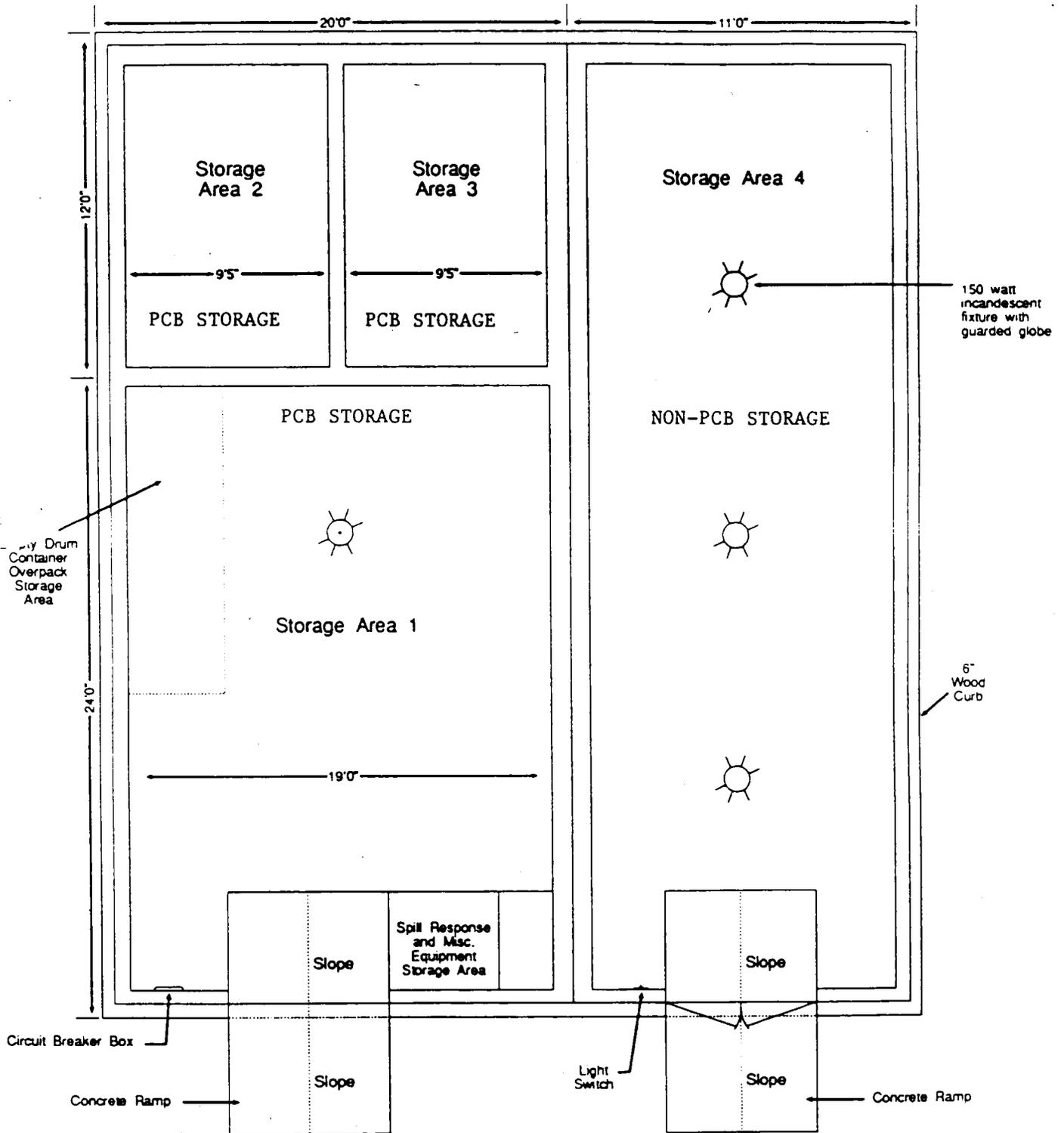




Figure D-11

Exterior View of Building 1440

The outdoor storage area near Building 859 began being phased-out as a hazardous waste storage site in October 1987. The transfer to Building 455 was completed on February 10, 1988. Appendix D.1 contains the closure documentation for the outdoor storage area.

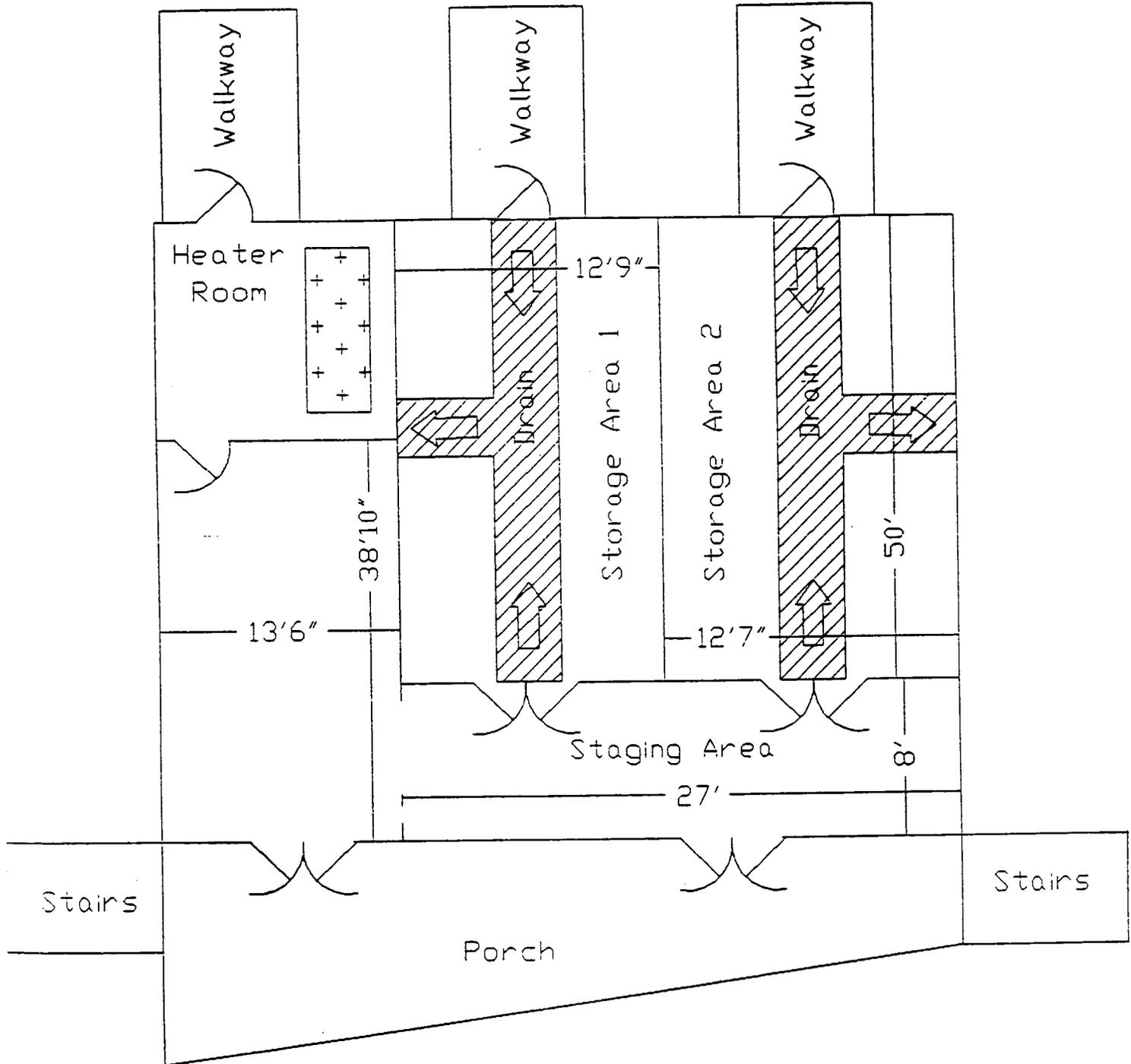
Buildings 212 and 328 are identical in design. Both are constructed of brick with concrete floors. As Figure D-12 illustrates, both buildings are divided into two individual bays. The two storage bays of each building are separated by impermeable walls and each bay will serve as a storage area for solid explosive hazardous waste. Building 212 will be used for storage of Class 1 Division 3 explosive hazardous waste and Building 328 will be used to store Class 1 Division 1 explosive hazardous waste. Table D-4 contains a description of the contents of each bay for Buildings 212 and 328, along with capacities and other significant features. Figures D-13 and D-14 are photographs that depict the exterior of Buildings 212 and 328. Fire protection for Building 212 is supported by a fire hydrant located approximately 32 feet across the access road. Fire protection for Building 328 is supported by a fire hydrant located approximately 120 feet from the building.

EHW stored in Buildings 212 and 328 will be thermally treated on-site by certified personnel. Buildings 212 and 328 will be operated by our Ordnance Department who will be responsible for providing all services for final treatment of hazardous wastes in accordance with the IHDIVNAVSURFWARCEN's RCRA Part B Permit Subpart X Miscellaneous Unit permit application.

The following discussions about containers are broken into four sub-sections.

D. Process Information

Figure D-12  
Floor Plan for Building 212 and 328



**Table D-4**

**Storage and Containment Capacities**

**BUILDING 212**

<b>Bay</b>	<b>Categories</b>	<b>Maximum Inventory Allowed (lb.)</b>	<b>Secondary Containment Capacity (gal.)</b>	<b>Ventilation</b>	<b>Temperature Control</b>	<b>Electrical</b>	<b>Sprinkler System</b>	<b>Fire Alarms</b>
Storage Area 1	1.3	25,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group D	No	No
Storage Area 2	1.3	25,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group D	No	No
Staging Area	Material is only allowed to pass through. No storage permitted.			Fans & Louvers	Steam Heated	Class 1 Division 1 Group D	No	No

**Table D-4 (Continued)**

**Storage and Containment Capacities**

**BUILDING 328**

<b>Bay</b>	<b>Categories</b>	<b>Maximum Inventory Allowed (lb.)</b>	<b>Secondary Containment Capacity (gal.)</b>	<b>Ventilation</b>	<b>Temperature Control</b>	<b>Electrical</b>	<b>Sprinkler System</b>	<b>Fire Alarms</b>
Storage Area 1	1.1	1,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No
Storage Area 2	1.1	1,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No
Staging Area	Material is only allowed to pass through. No storage permitted.			Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No

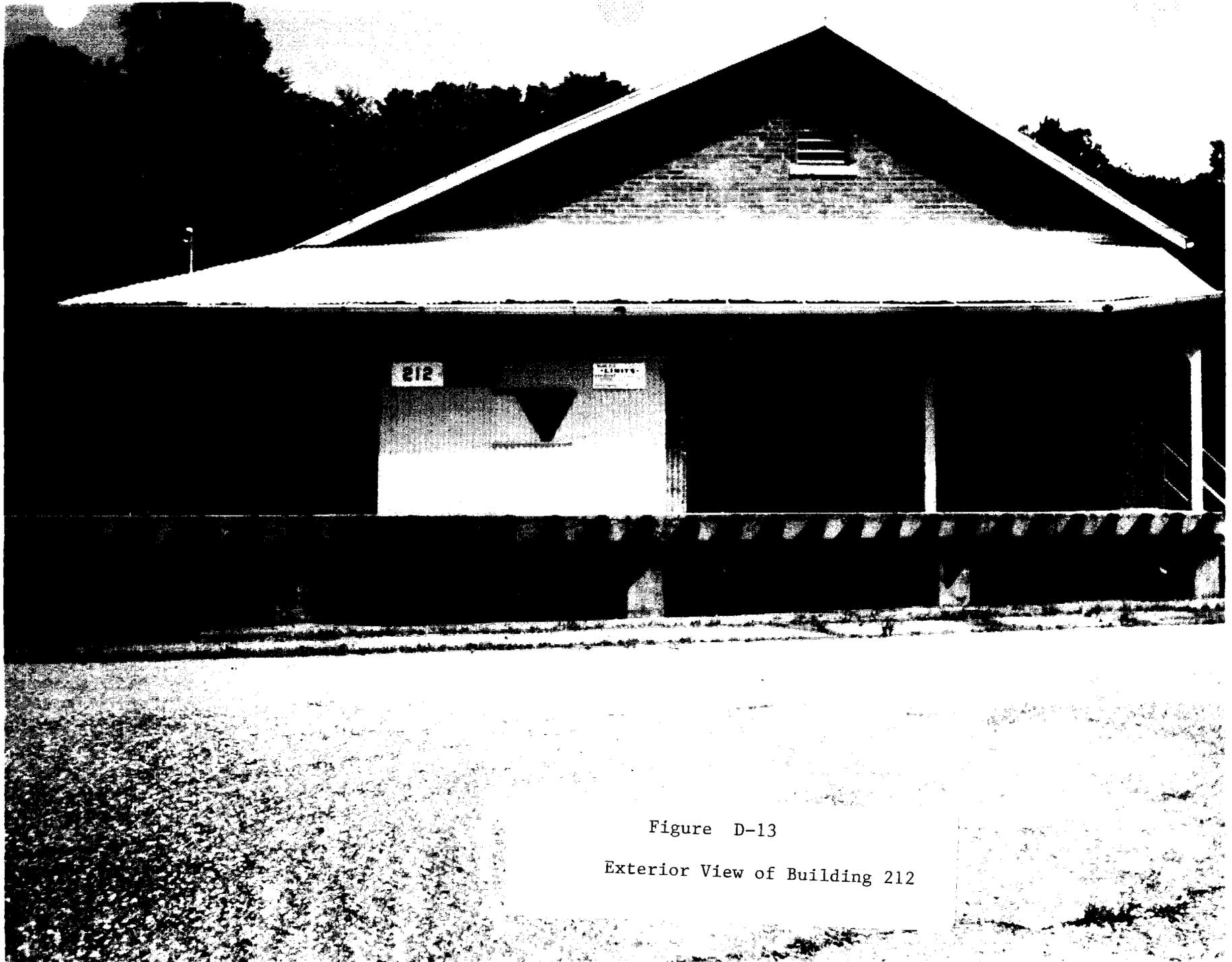


Figure D-13  
Exterior View of Building 212



Figure D-14  
Exterior View of Building 328

## **D-1 Containers (Building 455)**

### **D-1a Containers with Free Liquids**

#### **D-1a(1) Description of Containers**

In general, the most prominent storage container is the 55-gallon steel drum. The drums used to store liquids are usually the closed-head type with a 2-inch pipe thread bung for filling and a 3/4-inch pipe thread opening for venting. Products that potentially contain small amounts of free liquids are packed in removable head drums.

In addition to the 55-gallon drums, there are many small containers. Some of these are the original shipping containers; containers are constructed of fiberglass, steel, paper, etc. Wastes from the laboratories are occasionally stored in open-top drums referred to as bulk lab packs. All containers meet the standards specified in the Department of Transportation Standards 17H and 17C. Containers and liners are selected from materials that will minimize any reaction or corrosion as chemical industry practices dictate. All containers are palletized.

#### **D-1a(2) Container Management Practices**

Non-explosive and explosive hazardous wastes originate at various generator sites at the IHDIVNAVSWARFWARCEN. The hazardous waste is collected and analyzed at the generator site. The analysis report is the basis for storing the waste. This must be completed before the non-explosive waste is accepted at Building 455 for storage (see Section C for details of analysis performed on wastes).

The bays in Building 455 may, on rare occasion, be used to store hazardous material that has been exceeded from a specific area within the plant. Table D-1 indicates types of ventilation and temperature

control, presence of alarms and sprinkler systems, and electrical codes. Building 455 is equipped with locking doors and is located within the restricted area.

IHDIVNAVSURFWARCEN waste generators must provide a Waste Profile Sheet for all non-explosive waste the generator creates during the year. Once a profile has been established and a waste profile number assigned, the operator will only have to reference their profile number on turn-in document DD Form 1348-1 (See Figure C-1).

Each generator is responsible for:

- Performing all necessary analyses.
- Ensuring that each container meets applicable DOT specifications.
- Ensuring that each container/liner system is compatible with the waste being shipped/stored in accordance with good industry practices.
- Completing the DRMS Form 1930 (Waste Profile Sheet).
- Filling each container to only 95% full to reduce the potential problems associated with fluctuations in temperatures.
- Properly packaging, labeling, dating, and using DD Form 1348-1.
- Ensuring each container is free of defects or corrosion that might compromise the integrity of the container.
- Handling each container in such a manner as to prevent denting, rupturing, or puncturing.
- Fastening all bungs or closure rings securely.
- Notifying the Property Disposal Officer (PDO) when containers are ready to be moved to Building 455 for storage.

Before moving containers to storage, the PDO verifies the completion of these responsibilities. In the event the contents of a container have not been completely identified, the PDO may place the container in Bay 4 of Building 455 until the analysis is complete. Bay 4 has small sub-diked areas that provide separation within the bay. Containers that have not had their contents completely analyzed will be separated by two sub-diked areas from other containers in Bay 4 to prevent contact. While in Bay 4, the analysis will be completed. The PDO instructs the generator to correct any deficiency or discrepancy. The transporting of containers to Building 455 is conducted by the individual departments under the supervision of the PDO.

Upon delivery to Building 455, the container is stored in the appropriate bay, based on the grouping information provided on the DD Form 1348-1. At a minimum, two subdiked areas will be provided between incompatibles. If a non-explosive unknown waste has reached its 90-day storage limit in the plant, is moved into Bay 4 of Building 455 and placed into a diked area with additional containment such as an overpack drum, at a minimum, while testing is completed to identify the waste. Containers are never stored on the floor. Drums are placed on pallets, no more than two high (light fixtures prevent this in Bays 3 and 4). A minimum 5-foot aisle space will be maintained, with 2 feet between container rows.

All non-explosive hazardous wastes, not approved for on-site treatment, are shipped to permitted treatment/disposal facilities. The contract to dispose of the hazardous waste includes preparations for shipping, actual shipping, and disposal. The contractor consolidates shipments, as necessary, into shipping containers meeting DOT specifications and is responsible for the safe delivery of the hazardous wastes to the disposal site. In addition, the new disposal contract for the Activity requires the contractor to furnish certificates of disposal/treatment for all hazardous wastes.

As the inventory of waste approaches the maximum capacity, the disposal contractor is called to collect and transport the inventory to the contractor's licensed disposal facility.

Due to the construction features of Building 455, double brick walls, wooden truss-type roof, etc., extreme temperatures are not experienced. Some of the bays are periodically monitored with a thermometer to ensure safe operating temperatures. In addition, the generators fill each container to only 95% full to reduce the potential problems associated with fluctuations in temperatures. Extreme temperatures have never caused CHS to become unstable at Building 455.

### **D-1a(3) Secondary Containment System Design and Operation**

All of the bays currently have 6-inch diking that provides secondary containment (Figure D-15). Bay 4 is further separated by 4-inch dikes. All of the bays are protected by a chemical and spark resistant epoxy surface within the containment area. Table D-5 contains calculations that show the secondary containment capacities for each of the bays in Building 455.

The floor elevation of Building 445 is approximately 90 feet above Mean Sea Level (MSL). This places it 82 feet above the 100-year flood plain elevation. The floor is elevated 3 to 4 feet above the ground in the immediate area, thus preventing any run-on. The raised floor elevation provides for convenient loading and unloading of trucks. All of the bays have interior ramps that provide additional containment (Figure D-16).

The roof is a wooden truss-type with a 12 to 4 slope that prevents roof ponding, thus reducing the potential for leaks (Figure D-17). The sloped roof is equipped with a gutter system. There are no drains in the facility; any accumulated liquids are removed using absorbent material, as soon as possible following discovery.

**Table D-5**  
**Dimensions and Maximum Allowable Inventory**  
**of Building 455**

Bay	Length (ft)	Width (ft)	Height (ft)	Volume (ft <sup>3</sup> )	Secondary Containment Capacity (gal)
1	55.75	17	.5	474	3,545
2	55.75	17	.5	474	3,545
3	55.75	17	.5	474	3,545
4	55.75	27	.5	625*	4,676*
5	55.75	17	.5	474	3,545
6	55.75	17	.5	474	3,545
7	55.75	17	.5	474	3,545
8	55.75	17	.5	474	3,545
Totals				3,942	29,491

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\*Includes subtraction of volumes for elevator shaft, valve room, and ramp.

Figure D-15

Secondary Containment Dike in Building 455

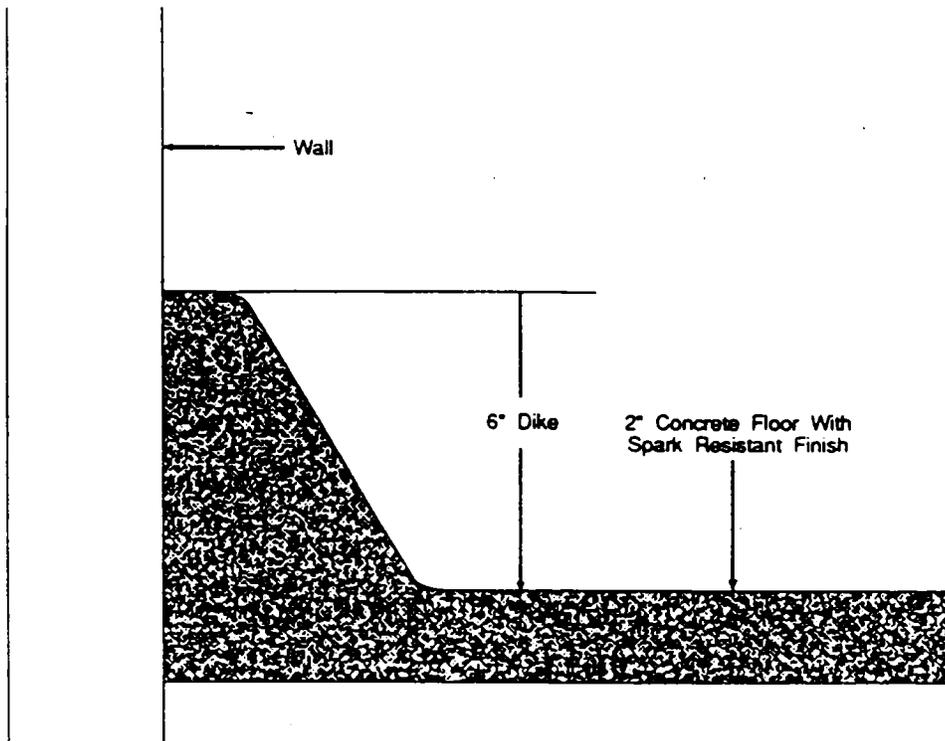


Figure D-16

Interior Ramps in Building 455

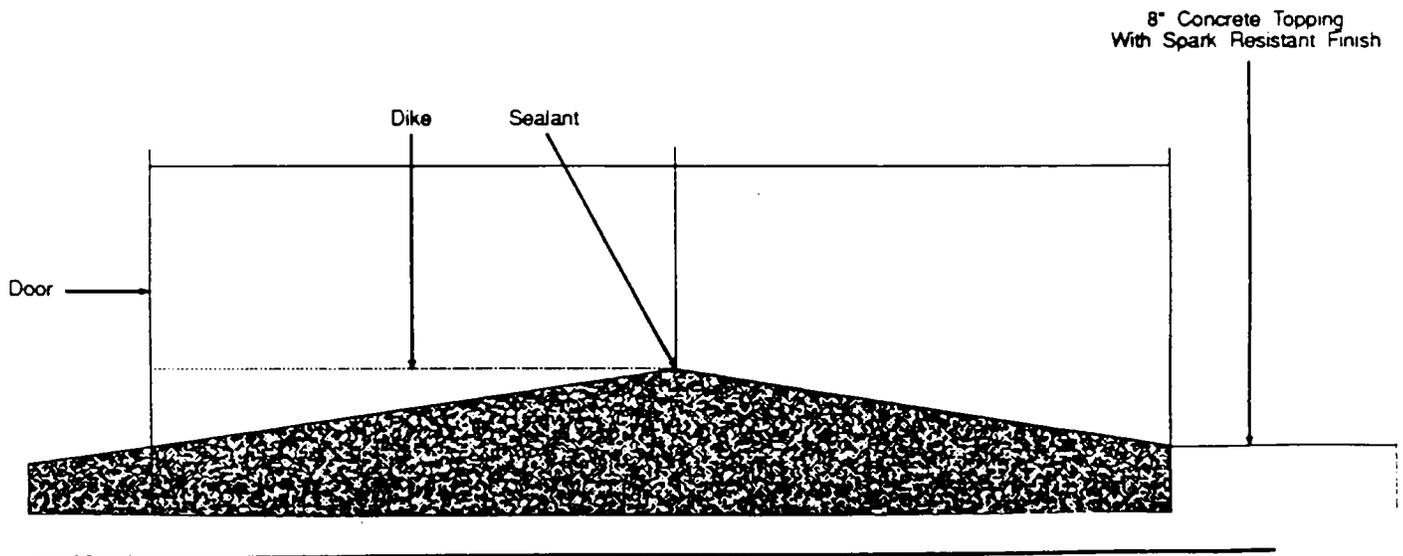
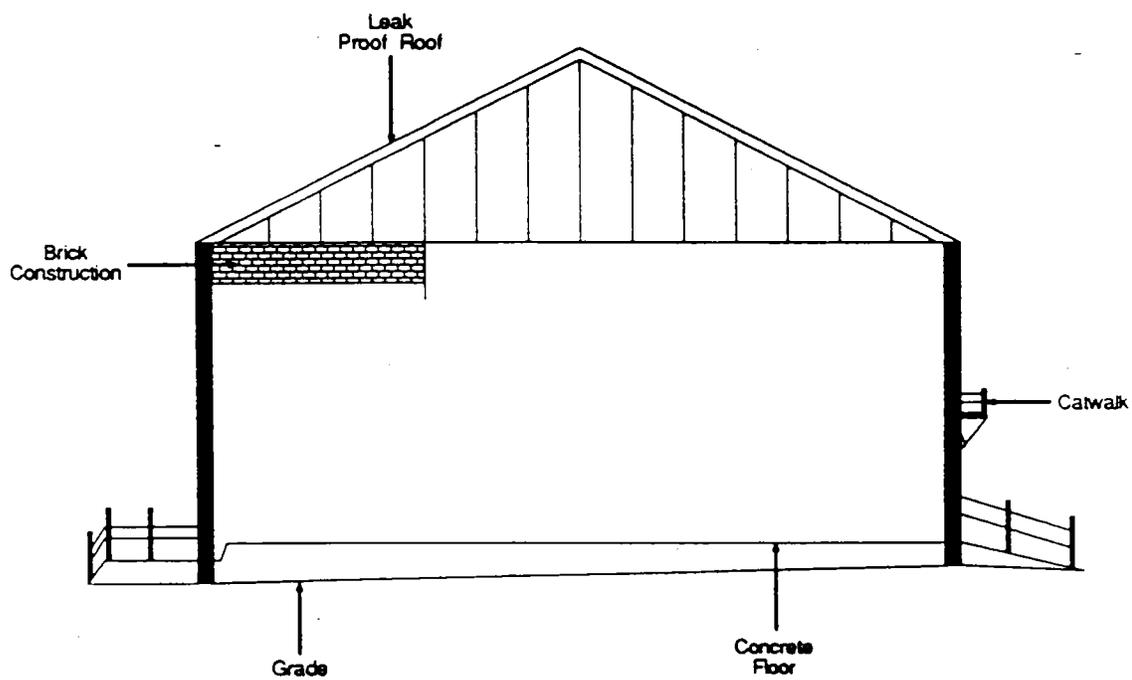


Figure D-17

Truss Type Roof in Building 455



#### **D-1a(4) Removal of Liquids from Containment System**

Minor spills and leaks within the containment system will be cleaned by the use of absorbent materials, squeegees, or absorbent socks. Large spills may require implementation of the site-specific spill contingency plan for Building 455. All spills leaving the building will be reported to the Fire Protection Division. The Fire Chief will determine the appropriate level of response. Empty 55-gallon drums and over pack drums are kept at Building 455 for storage of spill waste or the transfer of waste from leaking containers (refer to Appendix G.1 for the details of the contingency plan).

#### **D-1b Containers Without Free Liquids**

##### **D-1b(1) Test for Free Liquids**

The test for free liquids is the paint filter test described by the U.S. EPA (50 FR 18370) as specified in Method 9095 in EPA Publication SW-846.

##### **D-1b(2) - D-1b(4) Container Description, Management Practices, and Storage Area**

Drainage Information in Sections D-1a(1) - D-1a(3) is also applicable to containers without free liquids.

##### **D-1c Anticipated Future Reconfiguration of Building 455**

The IHDIVNAVSURFWARCEN foresees the need to change the permitted contents of certain bays in Building 455 periodically to better serve its waste management needs. The changes will be minor in nature, submitted to MDE in writing, and subject to the MDE's approval.

## **D-2 Containers (Building 1440)**

### **D-2a Containers with Free Liquids**

#### **D-2a(1) Description of Containers**

The IHDIVNAVSURFWARCEN is in the process of decommissioning all electrical distribution equipment that contain PCB dielectric fluids. To date, all of the transformers located at the Activity have been tested for PCBs. All PCB transformers have been removed from the Activity. The inventory consists of light ballasts, and, possibly, small capacitors from heat, ventilation, and air conditioning units. Leaks that are occasionally detected from this equipment are collected in drums.

Electrical equipment, such as capacitors and light ballasts, are intrinsically sound containers for PCBs in free liquid form. These electrical equipment items vary in size, shape, and capacity. Equipment with minor leaks are placed on special collection pans. The fluid will be pumped out prior to removal by the contractor. The disposal contractor then places the equipment "carcasses" into Department of Transportation (DOT)-approved containers for shipment to disposal facilities. Electrical equipment with no leaks can be shipped as is. The drums used for other PCB-contaminated materials comply with the Shipping Container Specification of the DOT, 49 CFR 178.80 (Specification 5 container without removable head), 178.82 (Specification 5B container without removable head), 178.102 (Specification 6D overpack with Specification 2S(178.35) or 2SL (178.35a) polyethylene containers) or 178.116 (Specification 17E container).

### **D-2a(2) Container Management Practices**

Building 1440 is the "queuing" site for equipment taken off-line and awaiting shipment to a permitted treatment/disposal facility. All management practices are according to the regulations prescribed under the Toxic Substances Control Act (TSCA) in 40 CFR 761.

Records of all PCBs and PCB items are kept according to the requirements addressed in 40 CFR 761.180. These records are the basis for the document log report detailing the IHDIVNAVSURFWARCEN's PCB waste stream. The records track the date when the PCB item was removed from service, placed in storage, placed into transport, and disposed at the disposal facility. In addition, the annual document log contains a summary report which includes totals of PCBs and PCB items in service, in storage, and disposal during a given year. Records also track the total weight of the contents of each item, number of PCB items, and monthly inspections.

Containers (capacitors, light ballasts, etc.) received at the PCB storage facility are checked for proper packaging, labeling, dating, and internal manifesting prior to acceptance. Containers accepted for storage must meet the following general standards:

- The contents must be identified in accordance with the Waste Analysis Plan.
- All containers must meet DOT specifications and be made of, or lined with, material that will not react, corrode, or otherwise be incompatible with PCBs. All PCB containers will be stored on pallets.
- An accurately completed DD Form 1348-1 must be prepared by the PDO.
- Each container must be in good condition (i.e., free of corrosion, structural defects, and leakage/spillage). Defective containers will be overpacked or the contents transferred to another compatible container. In the case of leaking transformers, special pans will be used to collect leaking PCB fluid. Leaking capacitors are overpacked in containers with a granular absorbent material, such as vermiculite.

- Each container must be opened, closed, and otherwise handled in such a manner as to prevent damage by denting, rupture, puncture, or other means. The closure mechanism (i.e., valves, plugs, rings, bungs) must be securely tightened.
- A piece count and waste inventory inspection is completed and compared to the DD Form 1348-1.

All containers bear the marking stickers as dictated in 40 CFR 761.40 and 761.65. No container is stored for more than one year. Containers are inspected twice a week. The aisles in Building 1440 are maintained at a minimum of 2 feet.

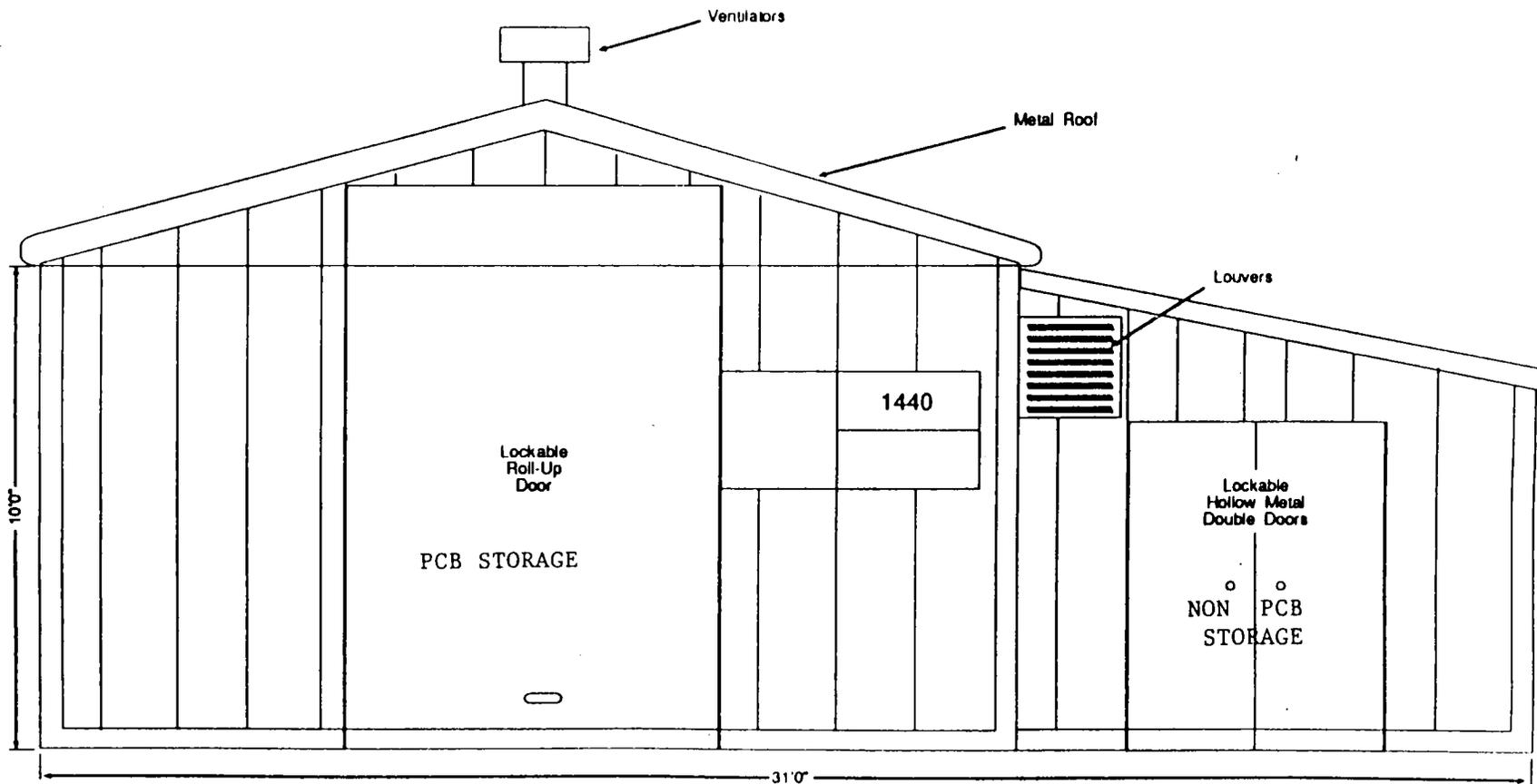
The disposal of PCBs is accomplished through the Defense Reutilization and Marketing Office (DRMO) which contracts for the transport and off-site disposal of PCB wastes generated at the IHDI VNAVSURFWARCEN. The DRMO is notified by the IHDI VNAVSURFWARCEN Supply Department of inventory changes as items destined for off-site disposal are received for storage at Building 1440 so transportation can be arranged prior to reaching the maximum inventory limitations.

The uniform manifest, signed by the PDO, is required for external transportation of CHS to permitted off-site treatment or disposal facilities. The designated treatment or disposal facility is responsible for accepting the shipment and documenting the disposal or treatment procedure(s). A signed copy of the uniform manifest is returned to the Waste Management and Prevention Branch.

### **D-2a(3) Secondary Containment System Design and Operation**

The floors in Building 1440 are concrete with 6-inch dikes. The concrete is free of intentional or unintentional penetrations and is sealed with an impermeable epoxy surface that prevents sparking. A metal roof with natural draft ventilators protects the interior of Building 1440 (Figure D-18). Table D-2 outlines the containment and storage capacities.

Figure D-18  
Front Elevation of Building 1440



The floor elevation of Building 1440 is approximately 10.5 feet above MSL. The 100-year flood elevation is 8 feet above MSL, hence, Building 1440 satisfies the requirements stated in 40 CFR 761.65 (b)(1)(v). Local drainage is directed away by grading around the building. There is a ramp at the entrance (sloped up outside the building and down inside the building) that precludes the possibility of run-on into the facility (Figure D-19).

#### **D-2a(4) Removal of Liquids from Containment System**

Spills will be removed by the use of absorbents and placed in drums meeting DOT specifications. For further details of spill removal refer to Appendix G.2.

#### **D-2b Containers Without Free Liquids**

##### **D-2b(1) Test for Free Liquids**

The test for free liquids is the paint filter test described by the U.S. EPA (50 FR 18370) as specified in Method 9095 in EPA publication SW-846.

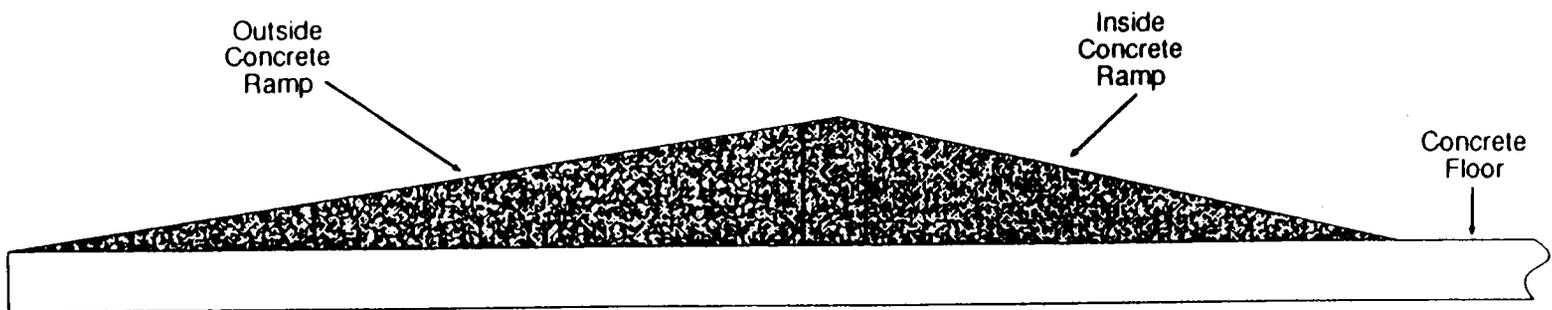
##### **D-2b(2) Description of Containers**

Non-liquid PCBs are stored in containers that comply with 49 CFR 178.33.

##### **D-2b(3) Container Management Practices and Storage Area Drainage**

Information in Sections D-2a(2) - D-2a(3) is also applicable to containers without free liquids.

Figure D-19  
Ramp for Building 1440



#### **D-2b(4) Removal of Liquids from Containment System**

Spills will be removed by the use of absorbents and placed in drums meeting DOT specifications. For further details of spill removal refer to Appendix G.2.

#### **D-2c Anticipated Future Use of Building 1440**

Based on IHDIVNAV SURFWARCEN's aggressive decommissioning program, the existing function of Building 1440 will be obsolete by the end of the decade. The IHDIVNAV SURFWARCEN envisions using Building 1440 as a hazardous waste/material storage area after the PCBs are removed and the building completes PCB closure. Its exact function has not yet been determined.

### **D-3 Containers (Buildings 212 and 328)**

#### **D-3a Containers with Free Liquids**

Liquids will not be stored in Buildings 212 and 328. These buildings will be used for storage of solid wastes only.

#### **D-3b(1) Description of Containers**

Solid wastes stored in Buildings 212 and 328 will be contained in various types of containers depending on the particular type of explosive hazardous waste. One example of a type of container that will be used is metal explosive scrap cans lined with conductive plastic bags.

Explosive scrap propellant grains that cannot be placed in containers will be tightly wrapped in conductive plastic and stored on carts off the ground. Sheetstock propellant will be stored in lever packs.

Expired and/or non-specification rocket motors will also be stored in these buildings off the ground on carts or pallets.

### **D-3b(2) Container Management Practices**

Explosive hazardous wastes originate at various generator sites at the IHDIVNAVSURFWARCEN. The hazardous waste is collected at the generator site.

Table D-4 indicates types of ventilation and temperature control, presence of alarms and sprinkler systems, and electrical codes. Buildings 212 and 328 are equipped with locking doors and are located within the restricted area.

IHDIVNAVSURFWARCEN EHW generators must provide a Strauss Avenue Thermal Treatment Point (SATTP) Scrap Sheet for each EHW prior to the placement of the EHW in either Building 212 or 328.

Each generator is responsible for:

- Performing all necessary analyses.
- Ensuring each container/liner system is compatible with the waste being stored in accordance with good industry practices.
- Completing the SATTP Scrap Sheet.
- Filling each explosive scrap can to a maximum of 75 pounds.
- Properly packaging, labeling, and dating.
- Ensuring each container is free of defects or corrosion that might compromise the integrity of the container.

#### D. Process Information

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- Handling each container in such a manner as to prevent denting, rupturing, or puncturing.
- Fastening all closure rings securely.
- Notifying the EHW Storage Site Manager (Site Manager) when containers are ready to be moved to Building(s) 212 and/or 328 for storage.

Before moving containers to storage, the Site Manager verifies the completion of these responsibilities. The Site Manager instructs the generator to correct any deficiency or discrepancy. The transporting of containers to Buildings 212 and 328 is conducted by the individual departments under the supervision of the Site Manager.

Upon delivery to Building(s) 212 and/or 328, the container is stored in the appropriate bay, based on the information provided on the SATTP Scrap Sheet. Containers are stored on the floor. Grains and rocket motors are placed on carts. Containers are never stacked. A minimum 5-foot aisle space is maintained, with 2 feet between container rows.

Each container will be labeled with a hazardous waste label. The hazardous waste label will include the accumulation date, waste identification, and quantity. EHW will be treated at the Strauss Avenue Thermal Treatment Point.

Due to the construction features of Buildings 212 and 328, double brick walls, wooden truss-type roof, etc., extreme temperatures are not experienced.

#### **D-3b(3) Secondary Containment System Design and Operation**

Liquids will not be stored in Buildings 212 or 328. These buildings will be used for storage of solid wastes only.

#### D. Process Information

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The floor elevation of Building 212 is approximately 45 feet above Mean Sea Level (MSL). Building 328 is approximately 34 feet above (MSL). This places Building 212 approximately 37 feet above the 100-year flood plain elevation and Building 328 approximately 26 feet above the 100-year flood plain elevation. The floor is elevated 3 to 4 feet above ground in the immediate area, thus preventing any run-on. The raised floor elevation provides for convenient loading and unloading of trucks. The roofs are a wooden truss-type with a 12 to 4 slope that prevents roof ponding, thus reducing the potential for leaks. Any accumulated liquid will be removed using absorbent material, as soon as possible following discovery. The sloped roofs are equipped with a gutter system. The floors contain center drains; however, they are sealed; only solids will be stored in Buildings 212 and 328.

#### **D-3b(4) Removal of Spilled Solids**

Minor spills and leaks will be cleaned by the use of dustpans and brooms. All spills leaving the building will be reported to the Fire Protection Division (Fire Chief). The Fire Chief will determine the appropriate level of response. Empty scrap cans will be kept at both buildings for storage of spilled waste or the transfer of waste from damaged containers.

#### **D-3c Anticipated Future Reconfiguration of Buildings 212 and 328**

The IHDIVNAVSURFWARCEN does not anticipate reconfiguring Buildings 212 and 328 at this time.

### **D-4 Hazardous Waste Treatment Processes**

#### **D-4a Spent Carbon**

The IHDIVNAVSURFWARCEN mixes spent carbon from the treatment of nitrate ester-contaminated wastewater with coal and uses it as a fuel to operate the Goddard Power Plant. In addition, the

NAVEODTECHDIV generates carbon from the treatment of wastewater contaminated with TNT and other explosives. This carbon is mixed with coal and is also used as a fuel to operate the Goddard Power Plant. In both processes, the spent carbon is technically classified as K045 waste; however, reactivity testing was done on the spent carbon to verify that it does not exhibit the characteristic of reactivity.

Appendix D.2 contains information describing the nitrate ester processes that generate the spent carbon and the reactivity testing that was performed on the carbon generated from the processes.

NAVEODTECHDIV's spent carbon is also classified by the Department of Transportation prior to shipment to our activity.

The current operation at the Goddard Power Plant requires a daily average of 150 tons of coal with hourly rates ranging from 4-8 tons. The coal is transferred from the coal pile to the hopper loading station using a front-end loader. The hopper then carries the coal to the top of the coal loading building where it is transferred onto a conveyor. The conveyor belt transports the coal to the power plant, where it is pulverized and fed into one of the three boilers. Each boiler has an approximate height of 50 feet and a width of 20 feet. The steam capacity of each boiler is 150,000 pounds per hour.

The spent carbon is delivered to the coal loading building in 55-gallon drums. The spent carbon is added manually to the hopper loading station. After one drum of spent carbon is added, the hopper carries three loads of coal to the top of the coal loading building before another drum of spent carbon is added to the hopper loading station. A maximum of 85 55-gallon drums of spent carbon are treated monthly at the power plant.

The power plant's stack gasses were monitored for nitrate esters during a spent carbon test burn. No nitrate esters were detected in the boiler emissions. A copy of the test emissions data is provided in Appendix D.3.

IHDIVNAVSURFWARCEN anticipates generating other spent carbon from the removal of nitrate esters or other explosives from wastewater not addressed in Appendix D.2. The Maryland Department of the Environment will be notified in writing 30 days prior to treatment of any new non-characteristic spent carbon at the power plant. The written notification will include test results showing that the spent carbon is not reactive.

#### **D-4b Elementary Neutralization**

The IHDIVNAVSURFWARCEN neutralizes wastes which are hazardous wastes only because they exhibit the corrosivity characteristic as defined in COMAR 26.13.02.12 or are listed in COMAR 26.13.02.16 - .19 only for this reason. Neutralization is performed in a tank, container, transport vehicle, or vessel as defined in COMAR 26.13.01.03. Appendix D.4 describes some of the elementary neutralization processes that are currently being performed at the Activity.

#### **D-4c Wastewater Treatment**

The IHDIVNAVSURFWARCEN treats wastewater which is a hazardous waste as defined in COMAR 26.13.02 in a wastewater treatment unit as defined in COMAR 26.13.01. Appendix D.5 describes some of the wastewater treatment processes that are currently being performed at the Activity.

**Appendix D.1**  
**Certification of Closure of CHS Storage Site Near Building 859**

COPY

5090

Ser 0433C/35  
APR 13 1989

Maryland Department of the Environment  
Hazardous Waste Program  
Attn: Mr. Edward Hammerberg  
2500 Broening Highway  
Baltimore, MD 21224

Gentlemen:

Per the requirements of COMAR 26.13.05.07, enclosed is the Certification of Closure to complete your file on the closure of the controlled hazardous substance storage site near Building 859 at the Naval Ordnance Station Indian Head, MD. The site was inspected by Barry Lincoln of your office on 29 March 1989.

Point of contact is Ms. Pamela Clements, Code 0433,  
(301) 283-7745

/s/

PETER RITZCOVAN  
Director, Environmental  
Protection Division  
By direction of  
the Commanding Officer

Encl:  
(1) Certification of Closure

Copy to:  
CHESDIV (114)

Blind copy to:  
A, 04, TDO2, 043D2, 280

Writer: C. Dow, 0433C, x7746  
Typist: C. Dow, 13 Apr 89

Certification of Closure  
of the  
Controlled Hazardous Substance Storage Site  
Near Building 859  
Naval Ordnance Station  
Indian Head, MD 20640-5000

I certify that I have inspected the storage site near building 859 at the Naval Ordnance Station both during and after closure and have observed completion of the required actions described in Attachment No. 6 and Attachment No. 9 of the Maryland Department of the Environment Controlled Hazardous Substance Facility Permit Number A-223 issued on April 14, 1988. In addition, the area has been steam-cleaned as described in the Naval Ordnance Station Quality Assurance Control Plan (Tab 1) and Maryland Department of the Environment letters of April 7, 1988 (Tab 2), and July 11, 1988 (Tab 3). These documents (Tab 1 thru 3) amended the original closure plan described in the Part B application which was approved by the Facility Permit.

Following the steam-cleaning operation, the contents of the sump were analyzed for evidence of residual contamination. The laboratory report (Tab 4) provided the following information:

Parameter	Standard (40 CFR 261.24)	Analysis	
		Sump	Blank
pH (at site)	6 to 9 (NPDES)	6.6	6.8
cadmium	1.0 mg/l	0.009 mg/l	0.001 mg/l*
chromium	5.0 mg/l	0.010 mg/l*	0.010 mg/l*
lead	5.0 mg/l	0.127 mg/l	0.281 mg/l
mercury	0.2 mg/l	0.001 mg/l*	0.001 mg/l*
TOX	Screening only	0.032 mg/l	0.012 mg/l

\* Value less than stated detection limit

The pH and metals are within allowable limits and are evidence that there is no heavy metal contamination. The Total Organic Halogen (TOX) test is a screening test which provides a positive value for many different halogenated solvents rather than indicating the presence of any one compound; however, the TOX value is below the one part per million level of 40 CFR 261.3(a)(2)(iv)(A) and is evidence that the site is not contaminated with halogenated solvents. (Pesticide contamination is ruled out by a review of the operating record.)

Based on the information presented above, I certify that the Naval Ordnance Station has completed the required closure procedure.

*Chester E. Davis*

CHESTER E. DAVIS  
P.E., MD 12280

*R. Scott Markert*

R. SCOTT MARKERT  
P.E., District of Columbia 008025

**ENCLOSURE(1)**

**Appendix D.2  
Spent Carbon Process Description  
and Reactivity Testing**

## NITRATION PLANT PROCESS

Due to the sensitive nature of the products manufactured at the Nitration Plants and the rigid product specification requirements, the operations must be under strict control. This is accomplished through fixed flow rates of feedstock and temperature and pressure controls. If, at any time during the nitration process, abnormal temperatures or pressures occur, the system automatically quenches the reaction with copious amounts of water.

The wastewater treatment facility at the Nitration Plants is a continuous process operation. During normal production, water is continuously generated through the transfer, neutralizing, and rinsing of nitrate esters. The water collects in a tank and then passes through each of four 55-gallon drums of carbon. The first drum in the series will adsorb the greatest amount of nitrate ester. The quantity of nitrate ester is currently measured at the input and output streams of each carbon drum. Typically, when any nitrate ester is detected at the output stream of the third drum, the first drum is removed, the other three drums are moved up, and an additional drum is added to the series.

In a worst case scenario, reactivity testing was performed on spent carbon that was generated from water with the highest nitrate ester concentration available. Water was taken from the catch tank during actual peak nitration plant operation. The water was nearly saturated with nitrate esters. No wash waters, which are lower in nitrate ester concentrations, were used to load the carbon. During normal plant operation, large amounts of wash water and other low nitrate ester concentration water passes through the carbon.

For the reactivity testing, the carbon was loaded until the concentration of nitrate esters going into the drum was the same as the concentration coming out of the drum. This meant that the carbon's capacity for adsorption had been fully utilized. The high concentrations of nitrate esters on the spent carbon were verified through testing, and the spent carbon samples were taken immediately from the plant to the laboratory for reactivity testing prior to any degradation or evaporation.

If at any time, the process significantly changes in such a way that it could change the characteristics of the spent carbon, reactivity testing will be completed to characterize the spent carbon again.

**SPENT CARBON FROM NITRATE ESTER**

**CONTAMINATED WASTEWATER**

<b>Nitrate Ester</b>	<b>% Nitrate Ester</b>	<b>% Water</b>	<b>Card Gap</b>	<b>Cap</b>	<b>Unconfined Burn</b>
Nitroglycerin Nitration	55%	< 5%	0 Cards	Negative	Negative
Propylene Glycol Dinitrate	69%	< 5%	0 Cards	Negative	Negative
Triethylene Glycol Dinitrate	40.30%	12%	0 Cards	Negative	Negative
Trimethylolethane Trinitrate	8.80%	< 5%	0 Cards	Negative	Negative
Extrusion Plant - Nitroglycerin	55%	3.50%	0 Cards	Negative	Negative

**NITROGLYCERIN NITRATION**

<b>% Moisture Content</b>	<b>Test Temperature</b>	<b>Impact MM</b>	<b>Sliding Friction PSIG</b>	<b>Electrostatic Discharge Joules</b>
2%	65F	175	420	0.250
2%	32F	175	235	0.625
4%	65F	175	420	1.250
4%	32F	200	315	1.250
6%	65F	225	750	1.250
6%	32F	225	560	1.250
7%	65F	150	560	1.250
8%	65F	175	560	1.250
10%	65F	200	750	>6.250
13%	65F	250	>980	>6.250
15%	65F	>600	>980	>6.250

**PROPYLENE GLYCOL DINITRATE**

<b>% Moisture Content</b>	<b>Test Temperature</b>	<b>Impact MM</b>	<b>Sliding Friction PSIG</b>	<b>Electrostatic Discharge Joules</b>
3%	65F	275	>980	0.250
5%	65F	300	>980	1.250
7%	65F	350	>980	1.250
9%	65F	350	>980	1.250
9%	32F	350	>980	1.250
11%	65F	>600	>980	1.250
13%	65F	>600	>980	>6.250
13%	32F	>600	>980	>6.250
15%	65F	>600	>980	>6.250
17%	65F	>600	>980	>6.250
17%	32F	>600	>980	>6.250

**TRIETHYLENE GLYCOL DINITRATE**

<b>% Moisture Content</b>	<b>Test Temperature</b>	<b>Impact MM</b>	<b>Sliding Friction PSIG</b>	<b>Electrostatic Discharge Joules</b>
3%	65F	>600	750	>6.250
5%	65F	>600	>980	>6.250
7%	65F	>600	750	>6.250
9%	65F	>600	>980	>6.250
11%	65F	>600	>980	>6.250
13%	32F	>600	>980	>6.250
13%	65F	>600	>980	>6.250
15%	32F	>600	>980	>6.250
15%	65F	>600	>980	>6.250
17%	32F	>600	>980	>6.250
17%	65F	>600	>980	>6.250

TRIMETHYLOLETHANE TRINITRATE				
% Moisture Content	Test Temperature	Impact MM	Sliding Friction PSIG	Electrostatic Discharge Joules
1%	65F	250	135	>6.250
3%	65F	275	750	>6.250
5%	65F	575	560	>6.250
7%	65F	550	560	>6.250
9%	65F	550	750	>6.250
11%	65F	>600	750	>6.250
13%	65F	>600	>980	>6.250
15%	65F	>600	>980	>6.250
17%	65F	>600	>980	>6.250

## EXTRUSION PLANT PROCESS

Due to the sensitive nature of the products manufactured at the Extrusion Plant and the rigid product specification requirements, the operations must be strictly managed. Grains are extruded using double base material that meets stringent specifications. After extruding, the grain must be machined down to meet a required size. Water is used as a safety precaution to reduce the chance of ignition while transporting the propellant chips from the machining process.

The wastewater treatment facility at the Extrusion Plant is a batch process operation. The wastewater is recycled through the machining process for typically three to four months until it reaches a predetermined level of nitrate esters. After reaching this level, the wastewater is collected in a holding tank and then passed through a minimum of two 55-gallon drums of new carbon. After passing through the carbon, the wastewater is sent to a holding tank until test results are received. After verifying through testing that the wastewater meets permitted National Pollutant Discharge Elimination System (NPDES) levels, it is released to an industrial outfall under permit #MD0003158.

The 55-gallon drums of carbon will be considered spent and sent to the power plant for treatment within five days. This time frame is important because the nitrate esters adsorbed on the carbon begin to decompose and generate nitrogen oxides within seven to ten days of being taken off-line.

In the future, the process may vary slightly to allow for conservation of the water. After passing through the carbon, the wastewater would be placed back into the system instead of discharging to a permitted outfall. When it becomes necessary to discharge the water, the testing described above will be completed prior to releasing to the permitted NPDES outfall.

In a worst case scenario, the nitrate ester contaminated wastewater used to load the carbon for reactivity testing was generated by soaking burlap sacks of double base propellant chips in tanks of agitated water. The generated wastewater was analyzed to ensure that it was nearly saturated with nitrate esters. After verifying this, it was used to load the carbon. During normal operation, the wastewater will be more dilute, since it will only be in momentary contact with the propellant chips as it is transported approximately 25 yards where the wastewater and propellant chips are separated.

For the reactivity testing, the carbon was loaded until the concentration of nitrate esters going into the drum was the same as the concentration coming out of the drum. This meant that the carbon's capacity for adsorption had been fully utilized. The high concentrations of nitrate esters on the spent carbon were verified through testing, and the spent carbon samples were taken immediately from the plant to the laboratory for reactivity testing prior to any degradation or evaporation.

Since the double base propellant contains lead, this carbon will also be tested using the Toxicity Characteristic Leaching Procedure (TCLP) to verify that the spent carbon is

nonhazardous.

If at any time, the process significantly changes in such a way that it could change the characteristics of the spent carbon, reactivity and TCLP testing will be completed to characterize the spent carbon again.

**EXTRUSION PLANT - SPENT CARBON WITH NITROGLYCERIN**

<b>% Moisture Content</b>	<b>Test Temperature</b>	<b>Impact MM</b>	<b>Sliding Friction PSIG</b>	<b>Electrostatic Discharge Joules</b>
3.50%	65F	250	>980	>6.250

Note 1: Non-explosive interim DOT hazard classifications have been assigned to Nitroglycerin loaded carbon from the Extrusion Plant, Nitroglycerin Nitration loaded carbon and Propylene Glycol Dinitrate loaded carbon.

Additional testing is required to finish the interim DOT hazard classifications for Triethylene Glycol Dinitrate loaded carbon and Trimethylolethane Trinitrate loaded carbon but all indications are that they will be classified similarly.

## NITRAMINE FINE GRIND AREA

Spent carbon is generated at our Nitramine Fine Grind area during the processing of water contaminated with cyclotrimethylene trinitramine (RDX) and isopropyl alcohol. The RDX is currently transported to our facility wet with 70% water and 30% isopropyl alcohol. During the drying operation, the isopropyl alcohol and water are evaporated off the RDX and collected into holding tanks. As part of the process, wastewaters containing under 24% by volume of isopropyl alcohol and low concentrations of RDX (2 to 4 parts per million) are run through a carbon column contained in a polyvinyl chloride (PVC) tube, four feet high by four inches in diameter. In the near future, this carbon column will be replaced by two columns that are six feet high by three feet in diameter.

After the wastewater is passed through the carbon column, it is sent to another holding tank until liquid chromatography test results are received. If any trace of RDX is found, the carbon is considered spent, and is replaced with new carbon. The wastewater is then run back through the new carbon and tested again. After there are no traces of RDX found, the wastewater is sent to our sewage treatment plant that discharges under a sanitary National Pollutant Discharge Elimination System (NPDES) permit, #MD0020885. Reactivity tests completed on this spent carbon are included in Attachment A.

Due to a change in Department of Transportation shipping regulations, we expect to receive the RDX wet only with water in the near future. At that point in time, only RDX contaminated wastewater will be run through the carbon columns. After testing to verify that there is no RDX present in the wastewater, it will be released to an industrial outfall under our NPDES permit, #MD0003158.

Another process in the Nitramine Fine Grind area that will be generating spent carbon is the RDX hopper cleaning operation. Operation of this facility will begin in the near future. The water from this operation will be recycled until it becomes necessary to replace with fresh water. At that point, the wastewater will be passed through one carbon column, six feet high by three feet in diameter. Testing will be completed as described above, prior to releasing to an industrial outfall under our NPDES permit, #MD0003158. Since this process has not yet begun operation, there is no reactivity data available on the spent carbon generated by this process.

**SPENT CARBON FROM CYCLOTRIMETHYLENE TRINITRAMINE**

**CONTAMINATED WASTEWATER**

<b>Explosive</b>	<b>Card Gap</b>	<b>Cap</b>	<b>Unconfined Burn</b>	<b>Impact MM</b>	<b>Sliding Friction PSIG</b>	<b>Electrostatic Discharge Joules</b>
Nitramine Fine Grind Area - Cyclotrimethylene Trinitramine	0 Cards	Negative	Negative	>600	>980	>6.250

## SAW WATER TREATMENT PROCESS

The Vandal grain is one of the many energetic items manufactured at our Activity. Due to the sensitive nature of the products specification requirements, the Cast Division and the rigid product specification requirements, the operations must be strictly managed. During the manufacture of the Vandal grain, a sawing operation is necessary to cut the grain to a specified length. The sawing operation requires the use of water as a safety precaution to keep both the blade saw and the grain cool to prevent ignition during the operation.

The wastewater treatment system is a batch process operation. The water generated during the sawing operation is collected into a sump and recycled. After sawing one grain, the water in the sump is sent through three separate filter housings in series. One housing contains 4 granulated carbon filters and the other two housings each contain 2 granulated carbon filters. The first filter housing will contain the greatest amount of nitrate ester. The quantity of nitrate ester is currently measured at the input and output streams of each filter housing. The spent carbon filters in all three filter housings (8 total) will be removed after each sawing operation and replaced with new carbon filters to eliminate any possibility of nitrate ester breakthrough. The treated water will be discharged to an industrial wastewater outfall under the National Pollutant Discharge Elimination System (NPDES) permit, #MD0003158.

Spent carbon generated from the sawing operation described above was analyzed for nitrate ester content. The results showed the highest nitrate ester content to be 2.56 percent. Since previous reactivity testing performed on spent carbon loaded with 55 percent nitrate ester demonstrated no reactivity, we believe that this spent carbon is also not reactive (see Attachment [A]).

In addition, since the propellant contains lead, the water was analyzed for lead content. However, the test results showed lead level to be insignificant.

If at any time, the process significantly changes in a way that it could alter the characteristic of the spent carbon, reactivity testing will be completed to characterize the spent carbon.

SPENT CARBON FROM SAW WATER TREATMENT PROCESS		
Nitrate Ester	Filter Housing	% Nitrate Ester
Nitroglycerin	1	2.56
Nitroglycerin	2	0.16
Nitroglycerin	3	ND

ND = NOT DETECTABLE

SPENT CARBON FROM NITRATE ESTER CONTAMINATED WASTEWATER: NITRATION PLANT					
Nitrate Ester	% Nitrate Ester	% Water	Card Gap	Cap	Unconfined Burn 
Nitroglycerin	55%	< 5%	0 Cards	Negative	Negative

## **PINK WATER TREATMENT PROCESS**

A steamout process is used to remove meltable main charge explosives from ordnance items by the use of steam at the Stump Neck Annex. Water and explosive material flow from the units as the explosive melts and the steam condenses. A large hose directs the flowing explosives/water mixer to a steam jacketed trough and into a steam jacketed kettle. During the steaming process, the steam turns to hot water and picks up dissolved TNT and other explosive constituents. This colors the water pink; hence the term "pink water." While the steamout process is under way, no steam is allowed to escape from the system. A vapor recovery system generates negative pressure over the kettle and the two pink water holding tanks and sends excess steam and accumulated vapor through a vapor scrubber. This scrubber consists of activated carbon which will remove explosive contamination from the moisture laden air that passes through it.

In the steam jacketed kettle, the molten explosive sinks to the bottom, while the pink water rises to the top. The pink water is pulled from the top of the kettle contents through a floating skimmer. This stream is pushed by an air driven diaphragm pump through a bag filter to one of two pink water holding tanks. The bag filter catches solid particles of explosive that are picked up by the skimmer. From the pink water holding tanks, the pink water is pumped through a cartridge filter and then through two activated carbon drums connected in series, where the remaining explosive constituents are removed. The wastewater exiting the carbon drums must meet the level of explosive contamination allowed by the National Pollutant Discharge Elimination (NPDES) permit for the industrial wastewater outfall, IW 49.

When carbon drums become spent, they are considered a hazardous waste, EPA hazardous waste number K045, and are shipped to IHDIVNAVSURFWARCEN for storage or treatment. However, prior to shipment to IHDIVNAVSURFWARCEN, the spent carbon is tested for reactivity and is DOT classified.

Only nonreactive spent carbon will be treated at the IHDIVNAVSURFWARCEN Power Plant. Reactive spent carbon will be thermally treated at the Stump Neck Annex's Range 3.

**Appendix D.3  
Test Emission Data**

5090  
Ser 3340D/806/mf  
9 Aug 90

MEMORANDUM

From: 3340D  
To: 2840A  
Via: 3340

Subj: GAS CHROMATOGRAPH/MASS SELECTIVE DETECTOR (GC/MSD) ANALYSIS OF FLUE GAS FOR THE PRESENCE OF NG

1. A sample of flue gas which emanated from the power plant was submitted to the lab in a metal sphere container. The flue gas was collected by Code 2840A in the metal sphere container at one (1) atmosphere. Code 2840A requested that the flue gas sample be analyzed for the presence of NG.

2. Analysis Procedure

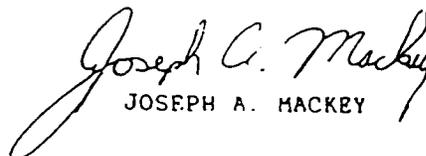
A one (1) ml/gas tight syringe was used to withdraw one ml of the gas sample volume and injected directly into the GC/MSD. The mass spectral analysis was conducted using selected ion monitoring (SIM) mode which offers the highest sensitivity and selectivity for detecting the presence of nitrate esters. A GC/MSD instrument standard (methyl stearate) was used to establish lower level of detection (LLD) for the instrument.

3. Results of Analysis

No NG or any other nitrate esters were detected. The LLD for the instrument was set at 100 picogram ( $10^{-10}$ g). The LLD correspond to 100 nanogram/cubic centimeter (100 PPB) of the analyte concentration (nitrate esters) in the gas sample.

4. Conclusion

GC/MSD analysis did not detect any nitrate esters present in the flue gas sample. However, our LLD for this analysis was 100 PPB. Other techniques may be used to concentrate the analyte (i.e., absorption traps) before analyzing by GC/MSD, thereby lowering the overall detection limits of the analysis.

  
JOSEPH A. MACKEY

8000  
Ser 3340D/836/mf  
28 Aug 90

MEMORANDUM

From: 3340D  
To: 2840A  
Via: 3340 *as*

Subj: GAS CHROMATOGRAPH/MASS SELECTIVE DETECTOR (GC/MSD) ANALYSES OF FLUE GAS SAMPLES

Ref: (a) Lab Log#s 888425, RR9069, 889253 & 889254

Encl: (1) Table I-GC/MSD Flue Gas Analysis Summary

1. Four samples of flue gas resulting from the burning of spent carbon contaminated with various nitrate esters were submitted to the laboratory for analysis. Code 2840A collected the flue gas samples at one atmosphere and requested that the flue gas samples be analyzed for the presence of specific nitrate esters, i.e., NG, PGDN, TEGDN & TMETN.

2. Analysis Procedure

A one (1) ml gas tight syringe was used to withdraw one ml of the gas sample volume and injected directly into the GC/MSD. The mass spectrum analyses were conducted using selected ion monitoring (SIM) mode which offers the highest sensitivity and selectivity for detecting the presence of nitrate esters. Standards of NG, PGDN, TEGDN and TMETN were used to establish lower limits of detection (LLD).

3. Results of Analyses

Table I summarizes the results of our analyses. None of the specific nitrate esters requested for each sample were detected in the flue gas samples. All samples were analyzed for the presence of NG, PGDN and TMETN in addition to the specific requested nitrate ester. The LLD for the above nitrate esters was 60 nanogram/cubic centimeter (ng/cm<sup>3</sup>).

4. If you have any further questions, please call Joe Mackey on X4759.

*Joseph A. Mackey*  
JOSEPH A. MACKRY

Table I

GC/MSD FLUE GAS ANALYSIS SUMMARY

<u>Log #</u>	<u>Date Rec'd</u>	<u>Sample ID</u>	<u>N.B.</u>	<u>Detected</u>	<u>LLD ng/cm<sup>3</sup></u>
888425	7/17	Flue Gas #62	PGDN	none	60
889069	8/13	TEGDN Contaminated Carbon	TEGDN	none	60
889253	8/14	Mixed N.E. Spent Carbon Flue Gas #21	NG, PGDN, TEGDN, TMETN	none	60
889254	8/17	TMETN Burn-Flue Gas	TMETN	none	60

Notes: N.E. Nitrate Ester

**Appendix D.4**  
**Elementary Neutralization Processes**

## Elementary Neutralization Processes at IHDIVNAVSURFWARCEN

<u>Area</u>	<u>Bldg</u>	<u>Process</u>	<u>Comments</u>
1. Chemicals Production	856	Wastewater from cyclodextrin nitrate manufacture with a pH below 2.	We neutralize the wastewater to a pH range of 6.0 to 9.0 with sodium hydroxide.
2. Laboratory	101, 600, 766, 444, 582, 1864	Acidic and basic waste from lab analyses.	Neutralization is done in lab containers, beakers, or flasks.
3. Propellant Production	334	Sodium hydroxide solution from caustic wash tank.	The pH of the wastewater can vary between 9 and 13. We neutralize the solution to a pH of 7 with hydrochloric acid.
4. Power House	873	Caustic or acidic water from Power Plant demineralizers.	The wastewater is corrosive approximately 1% of the time. We neutralize the wastewater with sulfuric acid or sodium hydroxide

\* All neutralized wastewater discharges are covered by National Pollution Discharge Elimination System (NPDES) permits.

**Appendix D.5**  
**Wastewater Treatment Processes**

**Wastewater Treatment Processes  
at IHDIVNAVSURFWARCEN**

<u>Area</u>	<u>Process</u>	<u>Comments</u>
1. CAD Test	<b>Static test firing of motors underwater in an autoclave. Although other heavy metals may be present, this water is typically TCLP toxic for lead and cadmium.</b>	<b>We treat this wastewater with MIDFLOC 1300L in the autoclave (a 300 gallon tank at Building 1523), pass the wastewater through a 1 micron filter bag, and discharge the effluent to a NPDES permitted outfall.</b>
2. Strauss Avenue Thermal Treatment Point	<b>Water from rain and wet scrap collects in the burn pans. This water is generated by the thermal treatment of propellant scrap which is a reactive hazardous waste. The resulting wastewater is a TCLP hazardous waste.</b>	<b>To remove heavy metals, we treat the burn pan water in a 1000 gallon tank at Building 497 with caustic and a flocculent. We then discharge the water to a NPDES permitted outfall.</b>
3. Small Motor Test	<b>Two 55 gallon drums of wastewater are generated when the firing bay walls are washed down with water. This water is TCLP toxic for lead.</b>	<b>We treat the wash water in a 1000 gallon tank at Building 497 with a flocculent to remove heavy metals. We then discharge the water to a NPDES permitted outfall.</b>

### **Section E Ground Water Monitoring**

Since there are no permitted surface impoundments, landfills, or land treatment facilities currently in use at the IHDIVNAVSURFWARCEN, there are no ground water monitoring requirements associated with these types of units. However, as part of the Navy's Installation Restoration (IR) Program, which addresses Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) issues, there are 10 permanent ground water monitoring wells at various locations throughout our Activity. In addition, as part of our Part B Permit Application for 40 CFR Subpart X Miscellaneous Units, the Activity is developing a ground water monitoring program for these units. The IHDIVNAVSURFWARCEN also has approximately 16 monitoring wells for its Underground Storage Tank (UST) Program. This number varies due to closures and removals of tanks.

## **Section F Procedures to Prevent Hazards**

Information contained in this section is submitted in accordance with the requirements of COMAR 26.13.07.02D (18), (19), (20), (22), and (24). The following subsections address required information:

- F-1 Security
- F-2 Inspection Schedule/Requirements
- F-3 Preparedness and Prevention Requirements
- F-4 Preventive Procedures, Structures, and Equipment
- F-5 Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes

Procedures apply to the respective CHS Management Units, Container Storage Building 455, PCB Storage Facility Building 1440, and the Explosive Hazardous Waste (EHW) Storage Buildings 212 and 328.

### **F-1 Security**

#### **F-1a Security Procedures and Equipment**

The IHDIIVNAVSURFWARCEN meets the requirements for security procedures and equipment through a combination of 24-hour surveillance and control of vehicles and pedestrians onto the Activity, into the Restricted Area, and 24-hour surveillance patrols within the Restricted Area. Natural and construction barriers, and warning signs at Buildings 455, 1440, 212, and 328 also add to security measures.

##### **F-1a(1) Twenty four-Hour Surveillance System**

A full-time, uniformed, armed, security staff maintains 24-hour surveillance at the IHDIIVNAVSURFWARCEN. In addition, key locations at the Activity are monitored by a dispatcher on

a continuous basis using surveillance cameras. The IHDIVNAVSWARFARCEN is located at the southern terminus of Maryland Route 210. All vehicular and pedestrian traffic onto the Activity is controlled at this point (Gate 1), by at least one guard from the security staff during non-peak entry hours (2 p.m. until 2 a.m.).

All four CHS Management Units are inside the IHDIVNAVSWARFARCEN Restricted Area. Vehicular and pedestrian traffic into the Restricted Area is controlled through a single-lane entry at Gate 2. At least one security guard maintains 24-hour surveillance at Gate 2 and, therefore, controls access into the Restricted Area.

The IHDIVNAVSWARFARCEN is located on a peninsula formed by the Mattawoman Creek to the east and south and the Potomac River to the west. The IHDIVNAVSWARFARCEN is separated from the adjacent town of Indian Head by a 7-foot-high, galvanized, chain-link fence that has a single gate, Gate 1. The Restricted Area is separated from the non-restricted portion of the Activity by a 7-foot-high, galvanized, chain-link fence. Access to the Restricted Area is through a gate in the second fence, Gate 2. Armed security guards in vehicles continually conduct patrols on roads adjacent to the fence lines, shorelines, buildings, and other areas of the IHDIVNAVSWARFARCEN. Less frequent inspections of shorelines by boat are also conducted. In addition, routine checks are made in both the non-restricted and restricted areas of the Activity to ensure that buildings have been locked. All guard units are equipped with two-way radios.

The following summarizes the security requirements for individuals within the Restricted Area:

- Proper identification
- Contractors and visitors cleared through the Pass Office
- Visit verification and escort of visitors and contractors coordinated by Pass Office
- Smoking **ONLY** in designated areas
- Lighters and matches prohibited

- Radio transmissions prohibited in areas marked by red lines painted on roadways and signs designating these areas.

### **F-1a(2) Barrier and Means to Control Entry**

#### **F-1a(2)(a) Barrier**

Section F-1a(1) describes water barriers and the fence which bars unauthorized entry into the IHDIVNAVSURFWARCEN Restricted Area. Figure B-3 shows the location of fences, gates, and water barriers. Buildings 455, 1440, 212, and 328 are located inside the Restricted Area. All are permanent structures equipped with locking doors. Security of these buildings is checked by armed patrols as described in Section F-1a(1). Doors are unlocked only to permit loading operations, inspections, and controlled maintenance. The Security and Supply Departments and the Emergency Response Personnel have access to keys to these buildings.

#### **F-1a(2)(b) Means to Control Entry**

Gate 2 is the single access for vehicular and pedestrian traffic into the Restricted Area. Locked doors at Buildings 455, 1440, 212, and 328 permit entry only during loading operations, inspections, or for controlled maintenance. Access to the keys for the doors to all CHS Management Units are restricted to the following:

<b><u>Code</u></b>	<b><u>Title</u></b>
09	Public Works Officer
11	Supply Department Head
112	Director, Material Transportation Division
1122	Manager, Property Disposal Branch

<u>Code</u>	<u>Title</u>
10	Security Department Head
103	Fire Protection Division
20	Ordnance Department Head
210	Cast Division Director
2130	Cast Operations Manager
2150	Plant Engineering Manager
	Emergency Response Personnel

### **F-1a(3) Warning Signs**

Warning signs are posted at building entrances of Buildings 455, 212, 328, and 1440. Signs in English bearing the warning "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT," are visible from road approaches and are legible from a distance of 25 feet.

### **F-1a(4) Communications**

All CHS Management Units are equipped with telephones. Security guards on patrol are equipped with a two-way radio communication system.

## **F-2 Inspection Schedule/Requirements**

### **F-2a General Inspection Requirements**

Trained IHDIVNAVSURFWARCEN personnel conduct regular inspections of the two CHS Management Units (Buildings 455 and 144), EHW Storage Units (Buildings 212 and 328), safety and

emergency response equipment, and fire fighting equipment. In addition, random hazardous waste management inspections may be conducted by the Waste Management and Prevention Branch Personnel.

Checklists are used to inspect the building's structural integrity and conditions, operational procedures, and the potential for discharges which may threaten or result in damage to human health or the environment. Doors, locks, and fences are also checked randomly by the uniformed security officers, but this does not require use of a checklist. The goal of highly frequent inspections is to identify and correct problems before human health or the environment is jeopardized.

#### **F-2a(1) Types of Problems**

Table F-1 summarizes the schedule for inspecting safety and emergency response equipment, fire fighting equipment, and CHS/EHW Management Units and their associated security devices. This schedule will be revised if more stringent requirements are promulgated. Potential problems and concerns associated with equipment and structure are also summarized in Table F-1. This schedule is maintained by the indicated Codes. Copies of this schedule are kept at each CHS/EHW Management Unit.

#### **F-2a(2) Frequency of Inspections**

Inspection periods are summarized in Table F-1. Inspections are made by trained personnel. The inspection of the mechanized loading equipment (forklift)(used only in Building 455), which is load-tested annually as required by U.S. Navy directive, is not included in Table F-1. Inspection periodicity is based on the following:

- Date of possible deterioration of equipment.

**Table F-1**

**Inspection Schedule Summary**

**Annually**

Code 0941 (Public Works Department Industrial Preventive Maintenance Branch) and 103 (Fire Protection Division) personnel conduct a joint inspection of the firefighting sprinkler system installed in Bays 2, 3, and 4 (Ignitable Wastes) of Building 455. There are no sprinkler systems in Buildings 212 and 328. Test procedures preclude introduction of water into any bay during testing.

**Monthly**

Responsibility: OSOT Leader/Code 0952A

<u>Category</u>	<u>Concerns/Potential Problems</u>	<u>Remarks</u>
Safety and Emergency Response Equipment	<ul style="list-style-type: none"> <li>• Accessibility</li> <li>• Inventory (also after each use)</li> <li>• Operability</li> <li>• Availability</li> <li>• Cleanliness</li> </ul>	

Responsibility: Fire Protection Division/Code 103

At-Site Portable Firefighting Equipment	<ul style="list-style-type: none"> <li>• Charged</li> <li>• Operability</li> </ul>	Indicated
Activity Fire Alarms	<ul style="list-style-type: none"> <li>• Operability</li> </ul>	Indicated

Responsibility: Public Works/Facilities Maintenance Division/Code 094

Bldg. 455-Outside Eyewash Stations	<ul style="list-style-type: none"> <li>• Operability</li> </ul>	Indicated
------------------------------------	---	-----------

**Table F-1**

**Inspection Schedule Summary (Cont'd.)**

**Weekly**

Responsibility: Independent Inspections, by the Property Disposal Branch/Code 1122 and the Cast Products Division/Code 210

<u>Category</u>	<u>Concerns/Potential Problems</u>	<u>Remarks</u>
Bldg. 455	• Ceiling, Vertical Integrity	
Bldg. 1440	• Floor, Containment Integrity	
Bldg. 212	• Precipitation Run-of/Run-off	
Bldg. 328	• Locks	
	• Security	
	• Inventory	
	• Containers	Include accumulation time for PCBs
	- Identification	
	- Accumulation Time	
	- Compatibility/Placement	
	- Integrity	
	- Closure	
	- Leaks, Spills	
	• Communications	
	• Ventilation	
	• Min. Aisle Space	
Adjacent Area	• Absence of Hazards	
	• Warning Signs Legible	

**Table F-1**

**Summary Schedule Summary (Cont'd)**

**Daily (Loading/Unloading)**

Responsibility: Property Disposal Branch/Code 1122 (Buildings 455 and 1440)  
Cast Operations Branch/Code 2130 (Buildings 212 and 328)

During loading and unloading, inspect area(s) on a continual basis to maintain Management Unit operational integrity. Inspect area(s) at the conclusion of handling operations.

Responsibility: Law Enforcement Operations Division/Code 101

Conduct frequent patrols of fence lines and gates, shorelines, and the immediate areas of CHS Management Units. Report unlocked doors (with no IHDIVNAVSURFWARCEN personnel in or near the building) and other breaches of CHS/EHW Management Unit Security to:

Property Disposal Branch/Code 1122 - Working Hours  
Command Duty Officer - Non-working Hours  
Cast Products Division - Working Hours

- Minimizing probability of an environmental or human health incident if deterioration, malfunction, or operational error occurs and is not detected between inspections.

Compliance posture is increased in particular through independent weekly inspections of Building 455, Building 1440, and adjacent areas by trained personnel from Code 1122. Weekly inspections will also be conducted on Buildings 212 and 328 by Code 210 personnel. Both CHS/EHW Management Units are also subject to unannounced inspection from Code 042B (Occupational Safety and Health and Explosive Safety Inspections Branch), Senior Safety and Supply Department Managers, and Waste Management and Prevention Branch Personnel throughout the year.

Records of inspections, summarized in Figure F-1 (for Buildings 455 and 1440), are retained by the Property Disposal Officer for a period of at least 3 years. Records of inspections for Buildings 212 and 328 will be retained by the Cast Division for at least 3 years. PCB inspection logs will also be retained by the Property Disposal Officer for a period of at least 5 years after termination of PCB storage activities. If any malfunctions, deteriorations, or operating deficiencies are noted during the inspection, the inspector will record the problem and recommend the corrective action. The Fire Chief will be notified in the event that an urgent resource response is require (see Section G).

## **F-2b Specific Process Inspection Requirements**

### **F-2b(1) Container Storage Inspection**

Buildings 455, 1440, 212, and 328 are inspected weekly. Trained inspectors use a copy of the inspection form shown in Figure F-1 to assess the operation of each CHS/EHW Management Unit. Buildings are inspected for the following:

- Management unit integrity and security

F. Procedures to Prevent Hazards

Figure F-1

Inspection Form

Date \_\_\_\_\_ Time \_\_\_\_\_ Inspector \_\_\_\_\_  
 Container Storage BLDG 445 \_\_\_\_\_ Code \_\_\_\_\_  
 PCB Storage Facility BLDG 1440 \_\_\_\_\_  
 Explosive Hazardous Waste Storage BLDG 212 \_\_\_\_\_  
 Explosive Hazardous Waste Storage BLDG 328 \_\_\_\_\_

Item	Nature of Potential Problem	Status		Action Recommended	Date of Correction
		Sat	Unsat		
<b>1. Structure</b>					
a. Warning Signs	Placement Damage Legibility Under 25'	-	-	_____	_____
b. Door(s)	Damage Obstructions	-	-	_____	_____
c. Lock(s)	Broken Missing Unlocked	-	-	_____	_____
d. Roof/Ceiling, Vertical Surfaces	Cracks Leaks	-	-	_____	_____
e. Floor, Storage Surface Integrity	Cracks Damage to Sealant Dikes	-	-	_____	_____
f. Housekeeping	Cleanliness Preservation	-	-	_____	_____
g. Adjacent Area (100')	Hazards Present	-	-	_____	_____
2. <u>Inventory</u> (DD 1348)	Availability Discrepancies	-	-	_____	_____
3. <u>Containers</u>	Labeling/Marking Leakage Deterioration Compatibility Distortion Corrosion Damage Improper Location	-	-	_____	_____
(PCB Only)	Receipt Date Missing	-	-	_____	_____

F. Procedures to Prevent Hazards

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Figure F-1

Inspection Form (Cont'd)

4. <u>Storage Space</u>		-	-	---	---
a. Main Aisle Space	Less than 5' Spillage	-	-	---	---
b. Secondary Aisle Space	Blocked Spillage Less than 2'	-	-	---	---
c. Stacking	Exceeds Limit	-	-	---	---
d. Pallets	Deteriorated	-	-	---	---
e. Handling Equipment	Inoperative Test Required	-	-	---	---
5. <u>Spill Supplies</u>		-	-	---	---
a. Absorbents	Availability Degradation	-	-	---	---
b. Empty Containers	Availability	-	-	---	---
6. <u>Safety Requirements</u>					
a. Ventilation	Inoperative	-	-	---	---
b. Lighting	Inoperative	-	-	---	---
c. Communication	Inoperative	-	-	---	---
d. Port. Fire Ext.	Overdue Test	-	-	---	---
e. Exterior Eyewash	Inoperative	-	-	---	---

- Container inventory, integrity, and storage procedures
- Compliance with storage requirements
- Availability of spill response supplies
- Efficacy of respective buildings' roofs and construction to control run-on and run-off.

The potential problems on the inspection form represent only a guide for the inspector to perform a thorough inspection. The inspector is required to check the status of each item and indicate whether its condition is satisfactory or unsatisfactory. If the status is unacceptable, specific observations will be recorded and the needed repairs and actions.

In Buildings 455 and 1440, inspectors verify that each container's unique DD Form 1348 Document Control Number is posted on the container. Each document control number corresponds to a specific DD Form 1348. This satisfies the inventory requirement, since each DD Form 1348 is a Bill of Lading and includes identification and quantity among its unit descriptors. The practice of posting the DD Form 1348 Document Control Number on the container independently of its associated DD Form 1348 insures that the Property Disposal Officer can resolve any questions about inventory which cannot be answered at the CHS Management Unit. The Property Disposal Officer maintains both automated and manual records of DD Form 1348 transactions.

#### **F-2b(1)(b) Container Storage Inspection for EHW Management Units**

In Buildings 212 and 328, inspectors verify that each container has a hazardous waste label properly filled out and a SATTP Scrap Sheet. This satisfies the inventory requirement since the hazardous waste label and SATTP Scrap Sheet includes the identification and quantity of contained material.

### F-3 Preparedness and Prevention Requirements

#### F-3a Equipment Requirements

The IHDIVNAVSURFWARCEN maintains the following equipment at the Activity:

- At site, or within 1,500 feet, fire call box communication system capable of providing immediate emergency response.
- External communications are provided by telephones, mounted on the exterior of Building 455, and immediately inside the door of PCB Storage Building 1440. Telephones for Buildings 212 and 328 are mounted outside on telephone poles approximately 50 feet from the buildings. Property Disposal Branch (Code 1122) Personnel, security patrols, and Fire Protection Division Personnel are also equipped with battery-operated, hand-held, two-way radios in the event of power failure. Some explosive devices are susceptible to initiation when exposed to radio frequency (RF) fields; therefore, personnel performing duties in Buildings 212 and 328 cannot carry radios.
- Portable fire extinguishers, fire control equipment, and equipment for spill control and decontamination, where applicable. According to OP-5, no one will fight explosive fires except the Fire Protection Division, which can reach any area within five minutes with a pumper truck capable of pumping water at a rate of 1,000 gallons per minute. Therefore, Buildings 212 and 328 will not have fire extinguishers because this might mislead employees into believing they could safely fight an explosive fire and possibly jeopardize their personal safety.
- Firefighting water at a flow rate of approximately 1,000 gpm and a minimum pressure of 100 psi from adjacent hydrants.

A list of specific equipment and the respective locations is provided in Section G.

All Activity communications and alarm systems, fire protection equipment, spill control equipment, and decontamination equipment are tested and maintained by trained personnel at the

IHDIVNAVSURFWARCEN. The Preventive Maintenance (PM) schedules range from a daily basis to a yearly frequency. The establishment of the schedule is based on the sensitivity and durability of the equipment.

IHDIVNAVSURFWARCENINST 11320.8 (Series) is the IHDIVNAVSURFWARCEN's Fire Bill. This bill incorporates requirements of NAVSEA Technical Manual OP-5, Ammunition and Explosives Ashore, and OPNAVINST 11320.23 (Series), Shore Activities' Fire Protection Program.

### **F-3b Aisle Space Requirements**

Aisle space requirements at the IHDIVNAVSURFWARCEN's storage facilities are discussed in subsection F-5c.

## **F-4 Preventive Procedures, Structures, and Equipment**

### **F-4a Unloading Operations**

Unloading operations for CHS and EHW are conducted by trained personnel at the IHDIVNAVSURFWARCEN. Although spills are unlikely, if an accident occurs and waste is spilled, the spill will be contained with appropriate standard industrial absorbents, sand bags, and other material. Spilled and residual wastes will be placed in drums for storage prior to transport to a permitted, off-site, controlled hazardous substance disposal facility, as applicable, if EHW, treated on-site.

Fork-lifts, hoists, hand trucks, or similar equipment are used to handle 55-gallon drums and other containers. The relatively large bays of Buildings 455, 212, and 328 minimize the necessity for stacking and therefore permit the nearly exclusive use of hand trucks for container handling. Hand trucks are

visually inspected weekly. Mechanized loading equipment is load tested annually, and the test is noted on the equipment. Whenever feasible, drums in storage are placed or moved on wooden pallets.

#### **F-4b Run-Off**

Buildings 455, 1440, 212, and 328 are all roofed buildings and are located above the 100-year floodplain. Roof and sidewall integrity are visually inspected weekly. Buildings 455, 212, and 328 are elevated at least 3 feet above surrounding terrain. PCB Storage Facility Building 1440 has a 6-inch diked entrance. The combination of design and construction features negates the possibility of run-on, contact with CHS/EHW, and run-off.

#### **F-4c Water Supplies**

The container storage buildings have concrete, sealed floors. The drains in Building 212 and 328 have been sealed using concrete. No adverse impact on the underlying groundwater is anticipated since any spilled wastes are expeditiously cleaned up after a spill. Buildings 212 and 328 will not contain liquid wastes.

#### **F-4d Equipment and Power Failures**

Equipment failures and power outages should not affect the planned operation of the storage areas. These operations are not dependent on specific equipment operation or power, and are able to remain functional and contain CHS/EHW in the event of a power failure.

#### **F-4e Personnel Protection Equipment**

Personnel protective equipment is routinely stocked and is used as required.

Standard Operating Procedures (SOP) number 900-007, Hazardous Waste Operation, Storage, and Management, originally approved 9 January 1989 established the appropriate personnel protection equipment for personnel handling CHS in Buildings 455 and 1440. This list is presented as Appendix F-1.

Standard Operating Procedure (SOP) number 198-242, "Less-Than-One-Year Explosive Hazardous Waste Storage Site Management", establishes the appropriate personnel protective equipment for personnel handling EHW in Buildings 212 and 328.

#### **F-5 Prevention of Reaction of Ignitable, Reactive, and Incompatible Wastes**

Ignitable, reactive, and incompatible wastes may be stored in the CHS/EHW Storage Buildings. However, each storage building has separate bays for segregation. CHS/EHW will also be segregated according to their reaction group number (RGN) as described in Section C.

#### **F-5a Precaution to Prevent Ignition or Reaction of Ignitable or Reactive Waste**

Containers for the storage of ignitable or reactive wastes are compatible with the specific substance contained. Containers will be kept closed (except to allow for sampling). The only potential source of ignition would be external to the container. Smoking is not permitted in Buildings 455, 1440, 212, and 328. Flammable gases or vapors that could accumulate will be removed via the active and passive ventilation systems.

Ignition of flammable or combustible liquids will be prevented by strict adherence to National Fire Protection Association (NFPA) Code 30 (1985). Details of the equipment and procedures that will be used to meet the code are described in the following paragraphs.

Precautions to prevent the reaction of CHS will be maintained through the use of a strict CHS segregation plan. Wastes stored in Buildings 455 will be segregated according to their reaction group number (RGN) as described in Section C. Wastes stored in Buildings 212 and 328 will be segregated in separate bays according to their explosive safety/handling instructions as described in SOP 198-242.

CHS will be segregated for storage in Building 455 by the use of containment bays. The Environmental Division will administer the segregation plan, including designating storage areas for previously unassigned wastes. The CHS stored in the various containment bays are shown on the Building 455 floor plan (Figure D-6).

In addition, the following actions are taken to prevent any potentially unstable virgin chemicals and CHS from becoming explosive hazards:

- Shelf-life expiration dates are tracked on all virgin materials in the Supply Department. If the material reaches its shelf-life expiration date, the individual who purchased the material is contacted for retesting recommendations and further storage guidance. Retesting of materials, such as adhesives, may be performed by the Test and Evaluation Department to extend the shelf-life expiration date based on economic evaluations. If the decision is reached to classify the virgin material as waste, actions are taken immediately to move the waste to Building 455 or a less-than-90-day accumulation site. In addition, the Supply Department reviews purchase orders of new materials to reduce the possibility of in-stock materials going overage.
- Prior to accepting CHS/EHW into Building 455, a Waste Profile Sheet must be completed (See Figure C-4). Included in this form under the Generator Certification Section is a requirement for the generator to certify whether the CHS has the potential for becoming unstable in the future. If the generator believes this CHS has the potential for becoming unstable in the future, the CHS is expeditiously processed through the disposal contractor.
- Prior to accepting EHW into Buildings 212 and 328, a SATTP Scrap Sheet must be completed (See Figure C-3). If the generator believes that this EHW is or has

the potential for becoming unstable in the future, the generator notifies the SATTP operators and the EHW is expeditiously treated at the SATTP.

### **F-5b General Precautions for Handling Ignitable or Reactive Waste and Mixing of Incompatible Waste**

Prior to handling containerized ignitable or reactive CHS, personnel will be trained in the proper procedures, including segregation practices, sampling techniques, and the use of personnel protective equipment.

The mixing of incompatible wastes will be prevented through the use of a specific segregation program. The segregation program is dependent upon information supplied the generator or on data obtained from the Waste Analysis Plan (see Section C) for ensuring segregation or separation of incompatible CHS. Mixing incompatible hazardous substances is unlikely at the IHDIVNAVSURFWARCEN, since the wastes are rarely mixed or bulked into larger containers. Small containers of compatible wastes are normally packaged (without opening) into 55-gallon drums (i.e., lab packs) for disposal (without opening). Some areas, such as the Test and Evaluation Department, tightly wrap EHW in conductive plastic and place various EHW bugs in scrap cans. This is unlikely to cause a compatibility problem since the EHW is individually wrapped and may be double-wrapped depending on the EHW. The segregation of compatibility groups is illustrated in Figure D-6.

### **F-5c Management of Ignitable or Reactive Wastes in Containers**

Precautions are taken in the container storage areas to prevent accidental fire and explosion, including the proper storage of containers (i.e., aisle space, labeling, and sealing of containers), segregated container storage, and appropriate warning signs. Prior to collection for storage, each container is sealed and labeled. IHDIVNAVSURFWARCEN personnel identify the contents of each container and provide the

date when the CHS/EHW was initially generated. Steel drums and cans of CHS are stored on pallets to minimize contact with leakage or spills, and are stacked a maximum of two high. A minimum 3 feet aisle space is maintained between container rows of ignitable or reactive wastes to allow access for inspections. A minimum of 5 feet of aisle space is maintained for equipment so that the risk of damaging containers by scraping or puncturing is minimized.

Container storage Building 455 is located 1,650 feet from the closest property line; the PCB Storage Building is located 1,100 feet from the closest property line; EHW Storage Building 212 is located 1,700 feet from the closest property line; EHW Storage Building 328 is located 2,400 feet from the closest property line (see Figure B-3). This meets Code of Maryland Regulations (COMAR) and National Fire Code Standards for container storage of ignitable or reactive wastes.

#### **F-5d Management of Incompatible Waste in Containers**

PCB Storage is restricted to PCB Storage Facility Building 1440. Accordingly, incompatible wastes are not stored in PCB Storage Facility Building 1440.

Section D of this application discusses the use of compatible containers for the storage of CHS/EHW Storage Buildings 455, 212, and 328. Incompatible wastes are not placed in the same containers. Incompatible CHS are separated by categorical segregation in the eight bays of Container Storage Building 455. Incompatible EHW are separated by categorical segregation in the two Bays of Buildings 212 and 328. Aisle spacing provides additional physical separation within individual bays. Bay 4 of Building 455 contains small sub-diked areas since it contains liquids. Containers awaiting complete analysis will be separated from other containers by two sub-dikes in Bay 4 of Building 455 to prevent reactions.

**Appendix F.1  
Personnel Protection  
Equipment**

900-007

## SAFETY EQUIPMENT LIST

## Description

- |  |   |
|--|---|
| <p>1. Eye Protection</p> <p><input checked="" type="checkbox"/> Goggles - Chem <input checked="" type="checkbox"/> Dust _____</p> <p><input type="checkbox"/> Safety glasses</p> <p><input checked="" type="checkbox"/> Face shield (secondary protection)</p> <p>2. Respiratory Protection</p> <p><input checked="" type="checkbox"/> Respirator, dust/mist</p> <p><input checked="" type="checkbox"/> Respirator, organic vapor (black filter)</p> <p><input checked="" type="checkbox"/> Respirator, organic vapor/acid gas (yellow filter)</p> <p><input type="checkbox"/> Respirator, HEPA (purple filter)</p> <p><input type="checkbox"/> Prefilter - Dust _____ Paint _____</p> <p><input type="checkbox"/> Respirator, airline</p> <p><input type="checkbox"/> Respirator, self-contained breathing apparatus (SCBA)</p> <p>3. Protective Clothing</p> <p><input type="checkbox"/> Gloves, nitrile buna rubber (NBR)</p> <p><input checked="" type="checkbox"/> Gloves, cotton cloth</p> <p><input checked="" type="checkbox"/> Gloves, cloth, leather-palm</p> <p><input checked="" type="checkbox"/> Gloves, chemical-resistant (impervious)</p> <p style="padding-left: 20px;"><input type="checkbox"/> 4-8 mil (light wt.)</p> <p style="padding-left: 20px;"><input type="checkbox"/> 9-16 mil (medium wt.)</p> <p style="padding-left: 20px;"><input type="checkbox"/> over 16 mil (heavy wt.)</p> <p><input checked="" type="checkbox"/> Gloves, solvent, gauntlet</p> <p><input checked="" type="checkbox"/> Hair protector (soft cap)</p> <p><input type="checkbox"/> Helmet, construction (hardhat)</p> <p><input checked="" type="checkbox"/> Shoes, safety, conductive</p> <p><input type="checkbox"/> Coat, lab</p> <p><input checked="" type="checkbox"/> Coveralls, cotton, flame-resistant</p> <p>4. Hearing Protection</p> <p><input type="checkbox"/> Ear protectors, muff</p> <p><input type="checkbox"/> Ear protectors, plugs</p> <p><input type="checkbox"/> Ear protectors, Sound Ban</p> | <p>5. Safety Systems and Fixtures</p> <p><input type="checkbox"/> Fire extinguisher</p> <p><input type="checkbox"/> Ventilation system</p> <p><input type="checkbox"/> Eyewash</p> <p><input type="checkbox"/> Safety shower</p> <p><input type="checkbox"/> Fire protection</p> <p><input type="checkbox"/> Telephone</p> <p><input type="checkbox"/> Shadow board (tooling board)</p> <p><input type="checkbox"/> Red flags</p> <p><input type="checkbox"/> Red lights</p> <p><input type="checkbox"/> Safety shields</p> <p><input type="checkbox"/> Grounding wires</p> <p>6. Environmental Protection</p> <p><input type="checkbox"/> Spill containment kit</p> <p><input type="checkbox"/> Waste water recovery system</p> <p>7. Special Items</p> <p><input type="checkbox"/> Back belt (optional)</p> <p><input checked="" type="checkbox"/> Disposable coveralls</p> |
|--|---|

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## **Section G Contingency Plan**

### **G-1 General Information**

#### **G-1a Location and Mission**

The Indian Head Division, Naval Surface Warfare Center (IHDIVNAVSURFWARCEN) is located in Indian Head, MD. The Activity celebrated its centennial in 1990. What began as a proving ground for naval gun technology has evolved into a research, development, and production center for many of the Navy's weapons and related programs.

Current programs at the IHDIVNAVSURFWARCEN involve gun and rocket propellant, underwater weapons, energetic chemicals, cartridge- and propellant-actuated devices, air-crew escape devices, test and evaluation, and special weapons. Additionally, the IHDIVNAVSURFWARCEN has two major tenant activities, the Naval School for Explosive Ordnance Disposal and the Naval Explosive Ordnance Disposal Technology Division. These tenants are located on the main peninsula and the Stump Neck Annex, respectively. Housing is also provided on the IHDIVNAVSURFWARCEN for the families of military personnel.

The IHDIVNAVSURFWARCEN stores its non-explosive hazardous waste in two buildings. Building 1440 is used exclusively as storage for capacitors and other items contaminated with PCB's. Building 455 stores all other non-explosive hazardous waste.

The IHDIVNAVSURFWARCEN also stores its explosive hazardous waste (EHW) in two buildings. Class 1.3 explosive wastes will be stored in Building 212 and class 1.1 explosive wastes will be stored in Building 328. Normally, all explosive hazardous wastes stored at Buildings 212 and 328 will be treated at the IHDIVNAVSURFWARCEN's Thermal Treatment Points. Information concerning the Thermal Treatment Points is contained in the RCRA Subpart X Miscellaneous Unit permit application.

Building 1440 is a steel-frame paneling building with a diked concrete floor, with approximately 1,116 square foot capacity. The maximum PCB inventory is 9,716 gallons.

Building 455 is a renovated brick building with diked concrete floors, sealed with an impermeable coating. Eight bays serve as storage areas for different types of hazardous waste. Building 455 has a maximum inventory capacity of 294,500 gallons.

Buildings 212 and 328 are renovated brick buildings with concrete floors, sealed with an impermeable coating. Two bays in each building serve as storage areas for solid explosive hazardous wastes. Building 212 has a maximum inventory capacity of 50,000 pounds. Building 328 has a maximum inventory capacity of 2000 pounds.

More detailed descriptions of these facilities and a general description of the hazardous waste stored at Buildings 455, 1440, 212, and 328 can be found in the site-specific spill plans.

### **G-1b Emergency Response Plans and Personnel**

The contingency plan described herein is for the IHDI VNAV SURFWARCEN and specifically for its four permitted storage facilities (Buildings 455, 1440, 212, and 238). The description of the contingency plan is two-tiered. The first tier details the IHDI VNAV SURFWARCEN response to spills, fire and personnel injury in general. The second tier is comprised of site-specific contingency plans. The site-specific contingency plans contain detailed information on floor plans, drains, power disconnects, underground utilities, hydrants, etc. The site-specific contingency plans for Buildings 455, 1440, 212, and 328 are contained in Appendices G.1 thru G.4.

For each of the emergency situations outlined in the general contingency plan, there is a designated team. The Fire Protection Division is the first responder to all emergency calls. This includes spills, fires, and

injuries. Fires and explosions are dealt with by the IHDIVNAVSURFWARCEN Fire Protection Division. Hazardous substance releases are handled by the On-Scene Operations Team (OSOT) under the supervision of the Fire Chief. Calls for medical emergencies are answered by the IHDIVNAVSURFWARCEN's Emergency Medical Technician (EMT) squad under direction of the Fire Chief.

The Fire Protection Division employs 40 certified firefighters, inspectors, and specialists. With the exception of the firefighters that comprise the EMT teams, all of the firefighters are full-time employees with no collateral duties. The Fire Protection Division is staffed 24 hours per day, 7 days per week with a minimum of 15 people on duty. All of the firefighters have attended the 40 hour 29 CFR 1910 HAZWOPER training.

The OSOT is comprised of approximately 17 trained employees. Most OSOT members have other assignments at the Activity. The work and training performed for the OSOT are collateral duties.

The EMT team is manned by 27 firefighters cross-trained and certified as EMTs. A minimum of two EMTs are on duty at all times. The ambulance is operated from the firehouse (Building 878).

### **G-2 Emergency Response Coordinators (ERC)**

The Commandant of the Naval District-Washington (NDW) has developed a contingency plan for the National Capitol Region, which includes Maryland facilities. The Commander of the Engineering Field Activity, Chesapeake (EFACHES) has been designated as the Navy On-Scene Coordinator (NOSC) by the Commandant NDW. The physical location of the Activity is under the EFACHES's jurisdiction.

The Commander of the IHDIVNAVSURFWARCEN is designated as the Facility Incident Commander (FIC) responsible for mitigating, containing, and cleaning-up oil discharges and hazardous substance

releases. The FIC relies on the Fire Chief to provide technical guidance in responding to situations involving hazardous substances. Figure G-1 shows the relationships of the various commands involved in the contingency plan.

If an emergency situation develops at the solid waste management units at the IHDIVNAVSURFWARCEN, the discoverer will immediately dial the Fire Protection Division Dispatcher at extension 4333 on the telephone and describe the situation to the dispatcher. The dispatcher position, which is staffed 24 hours a day, is located in the Fire Protection Division. The dispatcher then contacts the appropriate emergency authority.

The Fire Chief is Code 103 (presently Robert Harrison). It is his overall responsibility for emergency management operations. The Fire Chief relies heavily on the OSOT Leader's expertise and support when confronted with a fire or explosion involving hazardous substances.

For leaks or spills of hazardous substances, the dispatcher will immediately contact the primary OSOT Leader (presently Fred Cox). Table G-1 lists the information necessary to contact the OSOT Leader and/or his alternates in the order of priority. The Fire Chief assumes position as the FIC and remains until officially relieved by higher authority.

The Fire Chief, and his alternates have the authority to commit whatever IHDIVNAVSURFWARCEN resources are deemed necessary to control or mitigate the emergency. Table G-2 lists the Activity's resources available to the Fire Chief for use in emergencies.

If the emergency is of such magnitude as to exceed the capabilities of the Activity, the Fire Chief will, with approval from the Commander, IHDIVNAVSURFWARCEN, coordinate with outside organizations to augment the response efforts. The activity's Emergency Manager will assist with the coordination efforts. Table G-3 lists organizations to be contacted for various emergency situations.

Figure G-1

IHDIVNAVSURFWARCEN Contingency Plan Command Structure

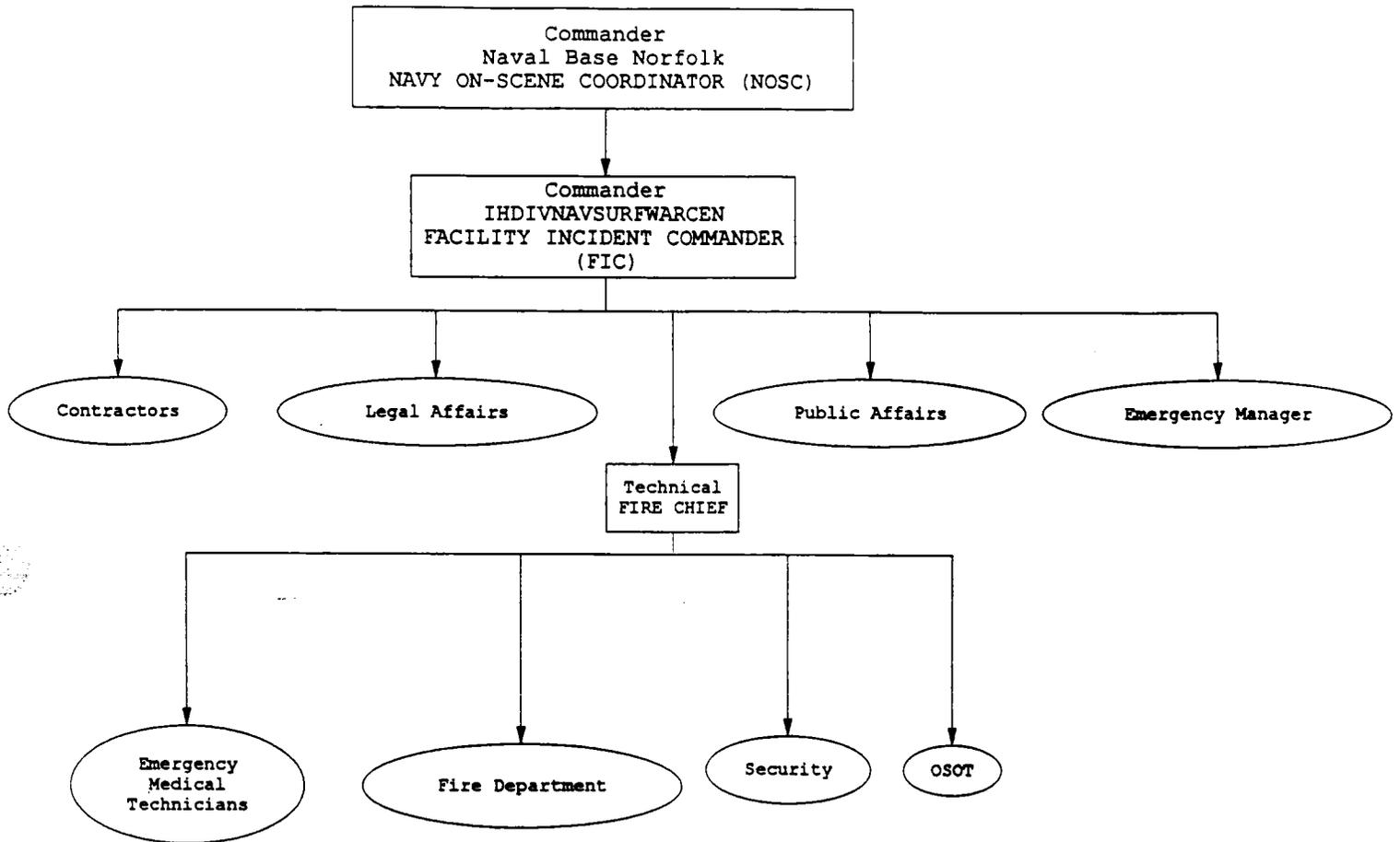


Table G-1

## Personnel Notification List

**Indian Head Division, Naval Surface Warfare Center  
101 Strauss Avenue  
Indian Head, Maryland 20640-5035**

<u>Organization</u>	<u>Name</u>	<u>Work Telephone No.</u>	<u>Home Telephone No.</u>
Fire Protection Division Fire Chief	Robert Harrison	x4333	(804) 224-9397
On-Scene Operations Team (OSOT) Leader	Fred Cox	743-6745/6746	(301) 375-9008
OSOT Backup-1	Dave Fuchs	743-4581	(301) 743-3786
OSOT Backup 2	Travis Yon	743-4654	(703) 663-2243
Spill Reporting Official (SRO)	Sherry Deskins	743-6745/6746	(301) 705-7006
SRO Designated Backup-1	Edward Dancausse	743-6745/6746	(301) 934-9450
SRO Designated Backup-2	Mataline Dillard	743-6745/6746	(301) 870-5683
Public Works Officer (PWO)	LCDR H. G. Chase	743-4286/4288	(703) 799-9331
PWO Designated Backup	Susan P. Adams	743-4320/4711	(301) 292-8852
Branch Medical Clinic		743-4449	
Public Affairs Officer	Christina S. Adams	743-1637/4627	(301) 870-9061
Property Disposal Officer (PDO)	Robert Steves	743-4343	(301) 423-5960
Emergency Manager	Bonnie Thompson	743-6724	(301) 934-5211
Safety Department Representative	John Kitchen	743-4484/6507	(301) 248-2565

**Table G-2**  
**Emergency Equipment and Locations**

<b>Equipment/material</b>	<b>Location</b>	<b>Grid Location (see Figure B-4)</b>	<b>Telephone</b>	<b>Inspection</b>
<b>Fire</b>				
1987 - Pierce 1000 GPM Pumper	Building 878	H-35	x4370	Daily
1988 - Pierce 1000 GPM Tele-Squirt	Building 878	H-35	x4370	Daily
Brush truck	Building 878	H-35	x4370	Daily
Saws	Building 878	H-35	x4370	Daily
Fire Pumps	Building 878	H-35	x4370	Daily
<b>Spill Response</b>				
Maps and Charts	Building 351	K-33	x4288/4286	N/A
Boat, Motor, Gas, & Life preservers	Building 510	M-31	x4269	Monthly
Floating boom (Class II), Boom warning lights, and Workboats	Building 406	S-32	x4269	Semi-annually
Nets & Absorbent mats	Building 406	S-32	x4269	Annually
Pumps	Building 406	S-32	x4269	Quarterly
Drums (empty 55 gal.)	Building 406	S-32	x4269	N/A
Sandbags	Building 24	K-6	x1289	Annually
Soda Ash (Sodium Carbonate)	Building 304/263	L-34/G-35	x4722	Annually

**Table G-2 (cont'd.)**  
**Emergency Equipment and Locations**

<b>Equipment/material</b>	<b>Location</b>	<b>Grid Location (see Figure B-4)</b>	<b>Telephone</b>	<b>Inspection</b>
Acetic acid	Building 410A	M-31	x1230	Annually
Hydrochloric acid	Building 410	M-31	x1230	Annually
Absorbents	Near Building 456 (Rail car USN 64-04245)	J-35	x4269	Annually
Floating booms	Between R-31 Buildings 127 and 412 (Rail car USN 61-0360)		x4269	Annually
<b>Medical</b>				
Ambulance (1989 Ford 350 Wheel- coach	Building 878	H-35	x4370	Daily
Automatic CPR device	Building 878	H-35	x4370	Daily
Helicopter pad	Building 1535	C-35	N/A	N/A

**Table G-3**  
**Emergency Contacts**

<u>Emergency Situation</u>	<u>Organization/Agency</u>	<u>Emergency No.</u>
Injuries	Charles County Dispatcher*	911
Need More Ambulances	Charles County Dispatcher*	911
Need Immediate Air Evacuation	Charles County Dispatcher*	911
Fire/Explosion	Charles County Dispatcher*	911
Hazardous Materials Spill or Release	National Response Center	1 (800) 424-8802
Maryland Dept. of the Env. (MDE) (7 days/week)		1 (410) 974-3551
MDE Enforcement Division (M-F, 0800 - 1700 hours)		1 (410) 631-3400
MDE Emergency Response Personnel (M-F, 0800 - 1700 hours) (nights/weekends)		1 (410) 333-2950 1 (410) 974-3551
If Spill Reaches Navigable Waters (7 days/week)	National Response Center Maryland Dept. of Environment	1 (800) 424-8802 1 (410) 974-3551
Large Spill EFACHES (7 days/week)	Navy On Scene Coordinator	1 (202) 767-1285

\*Charles County dispatcher determines which hospitals receive injured, which county fire departments should assist the IHDIVNAVSURFWARCEN fire department, and the necessity of air evacuation.

### **G-3 Implementation of the Contingency Plan**

The decision to implement the contingency plan will be determined by the degree of threat an imminent or actual hazardous substance incident poses to human health or the environment. The contingency plan will be initiated by any of the following triggers:

1. Fire and/or Explosion.
  - a. A fire causes the release of toxic fumes.
  - b. The fire spreads and could possibly ignite materials at other locations on-site or could cause heat-induced explosions.
  - c. The fire could possibly spread to off-site areas.
  - d. Use of water or water and chemical fire suppressant could result in contaminated run-off.
  - e. An imminent danger exists that an explosion could occur, causing a safety hazard because of flying fragments or shock waves.
  - f. An imminent danger exists that an explosion could ignite other hazardous substances at the Activity.
  - g. An imminent danger exists that an explosion could result in release of toxic substance.
  - h. An explosion has occurred.
  - i. The Fire Chief's discretion.
2. Spills or Substance Release
  - a. The spill could result in release of flammable liquids or vapors, thus causing a fire or gas explosion hazard.
  - b. The spill could cause the release of toxic liquids or fumes.

- c. The spill could be contained on-site, but the potential exists for ground water contamination.
  - d. The spill cannot be contained on-site, resulting in off-site soil contamination and/or ground or surface water pollution.
  - e. OSOT Leader's recommendation.
3. Personnel Injuries
    - a. Injuries requiring medical attention that exceed IHDIVNAVSURFWARCEN's capability in treating/transporting.

#### **G-4 Emergency Response Procedures**

##### **G-4a Notification**

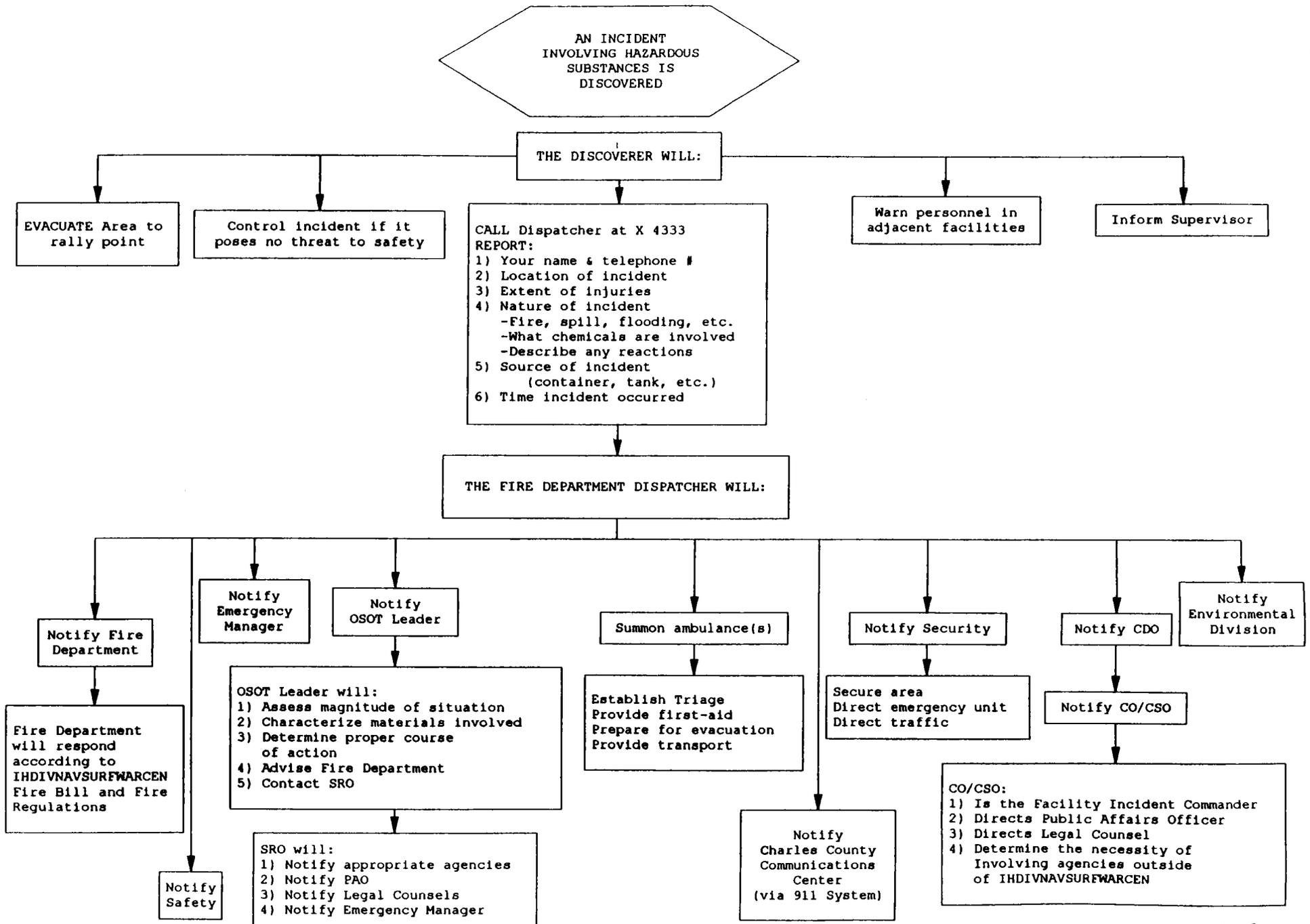
Figure G-2 contains a flow chart that depicts the order of responses to an incident involving hazardous substances.

In the event of a situation involving a hazardous substance,

- I. The discoverer will:
  1. EVACUATE the area to an appropriately safe distance or rallying point, and ACTIVATE ALARMS while exiting.
  2. CALL extension 4333 and report to the dispatcher:
    - His or her name and telephone number
    - Location of emergency, by building number
    - Extent of any injuries
    - Substance involved in spill, fire, etc., and volume
    - Description of any reactions

Figure 2

### Emergency Response Flow Chart



- Source of incident (container, barrel, etc.)
  - Time when the incident occurred.
3. INFORM his or her supervisor.
  4. ALERT personnel in adjacent areas.
  5. CONTROL the incident if it does not pose a safety or health threat.

II. The Fire Department Dispatcher will:

1. Notify Fire Department
2. Notify the OSOT Leader
3. Summon ambulance(s)
4. Notify Security
5. Notify CDO (CO/CSO)
6. Notify Emergency Manager
7. Notify Environmental Division
8. Notify Public Affairs
9. Notify Local Authorities via the 911 system, if necessary.

**G-4b Identification of Hazardous Substances**

Early in the response sequence, the Fire Chief will establish the exact nature of the incident by determining the physical and chemical properties of the substances involved, the exact source, volume, and the area of the extent of the release. To obtain this information, the Fire Chief will use:

- Signs posted on the exterior of the building.
- Interviews with observers/handlers.
- Labels or container identification.
- Internal Manifest.
- Uniform Manifest.
- Records pertaining to storage.
- Chemical analysis of samples.

The proper identification of the hazardous substance is essential to accurately assess the magnitude of the hazard to human health and the environment.

#### **G-4c Assessment**

The Fire Chief will use all information and resources available to him to assess direct and indirect threats to human health and the environment.

The site-specific contingency plans for Buildings 455, 1140, 212, and 328 contain immediate action plans, evacuation procedures, area layouts, building layouts, probable spill routes, and possible bay contents. The layouts depict locations of such structures as dikes, drains, alarms, hydrants, etc.

Robert Steves of the Property Disposal Office (PDO) is currently the Branch Manager in charge of operating Buildings 455 and 1440. Heidi McArthur is currently the designated site manager and will be in charge of Buildings 212 and 328. During an emergency situation, the PDO or site manager will provide as much information and support as necessary to control the incident. On the basis of verbal report, the Fire Chief will:

- (a) Formulate a plan of action to stop or mitigate the release of the hazardous substance;
- (b) Determine the need for additional emergency personnel and equipment; and
- (c) Designate areas to be evacuated.

The PDO/site manager will submit a written report to the Public Works Department, Waste Management and Prevention Branch, within four (4) hours to confirm the contents of the verbal report. The Public Affairs Officer and the Emergency Manager will also receive a copy of this report.

#### **G-4d Control Procedures**

The IHDIVNAVSURFWARCEN has a general contingency plan that provides guidelines of action and responsibility for responding to emergency situations. Beyond the general contingency plan, the IHDIVNAVSURFWARCEN maintains site-specific contingency plans for the various facilities that store significant amounts of hazardous substances/wastes.

The contingency plans address:

- Fire or explosion
- Hazardous substances spills/releases
- Personnel physical injury

#### **G-4d(1) Fire/Explosion**

##### On-Scene Command

In the event of fire, explosion, hazardous substance spill or release, the Fire Chief is the on-scene authority. He may delegate that authority at his discretion. If the fire scene involves hazardous substances, the Fire Chief will be advised and supported by the OSOT Leader. On rare occasions, it may be necessary for the OSOT (On Scene Operations Team) to enter a fire scene first to neutralize hazards to the firefighters.

### Immediate Action

When a fire is reported, the Fire Protection Division will respond immediately to the situation. Each building has a predetermined route by which the fire equipment will travel to the emergency site. The predetermined route will place the fire equipment at the optimal position relative to hydrants, assembly areas and safety zones. Once on the scene, the Fire Chief will evaluate the problem, evacuate the area as necessary, and take control of the site.

### Evaluation

Foremost among the concerns of the firefighters approaching a fire is the contents of the building. Many of the buildings at the IHDIVNAV SURFWARCEN contain various quantities and classifications of explosive substances and inert hazardous substances. The firefighters have access to a computer-based inventory of a buildings' contents. In addition to the computer inventory, firefighters use the identification signs posted on every explosive or inert hazardous substances building.

Buildings with explosive substances display signs that indicate the classification of material and the net explosive weight (NEW) limits. If a building is empty of explosive substances, it will display an "EMPTY" sign. If there is a discrepancy between the computer-generated inventory and the display signs, firefighters always use the information from the display signs. For evaluation purposes, firefighters always assume a building has the maximum NEW allowed unless posted as empty.

Explosive substances are classified by definitions set forth in NAVSEA OP-5 Ammunition and Explosives Ashore. Table G-4 describes the classifications.

**Table G-4**  
**Hazard Class I Division Designators and Type of Hazard**

Division	Type of Hazard
1	Mass detonating
2	Non-Mass detonating - Fragment producing
3	Mass fire
4	Moderate fire, No blast

Inert hazardous materials are identified by signs conforming to the National Fire Protection Association (NFPA) No. 704-1985 standards.

The Fire Chief will also consider in his evaluation:

- Weather conditions
- Proximity to adjacent buildings
- Advice provided by the OSOT Leader
- Physical barriers
- Injuries
- Elapsed time
- Information provided by area supervisors

The Fire Chief will determine the appropriate action based on available information and recommendations of knowledgeable personnel (area supervisors, safety, OSOT, Environmental, etc.). Table G-5 provides some burn/no burn criteria.

**Table G-5**  
**Suggested Criteria for "Burn/No Burn" Decisions**

<b>Criteria</b>	<b>Allow to burn</b>	<b>Extinguish</b>
Spill location	Isolated away from public and buildings	Proximate to public and buildings
Availability of safety equipment and protective clothing	Limited	Self-contained breathing apparatus
Population density	Low, evacuated	High, not evacuated
Presence of other combustible materials other	None present	Hazardous materials; petroleum or natural gas transmission or storage; wooded areas; and combustible structures
Substance spilled	High vapor pressure	Low vapor pressure
	High toxic vapors	Low toxic vapors and fumes
	Non-toxic combustion produced	Hazardous by-product(s) produced from combustion
Containment status	Complete	Uncontrolled status
Release from source	Continuing	Stopped
Availability of foams dry chemicals, or powders	Limited	Sufficient
Wind conditions	Calm	Strong, gusty

The IHDI VNAV SURFWARCEN Fire Department library contains many references for control of fire situations or flammable substances during spills. These references include:

- The EPA Flammable Hazardous Substances Emergency Response Handbook: Control and Safety Procedures.
- The NFPA Fire Protection Guide
- The Bureau of Explosive: Emergency Handling of HM in Surface Transportation.

### Evacuation

Every work area has a pre-determined assembly area at a safe distance from explosive areas. In the event the fire alarm is sounded, personnel will immediately evacuate the area and assemble at the designated assembly area. The area supervisor will conduct a head count.

After the Fire Chief has arrived on the scene, he will determine the necessity of evacuating adjacent buildings. Security personnel will conduct further evacuation.

The Fire Chief will also be available to assist appropriate officials in deciding whether the local areas should be evacuated. If the need arises for local residents to be evacuated, the Fire Chief will notify the proper local authorities via the Charles County Communications Center.

### Site Control

Upon arrival at a fire scene, the Fire Chief will:

- ESTABLISH a command post to coordinate activities from a safe distance.
- SEEK out the area supervisor to get information about building materials and personnel (area supervisors in explosive operations always wear yellow hats).
- ENSURE no personnel are within a minimum of 500 feet if explosive substances are involved.
- CLASSIFY incident stages as follows
  - Condition 1 - Accidental or false alarm; sprinkler trip with no fire.
  - Condition 2 - Small fire, i.e. brush, rubbish, gutter, dowel rod, or rolling mill fires which cause little damage and do not expose large amounts of explosives to fire; no waiting period involved.

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- Condition 3 - Working fire involving building(s) or area; moderate to large amount of damage; if potential for explosion exists as in mixer, press or magazine fire, a 30-minute waiting period will be observed.
- Condition 4 - Explosion or fire involving injury to personnel; major damage involved; if explosives are involved, a waiting period will be observed (30 minutes from the last explosion).

At the end of the mandatory 30-minute waiting period, the situation will be re-evaluated before firefighters/OSOT are allowed to enter a building.

### Fire Containment and Control

Once entry into a fire situation is allowed by the Fire Chief, firefighters will:

- Disconnect power supply
- Make initial attack
- Subsidize sprinkler system
- Cool adjacent structures or containers
- Ventilate structure after fire is out

The Fire Chief is continually advised by the OSOT Leader about ways of minimizing the environmental impact due to a hazardous substance fire. Once a fire is extinguished, the OSOT's efforts will be coordinated with the FIC.

### Documentation and Recovery

After each fire, the Fire Chief will prepare a Fire Report to the Naval Safety Center of the Atlantic Division in Norfolk, Virginia. The Navy Fire Marshal is required to investigate any fire whose

destruction is estimated to have exceeded \$100,000. The Fire Chief will request an investigation of any fire of suspicious origin.

#### **G-4d(2) Hazardous Materials Spills/Releases**

##### On-Scene Command

In the event of a hazardous substance spill, the on-scene authority is the Fire Chief. The official title during these types of situations is the FIC. He is the delegated authority of the Commander, IHDIVNAVSURFWARCEN. The FIC is closely supported by the OSOT Leader in spill response situations. The Fire Chief will activate the Site-Specific Contingency Plan immediately.

##### Immediate Action

The Fire Chief will assess the situation and immediately take all necessary actions to protect human health, the environment, and property. The Fire Chief, will direct and coordinate the following concurrent efforts of the emergency response units:

- On Scene Operations Team (OSOT)
  - RESCUE/EVACUATE all personnel from areas that may be exposed to the spilled substance, especially to vapors, smoke, or fire.
  - SECURE IGNITION. Secure electricity as soon as possible to reduce potential for fire or explosion. Remove ignition sources, such as combustion engines, electric motors, cigarette smoking, and open flames.
  - PREVENT spill from spreading, if possible, without getting exposed to the spilled substance.

**WARNING:** Rescue team shall enter a HIGH RISK area ONLY in the event of hazard imminent to life, and shall wear full protective gear, including Self-Contained Breathing Apparatus.

- Security
  - ISOLATE area of nonessential personnel.
  - ESTABLISH and CONTROL a patrolled perimeter at a safe distance from the affected area, to divert traffic and control public access.

The FIC will maintain radio communications in non-explosive areas with all units involved in the emergency. The IHDIVNAVSURFWARCEN Emergency frequency 139.525 kHz will be used.

Concurrent with immediate emergency actions, the Fire Chief shall initiate the following actions:

- ESTABLISH a command post at a safe distance upwind and uphill from the incident.
- ACTIVATE OSOT, as required. Designate a safe location and advise the responding units to stage at such location until instructed to take specific action.
- MAINTAIN an incident log of all actions taken during the course of the response, using the Spill Report sheet shown in Appendix G.5.

#### Site Control and Evaluation Actions

Promptly after arriving at the site, the Fire Chief will initiate actions to establish control of the affected area, so that effective stabilization of the spill is achieved with minimal risk to response personnel and the environment.

The following general rules shall apply in performing site control and evaluation operations:

- Site Control
  - The OSOT will coordinate their actions with the Fire Chief (i.e., establish and control the work and safety zones within the CONTROL SITE, consisting of the support area (command post, upwind), contamination reduction area (decontamination station), and contaminated area (immediate spill area in which actual or potential danger exists from hazardous condition)).
  - Entrances and exits from the contaminated area must be planned and emergency escape routes identified.
  - Only personnel with proper protective equipment and an assigned task will enter the contaminated area.
  - Decontamination procedures must be established to control the spread of contaminants into the clean areas. The decontamination station shall be operational before personnel are allowed to enter into the contaminated area.
  - Entry team shall be thoroughly briefed prior to each entry. They will also be debriefed after decontamination.
  - All personnel and equipment leaving the contaminated area shall be considered contaminated and shall pass through the decontamination station for proper decontamination. Decon Station personnel shall also wear protective equipment appropriate to their function and risk.
  - All spent wash and rinse solutions, brushes, sponges, etc. used in decontamination shall be considered contaminated and shall be properly decontaminated or disposed of.

Security will establish a patrolled perimeter at a distance from the spill (determined by the Fire Chief), to keep nonessential personnel and the public away from the CONTROL SITE.

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All non-response personnel within the perimeter affected by the CONTROL SITE will be evacuated from this area.

- Evacuation

The Fire Chief will:

- DETERMINE the need for evacuation of personnel from areas outside the CONTROL SITE. Evacuation distances and directions will be defined based on consultation of the appropriate technical references (e.g., DOT Emergency Response Guidebook), expert advice/recommendations, actual conditions (e.g., confined spaces, movement of toxic fumes), and the site-specific contingency plan.
- If evacuation of the civilian community off-base becomes necessary or advisable, IMMEDIATELY NOTIFY the proper local authorities via the Charles County Communications Center.

- Evaluation

The OSOT Leader shall direct the OSOT actions to define the hazards involved and severity of spill as quickly, safely, and completely as possible. The OSOT will use the Spill Report, provided in Appendix G.5, to record information gathered during these actions. This information may include the following:

- IDENTITY of hazardous substance(s) involved. Look for labels, markings, and shipping papers on containers. Ask site personnel (supervisor, persons involved, knowledgeable people on the scene). Consult the SITE-SPECIFIC CONTINGENCY PLAN.

- SAFETY HAZARDS AND RISKS associated with the hazardous substance(s) involved. Use reference library on response vehicle and appropriate MSDSs. Contact outside sources for technical assistance. These sources may include:

CHEMTREC (Chemical Transportation Emergency Center) 800-424-9300

NRC 800-424-8802

Association of American Railroads/Bureau of Explosives 202-639-2222

Maryland Department of the Environment 410-974-3551

- Relative seriousness of the situation. What is the condition of the spill? Is it contained? Stopped? If not contained, is it safe for response personnel to control/contain spill?
- IF NECESSARY, an entry team properly trained and equipped will carefully monitor the conditions near the immediate spill area and its surroundings, and take necessary samples to determine actual/potential dangers such as:
  - Possibility of fire/explosion
  - Oxygen deficiency--particularly in confined spaces
  - Presence of toxic gases or vapors
  - Presence of incompatible substances
  - Possibility of dangerous vapors affecting surrounding area

**WARNING:** EVERY ATTEMPT shall be made to assess the situation from a safe distance. Response personnel shall wear proper breathing apparatus and protective gear, if necessary, to approach the spill. A backup for every entry team shall stand by to provide support. Entry team shall approach the spill from upwind assuming worst-case ambient concentration of the substance. A Decon Station shall be established prior to entering the hazardous zone.

The following factors will influence the proper precautionary measures, spill control methods, and necessary resources (i.e., personnel and equipment) for stabilization of the incident:

- Substance characteristics
- Quantity spilled and physical state
- Actual/potential hazards
- Weather conditions
- Spill movement
- Existing containment barriers--natural or man-made
- Existing drainage
- Distance to environmentally sensitive or highly populated areas

#### Spill Containment and Control

The OSOT Leader shall ensure all appropriate safety precautions are taken, the best control methods have been selected, and proper spill response equipment is available. Control of immediate hazards, such as from fire, explosion, or toxic gas release, shall have top priority. Depending on the type and condition of the spill, some or all of the procedures in Table G-6 will be employed by the OSOT Leader to:

- **STOP SOURCE** of spill if it is still occurring, through such actions as:
  - Close valves
  - Plug leaks in containers
  - Upright containers
  - Replace leaking containers
  - Empty leaking containers into non-leaking container
  - Encapsulate leaking containers into larger recovery container

General considerations for stopping source of releases are given in Table G-7. The table gives a specific criteria and the subsequent results if an attempt was made to eliminate the criteria versus what would happen if no attempt was made.

Table G-6

## Methods for HS Spill Control and Containment\*

Technique	Use/Scenario	Equipment Requirements	Equipment Characteristics
Source Control <ul style="list-style-type: none"> <li>• Patching</li> <li>• Plugging</li> <li>• Valve shut-off</li> <li>• Uprighting/ draining container</li> </ul>	Stop release from leaking container or valve	<ul style="list-style-type: none"> <li>• Leak control kit</li> <li>• Hand tools</li> </ul>	<ul style="list-style-type: none"> <li>• Spark-resistant tools, non-ferrous</li> <li>• Spill site</li> </ul>
Gas/Vapor Reduction	Control/Mitigate immediate hazard from flammable, explosive, and toxic gases/vapors	<ul style="list-style-type: none"> <li>• Portable fans, blowers</li> <li>• Firefighting foams</li> <li>• Water sprays/mists</li> <li>• Sorbent pads/sheets</li> </ul>	<ul style="list-style-type: none"> <li>• Explosion-proof electrical equipment</li> <li>• No power tools</li> <li>• Inert, non-reactive absorbent special for vapor control</li> </ul>
Drains Covering	Avoid liquid spill run-off into floor/storm drains	<ul style="list-style-type: none"> <li>• Cover sheets</li> <li>• Plastic</li> <li>• Rubber</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical resistant</li> </ul>
Dust Covering	Prevent dispersion of powder chemical spills	<ul style="list-style-type: none"> <li>• Cover sheets</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical resistant</li> </ul>
Herding	Prevent expansion of liquid spills on land or insoluble, floating spills in water	<ul style="list-style-type: none"> <li>• Brooms</li> <li>• Water hose stream</li> <li>• Compressed air</li> </ul>	<ul style="list-style-type: none"> <li>• Inert, non-reactive broom material</li> </ul>
Diking/Damming	Contain liquid run-off or water stream contaminated by soluble or miscible spill	<ul style="list-style-type: none"> <li>• Earth moving equipment and tools</li> <li>• Foams (polyurethane)</li> </ul>	<ul style="list-style-type: none"> <li>• Inert, non-reactive sorbent material</li> <li>• Spark-resistant tools, non-ferrous</li> <li>• Absorbent barriers (sealed booms, pillows, sandbags)</li> </ul>
Ditch/Trench Excavations, Culverts	Divert liquid spills on land or water stream	<ul style="list-style-type: none"> <li>• Earth moving equipment and tools</li> <li>• Prefabricated culvert</li> </ul>	<ul style="list-style-type: none"> <li>• Spark-resistant tools, non-ferrous</li> </ul>
Floating Barriers	Contain insoluble floating spills	<ul style="list-style-type: none"> <li>• Booms</li> <li>• Device to deploy booms</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical resistant</li> </ul>

**Table G-6**  
**Methods for HS Spill Control and Containment (cont'd.)**

Technique	Use/Scenario	Equipment Requirements	Equipment Characteristics
Absorption	Contain, collect and remove liquid spill on land or insoluble floating spills in water	<ul style="list-style-type: none"> <li>• Sorbents</li> <li style="padding-left: 20px;">- sheets</li> <li style="padding-left: 20px;">- mops</li> <li style="padding-left: 20px;">- pillows</li> <li style="padding-left: 20px;">- booms</li> <li style="padding-left: 20px;">- granular</li> </ul>	<ul style="list-style-type: none"> <li>• Inert, non-reactive materials</li> <li>• Specific sorbent for specific spill substance</li> </ul>

\* Based on Naval Energy and Environmental Support Activity (NEESA) Document 15-022.

**Table G-7**  
**General Considerations for Stopping Source of Releases\***

<u>Criteria</u>	<u>Attempt</u>	<u>No Attempt</u>
Availability of safety equipment	Sufficient	None
Nature of discharge	Open valve or pump failure	Rupture or explosion
Type of substance	Toxic, nonreactive, nonvolatile, nonpersistent	Highly toxic, dangerously reactive, volatile, corrosive, persistent
Volume spilled/volume remaining ratio	Low	High
Containment of spillage	None	Present and sufficient
Rate of discharge	Slow, dripping	Fast, streaming
Size of hole or rupture	Small	Large
Potential of fire	No potential	Already existing
Relative difficulty in stopping discharge	Easy	Great

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Note:

In no instance should an attempt be made to stop a discharge without the proper protective clothing and safety equipment.

\* Based on NEESA Document 15-022.

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- **DISPERSE** toxic/flammable gases or vapors as soon as possible:
  - Ventilate indoor areas. Use blow-out ventilation or portable fans--**EXPLOSION-PROOF** only. Open doors and windows.
  - Dilute water-soluble liquids **ONLY IF ABSOLUTELY NECESSARY** to prevent imminent danger to life. Obtain authorization from Commander and notify NOSC. Be cautious of water-reactive chemicals. Consult Material Safety Data Sheets and other applicable technical references.
  - Flush corrosives to reduce vapors. Control run-off.
  - Use fog-streams to absorb vapors. Control run-off.
- **CONTAIN** spill or **PREVENT** spill run-off from entering sewer or drainage systems, or reaching surface or ground waters. Consult site-specific contingency plan for containment options and location of drains.
  - Construct dams or dikes to contain spill as close to the source as possible. Use sand, dirt, or any available inert absorbent material, foams, or gels suitable to dam the flow.
  - Excavate temporary ditch, trench, or channel to direct spill run-off to containment.
  - Use plastic cover for floor and storm drains.
- **MINIMIZE** spreading of dust or powder spills. Cover with non-reactive tarp to protect from wind or rain.

If the spill cannot be contained and enters, or threatens to enter the sanitary or storm sewer systems or the waters of the Potomac River or Mattawoman Creek, then continued response comes under the authority of the Navy On-Scene Coordinator (NOSC). The Fire Chief shall:

- **MAINTAIN** on-scene command until relieved by the NOSC, if necessary.
- **ANTICIPATE** the movement of the spill. Consult site-specific contingency plan for probable spill routes and secondary containment options, and implement containment options.

- INSTRUCT Public Works Officer (PWO) or his representative to take all necessary and possible action (construct dam, deploy temporary interception devices, etc.) to prevent the spill run-off from exiting the property.

Procedures applicable for controlling the spread of spill contamination, once it has entered the waterways, will depend on location, amount spilled, and properties of the substance spilled. Control methodology shall depend most strongly on how the material behaves in water (i.e., floats or sinks).

- DETERMINE the fate of the spill.
- PROVIDE the following information to the Spill Reporting Officer (SRO):
  - Hazardous substance(s) involved and quantity spilled.
  - Magnitude and severity of the threat to people, property, and the environment.
  - Affected areas.
  - Responsible party--Navy, non-Navy.
  - Anticipated containment and cleanup actions.
  - Type of assistance required.
  - Any other relevant information.
- COORDINATE activation of appropriate government/private response organizations with the NOSC, as necessary to control and remedy the situation.
- DIRECT in-house resources to take all possible action to minimize the impact and spreading of the spill until additional assistance arrives at the scene.
- COOPERATE with and SUPPORT all outside organizations directed by the NOSC, if necessary.
- MAINTAIN on-scene command until relieved by the NOSC, if necessary.
- When spill is contained and situation under control, DECLARE "End of Emergency" and DEACTIVATE OSOT units. Direct them to be on alert in case conditions change.
- SUBMIT Hazardous Substance Spill Report Message to FIC.

The Spill Reporting Official (SRO) will notify the NOSC of the spill and will determine whether the spill needs to be reported to the National Response Center (800-424-8802) and the state, local, or federal agencies.

The FIC will:

- NOTIFY the IHDIVNAVSURFWARCEN Public Affairs Officer to report to the scene. Direct him/her to keep informed of the size and nature of the spill and the response actions, and coordinate news releases with the NOSC Public Affairs Officer through the Area Response Center.
- NOTIFY the IHDIVNAVSURFWARCEN Legal Council. Direct him/her to report to the scene and coordinate all legal aspects associated with the spill.
- If the party responsible for the spill is other than the Navy:
  - INFORM them of the spill and their financial liability.
  - If a contractor is involved, NOTIFY the contracting office.
- VERBALLY NOTIFY the NOSC of the incident.

NOSC EFACHES.....PHONE: 1 (202) 767-1285

**Cleanup and Disposal**

Cleanup and disposal are the responsibility of the OSOT Leader under the authority of the FIC. Cleanup method will depend on the characteristics of the spilled substance, size of spill, location of spill, character of the area, and potential impacts. Table G-8 describes standard cleanup methods applicable to many IHDIVNAVSURFWARCEN hazardous substance spills.

The OSOT Leader shall ensure that cleanup efforts are sufficient to meet regulatory requirements, prevent risk to health and safety of the public, prevent further contamination, and restore environmental

Table G-8

## Methods for Hazardous Spill Cleanup\*\*

Technique	Use/Scenario	Equipment Requirements	Equipment Characteristics
Absorption	Contain, collect, and remove liquid spill on land or insoluble floating spills in water.	<ul style="list-style-type: none"> <li>Sorbent sheets, mops, pillows, booms, granular</li> </ul>	<ul style="list-style-type: none"> <li>Inert, non-reactive materials</li> <li>Specific sorbent for specific spill substance</li> </ul>
On-Site Neutralization	Neutralize acids or alkali spills to acceptable pH 6-8.	<ul style="list-style-type: none"> <li>pH meter or litmus paper</li> <li>Neutralizing solution</li> </ul>	<ul style="list-style-type: none"> <li>Neutralizer must be weak</li> <li>Acid spills: sodium bicarbonate, soda ash, or lime</li> <li>Alkaline spills: weak acetic acid or citric acid</li> </ul>
Dilution*	Dilute concentration of liquid spills on land to acceptable limits. Highly soluble unreactive in water chemicals only.	<ul style="list-style-type: none"> <li>Water hose stream</li> </ul>	<ul style="list-style-type: none"> <li>Inert non-reactive</li> </ul>
Excavation	Remove solid liquid spill substance and contaminated medium for proper disposal.	<ul style="list-style-type: none"> <li>Earthmoving equipment and tools</li> </ul>	<ul style="list-style-type: none"> <li>Spark resistant tools</li> </ul>
Skimming	Remove insoluble floating spills.	<ul style="list-style-type: none"> <li>Skimmer (DIP 3001)</li> <li>Specialized equipment</li> </ul>	
Dredging/Pumping	Remove insoluble, non-floating and contaminated medium from bottom of a body of water.	<ul style="list-style-type: none"> <li>Specialized equipment</li> </ul>	<ul style="list-style-type: none"> <li>Dredging equipment</li> <li>Pumping</li> </ul>
Suction	Remove liquid spills from land or water surface.	Vacuum Truck	<ul style="list-style-type: none"> <li>Specialized</li> </ul>

\* Use this method as a last resort ONLY and with the approval of NOSC.

\*\* Based on NEESA Document 15-022.

quality of the affected area. In cases of major releases, corrective actions, including remedial methods, clean-up levels, and methods of sampling and analysis, IHDIVNAVSURFWARCEN will work with the MDE to ensure acceptable cleanup. The OSOT Leader or his designate will direct efforts to:

- COLLECT all necessary samples of the affected lands/waters to determine degree of contamination.
- DETERMINE applicable cleanup method. Determine whether the spill material can be treated on-site or must be removed, treated, or disposed of elsewhere. Consult appropriate technical references or information sources listed in Table G-8 to determine correct procedures for cleaning up a spill of the specific substance involved.
- ASSESS OSOT capabilities to conduct cleanup operations and determine need for outside assistance.

If the decision is to clean up spill with Activity resources, the cleanup personnel shall use proper protective equipment and observe the standard health and safety procedures that sound industry practices mandate.

The Cleanup Team will:

- TREAT spill to mitigate hazards (i.e., neutralization), if safe and feasible.
- CLEAN UP and REMOVE spill material using proper procedures.
- THOROUGHLY CLEAN all contaminated surfaces of the spilled substance. Detergents and solvents can be used to remove residual spill substance from docks, asphalt, and other hard, impermeable surfaces.
- COLLECT spill residue, other contaminated material, and all nonreusable cleanup materials, including disposable clothing, sorbents, brushes, rags, brooms, and containers. PACKAGE material in DOT-approved container. MARK and LABEL container in accordance with DOT and environmental requirements.

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- Thoroughly DECONTAMINATE and inspect all reusable protective clothing and equipment before they are returned to their proper storage location.
- Thoroughly VENTILATE indoor areas.

If the cleanup is beyond the capabilities of the OSOT, the FIC shall activate the appropriate contract or agreement for the cleanup as established in this plan, or coordinate any required additional assistance with the NOSC. In the event of cleanup by outside contractor or agency, the OSOT Leader shall assume on-scene command and support cleanup as needed, until relieved by the NOSC if necessary.

After the spill cleanup, the OSOT Leader shall use all available resources to:

- ENSURE that all hazardous waste and contaminated articles generated by a spill and cleanup incident are properly containerized, stored, manifested, and turned in to the PDO for disposal according to the Hazardous Waste Management Plan.
- ASCERTAIN that all indoor areas affected by the spill are safe before normal operations in those areas are resumed.
- DETERMINE the need for necessary environmental restoration activities.

### Documentation and Cost Recovery

All IHDIVNAVWARSURFCEN Organizational Codes involved in the spill response efforts shall prepare a report describing their participation in the response and submit their report to the Environmental Division (Code 095) within 10 days following the incident. The report shall contain the following information:

- Description of response activities
- Time and duration of response activities
- Listing of personnel and equipment involved

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- Identification of any injuries or damages incurred
- Discussion of problems, suggestions, etc.
- Description of substances/hazards involved (include MSDS)

The Environmental Division shall document all expenditures incurred and submit a report to the NOSC within 15 days following the incident. Procedures for cost recovery will be pursued by the PWO, Code 09, in coordination with the IHDIVNAVSURFWARCEN Comptroller for routine spills, and with the NOSC area contingency plan.

### **G-4d(3) Emergency Medical Treatment Plan**

#### On-Scene Command

In the event of a fire, explosion, or hazardous substance spill, the Fire Chief is the on-scene authority. The Emergency Medical Technicians (EMTs) will not enter into an emergency scene unless directed by the Fire Chief. The first senior EMT to arrive at the scene will coordinate all EMT actions.

#### Immediate Action

The senior EMT will consult with the Fire Chief before taking any actions at the scene of any spill, fire or explosion. Coordination with the Fire Chief is to prevent unnecessary risk of life, further injury or contamination. At the direction of the Fire Chief, the senior EMT will:

- EVALUATE the extent of injuries.
- ESTABLISH control of emergency medical needs.
- EVACUATE in the most efficient manner.

### Evaluation

The senior EMT will first seek an accurate assessment of the emergency situation. The EMTs may not be able to enter an emergency scene, therefore, the Fire Chief becomes the first source of information. The Fire Chief will provide the EMTs with information concerning the number and types of injuries, hazardous substances involved, and any other pertinent data. The EMT teams will commence triage as soon as direct examination of victims is possible.

Triage is broken in five classes of casualties:

- Priority One - Red - Critically ill or injured person who requires immediate attention. Delay in treatment may be harmful to the patient, i.e., delay potentially threatens life or function
- Priority Two - Yellow - Less serious condition; requires emergency medical attention but does not immediately endanger the patient's life.
- Priority Three - Green - Non-emergent condition; requires medical attention but not on an "emergency" basis.
- Priority Four - Black - Does not require medical attention and may not require transport, e.g., obviously dead.

The EMTs will obtain treatment data from one or more of the following sources:

- The current version of the Emergency Response Guidebook, Department of Transportation, DOT P5800.4
- Material Safety Data Sheets Available from the IHDIVNAVSURFWARCEN Safety Department
- Maryland Institute for Emergency Medical Services System (MIEMSS).

Site Control

The IHDIVNAVSURFWARCEN EMT team will provide primary first aid to victims. The senior EMT will determine the necessity of requesting the support of outside emergency agencies. If advanced life support procedures are required, the EMT must request help through the Charles County Communications Center or from Charles County's Advance Life Support Team located in White Plains, Maryland. The Charles County Advanced Life Support Team is about 25 - 30 minutes away. The EMT will prepare the victims for transport to the nearest medical facility. Preparations may include decontamination at the direction of the OSOT Leader.

Evacuation

The IHDIVNAVSURFWARCEN maintains an ambulance at the firehouse (Building 878). The ambulance is capable of transporting a maximum of two victims. If there are more injuries than the IHDIVNAVSURFWARCEN EMTs and equipment are capable of handling, the Fire Chief will request the Charles County Communications Center dispatcher if additional medical assistance is needed. The dispatcher will send emergency equipment proportionate to the need.

The Fire Chief may request helicopter transport of victims to medical facilities. He will contact the Charles County Communications Center dispatcher who will coordinate the air evacuation. Helicopters are available from the Maryland State Police, U.S. Park Service, Andrews Air Force Base, and Med Star

If the incident involves multiple victims, the Charles County dispatcher will decide what hospitals will receive which victims. This allows the senior EMT more time for on-scene work. The Charles County dispatcher will use such factors as hospital census, degree of injury, distance, and capabilities.

### Documentation and Recovery

Every ambulance run is logged in and out. Emergency runs are summarized in a report. Copies of the report are kept at the IHDIVNAVSURFWARCEN and a copy is sent to the Maryland Institute for Emergency Medical Services System (MIEMSS).

#### **G-4e Prevention of Recurrence or Spread of Fires, Explosions, or Releases**

Buildings 455, 212, 328, and 1440 have several intrinsically safe features that prevent the spread of fires or explosions. Building 455 is partitioned by 18" masonry walls. Buildings 212 and 328 are partitioned by 13" masonry walls. Bays 2, 3, and 4 of Building 455 is protected by a wet-pipe sprinkler system. The nearest adjacent building to Building 455 is 100 feet away. The nearest adjacent building to Building 212 is approximately 240 feet away and the nearest adjacent building to Building 328 is 290 feet away. Similarly, Building 1440 is composed of non-flammable materials. The stored materials in Building 1440 contain varying concentrations of PCBs. PCBs were used in various items partly because of their low flammability characteristics and therefore pose a reduced threat of flame spread. Flame spread to adjacent buildings is prevented by more than 240 feet of distance to the nearest building.

#### **G-4f Storage and Treatment of Released Material**

Once an incident is under control, the OSOT Leader will make arrangements for the on-site collection and storage, or off-site treatment and/or disposal of recovered wastes, contaminated soil, surface run-off, or other contaminated material contained on-site, as a result of implementation of the plan.

#### **G-4g Incompatible Waste**

Incompatible CHS recovered during cleanup operations, if present at the site, will be segregated. Should temporary alternate storage of CHS be required, the OSOT Leader will direct operating personnel to maintain physical segregation and provide proper marking of CHS containers. Operations at the affected area(s) will not be resumed until decontamination is accomplished.

#### **G-4h Post-emergency Equipment Maintenance**

Emergency equipment used during an emergency event will be decontaminated. Equipment not suitable for use will be replaced. Cleanup may also require removal of contaminated soil. Personnel decontamination will include showers and cleaning of clothing and equipment. All contaminated materials, including sorbents, cloth, soil, wood, etc., that cannot be decontaminated will be treated or disposed of at an appropriate facility.

Prior to resuming operation, the Maryland Department of the Environment (MDE) will be notified that post-emergency equipment maintenance has been performed and that operations will be resumed.

#### **G-4i Container Spills and Leakage**

Spills of CHS could arise from dropping containers during packaging, overturning drums or PCB transformers, and deterioration or rusting of containers. Spills in container storage Building 455 will be confined by containment dikes. Small spills in these areas will be collected using absorbent pads or granules. The absorbents will be collected in drums and disposed of based on the identity of the spilled waste. Larger spills will be pumped into drums. Residual contaminants will be handled as discussed previously. Spills from PCB containers stored in Building 1440 will also be confined by contaminant dikes and handled by using absorbent materials and/or drums. Only solid explosive hazardous wastes will

be stored in Buildings 212 and 328. If a solid spill occurs, dust pans will be used to clean up the spill. The spilled material will be collected in cans and disposed of at the SATTP.

#### **G-4j Updating the Contingency Plan**

The Contingency Plan will be updated when 1) the IHDIVNAVSURFWARCEN CHS Facility Permit is revised; 2) the plan fails in an emergency; or 3) the IHDIVNAVSURFWARCEN's mission function substantially changes which causes an increase in potential emergency situations or changes in the response necessary in an emergency. The list of emergency coordinators and emergency equipment will be reviewed biannually and updates will be provided to the MDE through a request for an administrative change.

#### **G-5 Emergency Treatment**

The purpose of this section is to outline the process that the IHDIVNAVSURFWARCEN and the MDE will follow in an event involving unpermitted emergency treatment of hazardous wastes. Items requiring emergency treatment may include ordnance or unstable chemicals which have been deemed by IHDIVNAVSURFWARCEN's Safety Department to be an imminent hazard to human health and the environment, or have been designated as unsafe for transport on public highways in accordance with U.S. Department of Transportation (DOT) regulations. The IHDIVNAVSURFWARCEN Safety Department is the Navy office which assigns interim DOT hazard classifications for use by the Navy and the Marine Corps.

In extremely rare cases, IHDIVNAVSURFWARCEN may be forced to perform hazardous waste treatment in emergency situations. Prior to any such treatment, the MDE will be notified of the emergency, and approval of the treatment will be requested by the IHDIVNAVSURFWARCEN. However, if our Safety Department determines that an imminent hazard to human health and/or the

environment exists, IHDIVNAVSURFWARCEN may be forced to take steps to mitigate the threat before MDE approval can be obtained. Explosive Ordnance Disposal (EOD) emergency action conducted on-site to alleviate an immediate safety threat to civilian or military personnel or property is not subject to the Resource Conservation and Recovery Act.

This activity has been in operation over 100 years and has, on occasion, discovered ordnance from training exercises or past operations on-site. In response to this type of emergency, the EOD team which is located at the Dahlgren Division, Naval Surface Warfare Center, Dahlgren, Virginia, is contacted. The emergency telephone number for this EOD team is (703) 663-7379 or (703) 663-7425 during working hours. In case of surface ordnance, the U.S. Army 149th EOD Detachment which is located at Andrews Air Force Base, in Clinton, Maryland is contacted. The emergency number for this team is (301) 981-6216/17. If the EOD team is unavailable, the next closest EOD team will respond. The EOD team will evaluate the situation and, if possible, package the item for transport to a permitted treatment/disposal facility. Any ordnance items transported off-site for treatment will be properly manifested as a hazardous waste. If transportation of the item is impossible, treatment of the item must be performed on-site. Whatever means are necessary to reduce the hazards and protect personnel and the environment will be utilized.

During various operations, IHDIVNAVSURFWARCEN uses thousands of chemicals in its production of propellants, explosives, and other ordnance items. In the recent past, the IHDIVNAVSURFWARCEN has undergone several major house cleaning exercises to identify and properly dispose of chemicals which were excess, unknown, or unstable. Since those housekeeping exercises, the following procedures are now in place to prevent any virgin chemicals or CHS from becoming unstable:

1. Shelf-life expiration dates are tracked on all virgin materials in the Supply Department. If the material reaches its shelf-life expiration date, the individual who purchased the material is contacted for retesting recommendations and further storage guidance. The retesting of materials, such as adhesives, may be performed by the Test and Evaluation Department to

extend the shelf-life expiration date based on economic evaluations. If the decision is reached to classify the virgin material as a waste, action is taken immediately to move the waste to Building 455 or to a less-than-90-day accumulation site. In addition, the Supply Department reviews purchase orders of new materials to reduce the possibility of in-stock materials going overage.

2. In addition, prior to accepting CHS into Building 455, a Waste Profile Sheet must be completed (see Figure C-2). Included on this form, under the Generator Certification Section, is a requirement for the generator to certify whether the CHS is potentially unstable. If the generator believes that the CHS has the potential for becoming unstable in the future, the CHS is expeditiously processed through our disposal contractor.
3. Prior to accepting EHW into Buildings 212 and 328, a SATTP Scrap Sheet must be completed (See Figure C-3). If the generator believes that this EHW is or has the potential for becoming unstable in the future, the generator notifies the SATTP operators, and the EHW is expeditiously treated at the SATTP.

If, in spite of all the precautions, a chemical, CHS, ordnance item, or propellant/explosive becomes unstable, the IHDIVNAVSURFWARCEN will evaluate and consider the following possible treatment methods:

1. Package the item for off-site treatment and disposal.
2. Chemically stabilize/treat and transport the item off-site for disposal.
3. Thermally treat the item on-site.

Upon the Safety Department issuance of an imminent hazard notice or their determination that the item cannot be safely transported on the open road, Activity personnel will contact MDE and brief them on the situation, the treatment method chosen, and alternatives considered.

For situations where the Safety Department determines that an imminent hazard to human health and/or the environment exists, the IHDIVNAVSURFWARCEN may be forced to take action to mitigate the threat before MDE approval can be obtained. In all other circumstances, except EOD emergency action

conducted on-site, the IHDIVNAVSURFWARCEN will obtain MDE approval prior to treatment or transport.

The procedure for all emergency actions, except imminent threats to human health and/or the environment, will consist of the following:

1. Within a reasonable time limit, MDE shall administratively grant one-time authority for treatment or provide the Activity with specific treatment alternatives which must be investigated.
2. After further investigation, IHDIVNAVSURFWARCEN personnel will contact MDE and the review process will begin again.

### **G-6 Emergency Equipment**

Figure G-3 is a photograph of the emergency medical, fire, and spill response equipment for the IHDIVNAVSURFWARCEN. The emergency equipment list (Table G-2) is maintained by the ERC. The IHDIVNAVSURFWARCEN has outfitted a spill response trailer that is at the OSOT's disposal. The 24-ft. trailer serves as a mobile command post with all telecommunications equipment necessary to provide contact with all pertinent emergency organizations.

### **G-7 Coordination Agreements**

The IHDIVNAVSURFWARCEN has a Mutual Police Assistance Agreement with the Charles County (Maryland) Sheriff's Department. A copy of this agreement is included in Appendix G.6. The Activity also has verbal (unwritten) agreements with the Maryland State Police and the Maryland Department of Natural Resources, Marine and Inland Police to provide similar emergency assistance as required.



Figure G-3  
Emergency Response Equipment

The IHDIVNAVSURFWARCEN also has a Mutual Fire Fighting Assistance Agreement with Charles County, Maryland for fire and emergency medical response. A copy of this agreement is included in Appendix G.7.

The IHDIVNAVSURFWARCEN does not have formal contracts with outside emergency response or cleanup contractors because Activity personnel are capable of containing and responding to most spills/releases. If required at the direction of the Fire Chief/OSOT Leader, the head of the PWO has legal authority to contract for outside assistance. Additional contractor support is available through the Commanding Officer, EFACHES.

A list of contractors for the region who are registered with the U.S. Coast Guard, is contained in Appendix G.8.

#### **G-7a Police Protection**

The Law Enforcement Operations Division of the IHDIVNAVSURFWARCEN Security Department is responsible for security. In addition to routine security, the Law Enforcement Operations Division personnel respond to all fire alarms and ambulance calls in order to control traffic and secure the area so that emergency personnel are not hampered in their response efforts. The Law Enforcement Operations Division personnel provide required assistance to the Fire Chief/OSOT Leader during emergency situations.

#### **G-7b Fire Protection**

The IHDIVNAVSURFWARCEN Fire Protection Division is responsible for fire safety. A Fire Bill and the Fire Regulations describing the procedures used by this organization are available at the site. The Fire Protection Division maintains the following major equipment for response on a 24-hour basis:

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- Pierce Pumper (1,000 gpm) (1987) with "telesquirt," a remotely operated nozzle on a 50-foot boom.
- Pierce Pumper (1,000 gpm) (1987)
- Ward-79 Pumper (1,000 gpm) (1982)
- Chevrolet Bush Truck (1988)
- Ford Ambulance (1989)

Two of these fire trucks are stationed at IHDIVNAVSWARFARCEN. A fourth pumper (Seagraves Pumper [1,000 gpm] [1978] with "telesquirt," a remotely operated nozzle on a 35-foot boom) is maintained as a reserve at IHDIVNAVSWARFARCEN in case of a mechanical failure of one of the primary units.

### **G-7c Hospitals and Medical Support**

The Branch Medical Clinic at the IHDIVNAVSWARFARCEN is staffed by personnel of the Naval Medical Command National Capital Region. The normal staff consists of 2 medical officers, 1 physician's assistant, 18 hospital corpsmen, 1 dentist, 3 dental assistants, 3 industrial hygienists, 1 industrial hygienist technician, 1 occupational health nurse, 2 occupational health technicians, and 1 occupational health doctor.

First-aid treatment is provided to all personnel injured at IHDIVNAVSWARFARCEN. Injured personnel who require additional treatment are referred to the nearest appropriate facility, such as Physicians' Memorial Hospital in La Plata, Maryland; Southern Maryland Hospital Center in Clinton, Maryland; or Malcolm Grow Hospital at Andrews Air Force Base.

The IHDIVNAVSWARFWARCEN fire department has one ambulance available to respond to emergency calls. Helicopter evacuation of injured personnel is available.

The clinic has a Mass Casualty Plan in effect at the site. Injured personnel who require treatment can be evacuated to local hospitals in Charles County Rescue Squad ambulances if the Fire Protection Division ambulance is not available.

### **G-7d Contractors**

The IHDIVNAVSWARFWARCEN does not have formal contracts with outside emergency response or clean-up contractors because the facility's forces are capable of containing and responding to most spills/releases. If required, the PWO of the IHDIVNAVSWARFWARCEN has legal authority to contract for outside assistance. Additional contractor support is available through the Commanding Officer, EFACHES. A list of contractors for the region who are registered with the U.S. Coast Guard is contained in Appendix G.8.

### **G-8 Evacuation Plan**

The number of occupants and the quantities of CHS permitted in each building are governed by strict safety rules and by the Quantity-Distance Requirements and Standards specified in NAVSEA OP-5 (fifth revision), Ammunition and Explosives Ashore. The IHDIVNAVSWARFWARCEN Fire Bill and Fire Regulations (copy on file with the State), require that a fire monitor and an alternate be appointed for each building or group of buildings, as appropriate. A detailed Local Fire Bill is posted in the CHS buildings. Each Local Fire Bill includes designated evacuation procedures for the area in the event of an emergency and also a method of sounding the alarm to request emergency assistance. Specific procedures for the PCB storage facility (Building 1440), non-explosive hazardous waste container storage building (Building 455), and the two explosive hazardous waste storage buildings (Buildings 212

and 328) are presented in the ensuing discussions. Details of the evacuation routes for each of the CHS management units are presented in the subsection that follows. These routes can be seen in Figure G-4 .

### **G-8a Building 1440, PCB Storage Facility Evacuation**

The following routes will be utilized for evacuation of personnel from Building 1440:

- Primary Route - Left onto Olson Road; left onto Caffee Road to Hanlon Road; right onto Hanlon to Patterson Road; left onto Patterson Road to Farnum Road; Farnum Road to main gate.
- Primary Regrouping Point - Intersection of Caffee and Olson (approximately 400 feet).
- Alternate Route - Right onto Olson Road; left onto Voegel Road; right onto Gallery; left onto Greenslade; right onto Strauss; Strauss to Hanlon; left onto Patterson to Farnum; Farnum to main gate.
- Alternate Regrouping Point - Building 266.

### **G-8b Building 455, Controlled Hazardous Substance Storage**

In the event of an emergency, the following routes will be used to evacuate personnel from the CHS Storage Building 455:

- Primary Route - Right onto Patterson Road; right onto Farnum; Farnum to main gate.
- Primary Regrouping Route - Intersection of Farnum and the unnamed access road to the building (approximately 400 feet).

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- Alternate Route - Left onto Patterson Road, proceed to Hersey Road; await further instructions.
- Alternate Regrouping Point - Building 266 (approximately 1,000 feet).

### **G-8c Building 212, Explosive Hazardous Waste Storage**

In the event of an emergency, the following routes will be used to evacuate personnel from the EHW Storage Building 212:

- Primary Route - Left onto Bronson Road; right onto unnamed access road to Building 703.
- Primary Regrouping Route - Building 703.
- Alternate Route - Right onto Bronson Road; left onto Hanlon Road to Strauss Avenue, proceed to Building 714.
- Alternate Regrouping Point - Building 714.

### **G-8d Building 328, Explosive Hazardous Waste Storage**

In the event of an emergency, the following routes will be used to evacuate personnel from the EHW Storage Building 328:

- Primary Route - Left onto Bronson Road; right onto unnamed access road to Building 703.
- Primary Regrouping Route - Building 703.
- Alternate Route - Right onto Bronson Road; left onto Hanlon Road to Strauss Avenue, proceed to Building 714.

Alternate Regrouping Point - Building 714.

### **G-9 Required Reports**

IHDIVNAVSURFWARCEN will report a release, fire, or explosion which could threaten human health, or the environment, outside the activity, or, if the release exceeds the reportable quantity (RQ) to the National Response Center (NRC) and appropriate state agencies. Reporting will be initially made by telephone, typically confirmed by a message within five days (to the appropriate officials), and a written report within fifteen days. The following information will be included in the written report:

- (a) Name, address, and telephone number of IHDIVNAVSURFWARCEN;
- (b) Date, time, and type of incident;
- (c) Name and quantity of materials involved;
- (d) The extent of injuries, if any;
- (e) An assessment of actual or potential hazards to human health or the environment, where applicable; and
- (f) Estimated quantity and disposition of recovered material that resulted from the incident.

Every ambulance response requires a report to be sent to the MIEMSS.

**Appendix G.1  
Contingency Plan for  
Building 455**

**BUILDING 455  
IMMEDIATE HAZARDOUS MATERIAL EMERGENCY ACTION PLAN**

**WARNING:** Predesignated personnel at this facility have been specially tasked, trained, and equipped to respond to all hazardous substance spills. Unauthorized individuals shall never undertake the response or investigation to any actual or suspected hazardous substance spill.

**IN CASE OF A HAZARDOUS SUBSTANCE SPILL:**

- KEEP CALM, think, avoid panic and confusion.
- CLEAR area to a safe distance from the spill.
- IN CASE OF SPILL FIRE OR INJURY, use nearest ALARM BOX or TELEPHONE. KNOW the location of the nearest alarm box and the nearest telephone in your area.
- CALL IHDIVNAVSURFWARCEN Emergency Number x4333.
- WHENEVER POSSIBLE, give the following information if known or can reasonably be determined:
  - Your name and telephone number
  - Location of the spill (Building 1440)
  - Number and type of injuries
  - Identity or type and estimated amount of spilled material
  - Source of spill (e.g., tank, container)
  - Behavior of spilled material (reactions leak, spill, fire observed)
  - Anticipated movement of spill and actions being taken
  - Time when spill occurred
- SPREAD THE ALARM--PASS THE WORD.

- RESCUE any injured individual(s) when possible without risking your SAFETY.
- IMMEDIATELY REPORT spill by most expeditious means (i.e., voice, telephone), to your supervisor.
- ALL personnel except authorized response personnel shall clear the area.

### **Emergency Response Operations**

The Fire Chief will assume command of response operations. He shall assess the situation and take the following action:

- ACTIVATE and DIRECT Activity response personnel to implement emergency response operation to protect life and property. The order of operation will depend on existing conditions and may be concurrent.
- RESCUE any injured individuals without risking personal safety. If the spill occurs indoors, use Self-Contained Breathing Apparatus (properly trained and authorized personnel only) to perform rescue.
- SECURE the spill area from unauthorized personnel.
- STOP SOURCE AND PREVENT spill from entering floor or storm drains. Use on-site spill containment equipment and materials stored in the building. AVOID contact with liquids and fumes.
- RESTRICT all sources of ignition--smoking, combustion engine, open flame--if flammable vapors are suspected or present.
- ALERT personnel in trailers adjacent to Building 455.
- IF FIRE DEVELOPS, USE proper equipment at hand to extinguish the fire, pending arrival of the Fire Department. FIRE ALARMS and FIRE EXTINGUISHERS are noted on the attached building floor plans (see Fire Safety Plan).

- QUICKLY DETERMINE the need to evacuate all or part of the facility and implement the EMERGENCY EVACUATION PROCEDURES as required.

### **Emergency Evacuation Procedures**

The OSOT Leader/Security will notify supervisors if an evacuation may be necessary. EACH supervisor is responsible for directing employees and visitors in his/her work area to the proper exit and their assigned safe area outside the facility. **YOU SHALL BE FAMILIAR WITH THESE PROCEDURES BEFORE THE NEED TO VACATE THE FACILITY EVER ARISES.**

BE SURE you know ALL EXIT locations in the building and the safest and quickest way out of your work area. The floor diagram of Building 455, posted next to these procedures, shows each area of the building and the best route and exit to use for evacuating each area. PREDESIGNATED assembly areas for each work area are also described in the posted map.

WHEN an evacuation is announced, STOP WORK. Keep calm, think, avoid panic and confusion. Move to the nearest safe exit in your area.

When evacuating the facility WALK to the nearest safe exit. DO NOT RUN, nor LINGER in entrance ways or driveways.

LEAVE the facility and report to your designated assembly area (IF SAFE), or to a safe area away from the building. REPORT to your supervisor once outside the building and follow his/her instructions. STAY in your assigned safe area until otherwise instructed.

STAY outside the facility until notified by your supervisor to re-enter.

Each supervisor must conduct a "Head Count" and report to the Fire Monitor when his/her employees have cleared the facility, and if anyone is missing.

Security will notify the supervisors when it is safe to re-enter the facility.

### **WHAT NOT TO DO DURING AN EVACUATION**

- DO NOT delay evacuation of the facility for any reason.
- DO NOT assist in fire control unless properly trained.
- DO NOT lock doors when vacating the facility. The Fire Chief and emergency support personnel must have visual access to all areas to ensure that the facility is clear of personnel.
- DO NOT interfere with emergency operations. KEEP OUT of the way, stay clear of the facility.
- DO NOT re-enter the facility until instructed.

### **Fire Safety and Equipment**

A fire hydrant (#231-8) east of southeast corner (See Figures 1 and 2).

### **Utilities**

Power shut off is located on the exterior of the north wall between bays 4 and 5.

## **Contents**

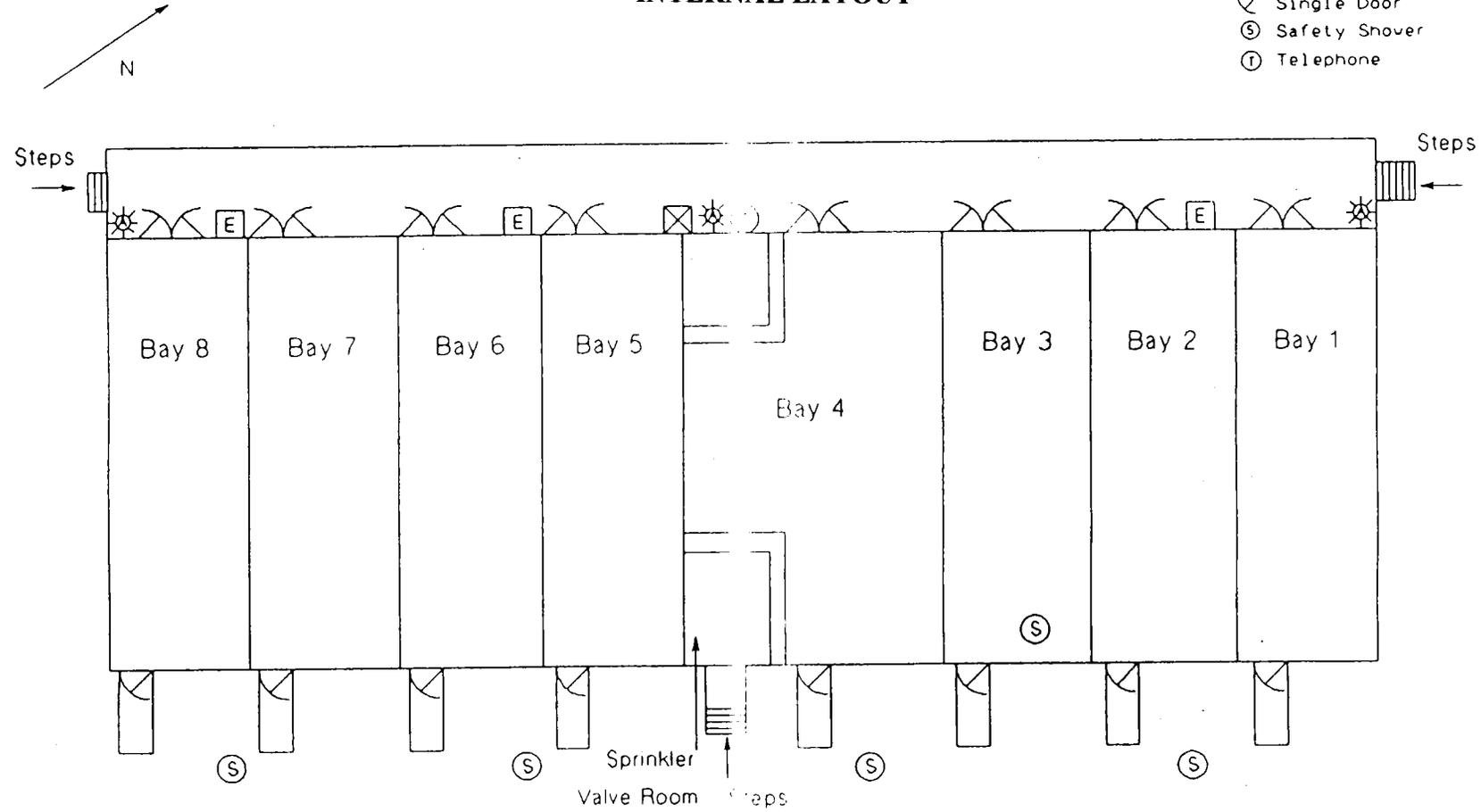
Table D-1 details information about Building 455. Maximum inventory is 259,100 gallons. Minimize reactions.

## **Probable Spill Routes**

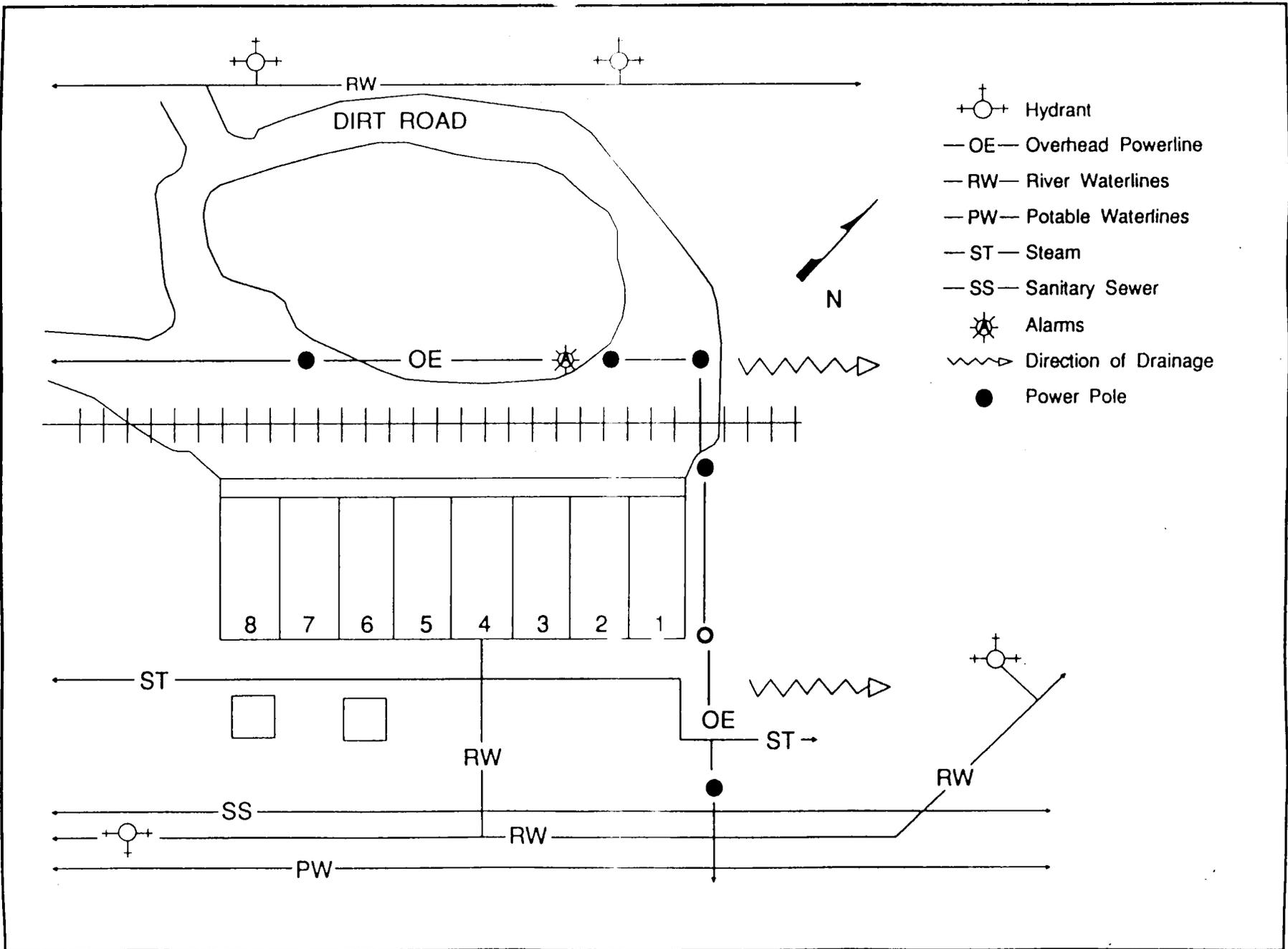
Large spills at Building 455 are not anticipated. However, runoff due to sprinkler activation could carry hazardous substances. The expected direction is shown in Figure 2.

**FIGURE 1**  
**BUILDING 455**  
**INTERNAL LAYOUT**

- ☼ Alarm
- Ⓔ Fire Extinguisher
- ⊠ Electrical Disconnect
- ⌵ Double Doors
- ∨ Single Door
- Ⓢ Safety Shower
- Ⓣ Telephone



**FIGURE 2**  
**BUILDING 455**  
**AREA LAYOUT**



**Appendix G.2  
Contingency Plan for  
Building 1440**

**BUILDING 1440**  
**IMMEDIATE HAZARDOUS MATERIAL EMERGENCY ACTION PLAN**

**WARNING:** Predesignated personnel at this facility have been specially tasked, trained, and equipped to respond to all hazardous substance spills. Unauthorized individuals shall never undertake the response or investigation to any actual or suspected hazardous substance spill.

**IN CASE OF A HAZARDOUS SUBSTANCE SPILL:**

- KEEP CALM, think, avoid panic and confusion.
- CLEAR area to a safe distance from the spill.
- IN CASE OF SPILL FIRE OR INJURY, use nearest ALARM BOX or TELEPHONE. KNOW the location of the nearest alarm box and the nearest telephone in your area.
- CALL IHDIVNAVSURFWARCEN Emergency Number x4333.
- WHENEVER POSSIBLE, give the following information if known or can reasonably be determined:
  - Your name and telephone number
  - Location of the spill (Building 1440)
  - Number and type of injuries
  - Identity or type and estimated amount of spilled material
  - Source of spill (e.g., tank, container)
  - Behavior of spilled material (reactions leak, spill, fire observed)
  - Anticipated movement of spill and actions being taken
  - Time when spill occurred
- SPREAD THE ALARM--PASS THE WORD.
- RESCUE any injured individual(s) when possible without risking your SAFETY.

- IMMEDIATELY REPORT spill by most expeditious means (i.e., voice, telephone), to your supervisor.
- ALL personnel except authorized response personnel shall clear the area.

### **Emergency Response Operations**

The Fire Chief will assume command of response operations. He shall assess the situation and take the following action:

- ACTIVATE and DIRECT facility response personnel to implement emergency response operation to protect life and property. The order of operation will depend on existing conditions and may be concurrent.
- RESCUE any injured individuals without risking personal safety. If the spill occurs indoors, use Self-Contained Breathing Apparatus (properly trained and authorized personnel only) to perform rescue.
- SECURE the spill area from unauthorized personnel.
- STOP SOURCE AND PREVENT spill from entering floor or storm drains. Use on-site spill containment equipment and materials stored in the building. AVOID contact with liquids and fumes.
- RESTRICT all sources of ignition--smoking, combustion engine, open flame--if flammable vapors are suspected or present.
- ALERT personnel in trailers adjacent to Building 1440.
- IF FIRE DEVELOPS, USE proper equipment at hand to extinguish the fire, pending arrival of the Fire Department. FIRE ALARMS and FIRE EXTINGUISHERS are noted on the attached building floor plans (see Fire Safety Plan).

- QUICKLY DETERMINE the need to evacuate all or part of the facility and implement the EMERGENCY EVACUATION PROCEDURES as required.

### **Emergency Evacuation Procedures**

The OSOT Leader/Security will notify supervisors if an evacuation may be necessary. EACH supervisor is responsible for directing employees and visitors in his/her work area to the proper exit and their assigned safe area outside the facility. **YOU SHALL BE FAMILIAR WITH THESE PROCEDURES BEFORE THE NEED TO VACATE THE FACILITY EVER ARISES.**

BE SURE you know ALL EXIT locations in the building and the safest and quickest way out of your work area. The floor diagram of Building 1440, posted next to these procedures, shows each area of the building and the best route and exit to use for evacuating each area. PREDESIGNATED assembly areas for each work area are also described in the posted map.

WHEN an evacuation is announced, STOP WORK. Keep calm, think, avoid panic and confusion. Move to the nearest safe exit in your area.

When evacuating the facility WALK to the nearest safe exit. DO NOT RUN, nor LINGER in entrance ways or driveways.

LEAVE the facility and report to your designated assembly area (IF SAFE), or to a safe area away from the building. REPORT to your supervisor once outside the building and follow his/her instructions. STAY in your assigned safe area until otherwise instructed.

STAY outside the facility until notified by your supervisor to re-enter.

Each supervisor must conduct a "Head Count" and report to the Fire Monitor when his/her employees have cleared the facility, and if anyone is missing.

Security will notify the supervisors when it is safe to re-enter the facility.

### **WHAT NOT TO DO DURING AN EVACUATION**

- DO NOT delay evacuation of the facility for any reason.
- DO NOT assist in fire control unless properly trained.
- DO NOT lock doors when vacating the facility. The Fire Chief and emergency support personnel must have visual access to all areas to ensure that the facility is clear of personnel.
- DO NOT interfere with emergency operations. KEEP OUT of the way, stay clear of the facility.
- DO NOT re-enter the facility until instructed.

### **Fire Safety and Equipment**

A fire hydrant is located about 100 feet east of Building 1440 along Olson Road. A fire extinguisher is mounted on the exterior to the left of the double swinging doors. A fire alarm pull box is located directly across Olson Road about 150 feet away (See Figures 1 and 2).

### **Utilities**

Power disconnect for Building 1440 is located on the inside wall to the left as one enters the large roll-up door. (See Figure 2).

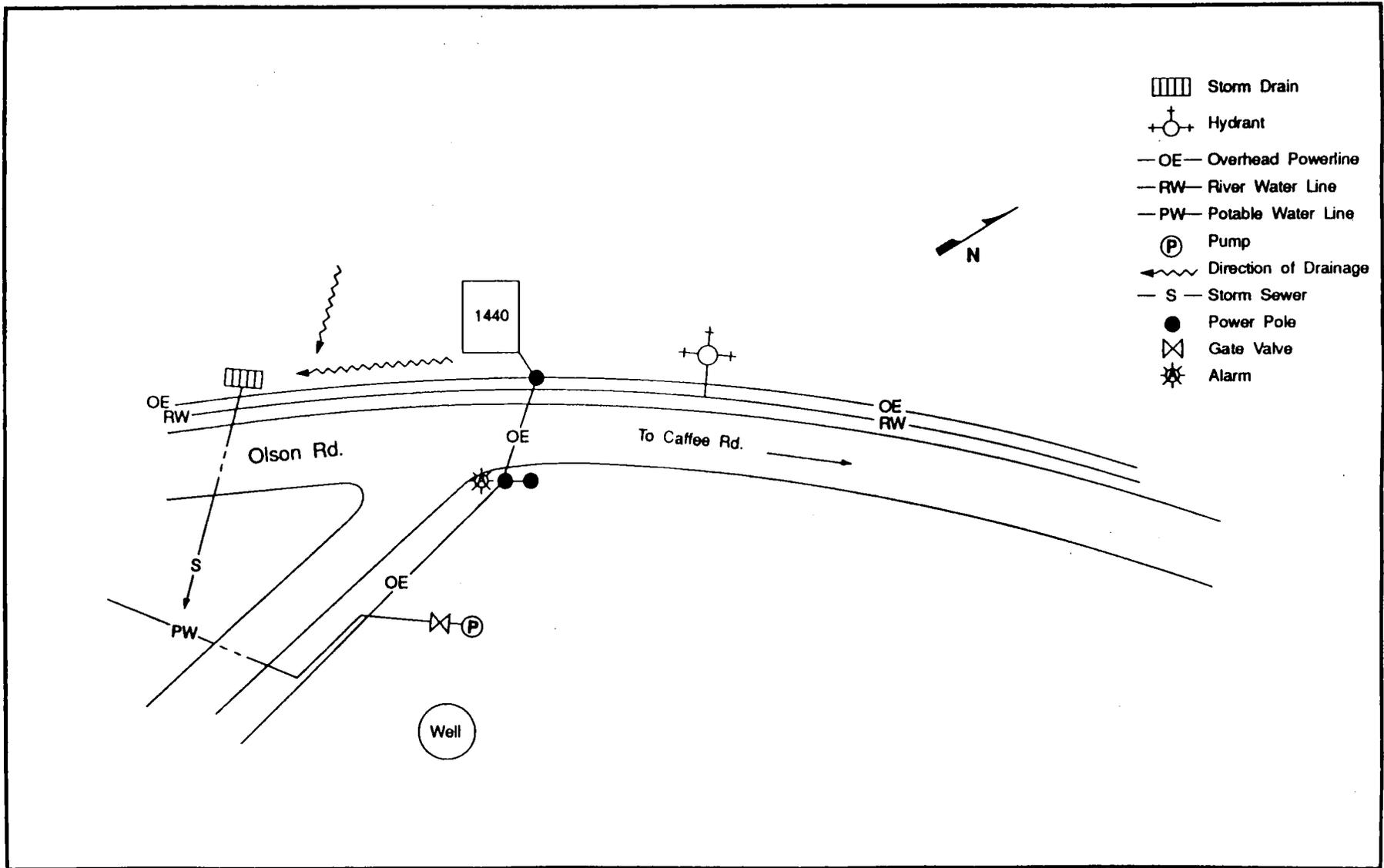
## **Contents**

Table 1 describes the diked areas in Building 1440. PCB contaminated products and containers are stored in Building 1440 including disconnected transformers.

## **Probable Spill Routes**

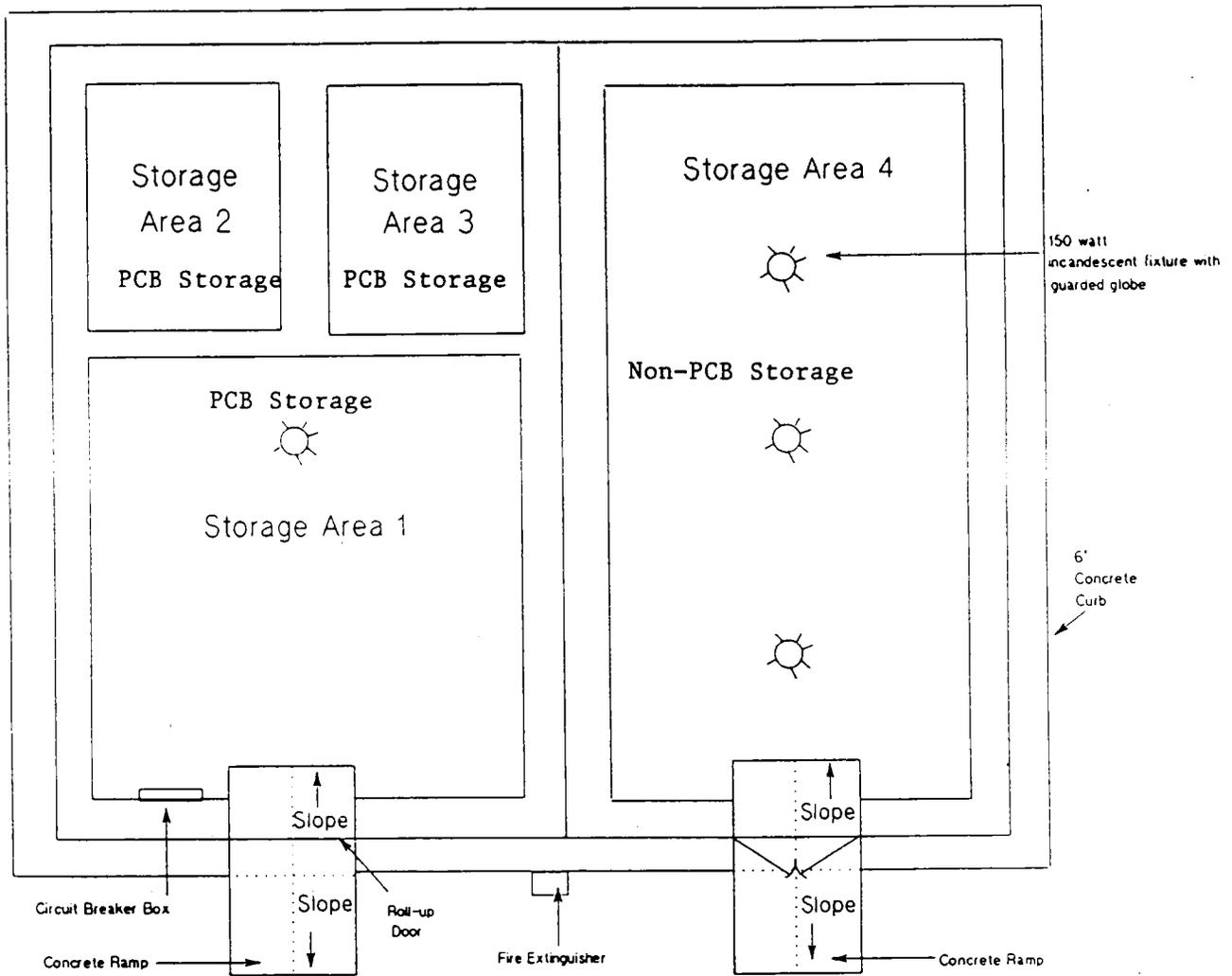
A storm drain is located about 100 feet west of Building 1440. It crosses Olson Road to the south. In the event of a spill that breaches the building secondary containment, drainage runs to the Mattawoman Creek (See Figure 1).

Figure 1  
Building 1440 Area Layout



-  Storm Drain
-  Hydrant
-  OE— Overhead Powerline
-  RW— River Water Line
-  PW— Potable Water Line
-  Pump
-  Direction of Drainage
-  S — Storm Sewer
-  Power Pole
-  Gate Valve
-  Alarm

**Figure 2**  
**Floor Plan of Building 1440**



**Table 1**  
**Maximum PCB Inventory for Building 1440**

Storage Area	Dimensions (feet)	Secondary Containment Capacity		Maximum Allowable PCB Storage Capacity* (gal.)	Maximum Container (gal.)
		(cubic ft.)	(gal.)		
1	22.5 x 19 x .5	213.75	1,599	6,396	799
2	9.25 x 12 x .5	55.5	415	1,660	207
3	9.25 x 12 x .5	55.5	415	1,660	207
4	35 x 10 x .5	175	1,309	**	**
Totals		499.75	3,738	9,716	

\*Maximum storage capacity as established under TSCA regulations, 40 CFR 761.65(b)(1)(ii).

\*\*Storage Area 4 has never been used to store PCB or PCB-contaminated equipment. There are no plans to use this area in the future for PCB storage.

**Appendix G.3  
Contingency Plan for  
Building 212**

**BUILDING 212  
IMMEDIATE HAZARDOUS MATERIAL EMERGENCY ACTION PLAN**

**WARNING:** Predesignated personnel at this facility have been specially tasked, trained, and equipped to respond to all hazardous substance spills. Unauthorized individuals shall never undertake the response or investigation to any actual or suspected hazardous substance spill.

**IN CASE OF A HAZARDOUS SUBSTANCE SPILL:**

- KEEP CALM, think, avoid panic and confusion.
- CLEAR area to a safe distance from the spill.
- IN CASE OF SPILL FIRE OR INJURY, use nearest ALARM BOX or TELEPHONE. KNOW the location of the nearest alarm box and the nearest telephone in your area.
- CALL IHDIVNAVSURFWARCEN Emergency Number x4333.
- WHENEVER POSSIBLE, give the following information if known or can reasonably be determined:
  - Your name and telephone number
  - Location of the spill (Building 1440)
  - Number and type of injuries
  - Identity or type and estimated amount of spilled material
  - Source of spill (e.g., tank, container)
  - Behavior of spilled material (reactions leak, spill, fire observed)
  - Anticipated movement of spill and actions being taken
  - Time when spill occurred
- SPREAD THE ALARM--PASS THE WORD.
- RESCUE any injured individual(s) when possible without risking your SAFETY.

- IMMEDIATELY REPORT spill by most expeditious means (i.e., voice, telephone), to your supervisor.
- ALL personnel except authorized response personnel shall clear the area.

### **Emergency Response Operations**

The Fire Chief will assume command of response operations. He shall assess the situation and take the following action:

- ACTIVATE and DIRECT facility response personnel to implement emergency response operation to protect life and property. The order of operation will depend on existing conditions and may be concurrent.
- RESCUE any injured individuals without risking personal safety. If the spill occurs indoors, use Self-Contained Breathing Apparatus (properly trained and authorized personnel only) to perform rescue.
- SECURE the spill area from unauthorized personnel.
- STOP SOURCE AND PREVENT spill from entering floor or storm drains. Use on-site spill containment equipment and materials stored in the building. AVOID contact with liquids and fumes.
- RESTRICT all sources of ignition--smoking, combustion engine, open flame--if flammable vapors are suspected or present.
- ALERT personnel in adjacent buildings.
- IF FIRE DEVELOPS, USE proper equipment at hand to extinguish the fire, pending arrival of the Fire Department. FIRE ALARMS and FIRE EXTINGUISHERS are noted on the attached building floor plans (see Fire Safety Plan).
- QUICKLY DETERMINE the need to evacuate all or part of the facility and implement the EMERGENCY EVACUATION PROCEDURES as required.

### **Emergency Evacuation Procedures**

The OSOT Leader/Security will notify supervisors if an evacuation may be necessary. EACH supervisor is responsible for directing employees and visitors in his/her work area to the proper exit and their assigned safe area outside the facility. **YOU SHALL BE FAMILIAR WITH THESE PROCEDURES BEFORE THE NEED TO VACATE THE FACILITY EVER ARISES.**

BE SURE you know ALL EXIT locations in the building and the safest and quickest way out of your work area. The floor diagram of Building 212, posted next to these procedures, shows each area of the building and the best route and exit to use for evacuating each area. PREDESIGNATED assembly areas for each work area are also described in the posted map.

WHEN an evacuation is announced, STOP WORK. Keep calm, think, avoid panic and confusion. Move to the nearest safe exit in your area.

When evacuating the facility WALK to the nearest safe exit. DO NOT RUN, nor LINGER in entrance ways or driveways.

LEAVE the facility and report to your designated assembly area (IF SAFE), or to a safe area away from the building. REPORT to your supervisor once outside the building and follow his/her instructions. STAY in your assigned safe area until otherwise instructed.

STAY outside the facility until notified by your supervisor to re-enter.

Each supervisor must conduct a "Head Count" and report to the Fire Monitor when his/her employees have cleared the facility, and if anyone is missing.

Security will notify the supervisors when it is safe to re-enter the facility.

### **WHAT NOT TO DO DURING AN EVACUATION**

- DO NOT delay evacuation of the facility for any reason.
- DO NOT assist in fire control unless properly trained.
- DO NOT lock doors when vacating the facility. The Fire Chief and emergency support personnel must have visual access to all areas to ensure that the facility is clear of personnel.
- DO NOT interfere with emergency operations. KEEP OUT of the way, stay clear of the facility.
- DO NOT re-enter the facility until instructed.

### **Fire Safety and Equipment**

A fire hydrant # 710-8 is located approximately 40 feet from Building 212 across the access road.

### **Utilities**

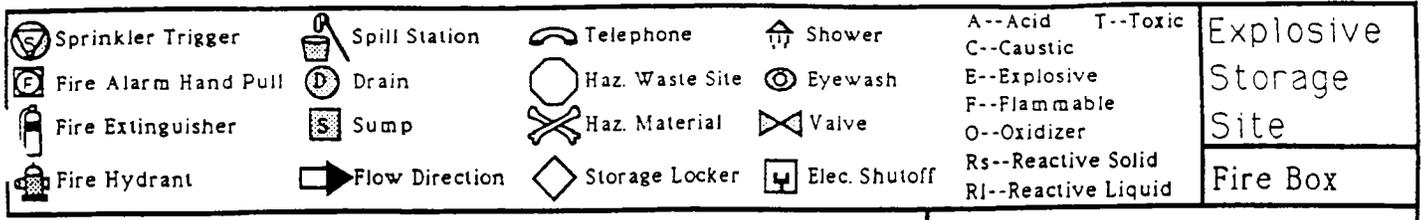
Power shut off is located on the interior wall across from storage area 2.

### **Contents**

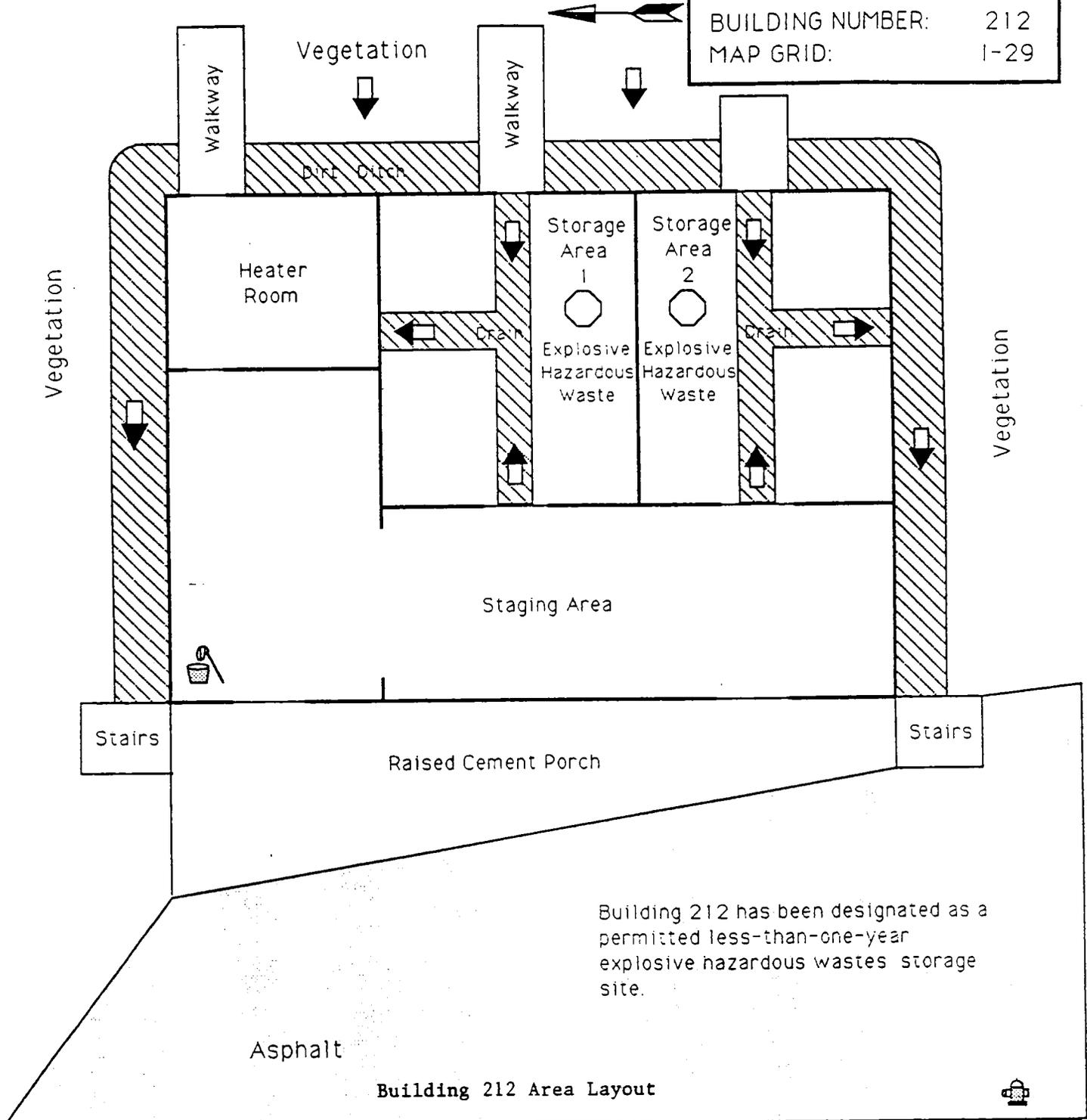
Table D-3 details information about Building 212. Maximum inventory is 65,000 pounds.

### **Probable Spill Routes**

Spills at Building 212 are not anticipated since this building will only be used to store solid explosive hazardous wastes. However, run-off due to sprinkler activation should carry hazardous substances. The expected direction is shown in Figure 2.



BUILDING NUMBER: 212  
 MAP GRID: 1-29



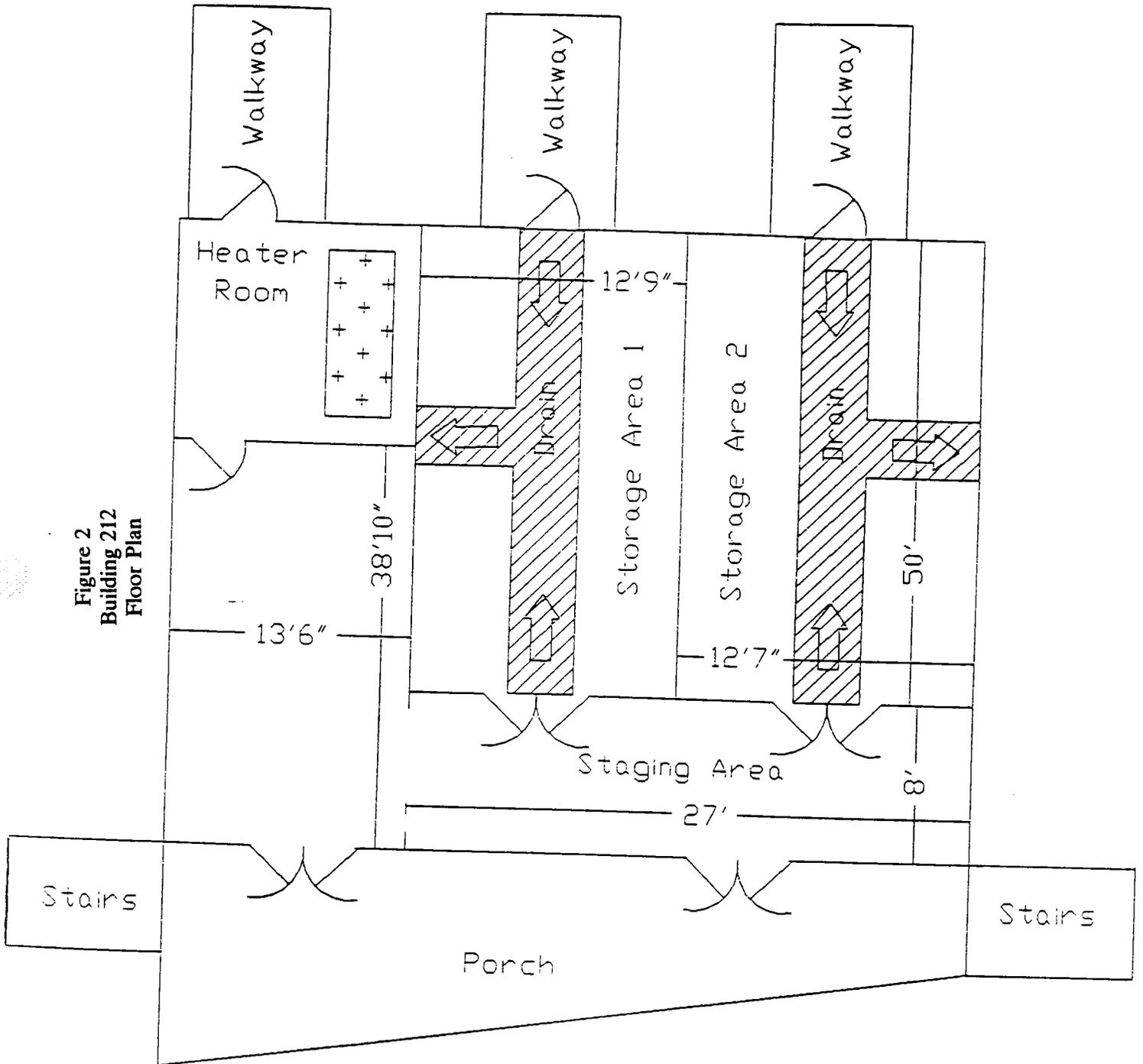
Building 212 has been designated as a permitted less-than-one-year explosive hazardous wastes storage site.

Building 212 Area Layout

<u>Muster Point</u>	<u>Possible Quantities</u>	<u>Possible Spill Contamination</u>
1000	Explosives 65,000 lbs (1.3)	To air, ground, and Mattawoman Creek.

Figure 1  
 Building 212 Area Layout

Figure 2  
Building 212  
Floor Plan



**Appendix G.4  
Contingency Plan for  
Building 328**

**BUILDING 328**  
**IMMEDIATE HAZARDOUS MATERIAL EMERGENCY ACTION PLAN**

**WARNING:** Predesignated personnel at this facility have been specially tasked, trained, and equipped to respond to all hazardous substance spills. Unauthorized individuals shall never undertake the response or investigation to any actual or suspected hazardous substance spill.

**IN CASE OF A HAZARDOUS SUBSTANCE INCIDENT**

- KEEP CALM, think, avoid panic and confusion.
- CLEAR area to a safe distance from the spill.
- IN CASE OF SPILL, FIRE, OR INJURY, use nearest ALARM BOX or TELEPHONE. KNOW the location of the nearest alarm box and the nearest telephone in your area.
- CALL IHDIVNAVSURFWARCEN Emergency Number x4333.
- WHENEVER POSSIBLE, give the following information if known or can reasonably be determined:
  - Your name and telephone number
  - Location of the spill (Building 328)
  - Number and type of injuries
  - Identity or type and estimated amount of spilled material
  - Source of spill (e.g., tank, container)
  - Behavior of spilled material (reactions leak, spill, fire observed)
  - Anticipated movement of spill and actions being taken
  - Time when spill occurred
- SPREAD THE ALARM--PASS THE WORD.
- RESCUE any injured individual(s) when possible without risking your SAFETY.
- IMMEDIATELY REPORT spill by most expeditious means (i.e., voice, telephone), to your supervisor.

- ALL personnel except authorized response personnel shall clear the area.

### **Emergency Response Operations**

The Fire Chief will assume command of response operations. He shall assess the situation and take the following action:

- **ACTIVATE** and **DIRECT** facility response personnel to implement emergency response operation to protect life and property. The order of operation will depend on existing conditions and may be concurrent.
- **RESCUE** any injured individuals without risking personal safety. If the spill occurs indoors, use Self-Contained Breathing Apparatus (properly trained and authorized personnel only) to perform rescue.
- **SECURE** the spill area from unauthorized personnel.
- **STOP SOURCE AND PREVENT** spill from entering floor or storm drains. Use on-site spill containment equipment and materials stored in the building. **AVOID** contact with liquids and fumes.
- **RESTRICT** all sources of ignition--smoking, combustion engine, open flame--if flammable vapors are suspected or present.
- **ALERT** personnel in adjacent to buildings.
- **IF FIRE DEVELOPS, USE** proper equipment at hand to extinguish the fire, pending arrival of the Fire Department. **FIRE ALARMS** and **FIRE EXTINGUISHERS** are noted on the attached building floor plans (see Fire Safety Plan).
- **QUICKLY DETERMINE** the need to evacuate all or part of the facility and implement the **EMERGENCY EVACUATION PROCEDURES** as required.

### **Emergency Evacuation Procedures**

The OSOT Leader/Security will notify supervisors if an evacuation may be necessary. EACH supervisor is responsible for directing employees and visitors in his/her work area to the proper exit and their assigned safe area outside the facility. **YOU SHALL BE FAMILIAR WITH THESE PROCEDURES BEFORE THE NEED TO VACATE THE FACILITY EVER ARISES.**

BE SURE you know ALL EXIT locations in the building and the safest and quickest way out of your work area. The floor diagram of Building 328, posted next to these procedures, shows each area of the building and the best route and exit to use for evacuating each area. PREDESIGNATED assembly areas for each work area are also described in the posted map.

WHEN an evacuation is announced, STOP WORK. Keep calm, think, avoid panic and confusion. Move to the nearest safe exit in your area.

When evacuating the facility WALK to the nearest safe exit. DO NOT RUN, nor LINGER in entrance ways or driveways.

LEAVE the facility and report to your designated assembly area (IF SAFE), or to a safe area away from the building. REPORT to your supervisor once outside the building and follow his/her instructions.

STAY in your assigned safe area until otherwise instructed.

STAY outside the facility until notified by your supervisor to re-enter.

Each supervisor must conduct a "Head Count" and report to the Fire Monitor when his/her employees have cleared the facility, and if anyone is missing.

Security will notify the supervisors when it is safe to re-enter the facility.

### **WHAT NOT TO DO DURING AN EVACUATION**

- DO NOT delay evacuation of the facility for any reason.
- DO NOT assist in fire control unless properly trained.
- DO NOT lock doors when vacating the facility. The Fire Chief and emergency support personnel must have visual access to all areas to ensure that the facility is clear of personnel.
- DO NOT interfere with emergency operations. KEEP OUT of the way, stay clear of the facility.
- DO NOT re-enter the facility until instructed.

### **Fire Safety and Equipment**

A fire hydrant # 726-4 is located approximately 58 feet northeast of Building 328 and fire hydrant # 722-8 is located approximately 110 feet south of Building 328 across the access road.

### **Utilities**

Power shut off is located on the interior wall across from storage area 2.

### **Contents**

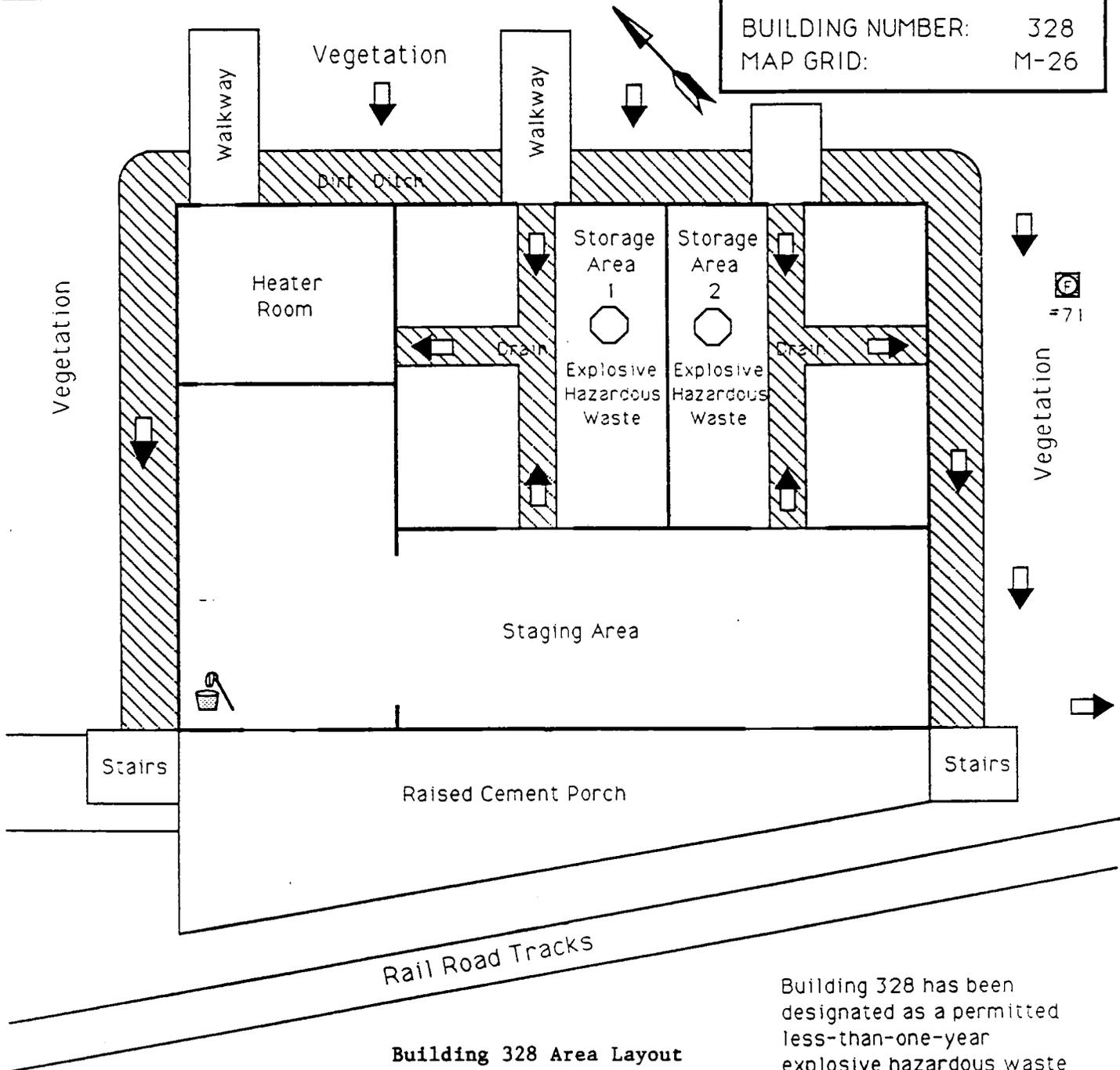
Table D-3 details information about Building 328. Maximum inventory is 2,000 pounds.

### **Probable Spill Routes**

Spills at Building 328 are not anticipated since this building will only be used to store solid explosive hazardous wastes. However, run-off due to sprinkler activation should carry hazardous substances. The expected flow direction is shown in Figure 2.

Sprinkler Trigger	Spill Station	Telephone	Shower	A--Acid	T--Toxic	Explosive Storage Site Fire Box #71
Fire Alarm Hand Pull	Drain	Haz. Waste Site	Eyewash	C--Caustic	E--Explosive	
Fire Extinguisher	Sump	Haz. Material	Valve	F--Flammable	O--Oxidizer	
Fire Hydrant	Flow Direction	Storage Locker	Elec. Shutoff	Rs--Reactive Solid	Rl--Reactive Liquid	

BUILDING NUMBER: 328  
MAP GRID: M-26



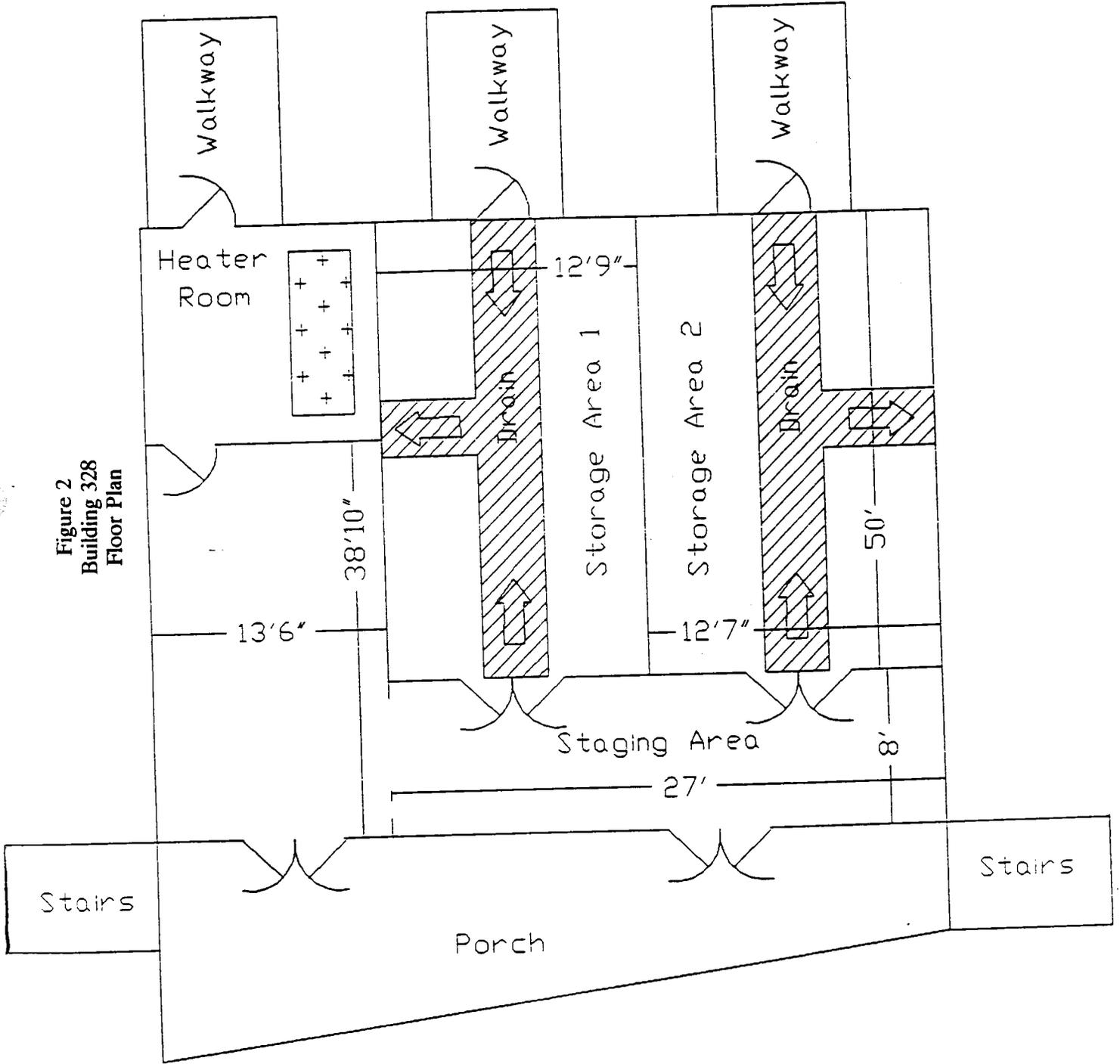
**Building 328 Area Layout**  
Vegetation

Building 328 has been designated as a permitted less-than-one-year explosive hazardous waste storage site.

Muster Point	Possible Quantities	Possible Spill Contamination
1000	Explosives 2,000 lbs (1.1) 20,000 lbs (1.3)	To air, ground, and Mattawoman Creek.

**Figure 1**  
**Building 328 Area Layout**

Figure 2  
Building 328  
Floor Plan



**Table 1  
Storage and Containment Capacities  
for Building 328**

<b>Bay</b>	<b>Categories</b>	<b>Maximum Inventory Allowed (lb.)</b>	<b>Secondary Containment Capacity (gal.)</b>	<b>Ventilation</b>	<b>Temperature Control</b>	<b>Electrical</b>	<b>Sprinkler System</b>	<b>Fire Alarms</b>
Storage Area 1	1.1	1,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No
Storage Area 2	1.1	1,000	Not Required (no liquid storage)	Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No
Staging Area	Material is only allowed to pass through. No storage permitted.			Fans & Louvers	Steam Heated	Class 1 Division 1 Group C & D	No	No

**Appendix G.5  
Spill Report**

NSWCIH SPILL REPORT

NSWC REPORT NUMBER: \_\_\_\_\_ - \_\_\_\_\_ LOCATION: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

MATERIAL: \_\_\_\_\_

QUANTITY: \_\_\_\_\_

REPORTABLE QUANTITY (RQ) \_\_\_\_\_ LBS

REPORTABLE: YES NO

NRC: \_\_\_\_\_ MDE: \_\_\_\_\_

NOTE: ANY AMOUNT OF OIL THAT IS RELEASED TO THE SOIL OF THE STATE MUST BE REPORTED TO THE MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE). IF THE OIL IS RELEASED TO THE WATER (S) OF THE STATE IT MUST ALSO BE REPORTED TO THE NATIONAL RESPONSE CENTER (NRC).

=====

MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE)

OIL SPILLS:  
WITHIN 2 HOURS YOU MUST REPORT TO MDE:

410-974-3551 (24 HOUR)

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

REPORTED TO: (name): \_\_\_\_\_ RANK: \_\_\_\_\_

MDE LETTER: \_\_\_\_\_ NAVAL MSG DTG: \_\_\_\_\_

=====

NATIONAL RESPONSE CENTER (NRC)

ALL REPORTABLE SPILLS: WITHIN 30 MINUTES YOU MUST REPORT TO NRC:

1-800-424-8802 OR 202-267-2675 (24 HOUR)

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

REPORTED TO (name): \_\_\_\_\_ RANK: \_\_\_\_\_

REPORT NUMBER (you may have to ask for it): \_\_\_\_\_

NOTE: REPORTABLE QUANTITY SPILLS MAY BE DETERMINED BY  
REFERRING TO

=====

IF REQUESTED, PROVIDE THE FOLLOWING INFORMATION TO NRC / MDE:

NAME \_\_\_\_\_ CODE \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

RESPONSIBLE PARTY: \_\_\_\_\_ CODE \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

SPIILLED MATERIAL: \_\_\_\_\_

SYNONYMS/TRADE NAME: \_\_\_\_\_

QUANTITY: \_\_\_\_\_

UN/NA NUMBER: \_\_\_\_\_ IMO DESIGNATION \_\_\_\_\_

49 STCC NUMBER: \_\_\_\_\_ CAS NUMBER \_\_\_\_\_

PHYSICAL DESCRIPTION: LIQUID \_\_\_\_\_ SOLID \_\_\_\_\_ GAS \_\_\_\_\_

COLOR: \_\_\_\_\_ ODOR \_\_\_\_\_

CAUSE OF SPILL: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

SPILL/RELEASED TO: SOIL \_\_\_\_\_ WATER \_\_\_\_\_ AIR \_\_\_\_\_ OTHER \_\_\_\_\_

LOCATION: \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

TIME OF SPILL: \_\_\_\_\_

HAS THE SPILL/LEAK BEEN STOPPED? YES NO

CONTAINED: \_\_\_\_\_

CONTAINMENT METHOD: \_\_\_\_\_

OTHER INFORMATION: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

ASSISTANCE REQUIRED: YES \_\_\_\_\_ NO \_\_\_\_\_

FROM: \_\_\_\_\_

TYPE: \_\_\_\_\_

CLEAN UP: GOVT. \_\_\_\_\_ CONTRACTOR: \_\_\_\_\_

LABOR (man hours): \_\_\_\_\_ COST: \_\_\_\_\_

MATERIALS USED: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

COST: \_\_\_\_\_

EQUIPMENT USED: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

COST: \_\_\_\_\_

DISPOSAL LOCATION: \_\_\_\_\_

DISPOSAL COST: \_\_\_\_\_

TOTAL COST \_\_\_\_\_

CLEANUP VERIFIED: DATE \_\_\_\_\_ TIME \_\_\_\_\_

NAME: \_\_\_\_\_

MONITORING INSTRUMENT USED: \_\_\_\_\_

PPM/MG/L: \_\_\_\_\_

COMMENTS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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**Appendix G.6**  
**Mutual Police Assistance Agreement**

## MUTUAL POLICE ASSISTANCE AGREEMENT

This agreement, made and entered into this 21st day of November 1988 by and between the Charles County, Maryland Sheriff and the Commanding Officer, Naval Ordnance Station, Indian Head, Charles County, Maryland.

WITNESSETH:

WHEREAS, each of the parties hereto maintains equipment and personnel for the protection of life, limb and property, and

WHEREAS, the parties hereto desire to augment the police protection available in their various agencies in the event of riot, insurrection or major disaster, and

WHEREAS, the lands of the parties hereto are adjacent or contiguous so that mutual assistance in an emergency is deemed feasible, and

WHEREAS, it is mutually deemed sound, desirable, practicable and beneficial for the parties to this agreement to render assistance to one another in accordance with these terms:

THEREFORE, BE IT AGREED THAT:

1. Whenever it is deemed advisable by the senior officer of the parties of this agreement, or by the senior officer of either party, on the scene of an emergency, to request police assistance under the terms of this agreement, he is authorized to do so, and upon receipt of such request the following action should be taken:
  - a. Immediately determine if equipment and personnel can be spared in response to the request.
  - b. Determine what equipment and personnel most effectively should be dispatched.
  - c. Forthwith dispatch such equipment and personnel as, in the judgment of the senior officer receiving the call, should be sent with complete instructions as to the mission to be accomplished.
2. The request for assistance should include:
  - a. Nature of the emergency
  - b. Number of personnel requested
  - c. Type of equipment, if needed

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IHDIVNAVSURFWARCEN

d. The name and location of the ranking officer to whom the requested personnel should report.

3. The assisting personnel shall have the use of deadly force only in defense against an attack that may result in death or serious bodily injury to the officer or to an innocent bystander.

4. The assisting personnel shall not become involved in matters other than those pertaining to the emergency.

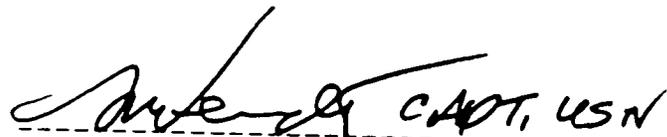
5. The Sheriff and his personnel are invited and encouraged to visit the Naval Ordnance Station for guided familiarization tours consistent with security requirements, and as feasible, to conduct pre-emergency planning inspections.

6. The technical heads of these parties are authorized to meet and draft any detailed plans and procedures of emergency operations to effectively be of assistance.

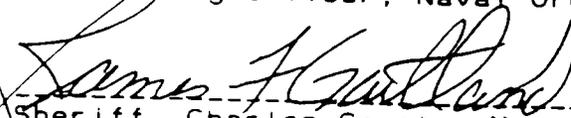
7. The rendering of assistance shall not be mandatory, but the party receiving the request for assistance should immediately inform the requester if, for any reason, assistance cannot be rendered.

IN WITNESS WHEREOF, the parties hereto have executed this agreement on the day and year first written above.

21 November 1988

  
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Commanding Officer, Naval Ordnance Station

  
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Sheriff, Charles County, Maryland

IHDIVNAVSURFWARREN

**Appendix G.7**  
**Mutual Aid Fire Fighting Agreement**

MUTUAL AID FIRE FIGHTING ASSISTANCE AGREEMENT

THIS AGREEMENT, made and entered into this 18th day of October, 19 85 by and between Charles County, Maryland and the Commanding Officer, U.S. Naval Ordnance Station, Indian Head, Maryland.

WITNESSETH:

WHEREAS, each of the parties hereto maintains equipment and personnel for the suppression of fires within its own areas, and

WHEREAS, the parties hereto desire to augment the fire protection available in their respective areas, and

WHEREAS, the lands or districts of the parties hereto are adjacent or contiguous so that mutual assistance in a fire emergency is deemed feasible, and

WHEREAS, it is the policy of the Navy Department and of the municipalities or other districts and of their governing bodies to conclude such agreements wherever practicable, and

WHEREAS, it is mutually deemed sound, desirable, practicable, and beneficial for the parties to this agreement to render assistance to one another in accordance with these terms;

THEREFORE BE IT AGREED THAT:

1. The rendering of assistance under the terms of this agreement shall be accomplished in accordance with detailed plans and procedures of operation drawn and agreed to by the technical heads of the fire departments involved and which are hereby incorporated by reference into this agreement.

2. Whenever it is deemed advisable by the senior officer of a fire department belonging to a party to this agreement, or by the senior officer of such fire department actually present at a fire, to request fire fighting assistance under the terms of this agreement, he/she is authorized to do so, and the senior officer on duty of the fire department receiving the request shall forthwith take the following action:

a. Immediately determine if the requested apparatus and personnel are available to respond to the call.

b. In accordance with the terms of this agreement, forthwith dispatch such apparatus and personnel as in the judgement of the senior officer receiving the call should be sent, with instructions as to their mission.

3. The rendering of assistance under the terms of this agreement shall not be mandatory, but the party receiving the request for assistance shall immediately inform the requesting service if assistance cannot be rendered.

4. The parties hereto waive all claims against every other party for compensation of any loss, damage, personal injury, or death occurring in consequence of the performance of this agreement.

5. All services performed under this agreement shall be rendered without reimbursement of either party or parties, except that the Charles County Fire Departments shall be entitled to seek reimbursement pursuant to section 11 of the Federal Fire Protection and Control Act of 1974 (15 U.S.C. 2210) and federal regulations issued thereunder (Title 44 of the Code of Federal Regulations 151) for all or any part of direct expenses and losses (additional fire fighting costs over and above normal operating costs) incurred in fighting fires on property under the jurisdiction of the United States.

6.a. No firefighting personnel below the age of eighteen (18) shall be permitted within the restricted areas of the Naval Ordnance Station. It shall be the responsibility of the officer-in-charge of each responding apparatus to see that this requirement is adhered to.

b. Each mutual aid apparatus responding into the restricted areas of the Naval Ordnance Station must be accompanied by an officer of the Naval Ordnance Station Fire Department.

c. Because of hazardous operations within the restricted areas of the Naval Ordnance Station, radio transmissions must be kept to a minimum. Responding mutual aid apparatus will report "10-23" or "on-the-scene" to Charles County Fire Headquarters before entering the restricted areas.

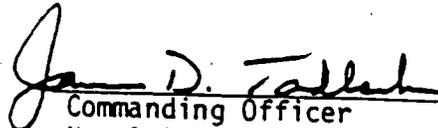
d. All mutual aid apparatus responding to the restricted areas of the Naval Ordnance Station will report to the Naval Ordnance Station Fire Headquarters before entering any restricted areas.

7. The senior officer of the fire department of the requesting service shall assume full charge of the operation. However, under procedures agreed to by the technical heads of the fire departments involved, a senior officer of the department furnishing the assistance may assume responsibility for the coordination of the overall operation.

8. The various officers and personnel of the fire departments of the parties to this agreement are invited and encouraged, on a reciprocal basis, to frequently visit each other's activities for guided familiarization tours consistent with local security requirements and, as feasible, to jointly conduct pre-fire planning inspections, drills, and training.

9. This agreement shall become effective upon the date hereof and shall remain in full force and effect until cancelled by mutual agreement of the parties hereto or by written notice by one party to the other party within sixty (60) days notice of said cancellation.

IN WITNESS WHEREOF, the parties hereto have executed this agreement at Indian Head, Maryland on the day and year first above written.

  
\_\_\_\_\_  
Commanding Officer  
Naval Ordnance Station

  
\_\_\_\_\_  
Charles County Volunteer  
Firemen's Association

  
\_\_\_\_\_  
Charles County Association of  
Emergency Medical Services

**Appendix G.8  
Contractors Registered with  
the U.S. Coast Guard**

**Contractors Registered with  
the U.S. Coast Guard**

Contractors registered with the U.S. Coast Guard to provide for containment and clean up of spills (Fifth Coast Guard District) are the following:

<u>Fire</u>	<u>Phone</u>
A & A Waste Oil Co, Inc. 3635 Woodland Avenue Baltimore, MD 21215	(410) 578-0956 (410) 526-6585
Clean America, Inc. 3300 Childs Street Baltimore, MD 21226	(410) 354-0751
Clean Harbors 3363 Hollins Ferry Road Baltimore, MD 21227	(410) 247-6900
Clean Venture, Inc. 806 P. Barkwood Court Linthicum, MD 21090	(410) 636-8290
Industrial Marine Service, Inc. 1301 Marsh Street P.O. Box 1779 Norfolk, VA 23501	(804) 543-5718
J & L Industries, Inc. 6923 Ebenezer Road Baltimore, MD 21220	(410) 488-0800
Maryland Liquid Waste, Inc. 3598 Picnic Grove Road Millers, MD 21107	(301) 239-8962
PetroChem Recovery P.O. Box 1458 Norfolk, VA 23501	(804) 627-8791

## **Section H Personnel Training**

The information in this section outlines the training program and its implementation for IHDIVNAVSURFWARCEN personnel connected with the operation of Controlled Hazardous Substance storage areas, Buildings 455, 1440, 212, and 328, as well as satellite and less-than-90-day accumulation sites. This information is provided in accordance with COMAR 26.13.05.02G and COMAR 26.13.07.02D(28).

### **H-1 Outline of the Training Program**

#### **H-1a Job Title and Duties**

Key individuals at the IHDIVNAVSURFWARCEN are trained to manage and dispose of CHS. The responsibilities and duties of the personnel are listed in Appendix H.1. Individuals assigned to the outlined positions are required to be trained in explosive and controlled hazardous substance management as a prerequisite for working in these positions. Records documenting the job title and description for each position at IHDIVNAVSURFWARCEN related to hazardous waste management and the name of the employee filling each job are maintained at IHDIVNAVSURFWARCEN.

The IHDIVNAVSURFWARCEN uses contractors to assist in transporting and disposing of non-explosive CHS off-site. These contractors are required to provide trained personnel for handling these CHS.

#### **H-1b Training Content, Frequency, and Technique**

Personnel training for CHS management activities have been divided into four training programs for the various personnel categories. Table H-1 contains a summary of the personnel training requirements and frequency of attendance, and Table H-2 presents the topics discussed in the course. All emergency response (ER) personnel will be trained in accordance with 29 CFR 1910.120 (HAZWOPER) using personnel who have the appropriate

H. Personnel Training

**Table H-1  
Personnel Training Requirements**

<b>Personnel Category</b>	<b>Training Outline</b>	<b>Initial Training<sup>(1)</sup></b>	<b>Annual Refresher<sup>(2)</sup></b>
<b>Fire Department and Fire Chief</b>	Emergency Response	40 Hours	8 Hours
<b>OSOT Leader and Backups</b>	Emergency Response	40 Hours	8 Hours
<b>Property Disposal Officer and Staff</b>	RCRA	8 Hours	8 Hours
<b>Less-Than-90-Day Site Managers and Backups</b>	RCRA	8 Hours	8 Hours
<b>Satellite Site Managers and Backups</b>	RCRA	2 Hours	2 Hours
<b>Thermal Treatment Operators</b>	RCRA OSHA	8 Hours 24 Hours	8 Hours 8 Hours
<b>Building 455/1440 Permitted Storage Site Operators</b>	RCRA OSHA	8 Hours 24 Hours	8 Hours 8 Hours
<b>Building 212/328 Permitted Storage Site Operators</b>	RCRA OSHA	8 Hours 24 Hours	8 Hours 8 Hours
<b>Carbon Treatment Operators</b>	RCRA OSHA	8 Hours 24 Hours	8 Hours 8 Hours
<b>General HW Operators</b>	RCRA	2 Hours	2 Hours

<sup>1</sup>Personnel must successfully complete the initial training within six months after the date of their employment or assignment to a new position and cannot work unsupervised until they have completed the initial training requirements.

<sup>2</sup>Refresher training can be provided as off-site or on-site classroom training or as documented on-the-job training (i.e., safety standards, weekly safety stand-up meetings, hazard control briefings).

**Table H-2**

**Hazardous Waste Training Course Topic Outlines**

**A. Topics for RCRA Course:**

- Overview of HW regulations
- Definitions of HW
- Site spill contingency plans
- HW storage and handling regulations
- HW disposal requirements

**B. Topics for Emergency Response Course:**

- RCRA overview
- SARA and OSHA regulations
- Hazardous material/waste regulations
- Site characterization and analysis
- Levels of personal protective clothing
- Maintenance, care, handling and storage of equipment
- Emergency field first aid
- Emergency response procedures
- Facility and site spill contingency plans
- Respirator fit-test
- Field exercises on spill incidents

**C. Topics for OSHA Course:**

- SARA and OSHA regulations
- Material Compatibilities
- Hazardous material/waste regulations
- Site characterization and analysis
- Levels of personal protective clothing
- Maintenance, care, handling, and storage of equipment
- Emergency field first aid
- Emergency response procedures
- Facility and site spill contingency plans
- Respirator fit-test
- Field exercises on spill incidents

## H. Personnel Training

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emergency response training. All other personnel will be trained by either off-site contractors or on-site personnel who have the appropriate CHS training.

In the past, the 40-hour HAZWOPER training was provided by off-site personnel including, but not limited to, HazTrain, Texas A & M, U.S. Coast Guard, University of Maryland, and Safety Systems.

The Resource Conservation and Recovery Act (RCRA) Course is intended for personnel who actually handle, store, or otherwise manage CHS at one of the on-site CHS management units or accumulation sites. This course provides information and procedures on the operation of the CHS facilities in a manner that is safe and protective of the environment, in accordance with regulatory requirements and Navy operating standards. The RCRA course, currently taught by Waste Management and Prevention Branch personnel, includes hazardous waste handbooks and case studies.

The Occupational Safety and Health Administration (OSHA) course is designed to inform workers exposed to hazardous chemicals of the risks associated with those chemicals. The course deals with determining hazards, obtaining and developing material safety data sheets (MSDSs), labeling of containers, etc.

Verification that all personnel managing accumulation sites, have been thoroughly trained in the management of CHS is accomplished through testing at the completion of the course. If at any time, additional training is requested by IHDIVNAVSURFWARCEN personnel, it will be provided. In addition, CHS accumulation sites are periodically audited for compliance of the regulations. Any intentional or willful disregard for the regulations will be dealt with through disciplinary action up to and including removal from the job.

## H. Personnel Training

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In addition to the RCRA course, the Property Disposal Officer of Buildings 455/1440 attends various courses related to off-site transportation and disposal (including land disposal restrictions) of hazardous waste.

An emergency response training seminar is also conducted, which includes an overview of emergency response procedures and communications, notification lists, emergency equipment and utilization, evacuation plan, and reporting of emergency incidents.

The New Employee Ordnance Safety Awareness Course is mandatory for new employees who may in any way be exposed to hazardous wastes.

### **H-1c Training Director**

The Environmental Division Director is responsible for ensuring that appropriate hazardous waste training is available and is trained in hazardous waste management. Area supervisors are responsible for ensuring that employees dealing with hazardous waste receive appropriate training.

### **H-1d Relevance of Training to Job Description**

Training courses are tailored to meet the needs of IHDIVNAVSURFWARCEN personnel based on their respective responsibilities. Refer to Appendix H.1 for responsibilities of key personnel involved in hazardous waste operations.

### **H-1e Training for Emergency Response**

The IHDIVNAVSURFWARCEN Emergency Response Training Course (Table H-2) is designed to ensure that employees receive emergency response training in accordance with COMAR 26.13.05.02G(1)(c) and 40 CFR 264.16(a)(3).

### **H-2 Implementation of Training Program**

The Waste Management and Prevention Branch is the director of the training program. All personnel currently involved with CHS handling, storage, and management have been trained in the practices and procedures outlined in this section. All new personnel will complete the outline training programs within six (6) months of assignment to CHS duties or within six (6) months of employment, whichever is later. Personnel assigned to the IHDIVNAVSURFWARCEN's CHS management program will not work unsupervised prior to completion of the required training.

In addition to the personnel office, the Waste Management and Prevention Branch also keeps copies of training records for each position title and assigned individual(s) as described in Table H-1. Training records pertaining to current employees are retained until completion of final closure. Training records for past employees are retained for 3 years from the last year in which the employee worked.

**Appendix H.1  
Responsibilities and Duties of Key Personnel  
Involved in CHS Operations**

**Position Title: Fire Protection Division Chief and Staff**

Responsibilities and Duties:

- First responder to all spills.
- Determine the nature and extent of spills and secure access to the immediate area of the spills.
- Contact designated responders.
- Provide initial containment of spills.
- Assume duties of Facility Incident Commander until relieved by higher authority.
- Support containment/clean-up effort until relieved by higher authority.
- Contact authority in emergency situations.

**Position Title: OSOT Leader**

Responsibilities and Duties:

- Assists and supports the Fire Chief in case of hazardous material/waste emergency.
- Assesses situation and advises Fire Chief on initiating action to mitigate danger to human health and the environment.
- Obtains information as to the character, exact source, and amount of released substance and the area affected.
- Determines the proper action to stop the spill and the removal or neutralization of the spilled substance.
- Advises the Fire Chief to contact any other necessary personnel.

**Position Title: Property Disposal Officer and Staff**

Responsibilities and Duties:

- Conducts total Property Disposal Operations which include management of hazardous wastes, hazardous materials, scrap, and miscellaneous categories of equipment.

**Position Title: Building 455/1440 Permitted Storage Site Operators**

Responsibilities and Duties:

- Receive, store, and remove hazardous waste when necessary.
- Maintain building cleanliness.
- Document hazardous waste management.
- Prepare hazardous waste manifests and associated documentation.

**Position Title: Building 212/328 Permitted Storage Site Operators**

Responsibilities and Duties:

- Receive, store, and remove explosive hazardous waste when necessary.
- Maintain building cleanliness.
- Document hazardous waste management.
- Inspect building for compliance with RCRA requirements.

**Position Title: Less-Than-90-Day Site and Satellite Site Managers and Backups**

Responsibilities and Duties:

- Maintain the site.
- Inspect the site for compliance with requirements and locate leaks or other dangerous conditions.
- Maintain inspection logs.
- Ensure conditions established by IHDIVNAVSURFWARCEN and the Federal and State governments are met.

**Position Title: Thermal Treatment Operators**

Responsibilities and Duties:

- Ensures all operations at the thermal treatment points are conducted safely in accordance with all DOD, Navy, Federal, and Standard Operating Procedures.
- Initiates "open burn" operations.
- Thermally treats explosively contaminated materials.
- Disposes of ash residue through the Property Disposal Office.
- Performs inspections.

**Position Title: Carbon Treatment Operators**

Responsibilities and Duties:

- Ensures all operations at the Power House are conducted safely in accordance with all DOD, Navy, Federal, and Standard Operating Procedures.
- Places drums of contaminated carbon in hopper.

## **Section I Closure and Post-Closure Requirements**

This Section is submitted in accordance with the requirements of the State of Maryland's Controlled Hazardous Substances (CHS) Regulations regarding closure of permitted storage facilities (COMAR 26.13.05.07).

### **I-1 Closure Plan**

This Closure Plan identifies the steps that will be implemented in the independent closings of Explosive Hazardous Waste (EHW) Storage Buildings 212 and 328, Container Storage Building 455, and PCB Storage Building 1440. A copy of this Section, herein referred to as the Plan, will be maintained by the IHDIVNAVSURFWARCEN Environmental Coordinator until the respective certifications of closure completeness have been submitted to, and accepted by, the Maryland Secretary of the Environment.

The Commander or his representative will notify the Secretary in writing at least 45 days before final closure begins at any waste management unit. The respective closures will begin within 30 days of receipt of the known final volumes of hazardous wastes at the EHW Storage Buildings 212 and 328, CHS Container Storage Building 455, and PCB Storage Building 1440.

The Plan may be amended to reflect changes in the operation or design of either hazardous waste management unit or to revise closure procedures and/or costs. A written request for permit modification will include a copy of the amended closure plan and will be submitted according to the following time requirements:

- At least 60 days before a proposed change in management unit design or operation.
- Within 60 days of an unexpected event that affects the Closure Plan.

- Not later than 30 days after an unexpected event necessitates a change during partial or final closure of either CHS Management Unit.

### **I-1a Closure Performance Standard**

All permitted CHS storage facilities will be closed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment.

A post-closure plan is not included in this application because the CHS stored at the permitted buildings will be removed from the Activity or thermally treated prior to completion of final closure. No on-site disposal of non-explosive CHS will occur.

### **I-1b Partial and Final Closure Activities**

Closure of Container Storage Building 455 is not anticipated before the end of the decade. Although all PCB transformers have been removed from the Activity, PCB items such as light ballasts and capacitors are still stored in Building 1440. We have not scheduled closure of this building because of this usage. However, based on its current use, we expect to close this building before the end of the decade.

Closure of the EHW Storage Buildings 212 and 328 is not anticipated before the end of the decade.

### **I-1c Maximum Waste Inventory**

The maximum inventory of Container Storage Building 455 is 294,500 gallons.

The maximum inventory of PCB Storage Building 1440 is 9,716 gallons.

## I. Closure and Post-Closure Requirements

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The maximum inventory of Explosive Hazardous Waste Storage Building 212 is 65,000 pounds of 1.3 material. The maximum inventory of Explosive Hazardous Waste Storage Building 328 is 2,000 pounds of 1.1 material.

### **I-1d Inventory, Removal, Disposal, or Decontamination of Equipment**

The details of closure for Container Storage Building 455, PCB Storage Building 1440, and Explosive Hazardous Waste Storage Buildings 212 and 328 follow. These procedures are applicable to both partial closures of individual facilities and final closures of the controlled hazardous substances management units at the IHDIVNAVSURFWARCEN.

#### **I-1d(1) Container Storage Building 455**

Closure of the container storage building is not planned in the foreseeable future. Building 455 is envisioned as a long-term facility servicing the CHS storage needs of the IHDIVNAVSURFWARCEN. When closure of this storage building is conducted, the procedures below will be followed:

- The remaining CHS inventory will either be transferred to another on-site permitted storage facility or transported off-site for treatment and/or disposal via a contractor.
- During and following removal of the containerized controlled hazardous substances, the floor, loading/unloading dock area, curbing, walls, frame, and other features of the building will be visually inspected for signs of spillage or leakage. Residues will be collected using an absorbent if in the liquid phase, or brushed/scraped if in the solid/semi-solid phase.
- The floor and curbing will be swept or scraped clean. Residues will be treated as controlled hazardous substances, if known to be the same, or as indicated by test results. The recovered residues will be sampled and tested for total organic carbon (TOC), total halogenated organics (TOX), and Toxicity Characteristic Leaching

## I. Closure and Post-Closure Requirements

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Procedure (TCLP), as appropriate. They will then be packaged, manifested, and disposed of off-site. Foreign material visible to the eye will be removed.

- The floor and curbing will be further inspected for visual signs of waste. The floor will be cleaned with acetone or other appropriate solvent. The floor will then be steam cleaned with special attention given to affected areas. The liquid will be collected in steel cans or drums using pumps, vacuums, or absorbents. The recovered liquids will be sampled and tested for TOC, TOX, TCLP, and pH, as appropriate. If the liquid tests as hazardous, it will be packaged in compatible containers and manifested for appropriate disposal.
- Controlled hazardous substances-related residues, or other matter will be identified according to the Waste Analysis Plan and, if necessary, packaged either for transfer to another permitted on-site location or for off-site disposal.
- The building and associated facilities (lights, telephone, etc.) may remain intact for future use (unrelated to CHS management activities).
- Signs referencing the permitted CHS storage facility will be removed.
- Equipment used to close the CHS storage building will be decontaminated, using appropriate solvents that will remove the contamination, and/or disposed of properly.
- A registered professional engineer will inspect the facility during and after closure to certify that closure has been carried out in accordance with this plan.

### **I-1d(2) PCB Storage Building 1440**

The PCB Storage Building will be closed when all of the PCB equipment in use at the IHDIVNAVSURFWARCEN has been phased out. This is the only storage location for PCB wastes at the IHDIVNAVSURFWARCEN. Closure of this building should occur before the year 2000.

## I. Closure and Post-Closure Requirements

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The procedures below will be followed at closure:

- The remaining PCB inventory will be taken by a qualified contractor for off-site treatment or disposal.
- During removal of the containerized PCB wastes, the building floor, curbing, walls, frames, and other features will be visually inspected for signs of spillage or leakage. Any residues found will be collected using an absorbent, followed by proper packaging and manifesting in compatible containers.
- The floor and curbing areas will be swept or scraped clean. Residues will be packaged and disposed of properly (as PCBs). All solid material visible to the eye will be removed.
- The floor, curbing, and walls will then be further inspected. The floor will be cleaned with acetone, kerosene, or other appropriate solvent. The floor will then be steam cleaned with special attention given to affected areas. The liquid will be collected and tested for PCBs. If the liquid tests as hazardous, it will be packaged in compatible containers and manifested for appropriate disposal.
- The building and associated facilities (lights, telephone, etc.) will remain intact for future use.
- Signs referencing the permitted controlled hazardous substances facility will be removed.
- Equipment used to close the PCB storage building will be decontaminated using methods described under 40 CFR 761.79(a) and (b), as appropriate, and/or disposed of properly.
- A registered professional engineer will inspect the facility during and after closure to certify that closure has been carried out in accordance with this plan.

**I-1d(3) Explosive Hazardous Waste Storage Buildings 212 and 328**

Closure of the EHW Storage Buildings 212 and 328 is not planned in the foreseeable future. Buildings 212 and 328 are envisioned as a long term storage facility servicing the EHW needs of IHDIVNAVSURFWARCEN. When closure of these storage buildings is conducted, the following procedures will be followed:

- The remaining explosive inventory will either be transferred to another on-site permitted storage facility or treated at the Strauss Avenue Thermal Treatment Point (SATTP).
- During and following removal of the explosive hazardous waste, the floor, loading/unloading dock area, staging area, curbing, walls, frame, and other features of the building will be visually inspected for signs of spillage or leakage.
- The floor and curbing will be swept or scraped clean. Residues will be collected by brushing into dust pans and treated as controlled hazardous substances, if known to be the same, or as indicated by test results. They will then be packaged and thermally treated on site. Foreign material visible to the eye will be removed.
- The floor and curbing will be further inspected for visual signs of waste. The floor will be cleaned with acetone or other appropriate solvent. The floor will then be steam cleaned with special attention given to affected areas. The liquid will be collected in steel cans or drums using pumps, vacuums, or absorbents. The recovered liquids will be sampled and tested using methods described in SW-846, for explosive content. If explosive, the liquids will be mixed with sawdust and treated at the SATTP or treated in the liquid form in the solvent tank at the SATTP. Any resulting ash will be sampled and tested for Toxicity Characteristic Leaching Procedure (TCLP). If the ashes test as hazardous, they will be packaged in compatible containers and manifested for appropriate disposal.
- The building and associated facilities (lights, telephone, etc.) may remain intact for future use (unrelated to explosive hazardous waste storage management activities).
- Signs referencing the permitted explosive hazardous waste storage facility will be removed.

## I. Closure and Post-Closure Requirements

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- Equipment used to close the explosive hazardous waste storage building will be decontaminated using appropriate solvents that will remove the decontamination, and/or disposed of properly.
- A registered professional engineer will inspect the facility during and after closure to certify that closure has been carried out in accordance with this plan.

### I-1e Closure of Disposal Unit

This subsection is not applicable to this facility since there are no disposal units at the IHDIVNAVSURFWARCEN.

### I-1f Schedule of Closure

Table I-1 shows the anticipated partial and final closure dates for CHS Management Units at the IHDIVNAVSURFWARCEN. Either may be closed independently of operations at the other unit.

**Table I-1**  
**Anticipated Closure Dates**  
**Final Closure**

<b>Facility</b>	<b>(year expected)</b>
CHS Container Storage Bldg. 455	After 2000
PCB Storage Bldg. 1440	2000
EHW Storage Bldg. 212	After 2000
EHW Storage Bldg. 328	After 2000

## I. Closure and Post-Closure Requirements

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Final closure operations are estimated to require up to 6 months for all units, if closed simultaneously, using the Closure Plan approved by the Secretary of the Environment.

### **I-1g Extensions for Closure Time.**

Requests for extension(s) are not anticipated.

### **I-2 Post-Closure Plan**

A post-closure plan is not included in this application because CHS will be removed from the facility.

### **I-3 Notice In Deed**

A notice in the IHDIVNAVSURFWARCEN deed is not required because disposal of CHS will not occur at the IHDIVNAVSURFWARCEN in connection with the operation of the facilities described herein.

### **I-4 Closure Cost Estimate**

The closure cost estimates provided in Table I-2 and I-3 were calculated using the respective maximum inventories at closure as the cost basis, per MDE's request. However, IHDIVNAVSURFWARCEN will remove all inventories of CHS prior to closure at all facilities. The costs will be reviewed and adjusted for inflation on an annual basis. The adjustments, to be completed by the Waste Management and Prevention Branch, will be performed in accordance with 40 CFR 264.143(b) by multiplying the latest adjusted closure cost estimate by the most recent inflation factor published by the Department of Commerce.

Table I-2

**Closure Cost Estimate for Building 455  
(1994 Dollars)**

Activity	Quantity	Cost/Unit	Total Cost
1. Remove/treat existing inventory	102,960 gallons*	\$34.30/gal	\$3,531,428
2. Testing for Soil Contamination	16	\$305.83/sample	\$4,894
3. Decontamination			
Personal Safety			
Equipment/Clothing	2	\$85.49/person	\$171
Pad	1	\$12,452.70	\$12,453
Testing	32	\$289.76	\$9,272
Disposal	1	\$106,263.04	\$106,263
4. Professional Engineer certification	1	\$ 3,108.54	\$3,109
<b>TOTAL</b>			<b>\$3,655,137</b>

\* This quantity is lower than the maximum inventory capacity of 294,500 gallons allowed by the regulations, due to space limitation.

I. Closure and Post-Closure Requirements

Table I-3

Closure Cost Estimate for Building 1440  
(1994 Dollars)

Activity	Quantity	Cost/Unit	Total Cost
1. Remove/treat existing inventory	9,716 gallons	\$13.74/gal	\$133,498
2. Testing for Soil Contamination	4	\$289.76/sample	\$1,159
3. Decontamination			
Personal Safety			
Equipment/Clothing	2	\$85.49/person	\$171
Pad	1	\$6,276.82	\$6,277
Testing	12	\$289.76	\$3,477
Disposal	1	\$5,484.75	\$5,485
4. Professional Engineer certification	1	\$3,108.54	\$3,109
<b>TOTAL</b>			<b>\$153,176</b>

I. Closure and Post-Closure Requirements

Table I-4

Closure Cost Estimate for Building 212  
(1994 Dollars)

Activity	Quantity	Cost/Unit	Total Cost
1. Remove/treat existing inventory	65,000 Pounds	\$4.28/lb	\$278,200
2. Testing for Soil Contamination	16	\$305.83/sample	\$4,893
3. Decontamination			
Personal Safety			
Equipment/Clothing	2	\$85.49/person	\$171
Pad	1	\$2,484.36	\$2,484
Testing	8	\$289.76	\$2,318
Disposal	1	\$106,263.04	\$106,263
4. Professional Engineer certification	1	\$ 3,108.54	\$3,109
<b>TOTAL</b>			<b>\$397,438</b>

I. Closure and Post-Closure Requirements

Table I-5

Closure Cost Estimate for Building 328  
(1994 Dollars)

Activity	Quantity	Cost/Unit	Total Cost
1. Remove/treat existing inventory	2,000 Pounds	\$4.28/lb	\$8,560
2. Testing for Soil Contamination	16	\$305.83/sample	\$4,893
3. Decontamination			
Personal Safety			
Equipment/Clothing	2	\$85.49/person	\$171
Pad	1	\$2,484.36	\$2,484
Testing	8	\$289.76	\$2,318
Disposal	1	\$66,944.85	\$66,945
4. Professional Engineer certification	1	\$ 3,108.54	\$3,109
TOTAL			\$88,480

### I-5 Financial Assurance Mechanism for Closure

The U.S. Navy, owner and operator of the IHDIVNAVSURFWARCEN, is legally responsible for all closure costs outlined in Section I-4.

State of Maryland Controlled Hazardous Substances Regulations, COMAR 26.13.05.08, Financial Requirement, is addressed by a letter dated 15 June 1983 from the former Naval Facilities Engineering Command (Chesapeake Division) to the State of Maryland, as follows:

- Section 6001 of Public Law 94-580, 21 October 1976, the Resource Conservation and Recovery Act of 1976, Subtitle F, Federal Responsibilities, requires all branches of the Federal Government having jurisdiction over or engaged in any activity that does or may result in the management or disposal of hazardous wastes to comply with Federal, State, interstate, and local requirements to the same extent as any person who is subject to such requirements, including the payment of reasonable service charges.
- Executive Order 12088, 13 October 1978, requires that the head of each executive agency will ensure that there will be sufficient funds requested in the agency budget to comply with applicable pollution control standards.
- Chief of Naval Operations Instruction 5090.1, 26 May 1983, requires that all Navy-wide facilities that are owned by the Navy or leased to the Navy must be designed, operated, monitored, and maintained to conform to all established Federal, State, and local standards.

The financial requirements of RCRA and COMAR 26.13.05.08 are not service charges. The choice of instruments provided in the regulations with which to meet the financial requirements are not available to Federal agencies, such actions being prohibited. The second clause of 31 U.S. Code Section 665A, Anti-Deficiency Act states, "nor shall any such officer or employee involve the government in any contract or other obligation, for the payment of money for any purpose, in advance of appropriations made for such purpose, unless such contract or obligation is authorized by law." The choices of financial instrument are

## I. Closure and Post-Closure Requirements

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a letter of credit, a surety bond, or a trust fund; none of which are service charges. Financial responsibility for closure of the CHS treatment areas is in compliance with Congressional, executive, and agency mandates, as allowed.

### **I-6 Post-Closure Cost Estimate**

Post-closure care is not required.

### **I-7 Financial Assurance Mechanism for Post-Closure Care**

Post-closure care is not required.

### **I-8 Liability Requirements**

The U.S. Navy, as an agency of the United States government, accepts legal and financial responsibility for sudden and nonsudden accidental occurrences that are directly or indirectly caused by the CHS management activities at the IHDIVNAVSURFWARCEN.

## **Section J Other Environmental Issues**

### **J-1 NPDES Status**

On May 4, 1990, the Maryland Department of the Environment issued National Pollutant Discharge Elimination System (NPDES) permit number 88-DP-2515 (EPA #MD0003158) for industrial discharges, a new application was submitted on November 3, 1994. On April 1, 1994, the Maryland Department of the Environment issued NPDES permit number 88-DP-2528 (EPA #MD0020885) for discharges from the wastewater treatment plants.

### **J-2 RCRA Subpart X**

IHDIVNAVSURFWARCEN has three open burning thermal treatment areas which are regulated under a RCRA Part B Subpart X (Miscellaneous Units) Permit Application. However, one of these thermal treatment areas, the Safety Thermal Treatment Point (STTP), is currently going through RCRA closure.

### **J-3 Less-Than-90-Day Sites**

IHDIVNAVSURFWARCEN operates less-than-90 day hazardous waste storage sites for both explosive and non-explosive hazardous wastes. Although the IHDIVNAVSURFWARCEN is not required to obtain permits for these sites, Table J-1 is provided for reference and identifies the location, responsible department, and operating manager associated with each less-than-90 day hazardous waste site. These accumulation sites open and/or close to support operations.

#### **J-4 Cultural Resources**

As part of the Department of the Navy's Cultural Resource Management Program, IHDIVNAVSURFWARCEN meets the requirements of:

- The National Historic Preservation Act;
- The Archaeological Resources Protection Act of 1979;
- The National Environment Policy Act of 1969; and
- Executive Order 11593 - Protection and Enhancement of the Cultural Environment.

#### **J-5 Natural Resources**

Information regarding natural resources laws will be provided in accordance with the requirements of 40 CFR 270.14(b)(20) at the request of the Environmental Protection Agency to demonstrate compliance with the federal laws listed in 40 CFR 270.3. At this time, however, it is believed that IHDIVNAVSURFWARCEN is in compliance with the following federal laws:

- The Wild Scenic Rivers Act, 16 U.S.C. 1273 et seq.;
- The Endangered Species Act, 16 U.S.C. 1531 et seq.;
- The Coastal Zone Management Act, 16 U.S.C. 1451 et seq.; and
- The Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq.

Table J-1  
Less-Than-90-Day Storage Sites

LESS-THAN-90 DAY ACCUMULATION SITES			
12-Jan-95			
RESPONSIBLE OPERATING DIVISION	BUILDING NUMBER	TYPE OF SITE	RESPONSIBLE SITE MANAGER
093	510	NE	K. Easter/S. Stankovlch
210	218	E	C. Dunnington
210	292	NE	J. Thomas
210	721	E	H. McArthur
210	1210	E	R. Waring/B. Roberts
210	1211	E	R. Waring/B. Roberts
210	1212	E	G. Bowman
210	1255	E	G. Bowman
210	1256	E	G. Bowman
210	1264	E	J. Thomas

**LESS-THAN-90 DAY ACCUMULATION SITES**

<b>12-Jan-95</b>			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
210	1785 (1 Bay)	NE	J. Jarvis
210	1787 (1 Bay)	NE	R. Waring/B. Roberts
220	212	E	M. Riley/B. Bulls
220	324	E	M. Riley/B. Bulls
220	876	E	F. Makle/C. Butler
220	1289	E	J. McGulgan
220	1310	E	M. Riley/B. Bulls
220	1743	E	R. Curlee/H. Krex
220	1827	E	J. Nolan/G. Windsor
220	1861	E	R. Curlee/H. Krex
220	1070 (Mag. Temp.)	E	B. Barnette

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
220	1105 (Mag. Temp.)	E	B. Barnette/F. Makle
220	520 (Mag.)	E	B. Barnette
220	539 (Mag.)	E	H. Krex/R. Curlee
220	580 (Outbuilding)	E	R. Curlee/H. Krex
220	583 (Mag. Temp.)	E	B. Barnette/F. Makle
220	606 (Mag. Temp.)	E	B. Barnette/F. Makle
220	684 (Mag. Temp.)	E	B. Barnette/F. Makle
220	738 (Mag. Temp.)	E	B. Barnette/F. Makle
220	761 (Mag. Temp.)	E	B. Barnette/F. Makle
220	A-108	E	J. McGuigan/ W. Johnson
220	A-109	E	J. McGuigan/W. Johnson

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
220	A-114	E	F. Makle/C. Butler
230	891	E	J. Cooper
230	1143	E	J. Cooper
230	1298	E	C. Dunnington/P. Proctor
230	1339	E	J. Cooper
230	1537	E	J. Cooper
230	1721	NE	J. Cooper
230	1740	E	P. Counts
230	1795	NE	J. Cooper
230	1820	E	P. Counts
230	1796 (Bay 1 & Bay 2)	NE	J. Cooper/K. Grimes

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
230	471 (Temporary)	E	C. Dunnington
230	859 (Temporary)	E	J. Fenwick/K. Grimes/J. Cooper
310	558	NE	J. Holly
310	1279	E	J. Holly
310	1718	NE	M. Greenhow
320	1247	E	J. Johnson
320	1818	E	J. Hunter
320	544C	NE	C. Barnes/G. Bivins
320	C-70	E	G. Bivins
330	1348	E	S. Wolfe
330	1530	E	S. Wolfe

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
330	1880	E	S. Wolfe
330	1819 (1883)	E	S. Wolfe
910	1275	E	T. Tolson
910	1286	E	R. Raines
910	1490	E	R. Farncomb
910	1799	NE	R. Farncomb
940	1261	NE	S. Atkinson
940	1262	NE	S. Atkinson
940	1263	E & NE	S. Atkinson
940	1265	NE	S. Atkinson
940	1266	NE	S. Atkinson

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
940	1267	E	S. Atkinson
940	1269	E	S. Atkinson
940	1270	E	S. Atkinson
940	1272	E	S. Atkinson
940	1273	E	S. Atkinson
940	1274	E	S. Atkinson
940	1276	E	S. Atkinson
940	1352	NE	S. Atkinson
940	1792	NE	S. Atkinson
940	1228 - Temp.	E	S. Atkinson
940	1292 - Temp.	E	S. Atkinson

**LESS-THAN-90 DAY ACCUMULATION SITES**

12-Jan-95			
<b>RESPONSIBLE OPERATING DIVISION</b>	<b>BUILDING NUMBER</b>	<b>TYPE OF SITE</b>	<b>RESPONSIBLE SITE MANAGER</b>
940	1311 - Temp.	E	S. Atkinson
940	1312-Temp.	E	S. Atkinson
940	1313 - Temp.	E	S. Atkinson
T/C	2057	E	M. Barton/N. Case
T/C	2136	E	M. Barton/N. Case
T/C	2156	NE	J. Meyers (Temporary)

**Section K Certification**

**Certification**

I certify under penalty of law that I personally examined and am familiar with the information submitted in this document and all attachments, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine or imprisonment.

Owner:

---

W. J. NEWTON  
Captain, USN  
Commander  
Indian Head Division  
Naval Surface Warfare Center  
Indian Head, MD 20640-5035

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Date