HAZEMATBINDER

MAKING A HAZARDOUS WASTE AUDIT

- 1) DETERMINE VISIT SOURCES WHERE IS WASTE COMING FROM?
- 2) FOLLOW ALL MOVEMENTS OF HAZARDOUS MATERIALS (COULD BECOME HAZARDOUS WASTES BY SPILLS, LEAKAGE, ACCIDENTS).
- 3) VISIT LOCATIONS OF POTENTIAL HAZARDOUS WASTES.
- 4) EXAMINE PRESENT:

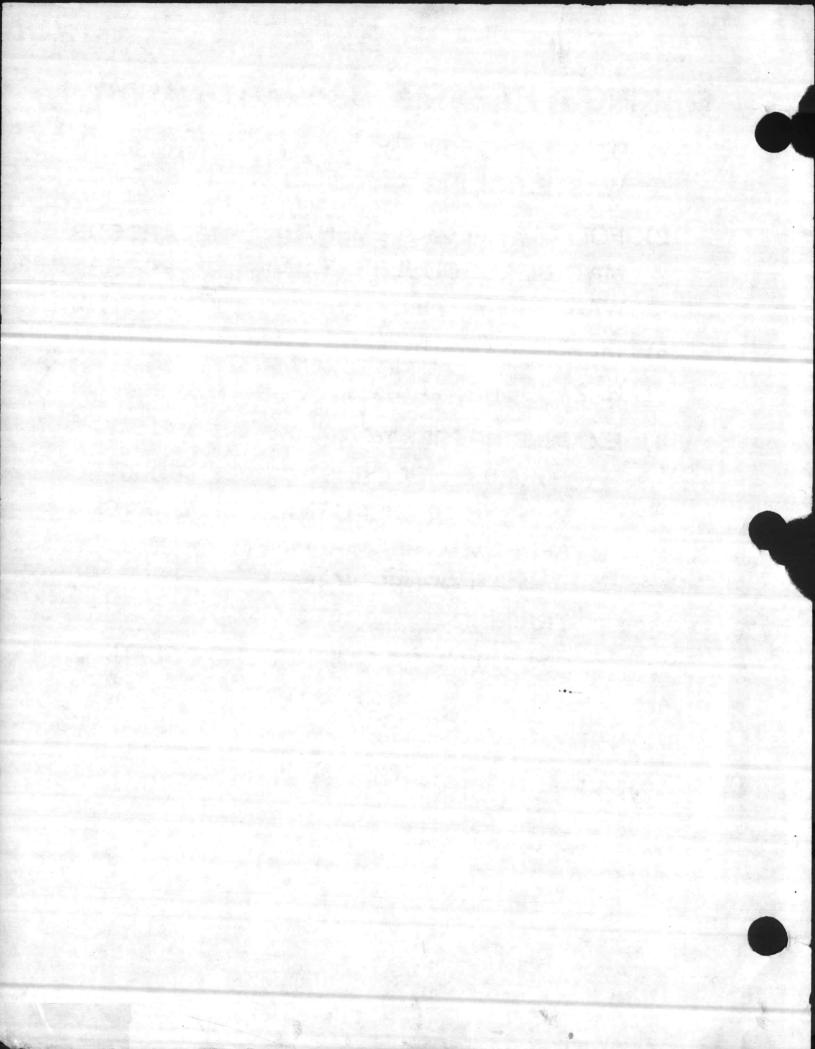
FORMS & RECORDS

MANNER OF DISPOSITION OF WASTES

APPROVAL REQUIREMENTS (WHO

CAN ORDER WHAT?)

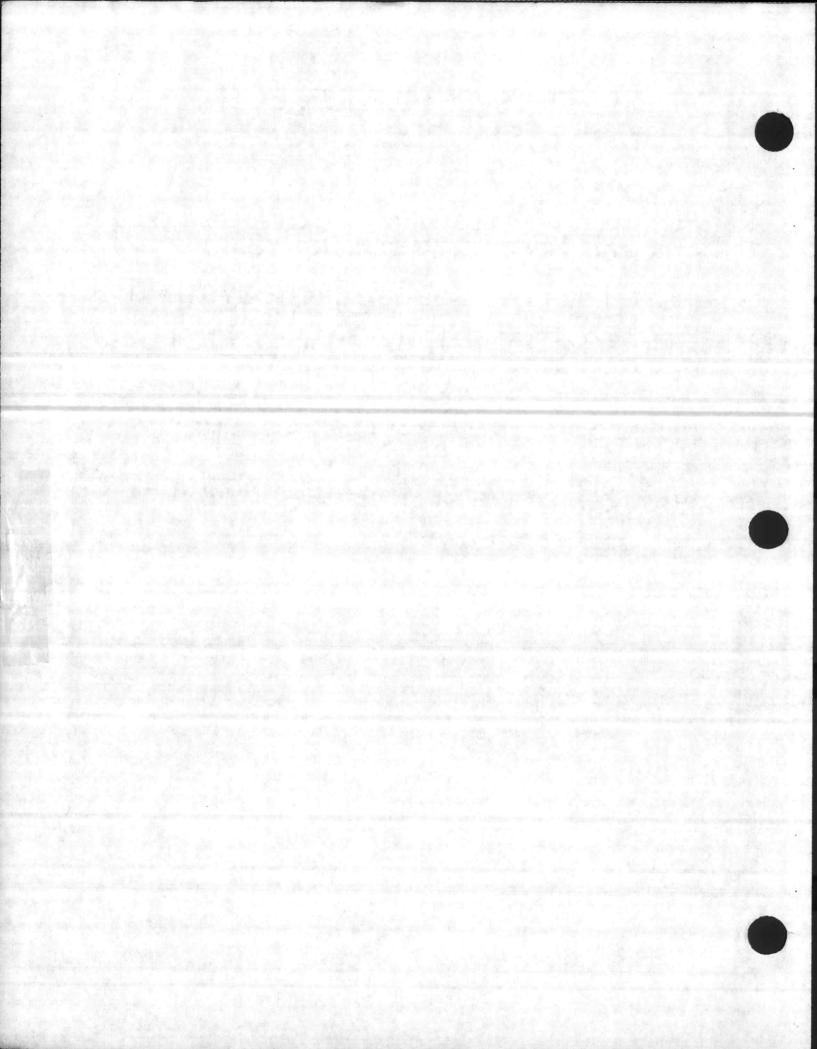
TRAINING
EMERGENCY & CONTINGENCY PLAN



LEVELS OF ACTION FOR WASTE REDUCTION

- 1) IMPROVE EXISTING FACILITIES

 (EXAMPLE REDUCE LEAKS U.C.C. SAVING \$700,000/YEAR: DOW \$2 x 10°/YEAR)
- 2) INSTALL RECOVERY OR RECYCLE SYSTEMS (EXAMPLE 3M RECLAIMED SOLVENTS FOR FUEL: SEND SOLVENT LADEN AIR TO BOILER COST \$300K, SAVE \$241K/YEAR)
- 3) REPLACE THE WASTE GENERATOR PROCESS WITH ONE THAT GENERATES LESS OR NO WASTE (EXAMPLE 3M WENT TO WATER BASE COATING CARRIER)



SECTION 4T

DETERMINING AND MEETING TRAINING NEEDS

PERSONNEL TRAINING

MINIMUM REQUIREMENTS

- RESPOND EFFECTIVELY TO EMERGENCIES
 - EMERGENCY PROCEDURES
 - _ EMERGENCY EQUIPMENT
 - _ EMERGENCY SYSTEMS

Transparency 4A-1

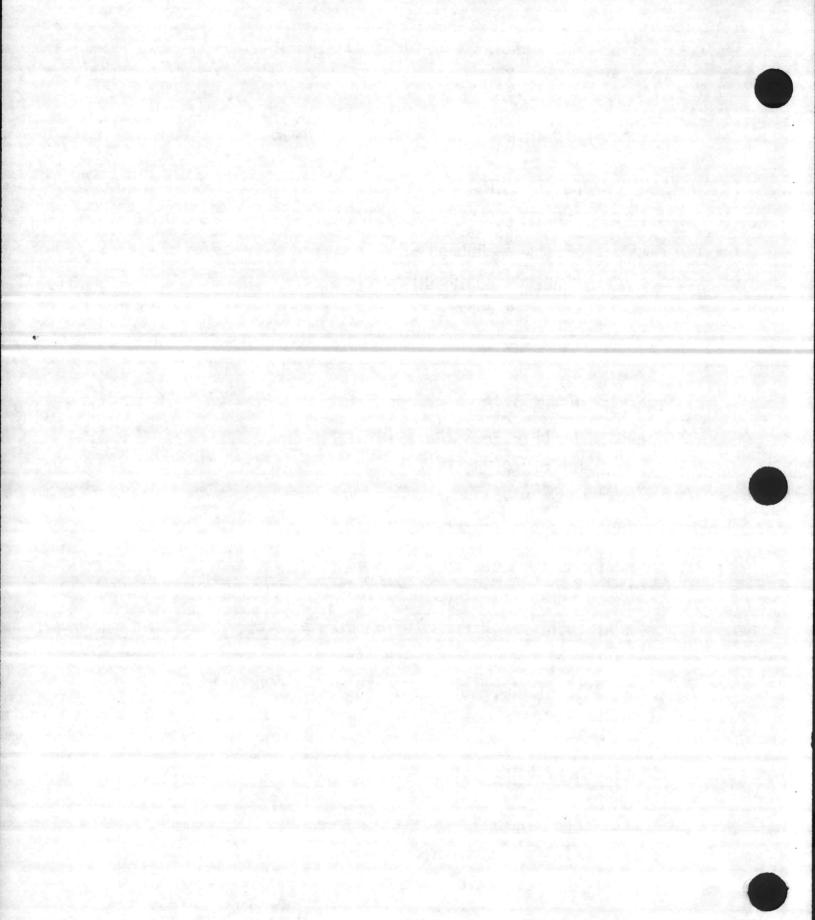
TRAINING NEEDS ASSESSMENT

- . WHO WILL BE PERFORMING TASK
- . WHAT ARE MAJOR DUTIES
- . WHAT TASKS MAKE UP JOB
- . HOW ARE TASKS ACCOMPLISHED
- . WHAT ARE WORK ELEMENTS OF TASK
- . UNDER WHAT CONDITIONS MUST TASK BE PERFORMED
- . WHAT TOOLS ARE NEEDED TO PERFORM TASKS
- . WHAT STARTS AND STOPS EACH TASK
- . WHAT IS STANDARD OF PROFICIENCY FOR TASK

Transparency 4A-2

SPECIFIC TRAINING ITEMS

- . KEY PARAMETERS FOR AUTOMATIC WASTE FEED CUT-OFF SYSTEMS
- COMMUNICATIONS OR ALARM SYSTEMS in some of a soil
- . RESPONSE TO FIRE OR EXPLOSIONS
- . RESPONSE TO GROUND-WATER CONTAMINATION INCIDENTS
- . SHUTDOWN OF OPERATIONS



ANNUAL REVIEW OF TRAINING

FACILITY PERSONNEL MUST TAKE PART IN AN ANNUAL REVIEW OF INITIAL TRAINING

Transparency 4A-4

TRAINING TIMETABLE

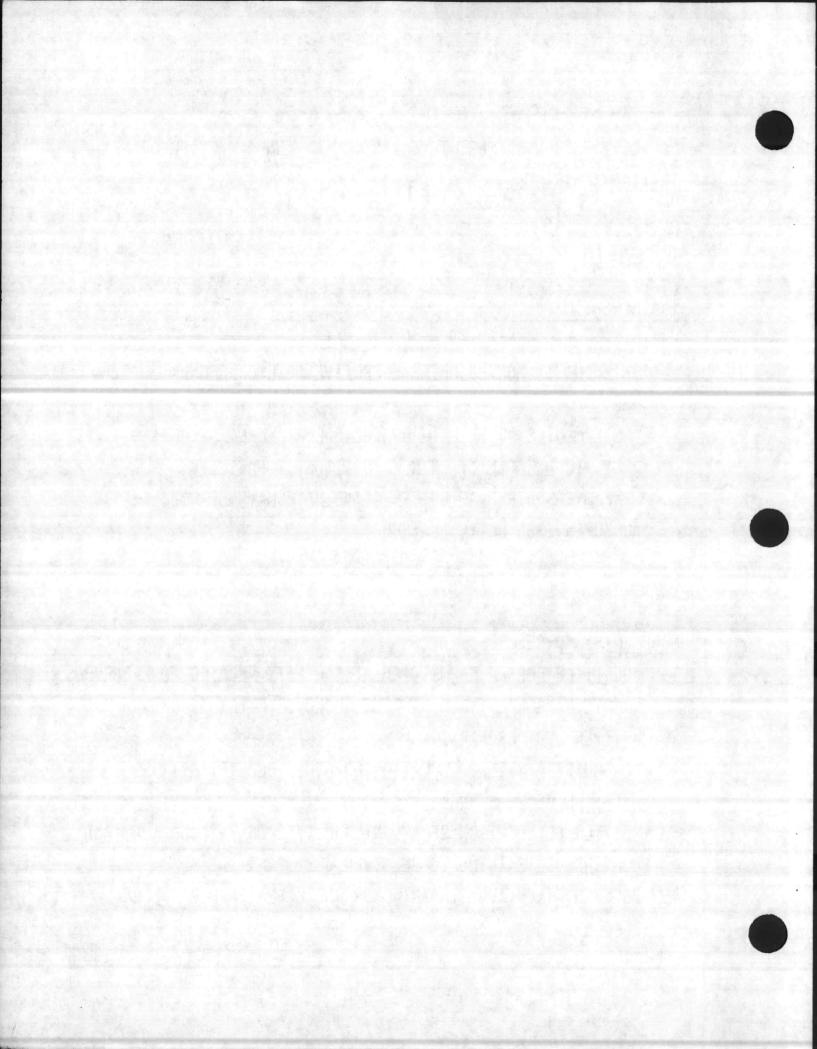
FACILITY PERSONNEL MUST COMPLETE TRAINING

- . WITHIN SIX MONTHS AFTER EFFECTIVE DATE OF REGULATIONS OR
- . SIX MONTHS AFTER DATE OF THEIR EMPLOYMENT OR ASSIGN-MENT TO A FACILITY OR NEW POSITION AT FACILITY
- . EMPLOYEES HIRED AFTER EFFECTIVE DATE MAY NOT WORK UNSUPERVISED UNTIL TRAINED

Transparency 4A-5

DOCUMENTS AND RECORDS

- 1. JOB TITLE FOR EACH POSITION AT FACILITY RELATED TO HAZARDOUS WASTE MANAGEMENT AND NAME OF EMPLOYEE FILLING JOB
- 2. WRITTEN JOB DESCRIPTIONS
 REQUISITE SKILL, EDUCATION OR OTHER QUALIFICATIONS
 DUTIES OF PERSONNEL
- 3. WRITTEN DESCRIPTION OF AMOUNT AND TYPE OF INTRODUCTORY AND CONTINUOUS TRAINING TO BE GIVEN
- 4. DOCUMENTATION THAT TRAINING OR JOB EXPERIENCE HAS BEEN COMPLETED



TRAINING RECORD RETENTION

CURRENT FACILITY
PERSONNEL CLOSURE

FORMER THREE YEARS FROM DATE
PERSONNEL LAST WORKED

(RECORDS MAY BE TRANSFERRED WITH PERSONNEL WITHIN SAME FACILITY)

Transparency 4A-7

INSTRUCTIONAL OBJECTIVES

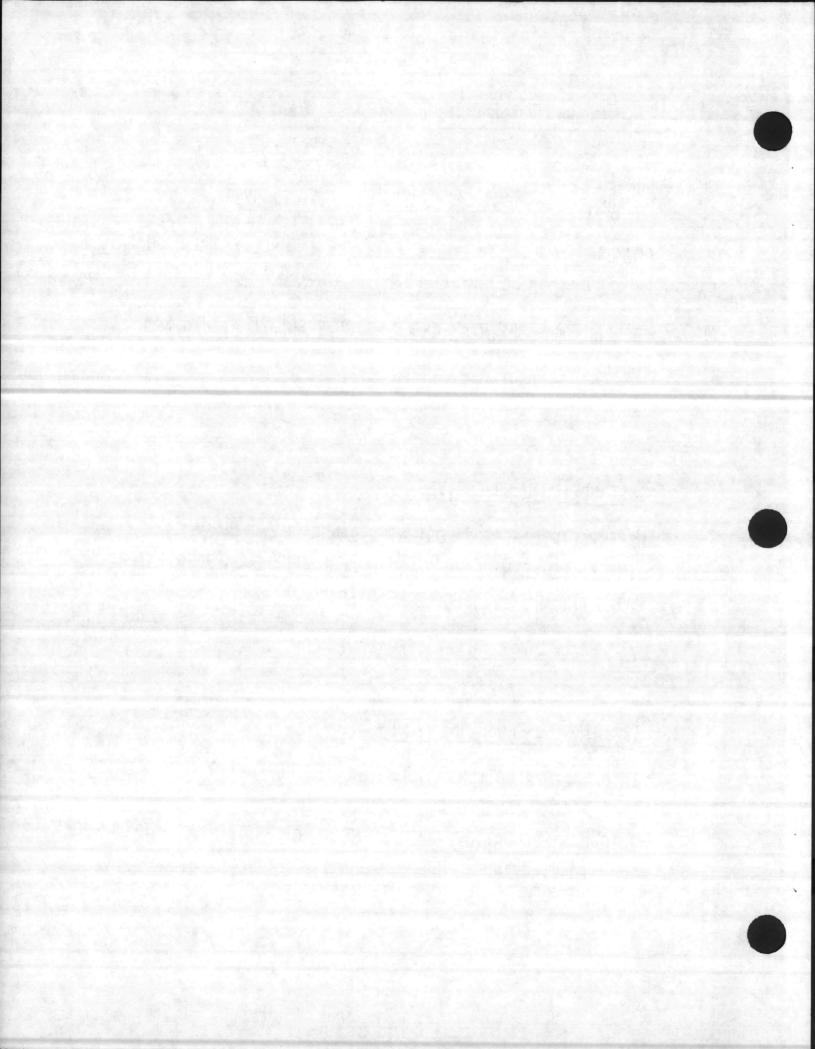
"THE EMPLOYEE WILL BE ABLE TO DESCRIBE HOW A RESPIRATOR WORKS AND WHEN IT SHOULD BE USED."

Transparency 4A-8

TRAINING RESPONSE AND FEEDBACK.

INTERNAL EVALUATION: DETERMINE IF INSTRUCTIONAL DEVELOPMENT
ACCOMPLISHED GOALS
EXTERNAL EVALUATION: DETERMINE IF ATTENDEES CAN PERFORM JOB
TO STANDARD

Transparency 4A-9



PREPAREDNESS AND PREVENTION REQUIRED EQUIPMENT

- . INTERNAL COMMUNICATIONS OR ALARM SYSTEM (VOICE OR SIGNAL)
- . DEVICE TO SUMMONS EMERGENCY ASSISTANCE FROM EMERGENCY RESPONSE TEAMS
- . PORTABLE FIRE EXTINGUISHERS, FIRE CONTROL EQUIPMENT,
 DECONTAMINATION EQUIPMENT
- . WATER AT VOLUME AND PRESSURE TO SUPPLY HOSE STREAMS, FOAM EQUIPMENT, SPRINKLERS OR WATER SPRAY EQUIPMENT

Transparency 4A-10

TESTING AND MAINTENANCE OF EQUIPMENT

TEST AND MAINTAIN AS NECESSARY TO ASSURE PROPER OPERATION

- . FACILITY COMMUNICATIONS OR ALARM SYSTEMS
- . FIRE PROTECTION EQUIPMENT
- . SPILL CONTROL EQUIPMENT
- . DECONTAMINATION EQUIPMENT

Transparency 4A-11

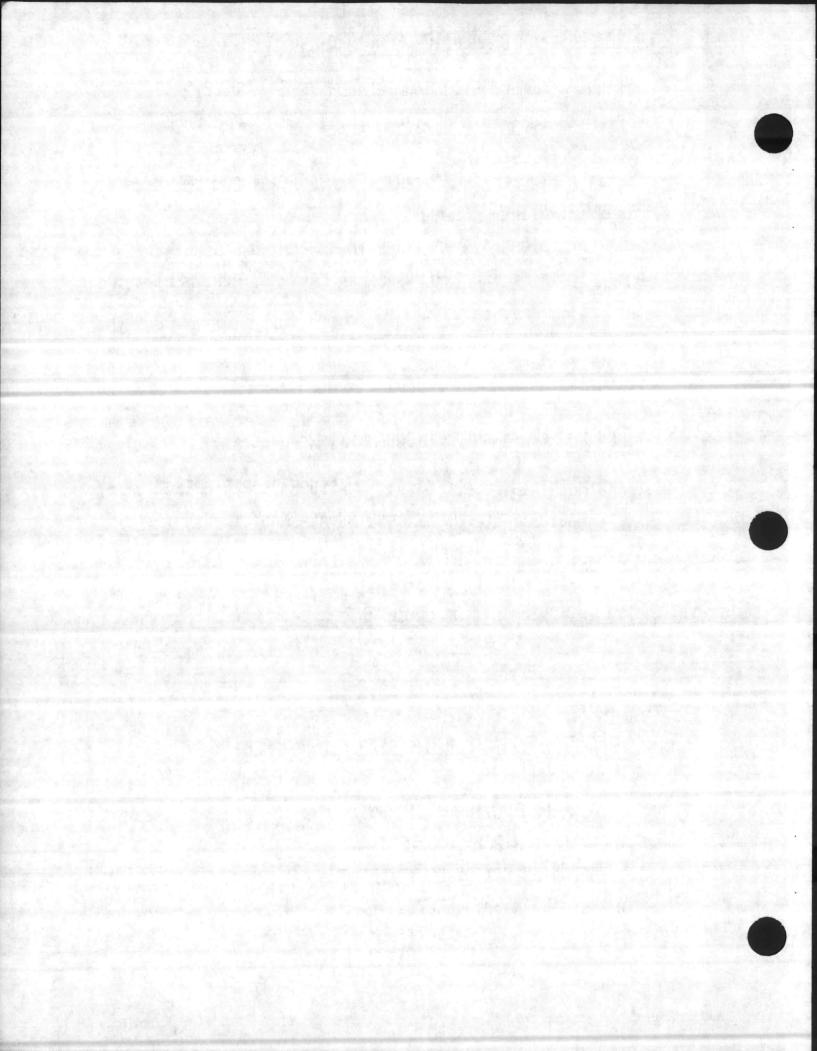
AISLE SPACE

AISLE SPACE ADEQUATE FOR UNOBSTRUCTED MOVEMENT OF

- . PERSONNEL
- . FIRE PROTECTION EQUIPMENT
- . SPILL CONTROL EQUIPMENT
- DECONTAMINATION EQUIPMENT

TO ANY AREA IN AN EMERGENCY

Transparency 4A-12



WASTE EXCHANGE CONSIDERATIONS

TECHNICAL FEASIBILITY: Match of properties of waste stream to need.

ECONOMIC FEASIBILITY: Balance savings in DISPOSAL

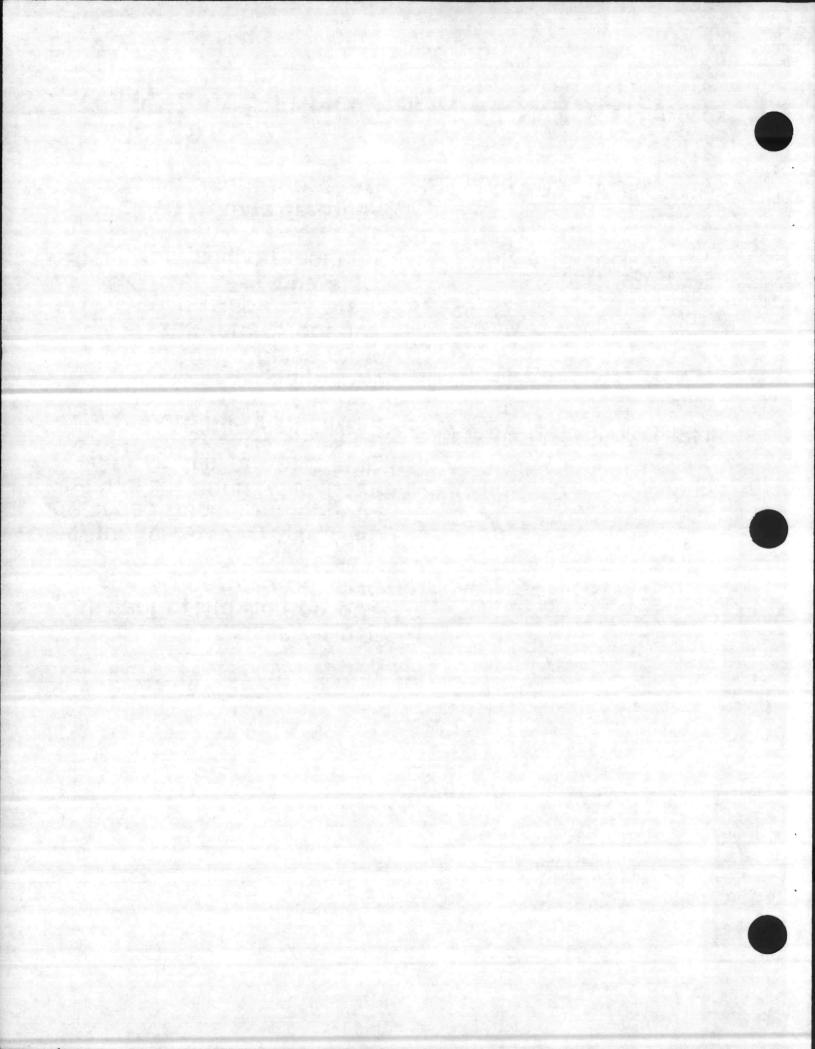
costs and RAW materials costs vs. administration, transport, and extra processing costs of the

exchange.

INSTITUTIONAL AND MARKETING FEASIBILITY:

Guarantee of supply and anonymity, need for mutual confidence among generator, user and transfer agent.

LEGAL AND REGULATORY: Must be allowed by law and be unlikely to lead to liability suits.



SECTION 9.T

EMERGENCY AND CONTINGENCY PLANS

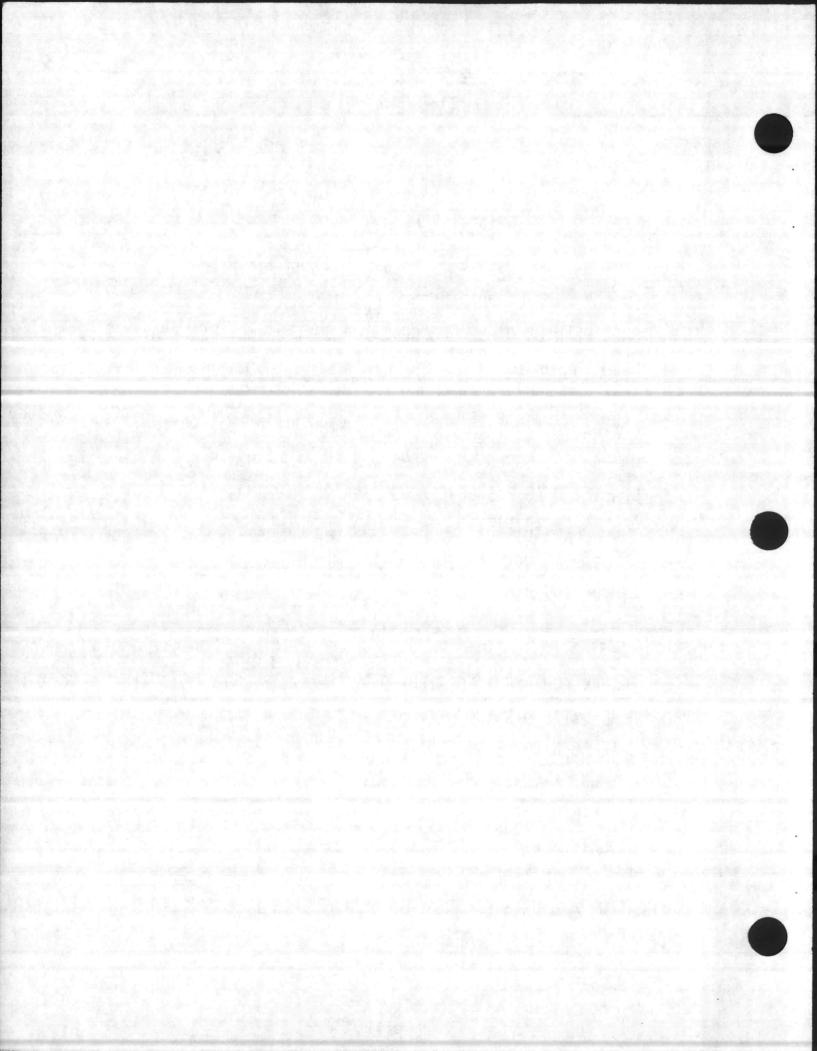
CONTENT OF CONTINGENCY PLAN

- . ACTIONS NECESSARY FOR .51 AND .56 AND FOR FIRES, EXPLOSIONS, OR UNPLANNED RELEASES
- . SPCC PLAN OR OTHER EMERGENCY OR CONTINGENCY PLAN MAY FORM THE BASIS
- . ARRAGNEMENTS AGREED TO BY LOCAL POLICE, FIRE, HOSPITALS, CONTRACTORS, STATE AND LOCAL EMERGENCY RESPONSE TEAMS
- . NAMES, ADDRESSES AND PHONE NUMBERS (O & H) OF ALL QUALIFIED AS EMERGENCY COORDINATORS (PRIMARY AND ORDER OF RESPONSIBILITY)
- . EMERGENCY EQUIPMENT AT FACILITY
- . EVACUATION PLAN

Transparency 9A-1

EMERGENCY EQUIPMENT POSSIBLY NEEDED

- . FIRE EXTINGUISHING SYSTEMS
- . SPILL CONTROL EQUIPMENT
- . COMMUNICATIONS AND ALARM SYSTEMS
 - . INTERNAL
 - . EXTERNAL
- . DECONTAMINATION EQUIPMENT
 LOCATION AND PHYSICAL DESCRIPTION OF EACH ITEM AND OUTLINE
 OF ITS CAPABILITIES NEEDED



COPIES OF CONTINGENCY PLAN

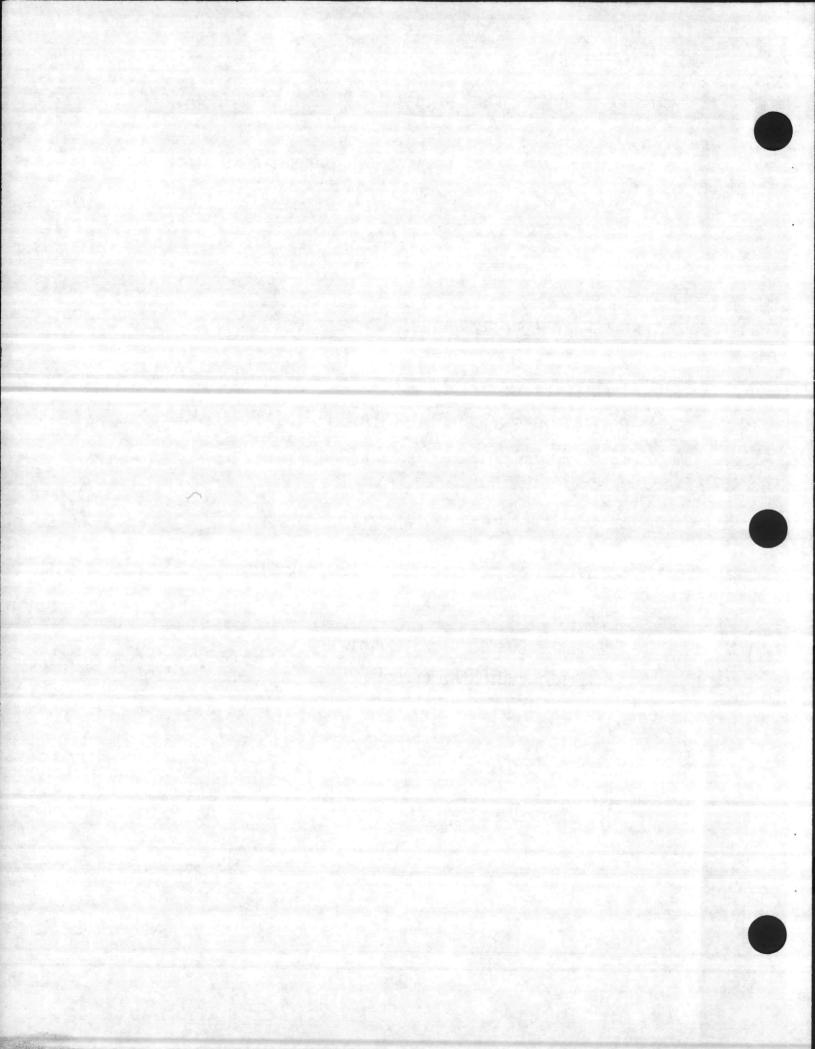
- . MAINTAINED AT FACILITY
- . SUBMITTED TO LOCAL POLICE, FIRE, HOSPITALS, STATE AND LOCAL EMERGENCY RESPONSE TEAMS

Transparency 9A-3

CONTINGENCY PLAN AMMENDMENT

- . REGULATIONS REVISED
- . PLAN FAILS IN AN EMERGENCY
- . FACILITY CHANGES THAT INCREASE POTENTIAL OR CHANGE RESPONSE
 - . DESIGN
 - . CONSTRUCTION
 - . OPERATIONS
 - . MAINTENANCE
 - . OTHER
- . EMERGENCY COORDINATORS CHANGE
- . EMERGENCY EQUIPMENT CHANGES

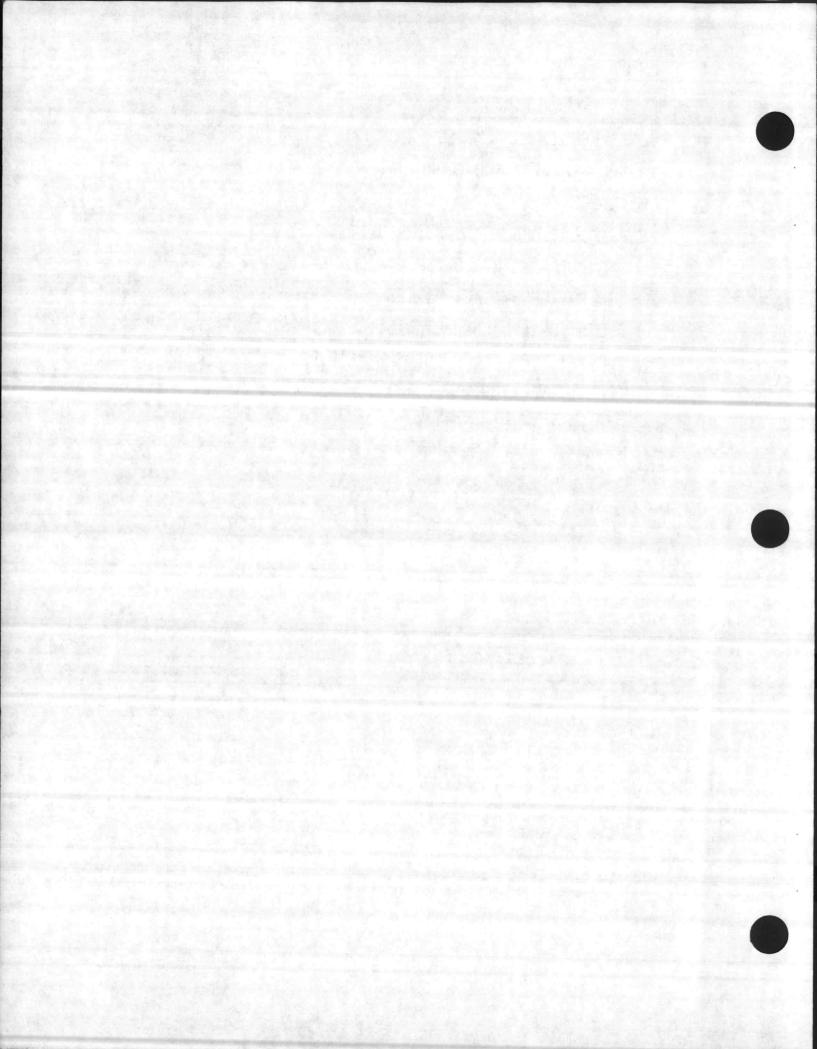
Transparency 9A-4



EMERGENCY COORDINATOR

- . ONE PERSON ON PREMISES OR ON CALL AT ALL TIMES WITH RESPONSIBILITY FOR COORDINATING EMERGENCY RESPONSE MEASURES
- QUALIFICATIONS OF COORDINATOR
 - . FAMILIAR WITH ALL ASPECTS OF PLAN
 - . OPERATIONS AND ACTIVITIES
 - . LOCATION AND CHARACTERISTICS OF WASTE
 - . LOCATION OF ALL RECORDS WITHIN FACILITY
 - . FACILITY LAYOUT
 - . AUTHORITY TO COMMIT RESOURCES

Transparency 9A-5



TRANSPORTER REQUIREMENTS, LIABILITY AND INSURANCE

A TRANSPORTER MUST NOT TRANSPORT HAZARDOUS WASTES WITHOUT HAVING RECEIVED AN EPA IDENTIFICATION NUMBER. GET A COPY OF THEIR CERTIFICATE.

A TRANSPORTER WHO STORES MANIFESTED SHIPMENTS OF HAZARDOUS WASTE IN CONTAINERS MEETING THE REQUIREMENTS OF 262.30 AT A TRANSFER FACILITY FOR A PERIOD OF TEN DAYS OR LESS IS NOT SUBJECT TO REGULATION AS A TSDF.

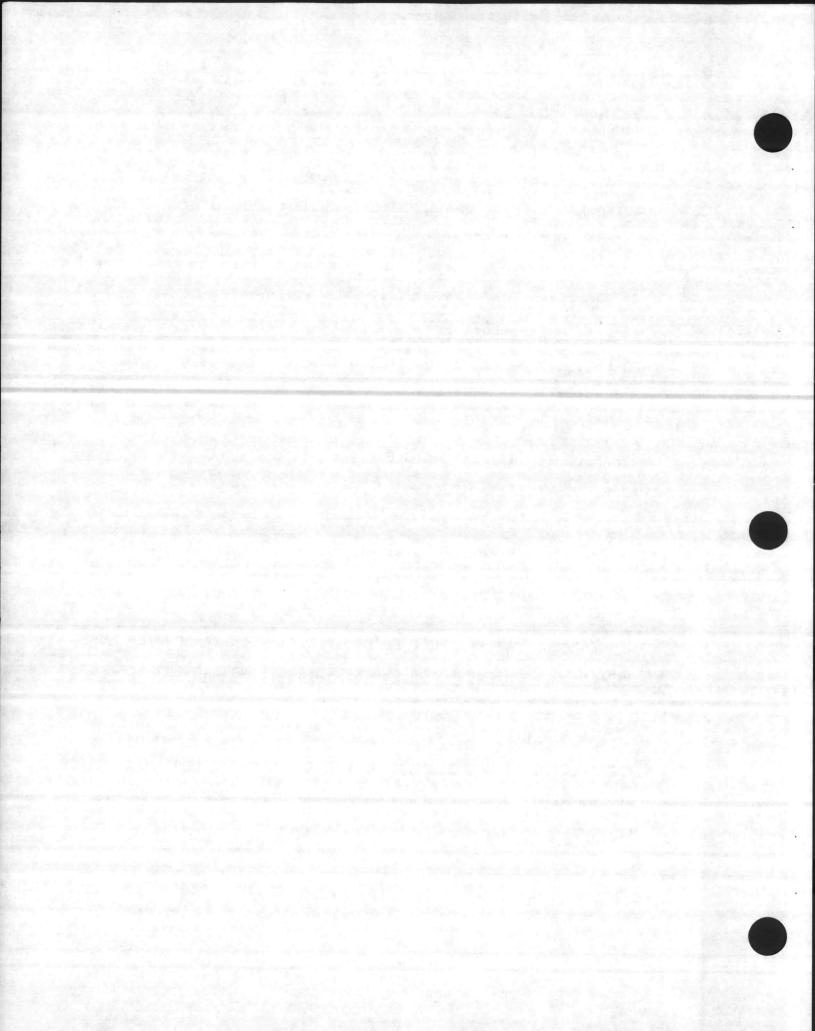
A TRANSPORTER IS RESPONSIBLE FOR CLOSING THE LOOP ON A HAZARDOUS WASTE MANIFEST.

THE TRANSPORTER MUST DELIVER THE ENTIRE QUANTITY OF WASTE MANIFESTED TO THE PROPER DISPOSAL FACILITY.

IF HAZARDOUS WASTE CANNOT BE DELIVERED, THE TRANSPORTER MUST CONTACT THE GENERATOR FOR FURTHER DIRECTIONS AND CORRECT THE MANIFEST ACCORDINGLY.

IN THE EVENT OF A DISCAHRGE OF HAZARDOUS WASTE DURING TRANSPORT,
THE TRANSPORTER MUST TAKE APPROPRIATE IMMEDIATE ACTION TO
PROTECT HUMAN HEALTH AND THE ENVIRONMENT.

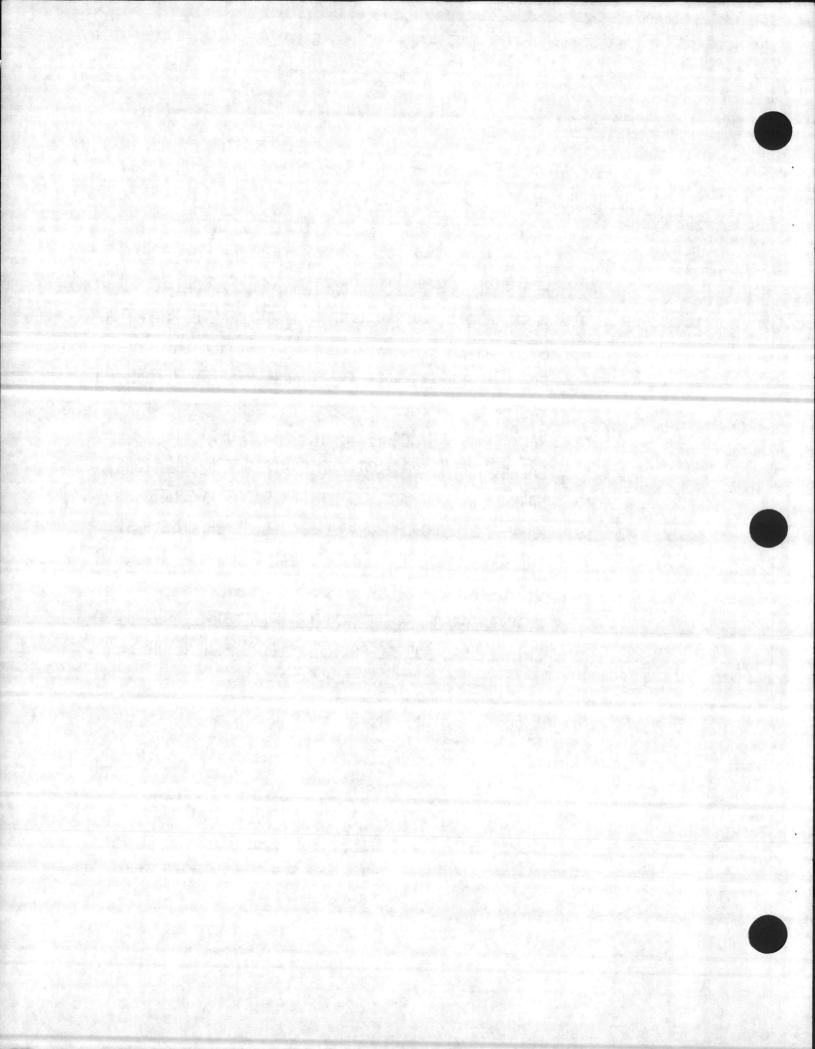
CHECK INTO AMOUNT OF LIABILITY INSURANCE THE TRANSPORTER HAS.



GENERATOR RESPONSIBILITY

A GENERATOR WHO TRANSPORTS, OR OFFERS FOR TRANSPORTATION, HAZARDOUS WASTE FOR OFF-SITE DISPOSAL MUST:

- PREPARE A MANIFEST BEFORE TRANSPORTING, TRANSPORTER CAN HELP YOU PREPARE MANIFEST.
- 2. DESIGNATE A PERMITTED FACILITY FOR HANDLING THE WASTE.
- 3. DESIGNATE AN ALTERNATIVE DISPOSAL FACILITY IN THE
 EVENT AN EMERGENCY PREVENTS ACCEPTANCE INTO INITIAL
 FACILITY OR INSTRUCT THE TRANSPORTER TO RETURN THE
 WASTE
- *4. PACKAGE WASTE ACCORDING TO DOT REGULATIONS
- *5. LABEL EACH PACKAGE ACCORDING TO DOT REGULATIONS
- *6. MARK EACH PACKAGE ACCORDING TO DOT REGULATIONS
- 7. MARK EACH CONTAINER OF 110 GALLONS OR LESS WITH: "HAZARDOUS WASTE - FEDERAL LAW PROHIBITS IMPROPER DISPOSAL..."
- 8. PLACARD OR OFFER THE INITIAL TRANSPORTER THE APPRO-PRIATE PLACARDS ACCORDING TO DOT REGULATIONS.
- * INITIAL RESPONSIBILITY IS GENERATOR'S.



TRANSPORTER REQUIREMENTS, LIABILITY AND INSURANCE, CONT.

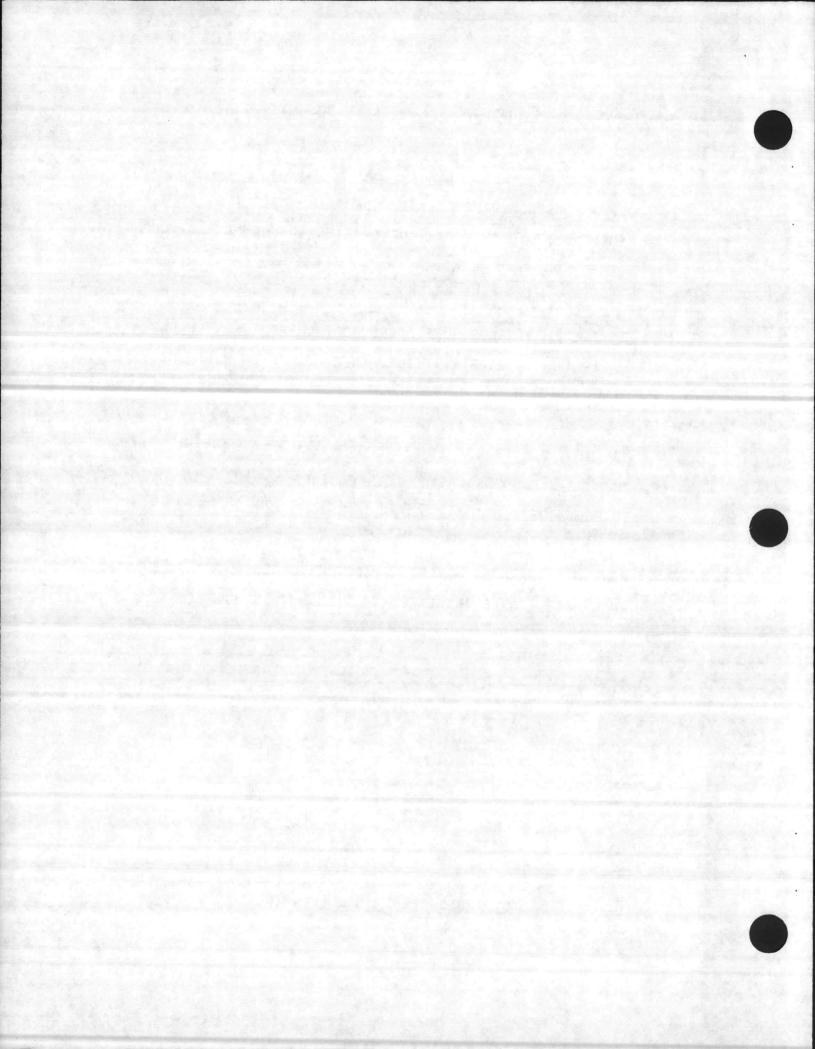
A TRANSPORTER MUST CLEAN UP ANY HAZARDOUS WASTE DISCHARGE THAT OCCURS DURING TRANSPORTATION OR TAKE ACTION REQUIRED BY THE FEDERAL, STATE OR LOCAL AUTHORITIES SO THAT THE DISCHARGE NO LONGER POSES A THREAT.

FOR BULK HAZARDOUS SUBSTANCES, DOT CURRENTLY REQUIRES \$1,000,000 IN LIABILITY INSURANCE AND WHICH WILL INCREASE TO \$5,000,000 IN JULY, 1985.

FOR OIL, OIL IS NOT A HAZARDOUS WASTE AT THIS TIME, AND DRUMMED HAZARDOUS WASTE, DOT REQUIRES \$500,000 IN LIABILITY, TO BE INCREASED TO \$1,000,000 IN JULY 1985.

FOR NON-HAZARDOUS MATERIALS, DOT REQUIRES \$500,000 IN LIABILITY INSURANCE, TO BE INCREASED TO \$750,000 IN JULY 1985.

TRANSPARENCY 6-2 (CONTINUED)



PROPER PERMITTING

SOME STATES REQUIRE A PERMIT FOR TRANSPORTING HAZARDOUS WASTE TO AND/OR THROUGH THE STATE. CHECK AND RETAIN COPIES OF THE TRANSPORTER'S STATE AND/OR LOCAL PERMITS TO HAUL CHEMICAL WASTE.

CHECK TO SEE IF THE TRANSPORTER IS REGULATED BY THE PUBLIC UTILITY COMMISSION AND IF THEIR RATE SCHEDULE IS PUBLISHED.

CHECK FOR STORAGE AND TRANSFER PERMITS WHEN APPLICABLE.

THOROUGHLY INVESTIGATE THEIR REPUTATION WITH OTHER USERS AND STATE REGULATORY AGENCIES.

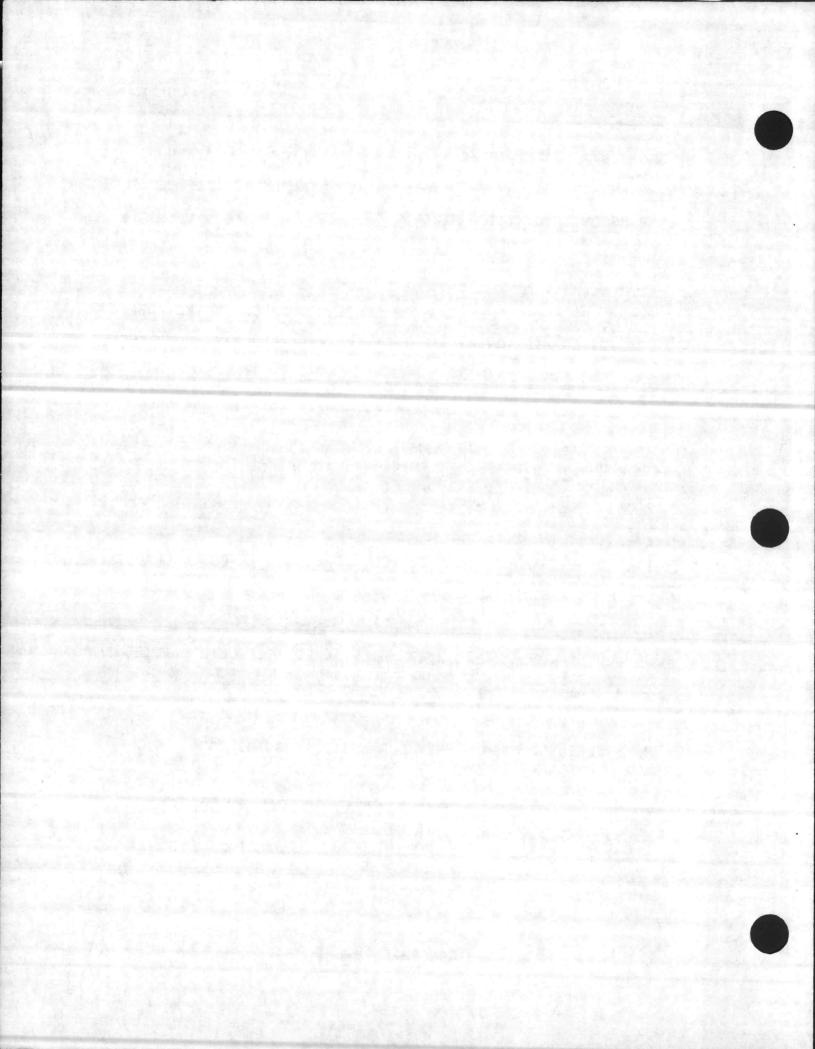
INSPECT INSURANCE CERTIFICATES TO BE SURE IT COVERS HAULING OF CHEMICALS. (MAKE SURE IT IS NOT EXPIRED)

DEVELOP A COMPREHENSIVE CONTRACT TO PROTECT BOTH PARTIES IN CONSIDERATION OF A SPILL OR OTHER LIABILITY.

MAKE SURE YOU KNOW WHERE YOUR WASTE IS GOING TO

ASK FOR! A LIST OF REFERRALS.

TRANSPARENCY 6-3



SECTION 10 T

THE IMPACT OF SUPERFUND ON HAZARDOUS WASTE GENERATORS

CERCLA (SUPERFUND)

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1989.

DECEMBER 11, 1980 THROUGH DECEMBER 11, 1985.

DEALS WITH:

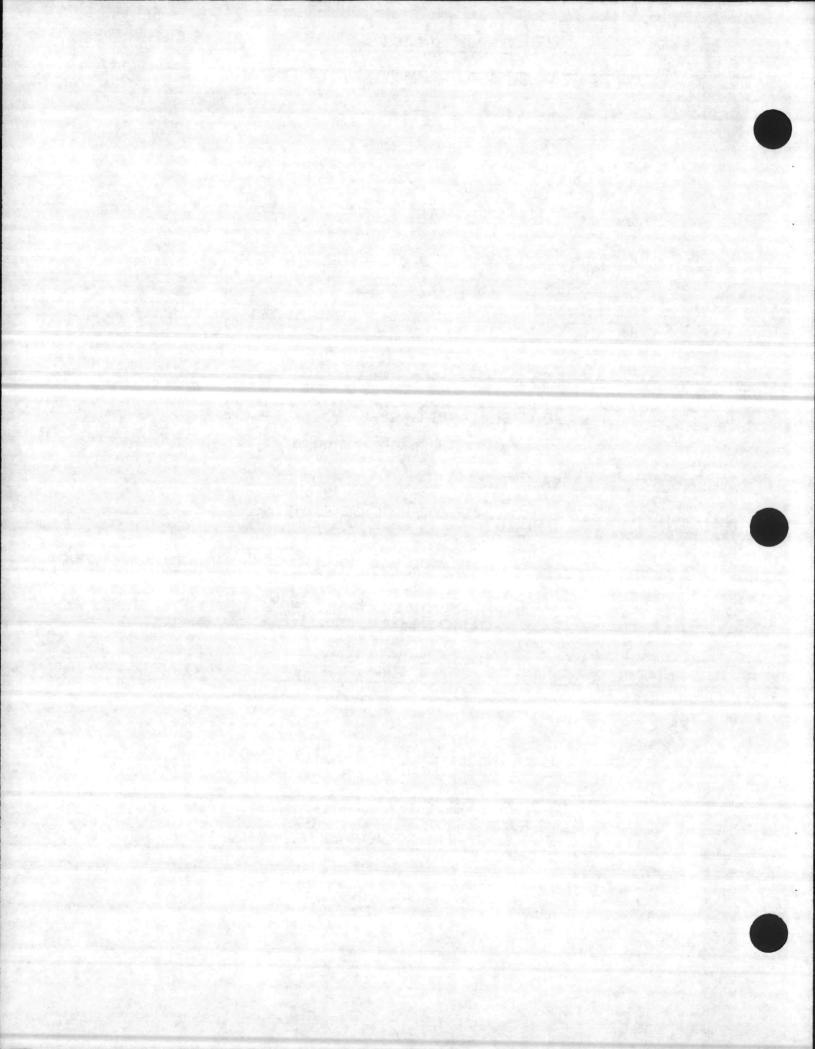
- 1. DANGEROUS TOXIC WASTE SITES.
- 2. CHEMICAL SPILLS.
- 3. NATIONAL CONTINGENCY PLAN.
- 4. ACT PROVIDES 1.68 BILLION (1.38 FROM CHEMICAL INDUSTRY TAXES).

TRANSPARENCY 10A-1

CEPCLA CHEMICAL SPILL NOTIFICATION PURPOSE

TO ALERT GOVERNMENT OFFICIALS TO RELEASES OF HAZARDOUS SUBSTANCES THAT MAY REQUIRE RAPID RESPONSE TO PROTECT HEALTH AND WELFARE AND THE ENVIRONMENT.

TRANSPAREICY 10A-2



CERCLA HAZARDOUS SUBSTANCE LIST

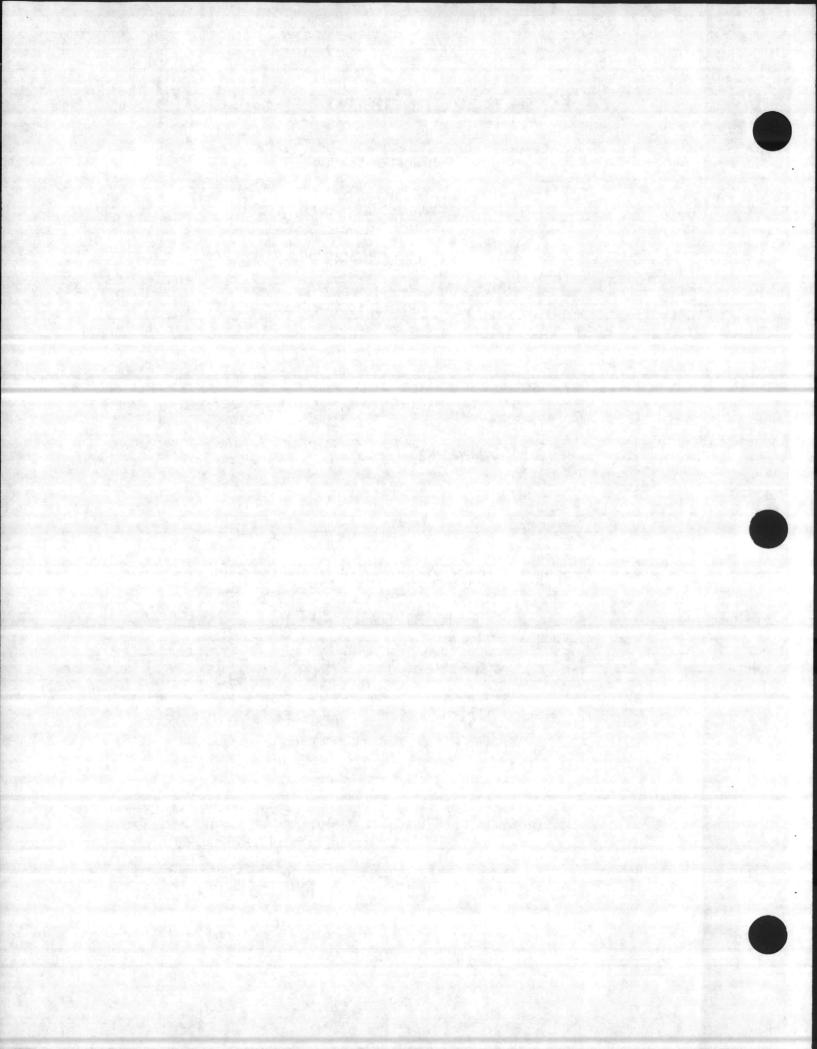
- 1. CERCLA, SECTION 102:
 DESIGNATED SUBSTANCES
- 2. CLEAN AIR ACT, SECTION 112:
 HAZARDOUS AIR POLLUTANTS
- 3. CLEAN WATER ACT, SECTION 307 TOXIC POLLUTANTS
- 4. CLEAN WATER ACT, SECTION 311
 DESIGNATED SUBSTANCES
- 5. RCRA, SECTION 256 . LISTED HAZARDOUS WASTE & ICRE WASTE
- 6. TSCA, SECTION 7
 IMMINENTLY HAZARDOUS CHEMICALS

TRANSPARENCY 10A-3

REPORTABLE QUANTITY ADJUSTMENTS BASED ON REACTIVITY

RQ	REACTIVITY WITH WATER	SELF-REACTIVE
10	NONE	NONE
10	INFLAMES NA CAC2	EXTREME - MAY CAUSE EXPLOSION
100	EXTREME REACTION SO2	HIGH - MAY POLYMERIZE; REQUIRES STABILIZER.
1000	HIGH REACTION ALUM	MODERATE CONTAMINATION MAY CAUSE POLYMERIZATION, NO INHIBITOR REQUIRED.
5000	MODERATE REACTION NH4;	SLIGHT - MAY POLYMERIZE WITH LOW HEAT RELEASE

TRANSPARENCY 10A-4



NOTIFICATION REQUIREMENTS FOR CHEMICAL SPILLS OR RELEASES

- 1. RCRA 10 CFR PART 264: OPERATORS OF TSD'S
- 2. HMTA 49 CFR SECTION 171.17
- 3. FWPCA 40 CFR SECTION 311
- 4. CERCLA 40 CFR PART 302, SECTION 103(A) & (B)

TRANSPARENCY 10A-5

EXCLUDED RELEASES

- 1. EXPOSURES SOLELY WITHIN THE WORKPLACE.
- 2. EMISSION FROM ENGINE EXHAUSTS.
- 3. RADIOACTIVE RELEASES SUBJECT TO NRC.
- 4. NORMAL APPLICATION OF FERTILIZER.

TRANSPARENCY 10A-6

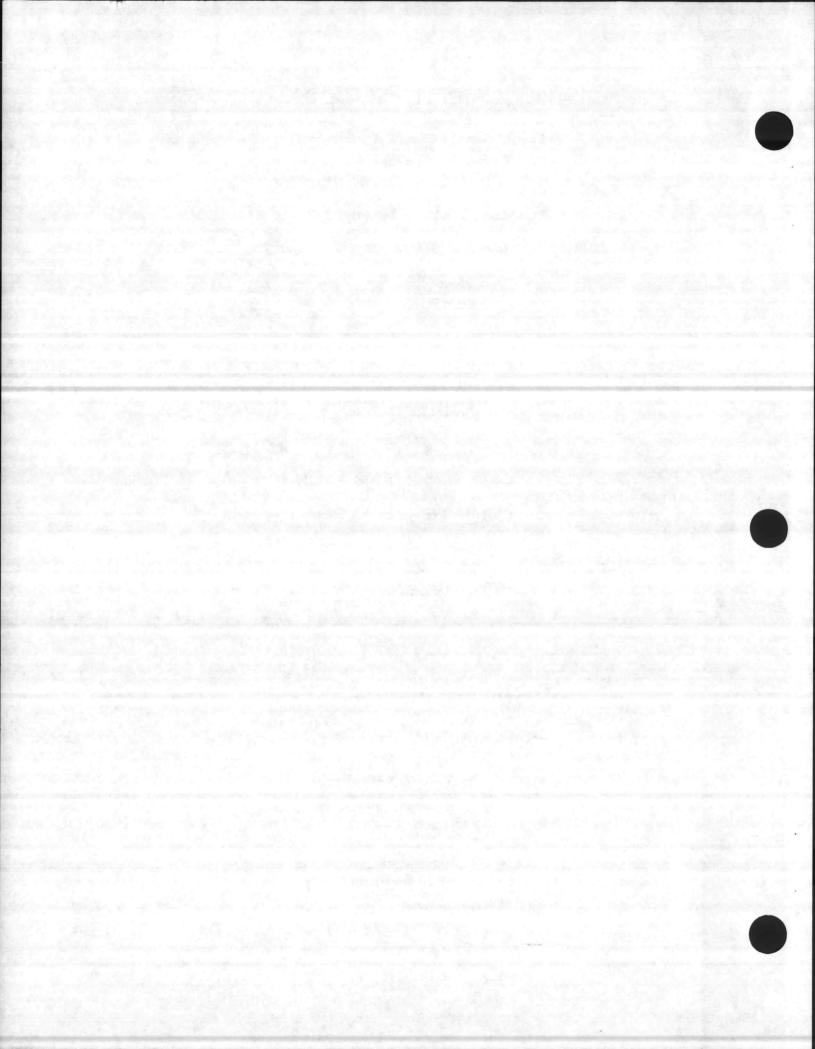
REPORTABLE QUANTITY ADJUSTMENTS

PRIMARY CRITERIA:

- 1. AQUATIC TOXICITY
- 2. MAMMALIAN TOXICITY
- 3. IGNITABILITY
- 4. REACTIVITY
- 5. OTHER TOXIC EFFECTS
- 6. CARCINOGENICITY

SECONDARY CRITERIA:

- 1. BIODEGRADEABILITY
- 2. HYDROLYSIS
- 3. PHOTOLYSIS



RANKING OF HAZARDOUS WASTE SITES

- 1. TOXICITY OF SUBSTANCE(S) INVOLVED.
- 2. CLOSENESS OF SITE TO HUMANS.
- 3. IMPACT ON ENVIRONMENT.

TRANSPARENCY 10A-8

SPILL LIABILITY

- A. ALL COSTS FOR REMOVAL OR REMEDIAL ACTION.
- B. ANY OTHER COSTS OF THIRD PARTY.
- C. DAMAGES FOR INJURY, DESTRUCTION OR LOSS OF NATURAL RESOURCES.

TRANSPARENCY 10A-9

DESIGNATION OF ADDITIONAL HAZARDOUS SUBSTANCES CANDIDATE LISTS

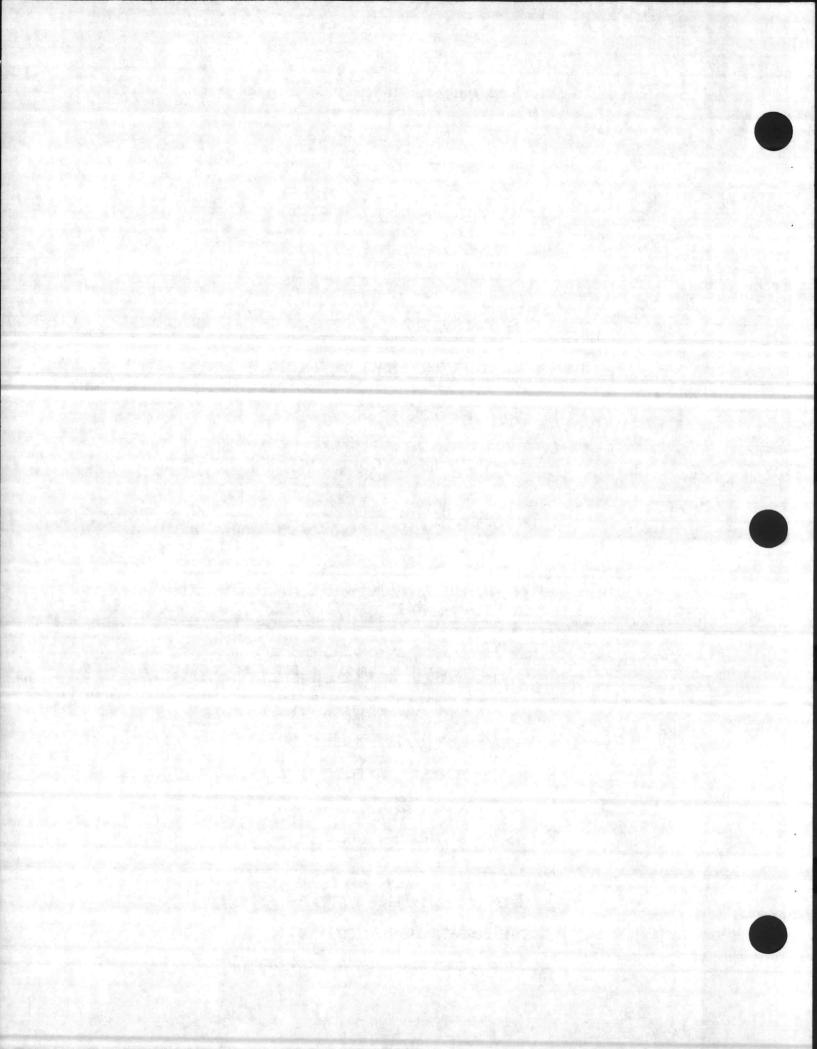
SPECIFIC LISTS:

- 1. FIFRA 600 OUT OF 40,000 PESTICIDE FORMULATIONS.
- 2. RCRA PART 261, APPENDIX VIII.
- 3. HMTA PART 172.101 & .102
- 4. IARC MONOGRAPH SUPPLEMENT, SEPT. 1979
- 5. ATF EXPLOSIVES
- 6. TSCA SECTION 4(E) LIST.

GENERAL LISTS:

- 1. CHEMICAL ACTIVITIES STATUS REPORT.
- 2. THE SUSPECT CHEMICAL SOURCEBOOK
- 3. 'ISCA CHEMICAL SUBSTANCE INVENTORY.

TRANSPARENCY 10A-10



SECTION 11 T

OSHA HAZARD COMMUNICATION STANDARD

HAZARD COMMUNICATION STANDARD

REQUIRES CHEMICAL MANUFACTURERS TO ASSESS THE HAZARDS OF CHEMICALS PRODUCED

EMPLOYERS MUST PROVIDE EMPLOYEES WITH INFORMATION CONCERNING THE HAZARDOUS CHEMICALS THEY WORK WITH BY MEANS OF A HAZARD COMMUNICATION PROGRAM, LABELS, PLACARDS, MATERIAL SAFETY DATA SHEETS, AND INFORMATION AND TRAINING

STANDARD DOES NOT APPLY TO CHEMICALS WHICH ARE COSMETICS, DRUGS, FOODS OR TOBACCO PRODUCTS WHICH ARE INTENDED FOR PERSONAL USE BY EMPLOYEES WHILE IN THE WORKPLACE

Transparency 11A-1

WRITTEN PROGRAM

LIST OF HAZARDOUS CHEMICALS PRESENT

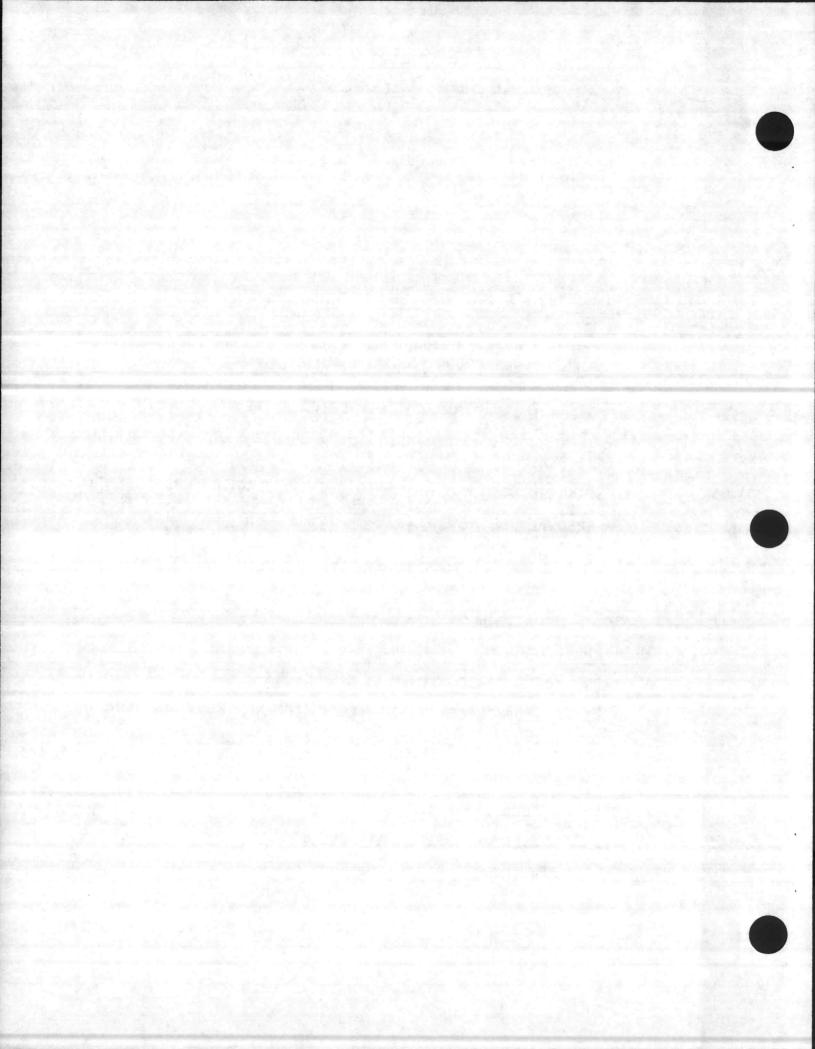
METHODS OF INFORMING OF HAZARDS OF NON-ROUTING TASKS

METHODS OF INFORMING CONTRACTOR'S EMPLOYEES

CRITERIA FOR:

LABELS, WARNINGS
MATERIAL SAFETY DATA SHEETS
TRAINING

Transparency 11A-2



EMPLOYEE

A WORKER WHO MAY, UNDER NORMAL OPERATING CONDITIONS OR FORSEEABLE EMERGENCIES, BE EXPOSED TO HAZARDOUS CHEMICALS IN A COVERED WORKPLACE, INCLUDES, BUT IS NOT LIMITED TO, PRODUCTION WORKERS, LINE SUPERVISORS, AND REPAIR OR MAINTENANCE PERSONNEL.

Transparency 11A-3

HAZARD DETERMINATION

EACH CHEMICAL MANUFACTURER SHOULD EVALUATE PRODUCTS TO DETERMINE IF HAZARDOUS.

EACH EMPLOYER SHOULD HAVE A HAZARD COMMUNICATION PROGRAM THAT INCLUDES:

PROCEDURES TO DETERMINE HAZARDS OF CHEMICALS PRODUCED.

LIST OF KNOWN HAZARDOUS CHEMICALS IN THE WORKPLACE.
METHODS TO INFORM EMPLOYEES OF NON-ROUTINE TASKS.

Transparency 11A-4

EMPLOYEE TRAINING SHOULD INCLUDE AT LEAST:

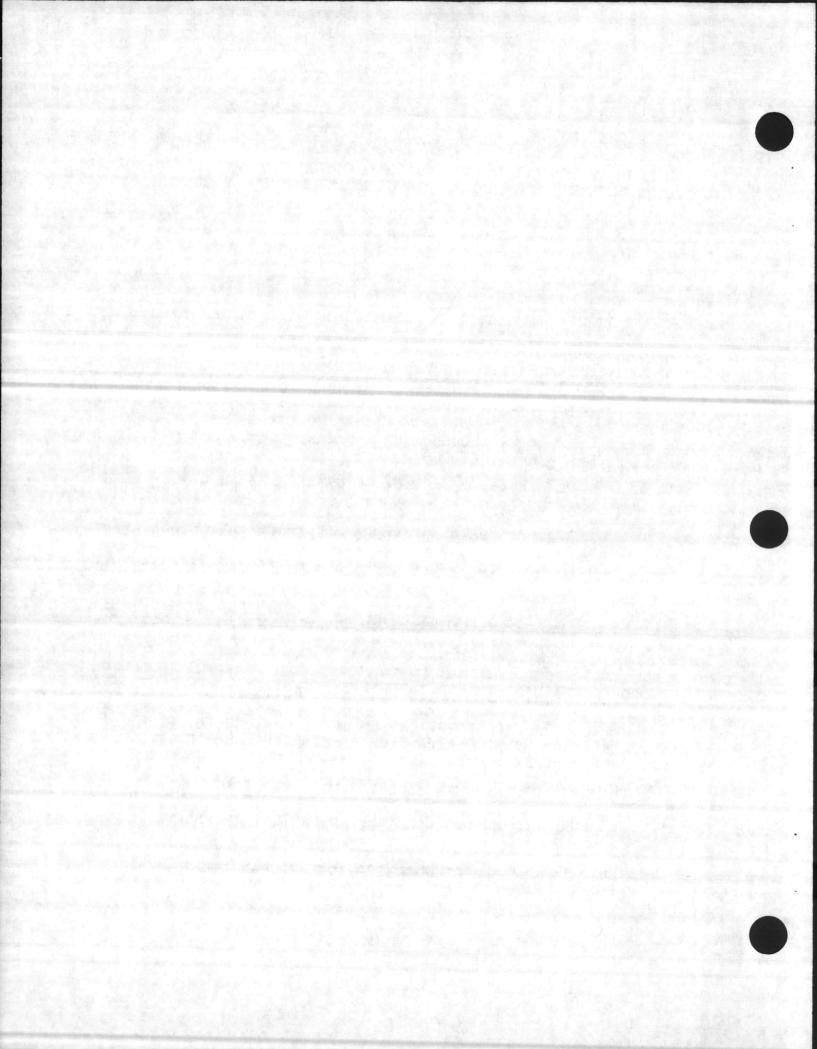
METHODS AND OBSERVATIONS EMPLOYEE MAY USE TO DETECT THE PRESENCE OR RELEASE OF A HAZARDOUS CHEMICAL IN THE WORKPLACE.

HAZARDS OF THE CHEMICALS IN THE WORKPLACE.

MEASURES EMPLOYEES CAN TAKE TO PROTECT THEMSELVES FROM HAZARDS.

DETAILS OF HAZARD COMMUNICATION PROGRAM.

Transparency 11A-5



MATERIAL SAFETY DATA SHEET INFORMATION

IDENTIFY ON LABEL:

SINGLE SUBSTANCE: CHEMICAL AND COMMON NAME

MIXTURE: NAMES OF INGREDIENTS

PHYSICAL AND CHEMICAL CHARACTERISTICS

PHYSICAL HAZARDS

HEALTH HAZARDS

ROUTES OF ENTRY

PEL, TLV

CARCINOGENIC LISTING

PRECAUTIONS

CONTROLS

EMERGENCY AND FIRST AID PROCEDURES

NAMES, ADDRESSES, TELEPHONE NUMBERS

Transparency 11A-6

EMPLOYERS SHOULD PROVIDE EMPLOYEES WITH SPECIFIC INFORMATION AND TRAINING ON HAZARDOUS CHEMICALS IN THE WORKPLACE AT THE TIME OF THEIR INITIAL ASSIGNMENT, AND WHENEVER A NEW HAZARDOUS CHEMICAL IS INTRODUCED INTO THEIR WORK AREA.

Transparency 11A-7

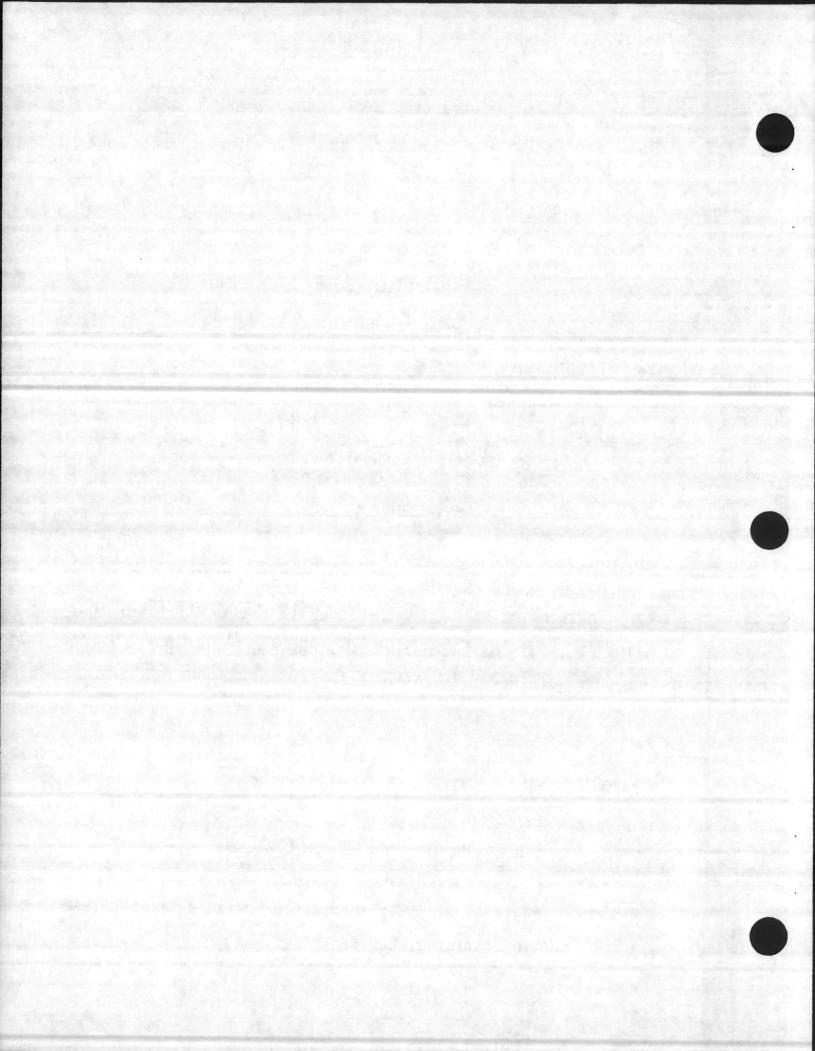
LABORATORIES

APPLIES AS FOLLOWS:

LABELS ARE NOT REMOVED OR DEFACED.

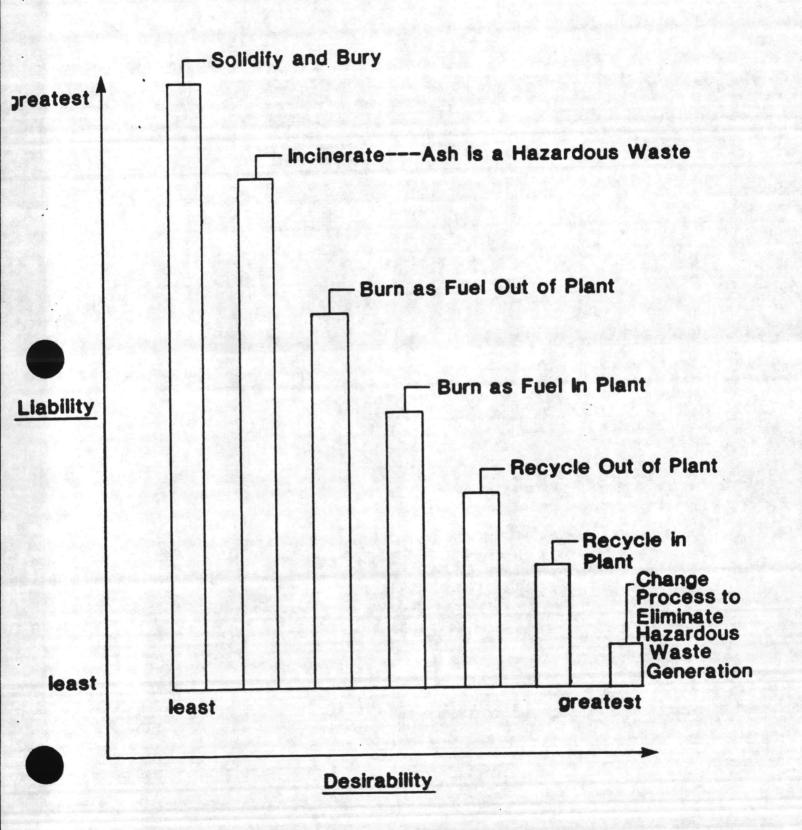
MSDS RECEIVED ARE ACCESSIBLE.

LAB EMPLOYEES ARE APPRISED OF HAZARDS, I.A.W. INFORMATION/TRAINING REQUIREMENTS.



SECTION 12T Figure 12.1

OPTIONS FOR MANAGING WASTE SOLVENTS



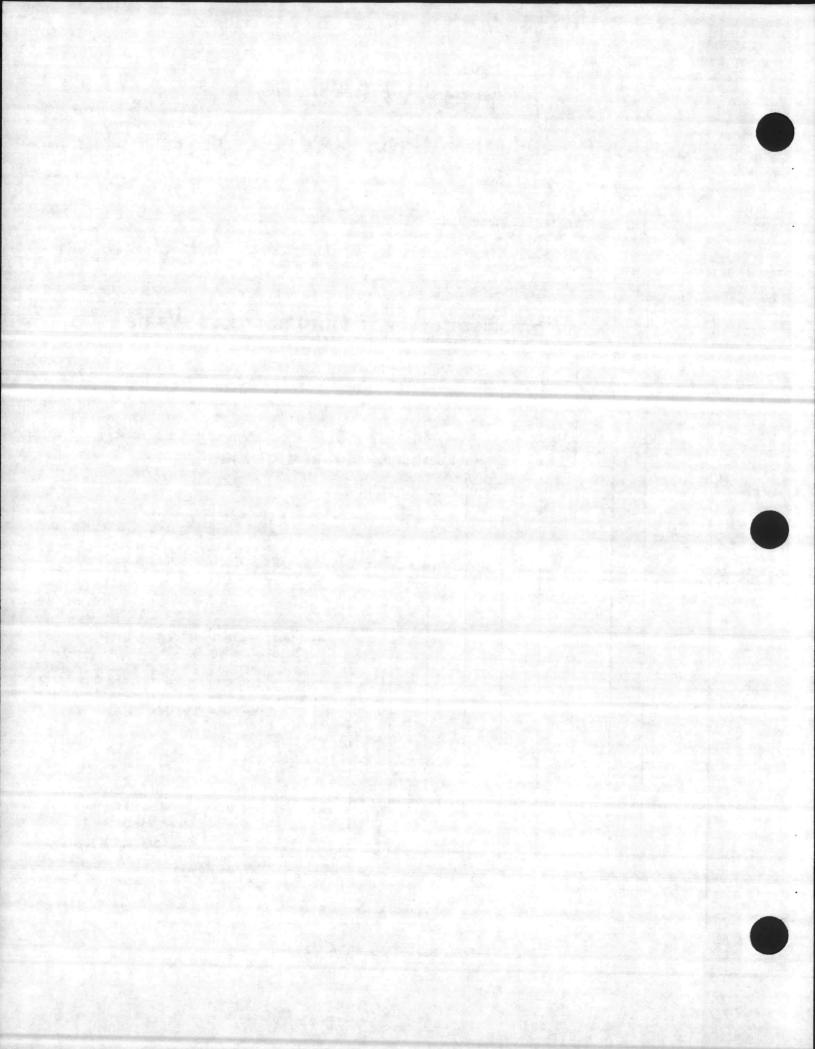


FIGURE 13T-3

DEFINITIONS OF WASTE OIL FUELS

ON SPEC WASTE OIL	ARSENIC	5	PPM	MAX-
	CADMIUM	2	PPM	MAX-
	CHROMIUM	10	PPM	MAX -
	LEAD	100	PPM	MAX-
	FLASH POINT	100°	F	MIN-

TOTAL HALOGENS: 1000 PPM (REBUTIABLE)
4000 PPM (NON-REBUTIABLE)

OFF-SPEC WASTE OIL EXCEEDS THE ABOVE LIMITS BUT CONTAINS LESS THAN 4000 PPM TOTAL HALOGENS AND HAS NOT BEEN MIXED WITH A HAZARDOUS WASTE

HAZARDOUS WASTE

OIL FUEL

USED OILS EXCEEDING 4000 PPM TOTAL

HALOGENS, USED OILS WHICH HAVE BEEN MIXED

WITH A HAZARDOUS WASTE, OR USED OILS

EXHIBITING A RCRA HAZARDOUS CHARACTERISTIC

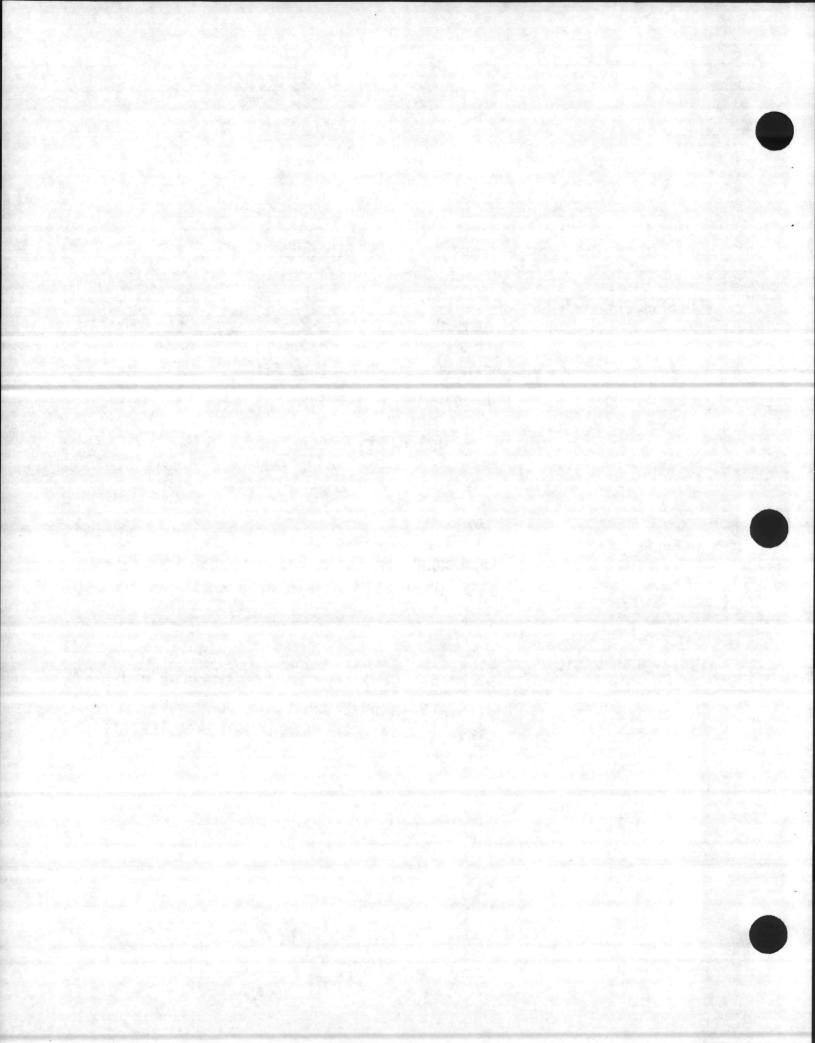


FIGURE 13T-2 BACKGROUND INFORMATION - USED OILS

EARLY 1970'S	- IT WAS REALIZED THAT USED OIL DISPOSAL POSED A THREAT TO GROUNDWATER AND STREAMS. THEREFORE A STUDY OF USED OIL WAS CONDUCTED UNDER THE 1972 FEDERAL WATER POLLUTION CONTROL ACT
1980	- CONTINUED CONCERN LED TO THE USED OIL RECYCLING ACT OF 1980
1984	- CONGRESS REVISED 1980 RULES IN 1984 HAZARDOUS AND SOLID WASTE AMENDMENTS TO RCRA
	- EMPHASIS ON PROTECTING HUMAN HEALTH AND THE ENVIRONMENT FROM HAZARDS ASSOCIATED WITH OIL RECYCLING
1985, '86	- LAWS ENACTED REGARDING BURNING STANDARDS FOR USED OILS
NOV. 1986	- LISTING AND MANAGEMENT PROPOSALS TO BE FINALIZED

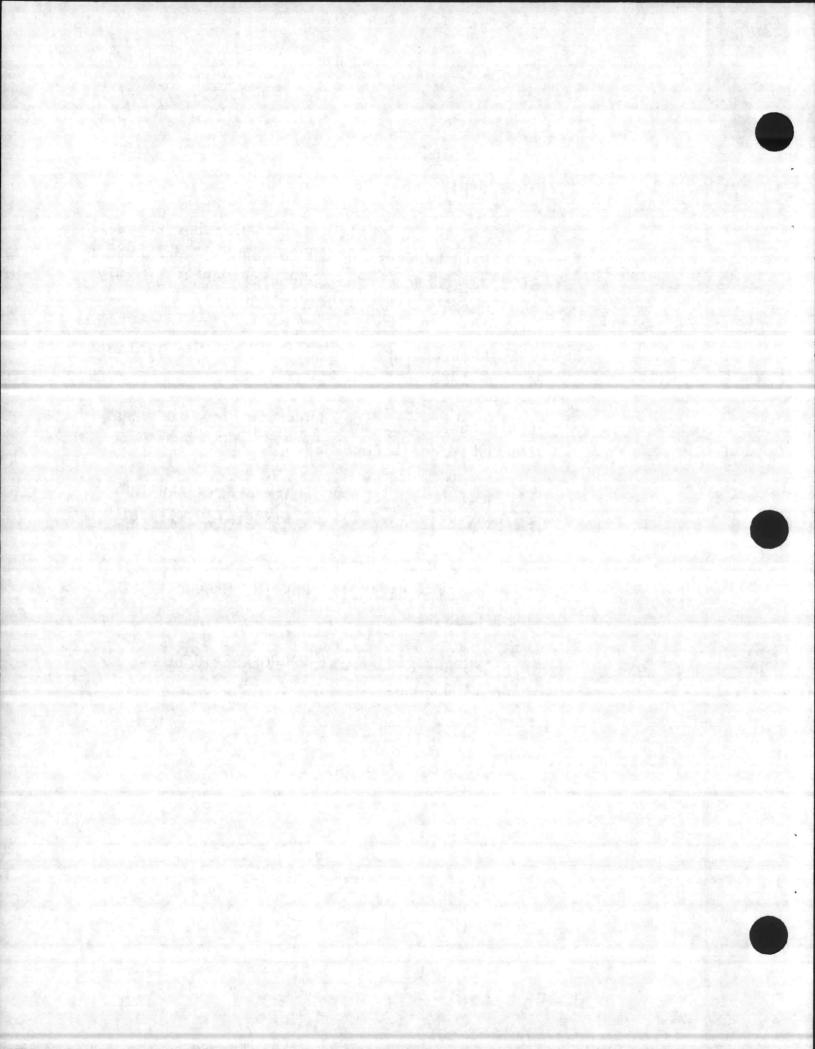


FIGURE 13T-8

UNDERGROUND TANK REGULATIONS

PUBLIC LAW 98-616 OF NOVEMBER 8, 1984, "THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984" HAS AS TITLE VI "UNDERGROUND STURAGE TANKS" (UST)

INCLUDES:

TANKS AND CONNECTED PIPES WITH GREATER THAN 10% BENEATH GROUND CONTAINING ANY SUBSTANCE DEFINED AS HAZARDOUS BY CERCLA (NOT WASTES) OR ANY PETROLEUM PRODUCT

EXCLUDES:

FARM OR RESIDENTIAL TANKS OF 1100 GALLONS OR LESS

HEATING OIL TANKS ON PREMISES WHERE OIL USED

SEPTIC TANKS

PIPELINE FACILITIES

FLOW THROUGH PROCESS TANK

STORAGE TANKS ABOVE FLOOR IN UNDERGROUND AREA

TANKS REMOVED FROM THE GROUND PRIOR TO MAY 8, 1986

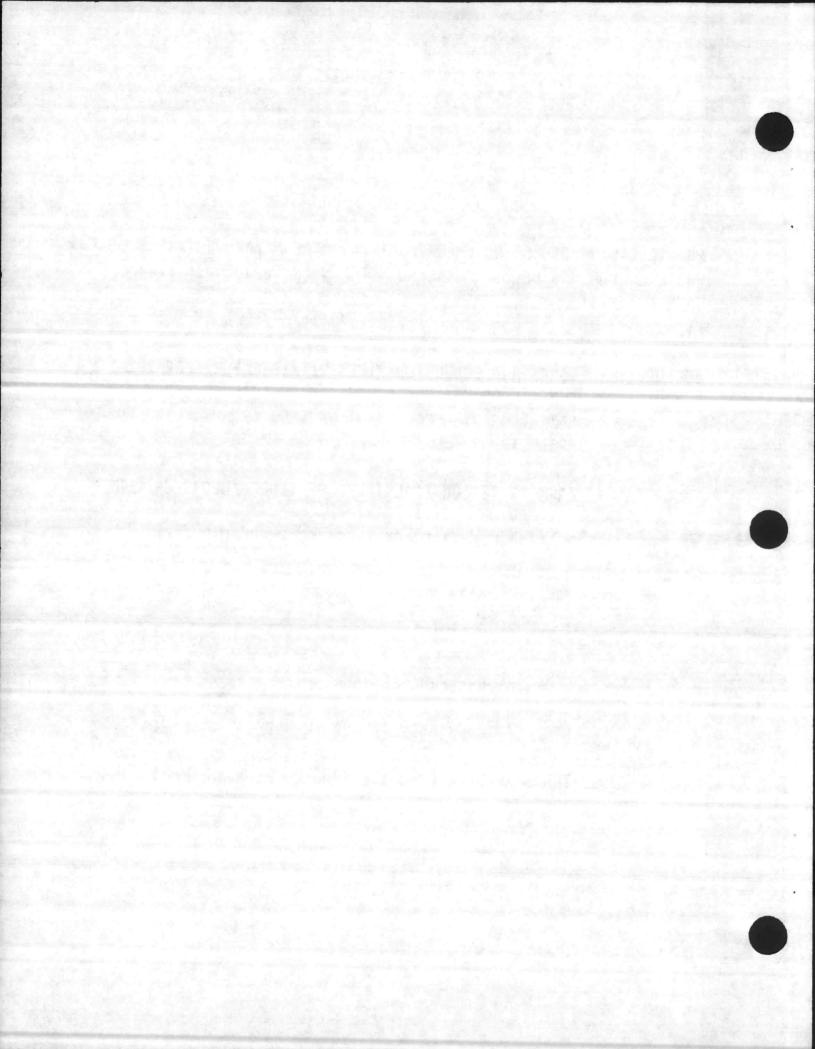


FIGURE 13T-9

UNDERGROUND TANK REGULATIONS

IN NORTH CAROLINA THE RESPONSIBLE AGENCY IS: THE ENVIRONMENTAL MANAGEMENT DIVISION OF NRCD. CONTACTS ARE: PERRY NELSON AND LEE LAYMAN AT 733-5083.

IMPORTANT DATES:

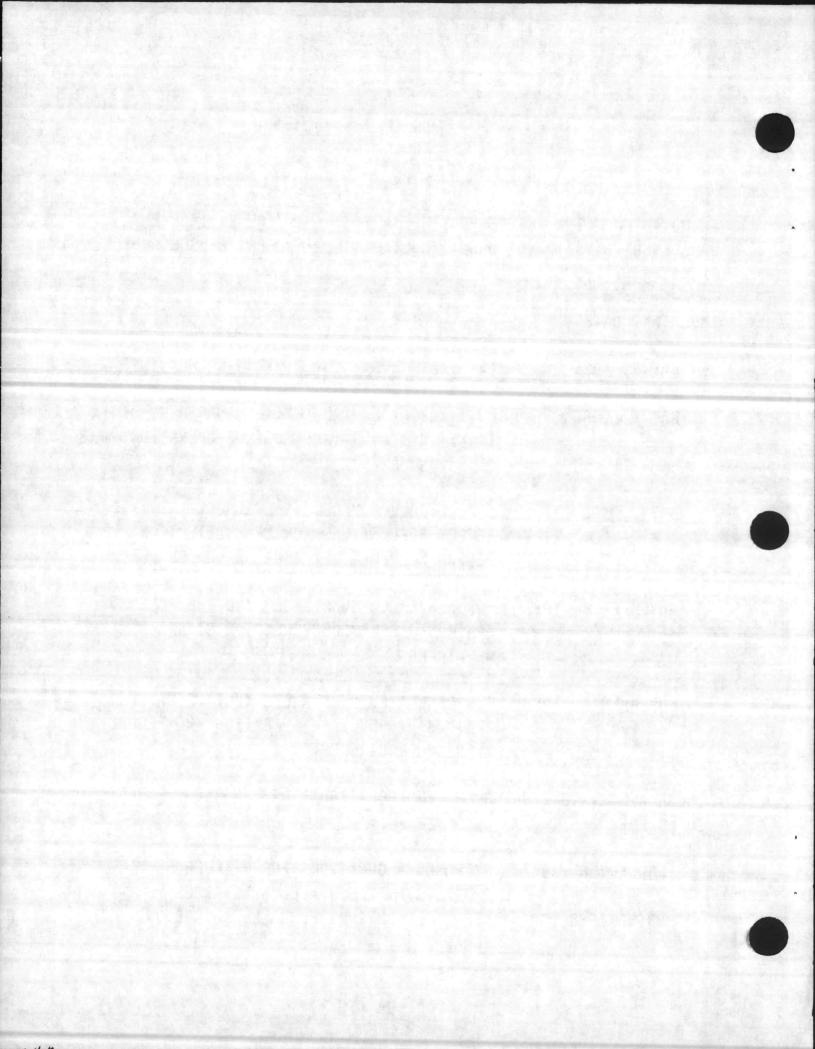
MAY 7, 1985	NEW TANKS MUST MEET MINIMUM REGULATIONS
MAY 8, 1986*	MUST NOTIFY ENVIRONMENTAL MANAGEMENT OF TANKS IN USE OR TAKEN OUT OF OPERATION AFTER JANUARY 1, 1974
MAY 8, 1987*	FOR PETROLEUM PRODUCTS EPA MUST PUT INTO EFFECT REGULATIONS FOR LEAK DETECTION, RECORD KEEPING, NEW TANK STANDARDS
NOVEMBER 8, 1987	FOR REGULATED SUBSTANCES (NOT PETROLEUM) EPA MUST ISSUE COMPREHENSIVE STANDARDS FOR NEW TANKS
NOVEMBER 8, 1988	FOR REGULATED SUBSTANCES (NOT PETROLEUM)

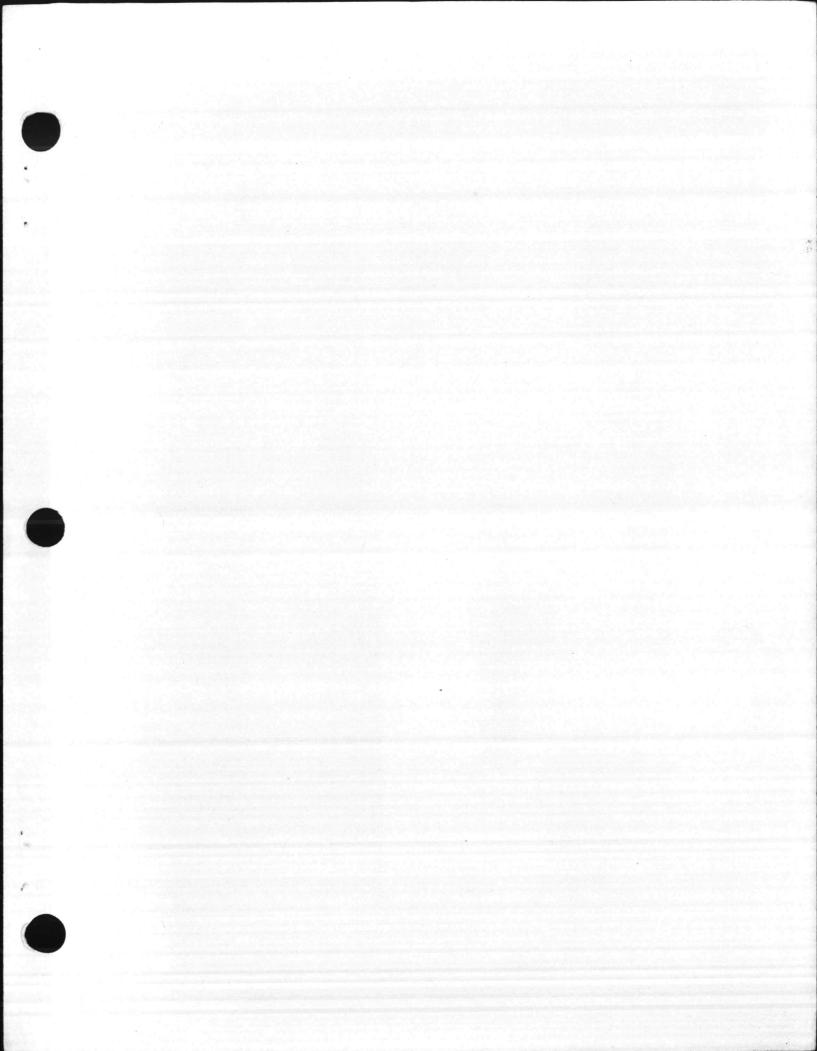
KEEPING REQUIREMENTS.

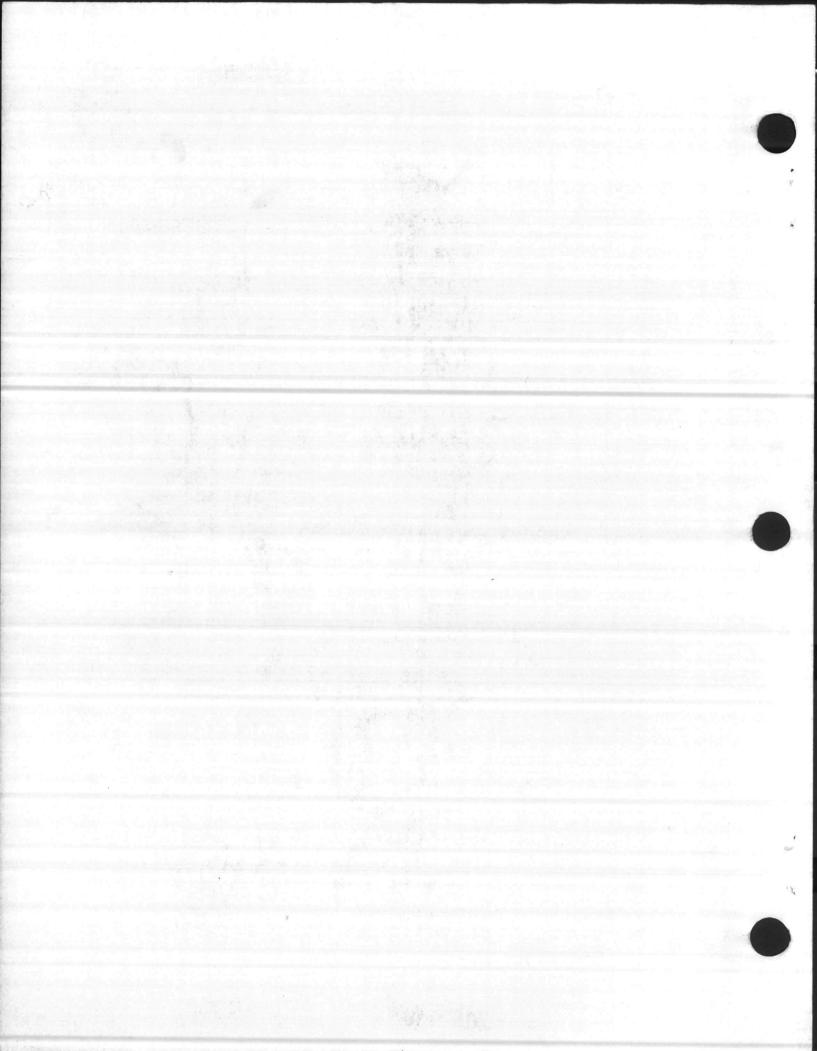
EPA MUST ISSUE LEAK DETECTION AND RECORD

PROPOSED REGULATIONS FOR PETROLEUM
PRODUCTS AND REGULATED SUBSTANCES
SPRING 1988
FINAL REGULATIONS FOR ALL UNDERGROUND
TANKS

THESE ARE STATUTE DATES EPA (ED MORRISON, 202/382-7989) EXPECTS TO FOLLOW:







CHAPTER I

THE HAZARDOUS WASTE PROBLEM

LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should have an understanding of the seriousness and complexity of hazardous waste problems. Throughout this course, you will be provided the information and tools necessary to perform your everyday duties in a more careful, thorough, and safe manner.

II. INTRODUCTION

- A. Over the past three decades, public awareness of this country's problems with hazardous wastes has surfaced. There have been reports in the media of environmental damage and threats to public health caused by improper handling of these wastes. Examples of hazardous waste incidents are those at are Love Canal, Valley of the Drums, and Times Beach. The Times Beach and Love Canal problems resulted in relocation of families, abandonment of homes, and suspected health problems including birth defects and miscarriages. As public interest increased, changes were demanded in the way hazardous waste were handled and disposed.
- B. The Navy generates large quantities of hazardous wastes that must be handled and disposed of in an environmentally acceptable manner. Table I lists some of the hazardous wastes generated by the Navy in calendar year 1983. In view of the Navy's extensive involvement in this area, regulatory requirements, the need to protect people from hazardous wastes, and the high level of public concern, a Navy program for the control of hazardous materials and wastes was initiated in 1980. The Navy's Environmental Protection Program (including Hazardous Waste Management) was implemented by OPNAVINST 5090.1 of 26 May 1983 and MCO P11000.8B of 9 December 1983. Naval personnel should be familiar with the requirements of these programs.
- C. There are several major problem areas associated with hazardous wastes that all personnel who handle or manage these substances should be aware of. What a hazardous waste handler or manager does can cause these problems or can result in someone else being faced with them.
 - 1. Safety and immediate (acute) health effects. Problems in this area directly affect the worker, coworkers, or others who may handle the waste later.

0933D Date of last revision: Jun 84

TABLE 1

TOP TEN CATAGORIES OF HAZARDOUS WASTE GENERATED
BY NAVY ACTIVITIES*

TYPE OF HAZARDOUS WASTE	EPA ID No. or (DOT ID No.)	AMOUNT GENERATEI in CY83 (tons)
Hazardous Waste, n.o.s.	(UN9189)	9114
Solid Wastes that exhibit the characteristics of Ignitability	D001	9052
Solid Wastes that exhibit the characteristics of Reactivity	D003	8379
Solid Wastes that exhibit the characteristics of lead EP Toxicity	D008	4669
Wastewater Treatment Sludges from Electro- plating Operations	F006	4135
Lead Compound, soluble, n.o.s.	(UN2291)	2484
Petroleum Distillate, n.o.s. or Road Oil	(UN1268)	2144
Acid, liquid, n.o.s.; Corrosive, liquid, n.o.s.; Paint, etc., corrosive liquid; various corrosive compounds	(NA1760)	1756
Benzene, hydroxy	U188	1242
Oil, petroleum, n.o.s.; Petroleum oil	(UN1270)	1108

^{*} THIS DATA IS AN EXCERPT FROM THE CY84 HAZARDOUS WASTE ANNUAL REPORTS RECEIVED AT NAVENENVASAA AND REFLECTS QUANTITIES GENERATED IN CY83.

- 2. Long-term (chronic) health effects. These effects may not show up for years but are, in many cases, just as harmful as acute effects.
- 3. Environmental effects. The world around us--air, water, land, wildlife, and humans--can be greatly affected by how hazardous wastes are handled. These wastes not only affect our environment but also the environment of generations to follow.
- 4. Laws and regulations. Many laws and regulations have been passed concerning hazardous materials and wastes. Employees of the Navy are subject to both civil and criminal penalties for noncompliance with the laws covering hazardous materials and wastes.
- 5. Public relations. Because of the intense public interest in this area, the military, along with others, is closely watched by citizens' groups, state officials, and the news media. Hazardous waste problems, even when not severe enough to violate laws or regulations, may nonetheless create a public outcry. Thus, Navy employees must be especially careful when dealing with these wastes.

III. SAFETY AND IMMEDIATE (ACUTE) HEALTH EFFECTS.

- A. Safety problems, usually accidents, can result in chemical burns, spills, inhalation of toxic fumes, and fires. All affect the health and well being of the worker and his coworkers. In addition, if hazardous wastes are not properly packaged, handled, labeled, stored, and transported, not only the worker, but others who handle the waste in the future may be injured. Most accidents and their associated adverse health effects can be prevented. The following lists indicate safety problems associated with hazardous waste handling.
 - 1. Safety hazards that could cause accidents.
 - (a) Inadequate or unused safety and protective equipment.
 - (b) Failure to follow facility operating procedures, including observing safety zones.
 - (c) Not knowing the dangers of what you are working with.
 - (d) Not knowing who to call or exactly what to do if there is an accident or spill.
 - (e) New people who have not been properly trained and old-timers who think they will never get burned.

- (f) Poor housekeeping.
- (g) Ineffective or infrequent safety inspections.
- (h) Not enough space for proper compatible storage; building not designed for hazardous waste handling.
- (i) Cracked pallets or deficiencies in materials handling equipment.
- 2. Safety hazards related to the hazardous wastes.
 - (a) Inadequate labeling of containers.
 - (b) Improper, corroded, or leaking containers.
 - (c) Storing incompatible wastes together.
 - (d) Heat or spark sources too close to flammable wastes.
 - (e) Careless or improper transfer of wastes.
 - (f) Improper or insufficient spill cleanup materials.
- B. An example of a disastrous result from a safety hazard was the fire at the Norfolk Naval Supply Center in Aug 81. The events of this fire are outlined in the Navy Lifeline article titled "3,000 Degrees of Mean" (located at the end of this chapter). The following list gives several valuable lessons to be learned from this fire.
 - 1. Small errors and mistakes can result in disaster.
 - Chemical fires are extremely destructive and generate intense heat.
 - 3. Hazardous wastes must be kept away from combustibles.
 - 4. Training for hazardous waste handlers is very important. The following areas should be included in training:
 - (a) Hazards of specific chemicals at their activity.
 - (b) Proper storage of hazardous wastes including segregation.
 - 5. Hazardous wastes must be stored with labels visible.
 - 6. Expired, damaged, and deteriorated chemicals are very dangerous.

IV. LONG-TERM (CHRONIC) HEALTH EFFECTS.

Long-term health effects are sometimes less apparent, but often just as serious as the immediate results of accidents. Long-term effects may result from the careless handling of hazardous wastes and may not appear for several years. We must be just as concerned about these effects. Chronic effects can be avoided by proper handling procedures. Some of these effects are:

- 1. Chronic illness.
- Family illness or behavioral changes due to wastes carried on workers clothing.
- 3. Latent chronic effects (disease after a waiting period).
- 4. Cancer.
- 5. Birth defects.
- 6. Sterility or other reproductive difficulty.

V. ENVIRONMENTAL EFFECTS.

A. The mishandling of hazardous wastes can adversely affect plants and animals as well as people. Also, chemicals from spills or unsafe disposal practices may reach plants, animals, and people by transmittal through surface and/or groundwaters.

The following are some aspects of how the environment works and how hazardous wastes may effect it.

- 1. Food chains. The environment is made up of a network of food chains. Plants absorb the energy from the sun, animals eat the plants, and other animals eat these animals. Food chains make different parts of the natural world dependent on each other.
- 2. Bioaccumulation. Each time an organism becomes food for another organism, some of the stored materials in its body are transferred. These materials may include persistent hazardous chemicals. Some chemicals can be used by the organism (metabolized), thus leaving the food chain. However, some hazardous chemicals build up in the tissue of the organism. This build-up is known as bioaccumulation. Bioaccumulated chemicals may remain in the food chain forever.
- Biomagnification. The introduction of a small quantity of some hazardous chemical into a lower level of a food chain may cause significant harm due to biomagnification. This process occurs when chemicals bioaccumulate in low level organisms and the organisms that depend on them. When biomagnification occurs, a higher concentration of the chemical is found in an animal at the top of the food chain then was present in the organisms lower on the chain.

- 4. Chemical persistence. Many chemicals do not easily decompose or degrade in the environment. They may still be hazardous even if they get into a food chain long after they are first released into the environment.
- 5. Synergistic effects. Some chemicals acting together may have greater health effects than either chemical acting alone in the human and animal body. This is a synergistic effect.
- 6. Groundwater. Spilled chemicals move slowly through the soil and may ultimately reach the groundwater table. Groundwater also moves slowly, therefore, contamination could persist for centuries. The contaminated water may be pumped out through wells to water livestock, irrigate crops, or provide drinking water to humans. Groundwater also may flow into ponds, lakes, and streams.
- 7. Ecosystem. Are usually more complicated than the simple food chains mentioned above. They consist of webs or networks of interrelating food chains. Since we humans are part of these food webs, effects on natural ecosystems may directly or indirectly affect us as well. We do not know how much chemical disturbance major ecosystems can sustain before they are permanently harmed.
- B. Environmental effects can be serious and long lasting. They can be magnified as they pass through the ecosystem and can be transmitted over great distances.

Harmful effects can be avoided by preventing entry of dangerous chemicals into the environment. This can be done by preventing spills and fires, ensuring that hazardous wastes are disposed of properly, and protecting critical parts of the environment such as ground water and surface water.

VI. LAWS AND REGULATIONS PERTAINING TO HAZARDOUS MATERIALS/WASTE.

- A. Federal laws and regulations have been developed to protect the environment and our health from hazardous chemicals. The Navy has implemented these laws and regulations. Both the Federal laws and regulations and the Navy hazardous materials management program are important because they affect how you and your supervisors do your jobs. Failure to follow the procedures and requirements of these regulations may result in fines and jail terms.
 - 1. Occupational safety and health. The Occupational Safety and Health Act (OSHA) of 1970 set requirements for worker safety and health. Since 1980, this act has applied to Federal civilian employees. Among other things, it regulates the levels of chemicals workers may be exposed to in the workplace, requires safety equipment in certain situations, and requires standards be set for materials handling equipment.

2. Labeling of chemicals. The Hazardous Materials Transportation Act of 1975 authorized the Department of Transportation (DOT) to issue shipping, labeling, and marking regulations for use during transport of hazardous chemicals. (DOT also requires reporting of spills which occur during transportation of regulated chemicals.)

3. Environmental and health protection.

- (a) The Clean Water Act of 1977 allows Environmental Protection Agency (EPA) to set water quality and effluent discharge standards for water pollutants. The implementing regulations specify the quantities of listed substances which must be reported if spilled in U.S. waters. They also require potential dischargers to have spill prevention, readiness, and response plans.
- (b) The Resource Conservation and Recovery Act (RCRA) of 1976 controls the management of hazardous wastes. The RCRA regulations set standards for generators, transporters, and owners or operators of treatment, storage, and disposal facilities. A tracking system for hazardous wastes, called "manisfesting," is required by the RCRA regulations. Another requirement is annual training. This course and annual refresher training, satisfies this training requirement.
- (c) The Toxic Substance Contral Act (TSCA) of 1976, gave EPA the authority to regulate chemicals used in commerce. The TSCA regulations cover manufacture, distribution, use and disposal of any chemical substance. TSCA makes special provisions for storing and handling chemicals called polychlorinated biphenyls (PCB).
- (d) The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (Superfund), requires reporting of hazardous material disposal sites and areas made hazardous by old spills, including those on Federal property. It requires us to report spills on land as well as water, and expands the definitions of hazardous substances to cover those defined as hazardous by other laws. Therefore, many more types of hazardous materials must now be reported if spilled.
- B. All of these laws not only regulate how you may do things as handlers of hazardous wastes, but also prescribe fines and jail terms for failure to act properly. These may be levied directly against the Navy, the activity commander, and the handler. Criminal action can be taken against an individual who violates various sections of these regulations. Examples of penalties imposed by these regulations include:
 - Drivers making false entries in the required daily logs up to \$12,000.
 - 2. Transporting poisons with foodstuffs up to \$40,000.

- 3. Failure to properly placard a motor vehicle up to \$1,000.
- 4. Failure to enter the proper DOT shipping name and hazard class on shipping papers up to \$2,000.
- 5. Failure to maintain driver files for those transporting hazardous materials up to \$7,000..
- 6. Drivers transporting shipments of hazardous materials without accompanying proper shipping papers up to \$4,000.
- C. To comply with these laws and regulations, the Navy has adopted policies and prepared requirements which detail how the Navy will handle, store, and arrange for the disposal of hazardous waste. The key to safe handling of all chemicals is to incorporate good planning and information on specific hazardous substances into facility operations. Many of the problems associated with handling hazardous wastes can be planned for, identified and prevented.

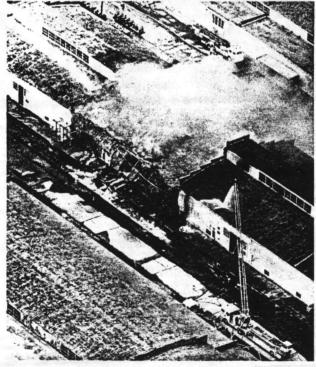
VIII. PUBLIC RELATIONS.

This is another area in which hazardous waste can become a problem. Given the potential for hazardous waste accidents, and stories about problems like Love Canal, it is not surprising that communities are sensitive about chemicals transported on their streets or stored nearby. People may appreciate a naval activity for its contributions to their local economy, but they will still be concerned about how that installation carries out its mission. Thus, any naval activity that handles hazardous wastes may have a future public relations problem if those wastes are not properly managed.

IX. SUMMARY.

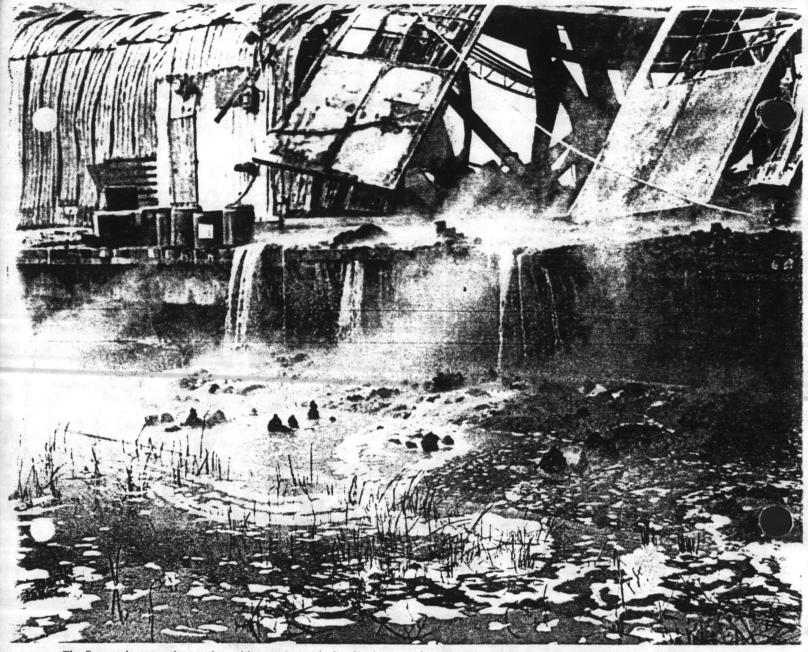
Hazardous wastes pose a number of very serious problems to individuals, society, and the environment. The Navy generates large quantities of hazardous wastes but it is the "Handler" of these wastes who is responsible for preventing these serious problems. The purpose of this course is to make certain that you, the handler, have the training you need to safely work with hazardous waste.

3.000 aeurees of



By Diane Hamblen

Firefighters were powerless to stop the destruction of Cell 6. One of their final jobs was to back up their greatest ally in this blaze - the 40-year-old firewalls which helped contain the fire - by cooling adjacent



The fire was hot enough to melt steel beams. It attacked a chemistry set of combustibles. These elements produced an alien landscape outside the burning warehouse. Firefighters pumped 400,000 gallons of water into and around the blaze. One firefighter suffered serious chemical burns on her legs when caustic runoff leaked into her boots.

THE best way to motivate people to learn about the hazardous materials they work with is by showing them what happens when they don't quite know enough. Small errors and minor mistakes usually take care of themselves, but every once in a while they mushroom into disaster.

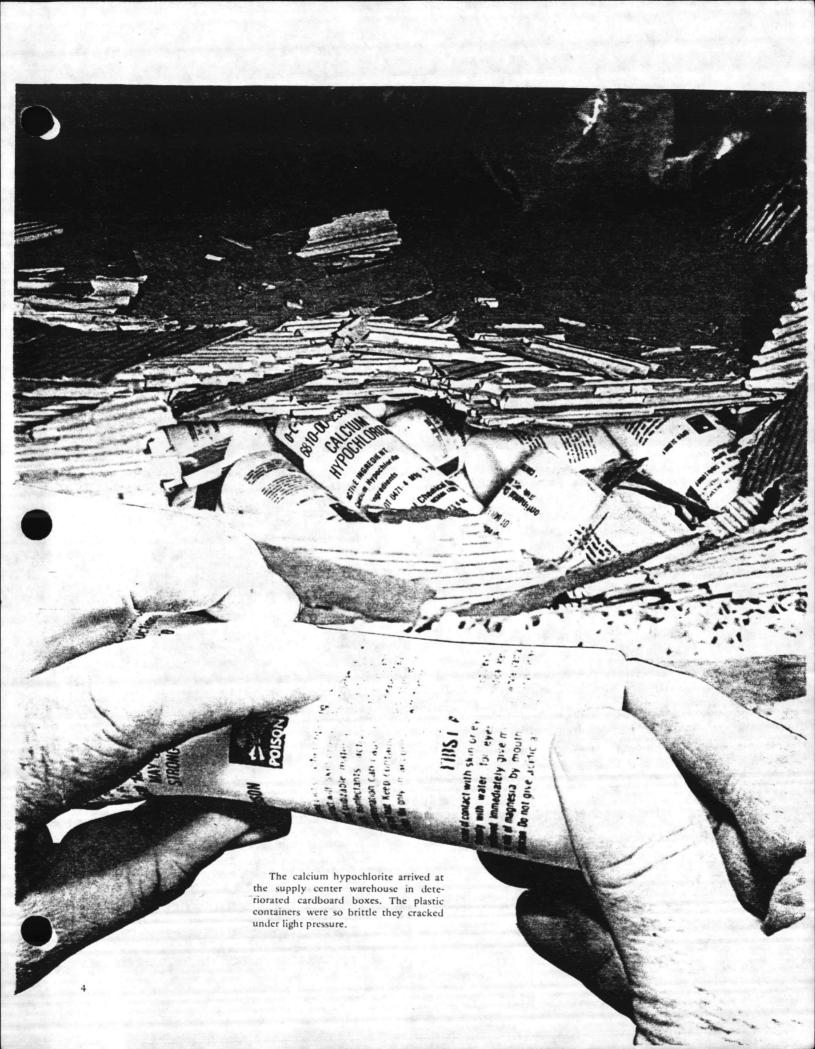
That's exactly what happened last August at the Norfolk Naval Supply Center's hazardous material storage warehouse, Building SDA-215. It's a 40-year-old single-story warehouse made of corrugated metal on steel. It squats solidly on a raised concrete slab. Two-foot-thick brick firewalls divide the building into nine 80 x 100-foot cells. These firewalls would be key players in the events which followed.

In the first four cells, the local public works center stores hazardous wastes which are awaiting disposal. The supply center uses the other cells to receive and store ready to issue, 'amaged, or expired chemicals and hazardous materials. There are more than 3,000 hazardous chemical substances in the supply center inventory.

On that August afternoon two warehousemen were dealing with just one: calcium hypochlorite (CHC), a powerful oxidizer used primarily to purify potable water and in sewage waste treatment.

The workers were transferring deteriorated cardboard boxes of expired 6-ounce containers of CHC from pallets into new triple-wall cardboard containers. The small plastic bottles were cracked and brittle, having been apparently exposed to high heat and humidity at their previous location. Using a forklift to lift the pallets, they pushed the bottles and cartons off the pallets by hand into the new containers. When both boxes were full, the workers left to get more triwalls.

A few minutes later a transportation driver from Norfolk Naval Shipyard arrived at Cell 6 to pick up a batch of chemicals. He entered the cell from the east door and noticed one triwall container had "fumes and vapors coming off it like there was a fan blowing them up from the bottom." He raced out of the cell to find the acting supervisor. On the way he



told two other workers what was happening. Three PWC sprinkler maintenance mechanics working in a nearby building saw the flames and smoke. They pulled the fire alarm on the north end of their building.

When the alarms rang in the stations, firefighters reacted instantly. "As soon as the dispatcher said SDA-215, they realized the hazards. We knew it could be a biggie," Clarence Rout recalls. Rout is the head fire marshal for the Naval Facilities Engineering Command's Atlantic division. Flames and smoke were shooting 1,000 feet in the air only minutes after the fire exploded.

Firefighter Debbie Bailey was inspecting a building on the far side of the Naval Air Station. SDA-215 rang a bell with her. "Almost every day someone would say, 'I hope that one never goes.' "As she sped along the highway behind the wheel of the fire truck, she was hoping it was just another faulty sprinkler system. "When the first unit on the scene reported heavy smoke and flame visible, we knew it was the real thing," she continues. She could see the column of smoke from the crest of an overpass 3 miles from the site.

Station One fire chief Ellis Owens was first on the scene. He circled the building and began positioning the trucks. When one firefighter pulled up to the building and got out to start the pumps, Owens ordered him to move the truck back.

"I was walking toward the back of the truck when the cell wall blew," the firefighter recalls. I turned and ran back toward the cab, knowing if I didn't get that truck out of there we'd lose it. I was shielding my face with my arm, and I knew I was burned," he continues. Since turnout gear is too bulky to wear when driving a truck, there is always a few minutes of xposure. He was out of work for 45 days recovering from a eep burn on his arm.

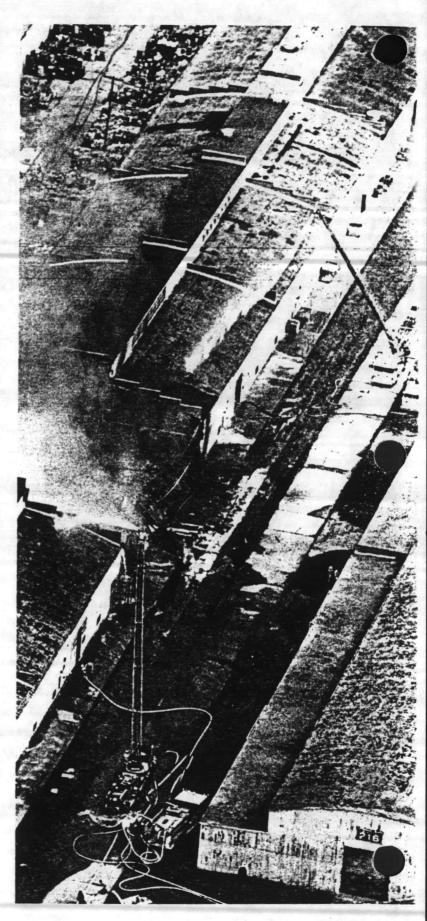
This incident shows the extraordinary heat and destructiveness of chemical fires. "This is the first fire I've investigated where I've seen that kind of metal damage," Rout says. "It melted 3-inch iron and cut sprinkler pipes in half. The melted metal looked like lava. We figured the fire hit 3,000 degrees," about as hot as a steel mill furnace. The average wood fire reaches only 900 degrees.

When a fire as hot as this one is cooking, firemen use almost anything as a shield from the heat. They took refuge behind twenty 55-gallon drums which had been dropped off for storage earlier that day. What they didn't know was that those drums were full of methyl ethyl ketone, a highly explosive liquid. The drums were properly labeled with DOT flammable liquid warnings, but the labels were turned to the inside of the nesting drums.

"If those drums had exploded, they would have had all the characteristics of flame throwers, burning everyone in their path and sucking oxygen from those they couldn't reach," says CAPT Sam Barboo, head of the Naval Safety Center's Occupational Health Division.

As with any fire involving hazardous materials, the potential for generating deadly toxic gases was uppermost in everyone's mind. Without an accurate inventory of what chemicals were involved, it was decided to treat the situation as a "worst case chlorine cloud." Luckily with an assist from Mother Nature, the worst case failed to materialize. The cloud of noke generated by the fire went straight up and out over the water.

Just 3 hours after the first alarm, the fire was out. It was a



fast, furious, and dirty 3 hours which left the firemen ex-

Then began the questions. Finding answers took a good deal longer than 3 hours. The NAVFAC fire investigation report listed the cause of the fire as CHC in contact with a combustible material, leading to rapid oxidation and ignition. It noted the triwalls were "wax-coated." Presumably the organic material in the wax served as the trigger.

"We still have some real questions about what caused that fire," Jim Bradley says. He is safety manager of Norfolk Naval Supply Center. "We know CHC was a major factor, but could it have reacted with the box that violently? We've talked to several chemists and industrial hygienists who aren't convinced. The triwall boxes looked like regular cardboard. Calling them 'wax-coated' may be technically correct, but you couldn't see or feel it. The plastic bottles originally came packed in cardboard inserts in a wooden crate, so there didn't seem to be much of a reason to think we couldn't put it back in cardboard. We were handling it in a hazardous material facility. We had it stored according to the guidelines in the Consolidated Hazardous Items List. The workers were wearing respirators, so they were aware of the health hazards of the material."

The NAVFAC report points out that workers who handle hazardous materials should know enough to "avoid interaction of chemicals with ordinary combustibles." It recommends "accelerated training."

"As far as CHC goes, the information available to the field wasn't very extensive," Bradley says. "Even if we'd sent our people to all the available classes we aren't sure anyone would have stressed this particular hazard. Classes about transporting and packing hazardous materials are pretty complete, but storage classes aren't. We've done a lot of research and still can't find anything that meets our specific needs here.

"One lesson we learned about training is that if you're going to have good training programs you have to develop your own. We give 3 hours of training to everyone who comes in contact with hazardous materials, more to supervisors. We stress the principles of segregation and separation. We teach them how to recognize both the DOT and NFPA labels. The main point of the training is 'How do you handle a hazardous material?' Often it boils down to simple things like don't mix red labels with yellow labels. But there are hundreds of oxidizers, flammables, and corrosives. Will we teach them every property of every material? There isn't any way to turn a warehouseman into a chemist. We try to teach the basics.

"This fire certainly reminded us that expired or damaged chemicals are more dangerous," he continues. "Deteriorated material demands extra precautions. We're segregating things a little differently now in this warehouse — we store the ready to issue material by itself."

The fire can also serve as a million dollar reminder to the rest of us about the importance and complexity of controlling hazardous materials. Labels must be accurate and visible. Workers must understand what those labels mean and follow the rules to the letter. Routine housekeeping becomes more important — one way to account for the rapid ignition of the CHC fire is by theorizing the triwall box was damp. Boxes and pallets must be handled and moved with greater care. None of these lessons is particularly new or startling.

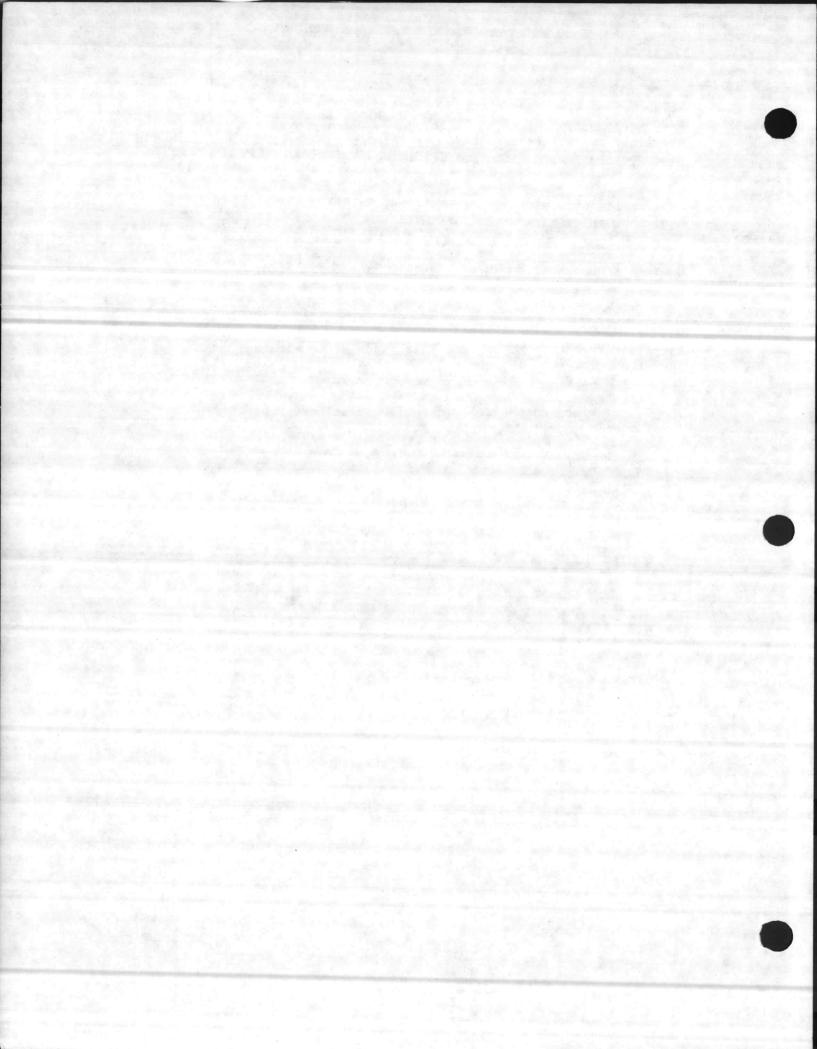
The firewalls installed 4 decades earlier kept this fire from becoming even more serious. The things that cause or prevent similar disasters are never quite as tangible as brick walls. They involve information systems and general awareness and personal habits. "If I stay in this department for 20 years, I hope I never see anything like that again," one firefighter observes. When we become aware of the potential, we're on the way to prevention.

QUIZ: MODULE I - THE HAZARDOUS WASTE PROBLEM

- 1. Which of the following materials is suspected of being a major contributor to the start of the Norfolk Supply Center fire?
 - a. Corrosive materials
 - b. Calcium hypochlorite
 - c. Flammable liquids
 - d. Methyl Ethyl Ketone
- 2. What prevented the spread of the Norfolk fire to other storage areas?
 - a. Firefighter foams
 - b. Sprinkler system
 - c. Favorable winds
 - d. Brick firewalls
- 3. Which of the following is an example of an <u>immediate</u> (acute) health effect caused by the improper handling of hazardous waste?
 - a. Cancer
 - b. Biomagnification
 - c. Burns
 - d. Sterility
- 4. The buildup of a chemical in an animal's body, without it being removed by any means, is an example of:
 - a. Bioaccumulation
 - b. Teratogenicity
 - c. Synergistic effects
 - d. OSHA
- 5. Annual training in hazardous waste management for handlers is required by:
 - a. Occupational Safety and Health Act (OSHA)
 - b. Toxic Substance Control Act (TSCA)
 - c. Clean Water Act (CWA)
 - d. Resource Conservation and Recovery Act (RCRA)
 - e. Superfund

TRUE or FALSE

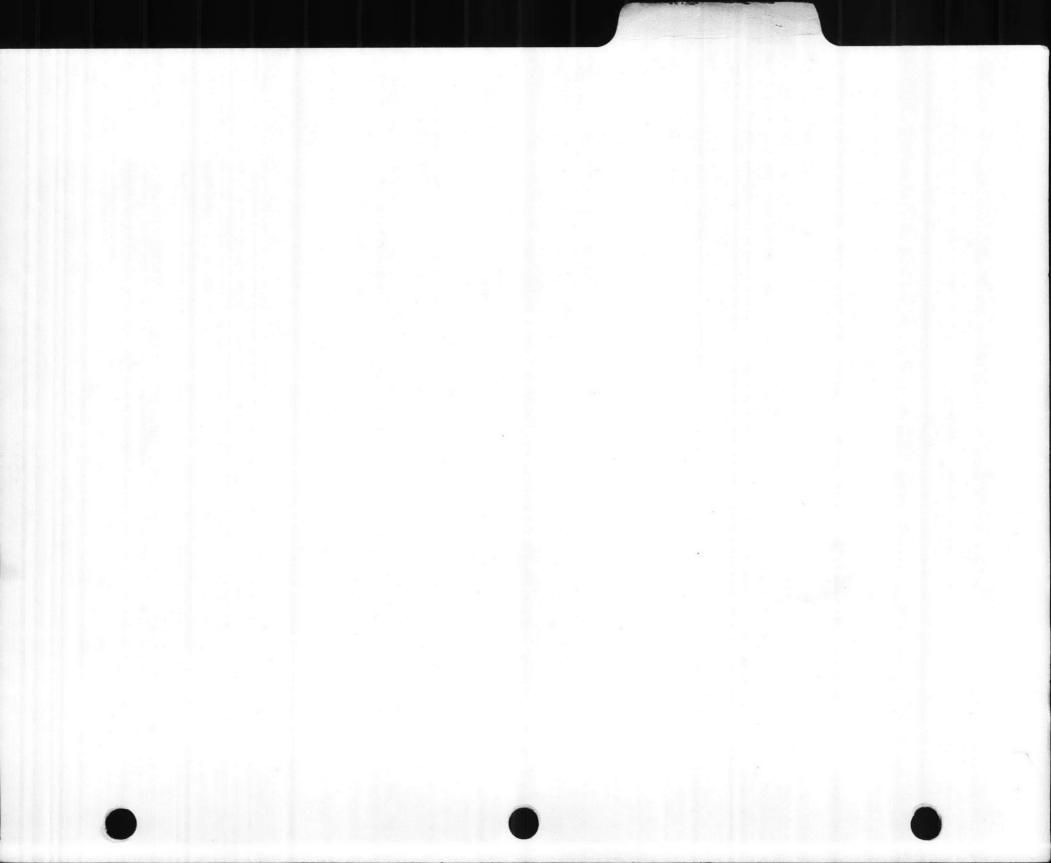
6.	Navy personnel, as federal employees, as exempt from any fines or jail sentences for the mismanagement of hazardous waste.
7.	DOD facilities are exempt from federal, state, and local laws concerning hazardous waste management.
8.	Because groundwater moves very slowly, any impact from hazardous wastes will be minor.
9.	When biomagnification occurs, organism at the top of the food chain have higher concentrations of chemicals than those lower on the chain.
10.	The Navy is less susceptible to public relations problems than private industry.



TAB PLACEMENT HERE

DES	CRIPTION:
	LAWS AND
	REGULATIONS
\boxtimes	Tab page did not contain hand written information
	Γab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



● DLA will take the lead in a coordinated DLA/DoD component effort to determine conforming storage project requirements to support the DLA assigned disposal mission.

ACTION REQUIRED: DoD components will take the following actions:

- The DoD component, to include DLA, who spills a hazardous substance, will continue to fund and accomplish spill cleanup, spill site restoration, and proper identification, packaging, and labeling of spill residue. DLA will program and accomplish the disposal of properly identified, packaged, and labeled spill residues for FY 83 and later years. Where the DoD components can provide a more cost effective spill residue disposal service as part of spill cleanup, the DoD components may obtain necessary funding for such service after coordination with DLA. DLA will provide, upon request, and as disposal service contracts are available, a spill residue disposal service for the remainder of FY 81 and FY 82 with the DoD components to provide necessary funding. (The DEQPPM 80-5 Interservice Task Group will define the operational procedures and parameters.)
- The DoD components will provide DLA with all available information on spill residue service contracts, to include services provided and cost.
- DLA will determine hazardous materials conforming storage requirements to support its assigned disposal mission. DLA will provide a milestone schedule for accomplishment of this task to the Deputy Assistant Secretary of Defense (Energy, Environment and Safety) and the DoD components within 60 days. A milestone date should be included to notify the DoD components of the DoD-wide prioritized list of DLA requirements at each installation. DLA will program to acquire these facilities at the earliest possible date.
- To assist in the preceding DLA effort, the DoD components will, in coordination with DLA, assess the adequacy of present storage capability at each installation to support the DLA hazardous materials disposal mission. The DoD components are to provide estimates to DLA of the projected generation of hazardous materials which will be turned in to DoD for disposal.
- The total requirement for hazardous material conforming storage facilities will be identified for each installation having a DLA hazardous materials disposal facility through a coordinated DLA/DoD component team effort under DLA lead. Where a storage facility is needed at the supporting Defense Property Disposal Office, DLA will program the MILCON or O&M funds required. When a joint use facility will best meet the total DoD requirement for a given installation or geographic region, DLA will work with the DoD component to determine program responsibility for the required MILCON/O&M funds in accordance with the provisions of DoD Directive 7150.5, dated August 26, 1978.

DLA should continue to address installation support problems on a case-by-case basis. The interservice task group that DLA chairs should continue to be used to address issues that may arise in the implementation of DEQPPM 80-5. DLA should surface unresolved issues to the Hazardous Materials Disposal Policy Steering Committee for resolution.

IMPLEMENTATION: The provisions of this DEOPPM are effective on this date, or as indicated in the preceding sections.

2) Marientfal George Marienthal

Deputy Assistant Secretary of Defense (Energy, Environment and Safety)

MODULE II

HAZARDOUS WASTE LAWS, REGULATIONS, AND POLICIES

I. LEARNING OUTCOMES DESIRED.

In this unit of instruction, we will be considering some of the requirements of Federal legislation as related to the handling of hazardous waste and materials. At the completion of this unit, you should:

- A. Have a basic understanding of the various laws and regulations and how they affect your job.
- Be able to perform your duties so that they neither violate laws or regulations nor cause others to violate them.

II. INTRODUCTION

- A. In the past decade or two, Congress has passed much legislation an attempt to manage the growing quantity of toxic and hazardous wastes. The following Federal laws relate to this topic:
 - 1. Clean Water Act (CWA)
 - 2. Toxic Substance Control Act (TSCA)
 - 3. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)
 - 4. Resource Conservation and Recovery Act (RCRA)
- B. In addition to these Federal laws specifically dealing with the management of hazardous wastes, there are two Federal laws which effect Naval personnel when handling hazardous wastes:
 - 1. Occupational Safety and Health Act (OSHA)
 - 2. Hazardous Materials Transportation Act (HMTA)
- C. Congress designed RCRA to be a program operated by the individual states within a federal framework. As a result, many states have established their own hazardous waste programs which have either been approved or are in the process of being approved by the EPA.

For Navy activities located in an approved or "authorized" state, the state program - rather than the EPA's - must be followed.

- D. As a result of this legislation, the Department of Defense (DOD), the Navy, and the Marine Corps have issued the following regulations:
 - Defense Environmental Quality Program Policy Memorandums ((DEQPPM)
 - OPNAVINST 5090.1 Environmental Protection and Natural Resourses Manual (formerly OPNAVINST 6240.3E)
 - 3. MCO P11000.8B Real Property Facilities Manual, Vol. 5

0946D Date of last revision: May 85

The Federal laws provide a framework within which our society will attempt to deal with a very complex and controversial problem. At the activity level, the commanding officer has the responsibility for compliance with these laws and their regulations. The commanding officer designates an environmental coordinator to serve as a focal point to coordinate activity hazardous materal/waste management programs. This coordinator develops a plan (the Hazardous Waste Management Plan) that describes how to handle hazardous wastes to remain in compliance with the laws and regulations.

Those who actually handle hazardous wastes at the activity play a key role in this plan. Their actions, to a large extent, determine the activity's compliance with applicable regulations. The way they handle hazardous wastes affects their own health and the health and environment of the people at the activity.

The hazardous waste handler is in a very important position, one which should be supported and respected by everyone. Handlers need not know the specifics of the Federal laws mentioned above, but a knowledge of the laws' basic requirements can help them do their job.

- B. The hazardous waste problem is complex and controversial for a number of reasons. For example:
 - Our society has grown accustomed to a chemical environment.
 We know that chemicals of various types are very useful and
 desirable. In many cases, however, we lack sufficient
 knowledge and background to make independent decisions on
 the use and disposal of specific chemicals.
 - 2. Economic and political pressures work against change.
 - Disposal methods for toxic and hazardous wastes are not completely satisfactory. For example:
 - (a) Incineration is an effective but expensive disposal method. It may also create air quality problems.
 - (b) Deep-well injection is basically a storage method and it may contaminate groundwater if geology is not considered, or if operation is not properly managed.
 - (c) Chemical landfills--similar to sanitary landfills, except engineered to prevent leachate from leaving disposal site-are expensive and may not entirely prevent leachate from contaminating groundwater. Chemical landfills are being outlawed in many states.
 - (d) Ocean dumping is relatively inexpensive, but may be heavily regulated in the future.
 - (e) Recycling of wastes is an ideal solution but may require expensive redesigning of processes and additional management requirements.

- (f) "Midnight dumping" is very popular, and cheap for the dumper. But it is very expensive for the rest of the society that it poisons.
- 4. Because of the way toxic and hazardous substances are being handled during manufacturing, use, and disposal, people are becoming more and more aware of the possibility of personal exposure. The scientific community is not unified on the effects of toxic and hazardous substances on health and the environment. It is difficult for people to determine which chemicals they may be exposed to, what the health effects may be, the type of personal protective equipment they should use, and how significant their exposure may be.

III. OVERVIEW OF FEDERAL LAWS AND REGULATIONS.

The following laws and their corresponding regulations are the framework for the Naval policy on handling hazardous wastes. The primary law for hazardous waste handling is the Resource Conservation and Recovery Act (RCRA). This section will give an overview of the other applicable laws and then go into detail on RCRA.

A. Occupational Safety and Health Act of 1970 (OSHA)

The Occupational Safety and Health Act (OSHA) (29CFR1910) was passed on 31 December 1970. The primary thrust of OSHA was directed at the private sector employer, however, Section 19 of OSHA directed Federal agencies to establish and maintain comprehensive and effective occupational safety and health programs consistent with standards promulgated under OSHA. The Navy program ensures that a safe and healthful workplace is provided for all personnel and includes: (1) compliance with all applicable standards; and (2) annual inspections of all workplaces by qualified OSH inspectors.

B. Hazardous Materials Transportation Act of 1975 (HMTA)

The Hazardous Materials Transportation Act (HMTA) was originally passed in 1975. Its purpose is to improve the regulation and authority of the Secretary of Transportation to protect the nation adequately against risks to life and property which are inherent in the transportation of hazardous materials in commerce. The Department of Transportation (DOT) was responsible for issuing the HMTA regulations (49CFR171-177). These regulations govern the packaging, the marking, the labeling, and the acceptable conditions of hazardous materials offered for intrastate or interstate transportation. It also covers the actual transportation procedures for motor vehicles, aircraft, railcar or vessels carrying hazardous materials. The Resource Conservation Recovery Act (RCRA) references the HMTA regulations as applicable to hazardous wastes offered for transportation. Therefore, generators of hazardous waste are responsible for complying with the HMTA regulations.

- C. Clean Water Act of 1977 (CWA)
 - 1. The basic objective of this act is to ensure that surface waters remain suitable for human uses. Congress has established some goals in the current legislation. They are:
 - (a) By July 1983, the waters of the United States will be clean to the point that they are "fishable" and "swimmable."
 - (b) By 1985, we will have no discharge of pollutants into the waters of the United States.

At this point, the 1983 goal has not been realized and no one expects the 1985 goal to be met.

- The requirements of the Clean Water Act that apply to toxic/ hazardous materials are:
 - (a) A permit system to provide a mechanism for regulating the pollutants discharged into water from a point source. At first, very few toxic substances were regulated by this mechanism. But then four environmental groups sued EPA for not controlling toxics properly. EPA lost the suit and the court required EPA to regulate 65 families of toxic chemicals by the National Pollutant Discharge Elimination System (NPDES) permits and by other provisions of the law.

The law also required certain Publicly Owned Treatment Works (POTW's or sewage treatment plants) to establish an Industrial Pretreatment Program to control pollutants placed in the sewer system.

(b) Hazardous substances spills.

The act requires the preparation of a National Contingency Plan for the removal of spilled oil and hazardous substances. The EPA has published a list designating "reportable quantities" of hazardous substances when they are spilled in water. The list has over 250 entries and the maximum that may be spilled without reporting varies from one to 5,000 pounds.

D. Toxic Substances Control Act (TSCA)

This law, effective I January 1977, authorized EPA to regulate chemicals used in commerce. The regulation covers manufacture, distribution, use, and disposal of any chemical substance. It was estimated that EPA would have jurisdiction over approximately 50,000 commercial chemicals manufactured or processed in 115,000 establishments in the United States. The following are some of the basic provisions of this legislation.

- 1. EPA was required to publish an inventory of all chemicals produced or processed in the United States, including location and volume. This inventory was published on 1 June 1979 and contained approximately 50,000 entries.
- EPA must be informed by a premanufacture notification 90 days before a new chemical is introduced into commerce. A new chemical is defined as any chemical not included in the inventory.

- 3. Manufacturers and processors may be required to do additional testing if more information is required about a new chemical.
- 4. Manufacturers and processors are required to maintain records concerning adverse health or environmental effects of their chemicals.
- 5. EPA has the responsibility to control or eliminate polychlorinated biphenyls (PCBs). EPA is now in the process of accomplishing the latter task.

E. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980-The Superfund

The purpose of this act is to assign liability, and provide compensation, cleanup, and emergency response for hazardous substances released into the environment and for the cleanup of inactive hazardous waste disposal sites. Although CERCLA funds are not available to Federal facilities, this law does affect the way those facilities operate, especially in the area of hazardous substance spills. The act requires a revision of the national contingency plan which was originally required by the Clean Water Act. The following new terms may result in new requirements in the national contingency plan:

1. Release.

Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injection, escaping, leaching, dumping, or disposing into the environment. This excludes workplace exposure, release of various nuclear materials, and normal application of fertilizers.

Environment.

The navigable waters, waters of the contiguous zone, some ocean waters, other surface waters, ground waters, drinking water supply, land surface, subsurface strata, or the ambient air, within the United States, or under the jurisdiction of the United States.

3. Listed Hazardous Substance.

Any substance designated under sections 307 (A) and 311 (B)(2)(A) of the Clean Water Act, section 112 of the Clean Air Act, and section 7 of the Toxic Substances Control Act, and RCRA Hazardous Wastes.

4. Facility.

- (a) Any building, structure, installation, equipment, pipe or pipeline, well, pit, pond, lagoon, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft.
- (b) Any site or area where a hazardous substance has been deposited, stored, disposed of or placed, or otherwise come to be located. This does not include any consumer product.

5. A Reportable Spill.

Any release (other than a federally permitted release) into the environment of a listed hazardous substance in quantities equal to or greater than listed quantities.

IV. RESOURCE CONSERVATION AND RECOVERY ACT (RCRA).

A. Overview of the Act.

RCRA is the law that has the most impact on how people handle hazardous waste (HW). Under subtitle "C" of RCRA, Congress gave EPA the job of developing and implementing a national plan to control hazardous waste. In February and May 1980, EPA published the first of its HW regulations in the Federal Register. The basic purpose of these regulations is to protect human health and the environment from improperly managed HW. Participants in the system include waste generators, waste transporters, and the owners and operators of waste treatment, storage, and disposal facilities.

B. Overview of the Regulations.

- 1. Hazardous Waste Identification.
 - (a) A waste is any material which has served its original purpose. This includes materials intended for reuse, recycling, and recovery even if sold for this purpose.
 - (b) Solid wastes are solid, liquid, semisolid, or contained gaseous materials, except:
 - Domestic sewage or mixtures of domestic sewage and other wastes going to a publicly owned treatment works (POTW).
 - Point source discharges subject to section 402 of the Clean Water Act.
 - Irrigation return flows.
 - Material subject to the Atomic Energy Act.
 - Mining materials not removed from the ground as part of the extraction process.
 - (c) Hazardous Wastes that are not excluded are defined as solid wastes which:
 - Exhibit the characteristics of ignitability, corrosivity, reactivity, or EP toxicity (contain certain listed contaminants after water-acid extraction); or
 - Are a listed waste or contain a listed waste (EPA listed approximately 400 chemicals and 85 process wastes in the regulations).
 - In addition, a waste may be declared hazardous by applying knowledge of the materials or the processes used.

- 2. Hazardous Waste generators are required to:
 - (a) Have notified EPA that they generate HW, by 18 August 1980. All generators who notified EPA received an EPA identification number.
 - (b) Determine if wastes are HWs.
 - (c) Prepare HW shipments for transport in accordance with EPA Department of Transportation (DOT) shipping regulations. Requirements for labeling and marking waste containers, and providing placards for transport vehicles are included in the regulations. Wastes stored temporarily (less than 90 days) outside of permitted storage facilities, must be placed in DOT shipping containers, or in storage tanks meeting storage facility requirements. The container must also be marked with the starting date of accumulation of waste. (NOTE: Personnel training, emergency equipment, and contingency plan requirements are the same for temporary storage as for permitted storage facilities.)
 - d) Prepare manifests meeting EPA minimum requirements for HW destined for off-installation treatment, storage, or disposal (TSD) facilities. The receiving facility and the transporter must be designated on the manifest, and the generator must ensure that both the transporter and the receiving facility have EPA identification numbers and are properly permitted to receive the wastes being shipped. Manifest requirements apply to shipments of HW from one location to another wherever public highways or right-of-ways are used.
 - (e) Prepare and submit an biennial report of HW shipped off-site. This biennial report was required by the Federal authorities on March 1, 1984 and will be required again in 1986. Maintain records of HW analyses, copies of manifests, and exception reports (reports to EPA of failures to receive signed manifests from the designated TSD facility within 45 days).
- 3. Requirements for Transporters of Hazardous Waste
 - (a) An EPA ID number must be obtained. The transporter becomes responsible for spill cleanup and for delivery of the entire quantity of HW to the designated TSD facility upon signing the manifest. Responsibility is transferred to the TSD facility only when the manifest is dated and signed by the authorized representative of the TSD facility.

- (b) In the event of a discharge of HW, the transporter must take immediate action to protect human health and the environment (for example, notify Federal, state, and local authorities, and take action as required or approved by these authorities).
- 4. Requirements for Owners/Operators of HW TSD Facilities.
 - (a) Standards applicable to TSD facilities will be published in several phases. The first phase included interim status standards (40 CFR 265), effective until TSD facility permits are issued. It also includes some of the standards which will be included in the TSD facility permits, required under 40 CFR 264. Additional Part 264 standards will be published as they are developed for specific wastes and industries.
 - (b) Compliance with Federal standards does not override the requirement to comply with applicable state and local regulations. States will be awarded primacy for HW control upon demonstration to EPA that the state program is equivalent to the Federal program.
 - (c) Under the interim status standards, the following actions were required by 19 November 1980:
 - Put into effect a written waste analysis plan for detailed chemical and physical analysis of each waste sufficient to allow for proper treatment, storage and/or disposal of the waste. The TSD facility operator may require that this data be submitted by the generator, but the operator must be prepared to verify the data when necessary.
 - Follow a written schedule for inspecting all monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment (such as dikes and sump pumps) important in preventing, detecting, or responding to environmental or human health hazards.
 - Develop contingency plans. Existing contingency plans may require minor modifications.
 - Develop written closure plans to identify the steps necessary to completely close the facility at any point during its intended life and at the end of its intended life. This requirement also applies to TSD facilities which are closed rather than upgraded to meet HW facility permit requirements. Plans must be submitted to EPA for approval not later than 180 days before the expected start of closure activities.

- Initiate operating records which describe wastes received for treatement, storage or disposal, waste location, dates of operation, results of analyses, emergency incident reports, and inspection and monitoring reports.
- Upgrade personnel records for personnel handling HW to include job title, job description, training requirements, and training received. All personnel must complete training requirements (either in the classroom or on the job) in routine and emergency HW management operations not later than mid-May 1981. New personnel hired after 19 November 1980 must complete training prior to working unsupervised with HW.
- Upgrade security in order to prevent the unknowing entry, and minimize the possibility for the unauthorized entry, of persons or livestock onto the active protions of the facility. This requirement may be satisfied if the facility of plant where the active portion of the TSD facility is located has its own surveillance system, or a barrier, and means to control entry.
- Provide emergency response facilities and equipment to ensure that employees have immediate access to internal alarm or communication systems, and that adequate emergency control equipment and water supplies are available.
- Ensure that uncovered tanks have at least two feet of freeboard, and for continuous waste feed operations, install waste feed cutoff or bypass mechanisms. Impoundments require at least two feet of freeboard and protective covers, such as grass, shale, or rock, to minimize wind and water erosion and to preserve their structural integrity.
- Submit Part A of the RCRA permit for HW facilities. Information required includes a topographic map extending at least one mile beyond property boundaries and showing facility outlines, locations of HW TSD facilities, springs, rivers, and other surface water bodies. Additionally, descriptions, and quantities of HW; and photographs and drawings of the facilities are required.
- Submit a Part B application which includes hydrogeological surveys, detailed operating plans, and other site specific plans. This application will in effect become the basis of the facility's RCRA permit.

- (d) Submit a biennial (or annual, in most states) report of HW activities. This report will include quantities and types of wastes received and processed, whether the HW was treated, stored and/or disposed and groundwater monitoring data. Groundwater monitoring applies only to those facilities that treat, store, or dispose of hazardous waste in surface impoundments, waste piles, land treatment units, or landfills.
- (e) The following actions were required of disposal operations by November 1981:
 - Install, operate, and maintain a groundwater monitoring system of at least four wells, one upgradient, for determining the facility's impact on the quality of groundwater in the uppermost acquifer underlying the facility. Separate monitoring systems for each waste management component of a facility are not required, provided that provisions for sampling upgradient and downgradient water quality will detect any discharge from the waste management area.
 - Develop and implement a groundwater sampling and analysis plan to include quarterly background sampling for one year. Continue reduced sampling frequencies after the first year.
 - Prepare an outline of a groundwater quality assessment program which would identify pollutant concentrations and the rate and extent of contaminant migration. Upon discovery and confirmation of significant increases of indicator parameters over background levels, EPA must be notified within seven days.
 - Upgrade landfills to provide for run-on diversion, run-off collection, and wind control. Place waste piles on an impermeable base and treat as if they were landfills, or provide protection from precipitation and run-on, and cease disposal of liquids and wastes containing free liquids in the pile.
- (f) RCRA includes management restrictions for HW containers, tanks, land treatment, incinerators, and other facilities. Special restrictions are established for management of ignitable and reactive HW.
 - Containers must be located at least 15 meters (50 feet) from the facility's property line.
 - Wastes may not be placed in tanks, surface impoundments, land treatment, landfills, or treatment facilities unless the waste is treated before or immediately after placement so the resulting material no longer meets the definition of ignitable or reactive waste. Waste may be deposited in a tank or surface impoundment in an emergency.

C. State Hazardous Waste Management Programs

EPA established criteria for the authorization of states to administer their own hazardous waste management program in 40 CFR 271. For a state to receive authorization, their hazardous waste (HW) management program must be at least as stringent as the Federal program. However, states may establish a program which is more stringent than the Federal program. The states are in various stages of authorization. Their status may change weekly. To obtain the current status, call:

Resource Conservation and Recovery Act (RCRA) Hotline 800-424-9346

or

Hazardous Material Technical Center (HMTC) Hotline 800-638-8958

A state may have Phase I, IIA, IIB, IIC of Interim Authorization or Final Authorization. The following authority corresponds to the specified phases.

Interim Authorization - State permitted to administer portions of the HW programs while working to establish the laws and regulations needed to administer the entire program.

- Phase I authority includes the identification and listing of HW's, the regulation of generators and transporters, the preliminary standards for HW Treatment, storage, and disposal facilities.
- Phase IIA authority to administer permits for HW Tanks and container storage units.
 - Phase IIB authority to administer permits for HW incinerators.
- Phase IIC authority to administer permits for landfills, land treatment units, waste piles, and surface impoundments.

Final Authorization - authority to manage the entire HW program in lieu of the EPA.

D. Uniform Hazardous Waste Manifest

The RCRA regulation requires generators who transport or offer for transportation, hazardous wastes for off-site treatment, storage or disposal to prepare a manifest which must accompany the waste.

EPA and the Department of Transportation (DOT) have issued regulations (49 FR 10490) implementing a Uniform Hazardous Waste Manifest. Figure II-1 is a copy of Uniform Hazardous Waste Manifest form. Table II-1 is instructions on how to fill it out. The forms provide space for states requiring additional information. The manifest forms will in most cases be distributed by the individual states. If there is no state-printed form, the manifest may be reproduced by generators for their own use. EPA will not be printing and distributing copies of this uniform manifest form.

Waste generators should be aware that EPA has established the following hierarchy for the utilization of the state modified uniform manifest.

- The generator must use the manifest issued by the state receiving the waste.
- If there is no state modified manifest required by the state of destination, then the modified form of the state from which the waste originates must be used.
- If neither the state of destination nor the state of origin requires the use of a state modified uniform manifest, then the basic EPA uniform manifest must be used.

As required by the Hazardous and Solid Waste Amendments of 1984, generators will be required to certify that they have reduced the volume of their waste to the maximum degree economically practical after 8 September 1985.

E. Applicability to Naval Activities

- The activity commander is the HW generator, transporter, and owner of TSD facilities. Individual facility managers are operators (i.e., PWC, NARF, DPDO, ETC.).
- 2. By 19 August 1980, HW generators, transporters, and owner/operators of TSD facilities were to have applied for an EPA identification number and to have notified EPA of HW activities. After 19 November 1980, it is illegal to contract for removal of HW, to transport HW off the installation, or to operate HW TSD facilities, until an ID number is obtained.
- 3. Small quantity generator exception. Activities generating less than 1,000 kg/month of HW, or accumulating less than a total of 1,000 kg of HW, or generating less than 1 kg of a listed HW, or accumulating less than 100 kg of any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, may qualify as a small quantity generator. Small quantity generators are subject to the HW regulations only in that they must determine if the waste is a HW, as specified in the RCRA regulations, and treat or dispose of the HW in a properly permitted on-site facility or ensure delivery to a properly permitted off-site facility. Wastes from tenant organizations must be included in installation totals.

"The Hazardous and Solid Waste Amendments" of 1984 require small quantity generators to use the Uniform National Manifest starting 05 Aug 85 and the EPA to promulgate additional standards for generators who produce more than 100 kg/month but less than 1,000 kg/month by 1986.

4. HW sludges and listed HW which are intended for use, reuse, recycling, or reclamation are subject to the HW regulations, only in that they must be transported and stored as HW prior to their use. Other HW intended for use, reuse, recycling, or reclamation are not subject to the HW regulations; however, EPA intends to establish some controls in future regulations.

UNIFORM HAZARDOUS WASTE MANIFEST	Generator's US EPA ID No.	Document No.	2. Page	2. Page 1 Information in the shaded a is not required by Fed law.		ne shaded area ed by Feder	
3. Generator's Name and Mailing Add	ess		A.Stat	e Manifest	Document	Number	
			B. Stat	e Generator	s ID		
4. Generator's Phone ()							
5. Transporter 1 Company Name	6. US EPA II	6. US EPA ID Number		C.State Transporter's ID D.Transporter's Phone			
7. Transporter 2 Company Name	8. US EPA II	D Number					
	1			E.State Transporter's ID F.Transporter's Phone			
9. Designated Facility Name and Site	Address 10. US EPA II	D Number		e Facility's			
			H.Faci	lity's Phone	eridetis Politik		
11. US DOT Description (Including Proper	Shipping Name, Hazard Class, and ID N		1	13. Total	14. Unit	I. Waste No	
		No.	Туре	Quantity	Wt Vol	AASSIS NO	
						- 1	
					1		
		A 100 BL. 1 A					
			1.1		1 1		
J. Additional Descriptions for Materials	Listed Above		K.Hen	dling Codes fo	or Wastes	Card/Asse	
			K.Hen	dling Codes fo	or Wastes		
			K.Hen	dling Codes fi	or Wastes		
5. Special Handling Instructions and A	dditional Information breby declare that the contents of this contents of the	and are in all rest	lly and ac	curately desc	ribed		
Special Handling Instructions and A GENERATOR'S CERTIFICATION: I he above by proper shipping name and are transport by highway according to applie	dditional Information breby declare that the contents of this contents of the	and are in all rest	lly and ac	curately desc	cribed on for	Date	
Special Handling Instructions and A GENERATOR'S CERTIFICATION: The above by proper shipping name and are of the second	dditional Information breby declare that the contents of this contents of the	and are in all rest	lly and ac	curately desc	cribed on for	Date	
Special Handling Instructions and A GENERATOR'S CERTIFICATION: I he above by proper shipping name and are transport by highway according to applie Printed/Typed Name	oreby declare that the contents of this conclassified, packed, marked, and labeled, a cable international and national governs	and are in all rest	lly and ac	curately desc	cribed on for	Date	
Special Handling Instructions and A GENERATOR'S CERTIFICATION: I he above by proper shipping name and are transport by highway according to applie Printed/Typed Name	oreby declare that the contents of this conclassified, packed, marked, and labeled, a cable international and national governs	and are in all rest	lly and ac	curately desc	cribed on for	Date fonth Day	
Special Handling Instructions and A GENERATOR'S CERTIFICATION: The above by proper shipping name and are of transport by highway according to applie Printed/Typed Name 7. Transporter 1 Acknowledgement of Printed/Typed Name	oreby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of Materials Signature Signa	and are in all rest	lly and ac	curately desc	cribed on for	Date fonth Day	
Special Handling Instructions and All GENERATOR'S CERTIFICATION: The above by proper shipping name and are transport by highway according to applie Printed/Typed Name 7. Transporter 1 Acknowledgement of Printed/Typed Name 8. Transporter 2 Acknowledgement or	oreby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of Materials Signature Signa	and are in all rest	lly and ac	curately desc	cribed on for	Date fonth Day	
Special Handling Instructions and A GENERATOR'S CERTIFICATION: The above by proper shipping name and are of transport by highway according to applie Printed/Typed Name 7. Transporter 1 Acknowledgement of Printed/Typed Name	oreby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of Materials Signature Signa	and are in all rest	lly and ac	curately desc	eribed on for	Date fonth Day	
6. GENERATOR'S CERTIFICATION: The above by proper shipping name and are transport by highway according to applie Printed/Typed Name 17. Transporter 1 Acknowledgement of Printed/Typed Name 8. Transporter 2 Acknowledgement or Printed/Typed Name	dditional Information breby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of Materials Signature Signat	and are in all rest	lly and ac	curately desc	eribed on for	Date fonth Day) Date fonth Day)	
15. Special Handling Instructions and A 16. GENERATOR'S CERTIFICATION: The above by proper shipping name and are a transport by highway according to applic Printed/Typed Name 17. Transporter 1 Acknowledgement of Printed/Typed Name 18. Transporter 2 Acknowledgement or Printed/Typed Name 19. Discrepancy Indication Space	dditional Information preby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of this conclassified, packed, marked, and labeled, cable international and national governments of this conclusion. Signature Signature	and are in all respondence in all respondence in all regulation	illy and accepts in p ns.	curately descroper condition	eribed on for	Date fonth Day) Date fonth Day)	
16. GENERATOR'S CERTIFICATION: The above by proper shipping name and are transport by highway according to applie Printed/Typed Name 17. Transporter 1 Acknowledgement of Printed/Typed Name 18. Transporter 2 Acknowledgement or Printed/Typed Name 19. Discrepancy Indication Space	dditional Information preby declare that the contents of this conclassified, packed, marked, and labeled, cable international and national governments of this conclassified, packed, marked, and labeled, cable international and national governments of this conclusion. Signature Signature	and are in all respondence in all respondence in all regulation	illy and accepts in p ns.	curately descroper condition	eribed on for	Date fonth Day) Date fonth Day)	

EPA Form 8700-22 (3-84)

BILLING CODE 6560-50-C

Preparing the Uniform Waste Manifest

On March 20, 1984, EPA and DOT published the Uniform Hazardous Waste Manifest (UHWM), a ruling which supercedes all State manifesting requirements (See *HMTC UPDATE*, Vol.3, No.3, p.3). Numerous State manifests will now be replaced by this one standard form (see illustration).

To assist the individuals responsible for the completion of the UHWM, this Technical Bulletin will highlight the Federally-required information that must be provided for all shipments of hazardous waste. Generators and transporters of hazardous materials and also owners or operators of hazardous waste treatment, storage, and disposal facilities are required to provide the following information on the UHWM:

Item 1. Generator's U.S. EPA ID Number—Manifest Document Number

Enter the generator's U.S. EPA twelve-digit ID number and the unique five-digit number assigned to the manifest by the generator.

Item 2. Page Numbers

Enter the total number of pages used to complete the manifest.

Item 3. Generator's Name and Mailing Address Self-explanatory.

Item 4. Generator's Phone Number
Use the Generator's emergency phone number here.

Item 5. Transporter 1 Company Name Self-explanatory.

Item 6. U.S. EPA ID Number

Enter the EPA ID Number of the first transporter identified in Item 5.

Item 7. Transporter 2 Company Name

If applicable, enter the company name of the second transporter who will transport the waste.

Item 8. U.S. EPA ID Number

Enter EPA ID Number of second transporter.

Item 9. Designated Facility Name and Site Address
Enter the company name and site address of the facility
designated to receive the waste listed on the manifest.

Item 10. U.S. EPA ID Number

Enter the EPA ID Number of the designated facility in Item 9.

Item 11. U.S. DOT Description [including proper Shipping Name, Hazard Class, and ID Number (UN/NA)]

Enter the DOT Proper Shipping Name, Hazard Class, and ID Number (UN/NA) for each waste as identified in 49 CFR 171 through 177. (A continuation sheet is available if more space is required for the DOT description and related information in Item 11.)

Item 12. Containers (Number and Type)

Enter the number of containers for each waste and the appropriate abbreviation from the following table:

DM = Metal drums, barrels, kegs DW = Wooden drums, barrels, kegs

DF = Fiberboard or plastic drums, barrels, kegs

TP = Tanks portable

TT = Cargo tanks (tank trucks)

TC = Tank cars

DT = Dump truck

CY = Cylinders

CM = Metal boxes, cartons, cases (including roll-offs)

CW = Wooden boxes, cartons, cases

CF = Fiber or plastic boxes, cartons, cases

BA = Burlap, cloth, paper or plastic bags

Item 13. Total Quantity

Enter the total quantity of waste described on each line.

Item 14. Unit (Weight/Volume)

Enter the appropriate abbreviation from the following table:

G = gallons (liquids only)

P = pounds

T = tons (2000 lbs)

Y = cubic yards

L = liters (liquids only)

K = kilograms

M = metric tons (1000 kg)

N = cubic meters

Item 15. Special Handling Instructions and Additional Information

Generators may use this space to indicate special transportation, treatment, storage, or disposal information or bill-of-lading information.

Item 16. Generator's Certification

The generator must read, sign, and date the certification statement on the manifest.

Item 17. Transporter 1 Acknowledgment of Receipt of Materials

Enter the name of the person accepting the waste on behalf of the first transporter.

Item 18. Transporter 2 Acknowledgment of Receipt of Materials

If applicable, enter the name of the person accepting the waste on behalf of the second transporter.

Item 19. Discrepancy Indication Space

The authorized representative of the designated facility owner must note in this space any significant discrepancy between the waste described on the manifest and the waste actually received at the facility.

Item 20. Facility Owner or Operator: Certification of Receipt of Hazardous Materials Covered by this Manifest Except as Noted in Item 19.

Print or type the name of the person accepting the waste on behalf of the owner or operator of the facility.

Items A-K are not required by Federal regulations for intra- or interstate transportation. However several States will require generators and owners or operators of treatment, storage, or disposal facilities to complete some or all of items A-K as part of State manifest reporting requirements.

Some 20 States are modifying the Uniform Hazardous Waste Manifest form for shipments destined to their State. In modifying the form, States may not seek new information but may add items such as special handling instructions, copy distribution instructions, and emergency telephone numbers.

Of the States that plan to issue their own forms, most plan to provide the forms free of charge, but some States, such as Arkansas, are charging for the form. EPA's Caroïyn Barley stated at a recent seminar that Federal enforcement actions cannot be taken against a transporter for failure to fill in the State-added portions of the manifest form.

States requiring the use of a State-modified UHWM form are:

Alabama
Arkansas
Connecticut
Delaware
Georgia
Illinois
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota

New Hampshire New Jersey New York Oklahoma Pennsylvania Puerto Rico Rhode Island South Carolina Texas Vermont Wisconsin Obtaining the proper form follows an acquisition hierarchy:

1st- Consignment State. This is the State that will be accepting the hazardous waste. Obtain the form from this State whenever possible.

2nd-Generator State. This is the State generating the hazardous waste.

3rd- Any Other Source. This can be any local, State, or Federal agency involved in hazardous waste management.

After September 20, 1984, all States, regardless of previous manifest requirements or interim status, are required to implement the UHWM form as their own. Any personnel involved with the shipment of hazardous wastes should obtain a copy of the Federal Register (49 FR 10490) detailing the regulations concerning the UHWM.

- V. DEPARTMENT OF DEFENSE (DOD) REGULATIONS.
 - A. The DOD Consolidated Hazardous Material/Hazardous Waste Disposal Guidance of June 1981

The DOD Consolidated Hazardous Material/Hazardous Waste Disposal Guidance of June 1981 clarifies the operational instructions for implementation of DOD Hazardous Material/Hazardous Waste (HM/HW) disposal guidance for all DOD levels is included as Appendix II-A.

- 1. This document summarizes guidance found in:
 - (a) Defense Environmental Quality Program Policy Memorandum (DEOPPM) 80-5. DEOPPM 80-5 states the DOD hazardous material disposal policy, which is to dispose of hazardous materials in an environmentally acceptable manner. It designates the Defense Logistic Agency (DLA) as the responsible agency within DOD for the worldwide disposal of all hazardous material (except for those categories of materials specifically designated for DOD component disposal). DEOPPM 80-5 also defines "Hazardous Material":

Material is hazardous when, because of its quantity, concentration, or physical, chemical, or infectious characteristics, it may: (a) cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

(b) DEOPPM 80-8. This memorandum provides policy guidance on DOD implementation of the hazardous waste management regulations of RCRA. DOD policy is:

To limit the generation of hazardous waste through alternative procurement practices; to reuse, reclaim or recycle resources where practical; to dispose of hazardous waste in an environmentally acceptable manner according to the disposal policy established in DEOPPM 80-5; and to implement EPA and/or state hazardous waste management regulations.

(c) DEOPPM 80-9. This memorandum provides guidance on the proper handling, storage, and disposal of PCBs. This policy includes:

Full compliance with EPA regulations on handling, storage, marking, and disposal of PCBs and PCB items; inventory all PCBs and PCB items in their accountability; establish

inspection procedures for PCB transformers and other PCB equipment in storage; construct, as necessary, storage areas for PCBs and PCB items that are awaiting disposal; and develop and implement a program to educate appropriate personnel on the hazards of PCBs.

- 2. In addition to the DEQPPMs explained above, there are two more that apply to hazardous waste management.
 - (a) DEQPPM 81-3. This memorandum provides guidance on hazardous substance spill residue cleanup. The DOD component will fund and accomplish the hazardous substance spill residue cleanup, spill site restoration, and proper identification, packaging and labeling of spill residue; DLA will program and accomplish the disposal of properly identified, packaged, and labeled spill residues for FY83 and later years. This document is provided as Appendix B to this chapter.
 - (b) DEQPPM 81-5. This memorandum addresses the Installation Restoration (IR) program which identifies and evaluates past DOD hazardous waste disposal sites to determine any potential problem sites. It also provides the means to control the migration of contaminants.

VI. NAVAL REGULATIONS

A. Navy Regulations.

The Navy's environmental policy is set forth in OPNAVINST 5090.1 (formerly 6240.3E) which is the Environmental Protection and Natural Resources Manual. This manual promulgates Navy policy, identifies requirements and guidelines, and assigns responsibilities within the Navy for implementing a Navy-wide program for the protection of the environment, conservation of natural resources, and the preservation of cultural and historic resources.

The most important part of that instruction for hazardous waste handlers is Chapter 11, "Hazardous Materials Environmental Management Ashore." This Chapter identifies requirements and responsibilities applicable to the prevention and control of pollution from hazardous materials, including hazardous waste at Navy shore facilities. It is divided into three sections:

- 1. Hazardous Materials and Hazardous Waste Management
- 2. Inactive Hazardous Substance Disposal Sites
- 3. PCBs

The OPNAVINST section on hazardous materials and waste management gives guidance on generation, transportation, storage, treatment, and disposal operations. It discusses how Federal laws apply to Navy activities and lists specific requirements. It also mentions the DLA role in hazardous substance disposal, the Navy's hazardous waste responsibilities as assigned by DOD, and the responsibilities of different Navy commands. The requirement for submission of the Annual HW Report by Naval facilities is set forth in OPNAVINST 5090.1.

B. Marine Corps Regulations.

Environmental policy for Marine Corps Activities is set forth in MCO P11000.8B, The Real Property Facility Manual. The Marine Corps policy is essentially the same as the Navy policy outlined in OPNAVINST 5090.1

C. Application of Regulations to Navy Ships.

OPNAVINST 5090.1, the Environmental Protection and Natural Resources Manual, defines the Navy ships responsibilities as follows:

1. In instances where Navy ships transfer EHM or HW ashore, responsibility for proper management is transferred to the receiving facility. Prior to transfer ashore, hazardous waste shall be properly segregated, containerized, and labeled in accordance with the Shipboard HM/HW Management Plan and Navy Ships Technical Manual (NSTM), Chapter 593. Failure to do so may result in a charge for the cost to the fleet of laboratory analyses to identify the HW. When visiting Navy ports, Navy vessels shall request HW pickup by the cognizant shore activity representative (usually the Public Works Office/Center). Person-to-person contact is required during the actual transfer of the HW to the shore activity. Ships force are to complete DD Form 1348-1 at the time of HW transfer.

When visiting non-Navy ports and foreign ports, Navy vessels shall offload HW whenever it is necessary and feasible. The ship shall identify in the LOGREQ the HW to be offloaded. If unable to find adequate facilities at non-Navy ports, the ship must hold HW for offloading at a Navy port. All HW must be properly labeled and containerized.

Navy vessels may not discharge hazardous substances in harmful quantities into or upon navigable waters of the United States, adjoining shorelines, or into or upon waters of the contiguous zone (12 nm from shore). Details concerning such hazardous materials and their respective harmful quantities are provided in NSTM Chapter 593.

- 3. Navy vessels operating in the territorial seas (up to 12 nm) of foreign countries shall abide by discharge regulations specified in the applicable Status of Forces Agreement (SOFA), as defined in Chapter 1. If no SOFA exists, vessels shall operate consistent with the substantive discharge standards observed by the host country's military forces, until a satisfactory arrangement on the subject can be effected. Unless otherwise provided in a SOFA, Navy vessels operating temporarily within a foreign jurisdiction are subject to that country's standards to the extent specified by the clearance for visit. Where the discharge standards for a foreign country are undefined, no hazardous material shall be discharged within 12 nm of land.
- 4. Navy vessels may discharge ship-generated hazardous substances beyond the above-mentioned areas only in accordance with the guidelines provided in NSTM Chapter 593.

D. Application of Regulations to Activities in Foreign Countries.

Navy activities in foreign countries are not, in general, subject to specific requirements that are based on U.S. laws and regulations. Nevertheless, HM, including HW, must be properly managed to assure protection of human health and the environment.

The Commanding Officers of Navy Activities in foreign countries are responsible for:

- Designating an activity focal point to coordinate activity HW management programs.
- Surveying the activity's HM and developing a HW management plan. The plan shall be designed and implemented, at a minimum, to comply with environmental standards of general applicability in the host country or jurisdiction, and go beyond such regulations as necessary to ensure reasonable protection of the environment and human health in the handling and disposal of HW. Where host country regulations do not adequately define/list HW, the list in 40 CFR 261 shall be used as a basis. The activity HW management plan shall be reviewed by the cognizant NAVFAC EFD prior to finalization.

VII. SUMMARY

There are a great many laws, regulations, and policies concerning hazardous materials and hazardous wastes. Hazardous wastes are now tracked from "cradle to grave" and enforcement agencies and the public closely monitor all activities in this field. While handlers may not be directly involved in preparing manifests, developing reports, or completing other management tasks, their activities are linked to these legal requirements. Therefore, they should be concerned how their activities may affect another individual's ability to comply. Even though the activity commander is responsible for compliance, the handler can be prosecuted in cases of willful negligence.

An error or problem anywhere in the hazardous wastes system can create administrative and management problems all along the line. Thus, handlers must remember that they are part of a large, legally required management program and that the performance of their jobs may have a major effect on the ability of their activity to comply with laws and regulations.

Appendix A

CONSOLIDATED HAZARDOUS MATERIAL/HAZARDOUS WASTE DISPOSAL GUIDANCE JUNE 1981

I. Purpose:

This publication consolidates and further clarifies the operational instructions for implementation of DOD Hazardous Material/Hazardous Waste (HM/HW) disposal guidance and is for use at all DOD levels. This guidance is effective until further superseded, amended, or included in DOD 4160.21-M.

II. References:

- A. "Defense Environmental Quality Program Policy Memorandum" (DEQPPM 80-5) subject: Department of Defense Hazardous Material Disposal Policy, dated 13 May 80. This memorandum provides DOD policy guidance relative to disposal mission assignment and related responsibilities for hazardous materials.
- B. "Defense Environmental Quality Program Policy Memorandum" (DEQPPM 80-8) subject: RCRA Hazardous Waste Management Regulations, dated 21 Oct 80. This memorandum publishes policy guidance to implement within the Department of Defense the hazardous waste management regulations of the Resource Conservation and Recovery Act (RCRA).
- C. "Defense Environmental Quality Program Policy Memorandum" (DEQPPM 80-9) subject: Department of Defense (DOD) Management of Polychlorinated Biphenyls (PCBs) and PCB items, dated 10 Nov 80. This memorandum provides additional DOD guidance on the proper handling, storage, and disposal of the hazardous chemical PCB and PCB items.
 - D. This publication supersedes the messages listed in IX. A-N below.
- E. Definitions and abbreviations applicable to the contents of this publication are provided in X below.

III. Responsibilities:

A. DLA/DPDS

- 1. DLA has been designated by DEQPPM 80-5 (ref A) as the responsible agency within DOD for the worldwide disposal of all hazardous materials except those categories listed in paragraph III.B below.
- 2. DLA has delegated operational responsibilities for this expanded mission to DPDS.

- B. The DOD components are responsible for disposal of the following categories of property:
- 1. "Toxicological, biological, radiological, and lethal chemical warfare materials which, by U.S. law, must be destroyed. Disposal of the by-products of such material is the responsibility of the DOD component with assistance from DLA."
- 2. "Material which cannot be disposed of in its present form due to military regulations, e.g., consecrated religious items and cryptographic material." This category would include those instances where military regulations require the obliteration of all markings that could relate an excess material to its operational program. Once the appropriate actions are taken to meet the military regulation, the resulting material could then be turned in to the servicing DPDO.
- 3. "Municipal type garbage, trash, and refuse resulting from residential, institutional, commercial, agricultural, and community activities, which the facilities engineer or public works office routinely collects."
- 4. "Contractor generated materials which are the contractor's responsibility for disposal under the terms of the contract."
- 5. "Sludges resulting from municipal type wastewater treatment facilities."
- 6. "Sludges and residues generated as a result of industrial plant processes or operations." The services are responsible for disposal of sludges and residues resulting from industrial waste treatment facilities or for co-mingled materials resulting from industrial plant facilities which are accumulated into co-mingled storage for disposition in lieu of processing through industrial waste treatment facilities. DPDO's will accept all other segregated generations of material from industrial plant processes or operations where the basic ingredients and contaminants are identified.
- 7. "Refuse and other discarded materials which result from mining, dredging, construction, and demolition operations."
- 8. "Unique wastes and residues of a non-recurring nature which research and development programs generate."
- IV. DEQPPM 80-5 is being implemented in three phases:
 - A. Phase one (Turn-in procedures as of 1 November 1980).
- 1. The DPDO will accept the turn-in of all hazardous materials except for those categories outlined in paragraph III.B above. The reutilization, transfer, donation, or sales potential of property is not criteria for acceptance by the DPDO. If the DPDO has the proper facilities, he will take physical custody along with accountability; if proper facilities are not available to the DPDO, then he will take accountability but not physical custody. Proper facilities will be determined based on the guidelines provided in paragraph VI.A below.

- 2. Turn-in requirements are outlined in paragraph V below.
- B. Phase two (existing service contracts).
- 1. As of FY82, DPDS will assume responsibility for existing DOD component service contracts for disposal of material assigned to DPDS.
- 2. This material includes such things as the material routinely generated by an activity, but because of condition or physical characteristics or other factors, is being disposed of by existing DOD component service contracts since it was previously determined that the DPDO should not assume those responsibilities at that time.
- C. Phase three (new service contracts). Pending complete implementation of phase two, in those cases where hazardous wastes are accumulated and the DOD component has no existing service contract, the turn-in activity will work with the servicing DPDO to assure timely removal. In most instances, arrangements can be made for the turn-in installation to provide contractual support utilizing DLA funds.

V. Turn-In Requirements:

A. Identification

- 1. Property must be identified by NSN, LSN, or FSC. Noun name is required with NSN. LSNs and FSCs must include complete description including manufacturer's part number, if applicable.
 - 2. Amount and type of contaminant must be identified.
- 3. Laboratory analysis is not required for turn-in of anything other than PCBs (see paragraph VIII.A). However, adequate information must be provided to permit valid identification of material and any contaminants being turned in. This information is required to preclude more costly identification measures and to insure prompt and environmentally acceptable disposal of hazardous material.

B. Packaging

- 1. Property turned in to the DPDO must be in containers that are non-leaking and safe-to-handle. The containers must be able to withstand normal handling or the turn-in will be rejected.
- 2. DOT specified containers are required for accumulation, storage, and movement of pre-determined hazardous wastes as listed in XI. A-H below. These wastes may also be accumulated in bulk in RCRA permitted facilities.
- 3. DOT specified containers are not required for turn-in to the DPDO of anything other than the predetermined hazardous wastes. The transporting agency does have a responsibility to comply with DOT requirements for transport over public highways.

- C. Labeling
- Property should be labeled in conformance with established criteria.
 - 2. PCB marking requirements are specified in paragraph VIII.A.3.
 - D. Disposal Turn-In Document (DTID)
- 1. All property turned in to the DPDO will be done so with a properly prepared DTID. Standard procedures for preparation of a DTID are found in paragraph 5-5 of DOD 4160.17M, MILSTRIP.
- 2. The DTID will be modified/changed to satisfy internal DOD auditing requirements and shipping manifests as required by the EPA or State as follows:
- a. Block A "Shipped From": add telephone number and EPA identification number. Installations qualifying as RCRA defined "small generators" will enter "small generator exclusion" in lieu of the EPA identification number.
- b. Block B "Ship To": add telephone number and EPA identification number.
- c. Block C "Mark For": (normally left blank): insert HM (if turn-in is hazardous material) or HW (if turn-in is predetermined hazardous waste, as identified in Appendix C).
- d. Block U "Freight Classification Nomenclature": add six character (two alpha, four numeric) identification number as shown in 49 CFR, Part 172.
- e. Block Y Use this block (in lieu of Blocks AA through EE) for the deposit account number. Note: This is not an entry required on behalf of hazardous material/waste documentation but a movement of data prescribed to permit use of the previously identified blocks for other purposes.
- f. Blocks AA and BB Use these two blocks for the transporter's name and EPA identification number.
- g. Block CC Have transporter (identified in Blocks AA and BB) sign and date for shipment received.
- h. Blocks DD, EE, FF and GG Insert the following statement in these blocks (note: Rubber stamp, typewritten or machine produced copy required): "This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of DOT and EPA". The turn-in activity will sign under the certification statement as the generator to comply with RCRA.

- 3. It is stressed that the information outlined in V.D.2 d, f, g, and h above is required only when transporting predetermined hazardous wastes (Appendix C) over public highways to a servicing DPDO. Other management actions taken to implement RCRA are described in paragraph VII.
- 4. Block 8 The DPDO will sign and enter date. The signed copy of the DTID will serve as a valid receipt of both accountability and responsibility of the hazardous material or predetermined waste by the DPDO. For shipments within DOD (whether on the same installation or between installations) the turn-in activity's responsibility terminates upon receipt of the signed copy of the DTID which serves as the internal manifest between the generator and the servicing DPDO IAW DEOPPM 80-8 guidance.

VI. Physical Custody

- A. Physical custody of hazardous materials/hazardous waste will be accepted if the DPDO has the proper facilities.
- 1. If the DPDO possesses conforming storage, the DPDO will accept physical custody at the time it accepts accountability.
- 2. If the DPDO does not possess conforming storage, and the generating activity has conforming storage in support of mission requirements, the generating activity will retain physical custody, and DPDO will accept accountability.
- 3. In those instances where neither DLA nor the generating activity possesses conforming storage, the activity with the "most nearly" conforming storage will accept or retain physical custody and the DPDO will accept accountability.
- 4. DLA will be responsible for the long term programming for conforming storage in support of its disposal mission.
- B. Close coordination between the DPDO and host installations is required concerning physical receipt of hazardous property at the DPDO. Any unresolved issues will be expressed in writing through normal command channels.
- C. DOD conforming storage. DLA/DPDS and the DOD components are working together to identify the conforming storage requirements for the disposal mission.
- 1. DLA/DPDS will expedite determination of DPDO hazardous materials/hazardous waste storage requirements.
- 2. Each installation's total requirements for hazardous material/waste storage facilities will be jointly identified, and the most efficient means of providing such facilities will be determined through a coordinated DOD component/DLA team effort.
- 3. The DOD components will be requested to provide inputs and assistance for this effort in the near future.

VII. Implementation of RCRA:

A. Permits

- 1. The installation commander is reponsible to insure compliance with all RCRA requirements for the installation. The installation commander is also responsible to notify, to apply for permits, and to report to EPA or the State, as required, for all installation activities, including tenants.
- 2. The individual facility operational managers are accountable for conducting their activities in accordance with RCRA. Those facilities' managers, including tenants, will provide necessary documentation to the installation commander for permit applications, will provide to the installation commander reports required by EPA or the State, and will ensure compliance with RCRA regulations and permit requirements at the facility.
- 3. All reports to EPA or the State will be co-signed by the installation commander and facility operator or their designated official. The installation commander will sign as the owner and the facility manager (DPDO Chief) will sign as the operator.

B. Hazardous Waste Management Plan

- 1. Installation commander is responsible for developing and implementing a hazardous waste management plan to include all tenants on the installation. This plan shall identify and implement hazardous waste management actions required by RCRA.
- 2. All tenants will comply with applicable portions of the hazardous waste management plan and insure internal operational procedures are consistent.
- 3. The DPDO will insure inspections, safety precautions and actions, records, etc., as established in the installations hazardous waste management plan, are accomplished for hazardous waste for which he has accountability.
- 4. Required support or assistance that is available at the host installation will be provided to the DPDO upon request. When the costs warrant, reimbursement may be required.

C. Manifesting

- 1. The procedures for manifesting from a turn-in activity to a DPDO are outlined in paragraph IV.D.2.
- 2. DPDS is responsible, IAW DEQPPM 80-8, for advising DOD components as to which of the "used" hazardous materials, for which DLA has been assigned disposal responsibility, are to be controlled as a hazardous waste. DPDS has published a list of predetermined wastes as Appendix C. These predetermined wastes are required to be managed as a hazardous waste upon generation. Only the property on this list, or subsequently identified by DPDS, is to be turned in to the DPDO identified as a hazardous waste, i.e., HW (paragraph V.D.2.c).

D. Recordkeeping and Reporting (Reserved)

VIII. Specific Item Turn-In Procedures:

- A. Polychlorinated Biphenyls (PCB). DPDS is responsible for disposal of PCB fluids and materials contaminated with PCBs. The following turn-in requirements apply.
- 1. Properly identified as containing PCBs. A scientifically reliable analysis (DPDS prefers gas chromatograph) will accompany the DTID unless the property has a manufacturer's label or nameplate that indicates the presence of PCBs, e.g. generic or commercial name. The analysis will indicate the amount of PCB in parts per million (ppm) or in the following ranges:
 - a. Less than 50 ppm
 - b. 50-499 ppm
 - c. 500 ppm or more

Individual analysis is required for each item. DPDS may accept batch testing results on a case-by-case basis. However, approval for batch testing will be obtained from DPDS prior to turn-in.

- 2. Properly containerized. The property must be enclosed, non-leaking, and safe to handle. The DTID will be prepared in accordance with paragraph V.D above.
- 3. The property must be marked as prescribed by the EPA in 40 CFR 761.44. Items containing 50 ppm or more PCB must be marked, with the exception of transformers. Only PCB transformers, i.e. 500 ppm or more PCB, must be marked.
- B. Asbestos. Friable asbestos will be packaged in accordance with Federal standards prior to being turned in to the DPDO.
 - C. Empty Containers (reserved paragraph).

- IX. Instructions Superseded
- A. DPDS-LPE message DTG P061751Z Jun 80, subject: Data Call for DEQPPM 80-5
- B. DPDS-LPE message DTG P132052Z Jun 80, subject: Interim Guidelines on Expanded Mission
- C. DPDS-LPE message DTG P161917Z Jul 80, subject: Implementation of DoD Hazardous Material Disposal Policy
- D. DPDS-LPE message DTG P051415Z Sep 80, subject: Transformer Testing Policy Change
- E. DPDS-LPE message DTG R101213Z Sep 80, subject: Clarification of Testing Requirements for Turn-Ins Under DEQPPM No. 80-5
- F. DPDS-LPE message DTG R191835Z Sep 80, subject: Hazardous Materials Disposal Procedures (Termination of Interim Turn-In)
- G. DPDS-LPE message DTG P292040Z Sep 80, subject: Hazardous Materials Disposal Procedures (Delays Implementation of 80-5)
- H. DPDS-LPE message DTG P201820Z Oct 80, subject: Hazardous Materials Disposal Procedures (Describes phased implementation)
- I. DPDS-LPE message DTG P281400Z Oct 80, subject: Implementation Procedures for RCRA
- J. DPDS-LPE message DTG R061300Z Nov 80, subject: Modification of Disposal Turn-In Document (DTID) (DD Form 1348-1) to Accommodate RCRA Manifest Requirements
- K. DPDS-LPE message DTG R152029Z Dec 80, subject: Modification of Disposal Turn-In Document (DTID) (DD Form 1348-1) to Accommodate RCRA Manifest Requirements
- L. DPDS-LPE message DTG R151545Z Dec 80, subject: RCRA Hazardous Waste Identification List
- M. DLA-SME message DTG 022000Z Jan 81, subject: Hazardous Material/Waste Storage Sites
- N. DLA-SME message DTG R241300Z Feb, subject: Implementation of DEQPPM 80-5, 80-8, and 80-9

X. Abbreviations and Definitions:

The following is a list of abbreviations and definitions applicable to the contents of this publication.

A. Abbreviations

- 1. DLA Defense Logistics Agency
- 2. DOT Department of Transportation
- 3. DPDO Defense Property Disposal Office
- 4. DPDR Defense Property Disposal Regions
- 5. DPDS Defense Property Disposal Service
- 6. DTID Disposal Turn-In Document
- 7. EPA Environmental Protection Agency
- 8. PCB Polychlorinated Biphenyls
- 9. RCRA Resource Conservation and Recovery Act

B. Definitions

1. Conforming Storage - a facility or location which conforms to regulations of the Environmental Protection Agency and other regulatory authorities governing the storage of hazardous materials.

2. Container

- a. Any portable device in which a material is stored, transported, disposed of, or otherwise handled. For purposes of these procedures, the definition is expanded as follows: any container which is normally turned in to the DPDO for disposal including any container whose last content was a hazardous or an acutely-hazardous substance.
- b. Containers that have held hazardous or non-hazardous materials are considered "empty" (for turn-in purposes) if the container contains no more than 2.5 centimeters (one inch) of residue on the bottom after all materials have been removed from the container that can be removed using the practices commonly employed to remove material from that type of container.
- c. Hazardous and acutely hazardous are defined by federal, state, and local laws and regulations.
- 3. <u>DOD Components</u> the Military departments and all defense agencies, except disposal operating entities of DLA (DPDS, DPDR, and DPDOs).
- 4. Generating Activity an organization or element authorized to turn-in property to the Defense Property Disposal Service.

5. Hazardous Material

- a. A material, because of its quantity, concentration, or physical, chemical, or infectious characterixtics, may:
- (1) cause, or significantly contribute to, an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or
- (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.
- b. For the purposes of this publication, hazardous materials do not include those radioactive materials that the Nuclear Regulatory Commission controls. Licensees shall be responsible for the disposal of those materials per 10 CFR 20.
 - c. Hazardous material includes personal property consisting of:
- (1) Items All unused, used, or contaminated property of combinations of property, (unused, used, mixed, or contaminated) which can be identified by a national stock number, manufacturer's part number, military specification number, or locally purchased property with a locally applied stock number. Also, that property which by military regulation requires application of a local stock number prior to disposal.
- (2) Scrap Used or unused property which has no value except for basic material content.
- (3) Waste Used or unused property, residues, by-products, sludges, and other materials, which have no known utility and must, therefore, be discarded.

XI. List of Predetermined Hazardous Wastes

- A. F001 The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1, 1, 1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons.
- B. F002 The following spent halogenated solvents: tetrachloroethylene, methylene, chloride, trichloroethylene, 1, 1, 1-trichloroethane, chlorobenzene, 1, 1, 2-trichloro-1, 2, 2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane.
- C. F003 The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol.
- D. F004 The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene.

- E. F005 The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, and pyridine.
- F. F007 Spent cyanide plating bath solutions from electroplating operations (except for precious metals electroplating spent cyanide plating bath solutions*).
- G. F009 Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (except for precious metals electroplating spent stripping and cleaning bath solutions*).
- ${\rm H.}~{\rm F015}$ Spent cyanide bath solutions from mineral metals recovery operations.

*These solutions and sludges are turned in for processing under the Precious Metals Recovery program and should be turned in as HM.

Appendix B

DEQPPM 81-3



AND LOGISTICS

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

1 5 JUN 1981

DEFENSE ENVIRONMENTAL QUALITY PROGRAM POLICY MEMORANDUM (DEQPPM) 81-3

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (IL&FM)

ASSISTANT SECRETARY OF THE NAVY (S&L)

ASSISTANT SECRETARY OF THE AIR FORCE (MRA&I)

ASSISTANT SECRETARY OF THE AIR FORCE (RD&L)

DIRECTORS OF DEFENSE AGENCIES

SUBJECT: Department of Defense (DoD) Hazardous Material Disposal Policy

PURPOSE: This is to provide additional DoD policy guidance on the disposal of hazardous materials. This memorandum supplements policy published in DEQPPM 80-5, "Department of Defense Material Disposal Policy," of May 13, 1980; DEQPPM 80-8, "RCRA Hazardous Waste Management Regulations," of October 21, 1980; and DEQPPM 80-9, "Department of Defense (DoD) Management of Polychlorinated Biphenyls (PCBs) and PCB Items," of November 10, 1980.

BACKGROUND: On May 13, 1980, DEQPPM 80-5 was published to provide DoD policy on the disposal of hazardous materials. That policy designates the Defense Logistics Agency (DLA) as responsible for the disposal of all hazardous materials except those that specifically remain the other DoD components' responsibilities. On October 21, 1980, DEQPPM 80-8 was published to provide DoD policy on the implementation of the hazardous waste management provisions of the Resource Conservation and Recovery Act (RCRA) of 1976. Finally, on November 10, 1980, DEQPPM 80-9 was published to provide additional DoD guidance on the proper handling, storage, and disposal of polychlorinated biphenyls (PCBs) and PCB items.

On March 12, 1981, DLA Headquarters and the Defense Property Disposal Service (DPDS) briefed the Hazardous Materials Disposal Policy Steering Committee and Working Committee on their progress to implement DEQPPM 80-5, DEQPPM 80-8, and DEQPPM 80-9. The actions, responsibilities, and assignments which follow were identified at that briefing.

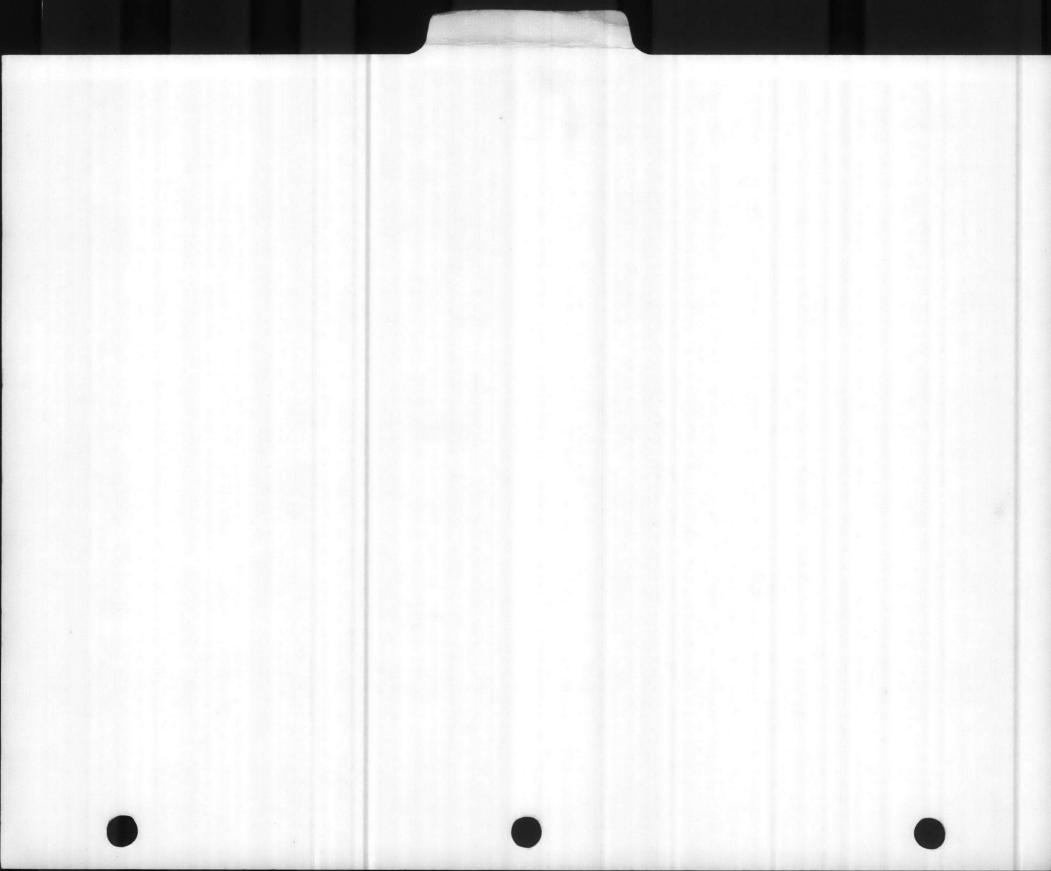
POLICY: The DoD policies are:

DoD components, to include DLA, who spill a hazardous substance will fund and accomplish the hazardous substance spill residue cleanup, spill site restoration, and proper identification, packaging and labeling of spill residue. DLA should program for disposal of residues which are properly identified, packaged, and labeled for spills which occur in fiscal year 1983 and later years.

TAB PLACEMENT HERE

DE	SCRIPTION:
	HEALTH AND
	ENVERONMENTAL EFFECTS
	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



CHAPTER III

HEALTH AND ENVIRONMENTAL EFFECTS

LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Identify the potential harm, to both the environment and human health, from exposure to certain hazardous wastes.
- B. Recognize and avoid potential health hazards when dealing with hazardous wastes.
- C. Understand the consequences of environmental damage.

II. INTRODUCTION

Determining the effects of hazardous substances on the environment is often a difficult task because of the diversity and complexity of the environment. However, we often find that the environmental effects caused by the improper management of hazardous wastes are extremely detrimental because of natures's interrelationships. Acute health effects may be easier to observe. People who work directly with hazardous substances may become involved with both environmental and health problems. Problems can result from spills and fires which can provide a direct path for the hazardous substance to enter the environment.

Handling hazardous wastes can provide many opportunities for direct exposure to the handler. Depending on the type of waste and amount of exposure, the handler could experience either severe immediate problems or problems that appear years later. The prudent thing to remember when handling chemicals of any type is to eliminate any and all unnecessary exposure. No matter how toxic a substance is, it will cause no harm to either people or the environment if there is no exposure to that substance. Proper respect for hazardous substances, which leads to proper handling, storage and disposal, can prevent exposure. Again, no exposure, no problem.

III. TOXICITY

This term generally refers to substances which cause damage to the structure or function of the body once they enter it. In order to ensure the safety of persons handling toxic and hazardous substances, all means of exposure to these substances must be protected against and minimized.

- A. Toxicity can be subdivided on the basis of duration of exposure:
 - Acute exposure refers to short-term exposure of seconds, minutes, or hours.

1011D Date of last revision: Jun 84

- 2. Subacute exposure refers to exposure between acute and chronic, duration up to about 90-days.
- 3. Chronic exposure is of long duration. It refers to prolonged or repeated exposure to substances which are inhaled or absorbed into the body.
- B. The following information provides some insight into the manner by which harmful substances may enter the body. These routes of entry are: inhalation, skin absorption, ingestion, and eye contact.
 - 1. Inhalation The respiratory system has the largest amount of surface area (35m²) available to come in contact with external contaminates. Breathing a gas, vapor, mist, fumes or dust (chemicals may be trapped on particles) is the most common form of accidental exposure. Inhalation affects the linings of the air passages of the nose, throat, and lungs, and usually results in an irritation and may cause burns. There may also be absorption of the chemical from the lungs to the bloodstream. The blood then distributes the chemical throughout the body tissue and can cause cancer, emphysema, and asphyxiation.
 - 2. Skin Absorption The skin has a surface area of 2m² and is easily exposed. Skin exposure to hazardous substances may result in skin irritation or penetration. The most common skin irritation is dermatitis (chronic swelling, redness, itching of the skin) in which the chemicals do not enter the blood. Some chemicals have the capacity to penetrate the unbroken skin and are picked up by the bloodstream and distributed throughout the body, for example: carbon tetrachloride, chlordane, and PCBs. Sharp objects contaminated with harmful chemicals may pierce the skin, injecting the substance through the skin into the body. Skin penetration is probably the second most common accidental means of entry of chemicals into the body.
 - 3. Ingestion Toxic amounts of hazardous wastes can be carried to the mouth by hand when drinking, eating, smoking, chewing on pencils, or chewing on eyeglasses. If the food we eat or the liquids we drink are contaminated with hazardous substances, they may enter the bloodstream along with the digested food.
 - 4. Eye Contact The eye may be harmed by chemicals in solid, liquid or vapor form. Irritant effects vary in degree from mild to severe. Most chemicals have the ability to injure the eye to some degree through surface contact or absorption, and damage may be irreversible within a matter of seconds.

IV. HEALTH EFFECTS.

A primary concern is whether or not the chemicals a worker is exposed to in the workplace causes the workers health to be damaged. Science is often years behind in determining health effects. Thus, it is important to take care when dealing with hazardous substances even if there is no currently identified health effect.

Under conditions of identical exposure to potentially harmful substances, there is often marked variability in the manner in which individuals respond. These responses may range from the discomfort of an itch to violent attacks of asthma or swelling of membranes, thereby closing off breathing passages

Some toxic substances are retained in the body for long periods of time and are excreted very slowly, if at all. The levels of the chemical in the body are increased as a function of duration of exposure. Examples of chemicals which the body retains include such heavy metals as mercury and lead. Upon repeated or continuous exposure, these substances can reach levels resulting in illness or even death. Bodily process changes associated with long-term subacute exposure are often irreparable.

Previous damage or injury to such key organs as the liver, kidney, lungs, and brain can change the way exposure to toxic substances affect individuals. The liver and kidney function to screen and scavenge many toxic substances from general circulation and to excrete them from the body. Impairment of these functions allow potentially dangerous buildups to occur and may lead to further damage to these vital organs. Similarly, previous lung damage enhances the likelihood of further damage from inhaled toxic substances and may reduce the effectiveness of the lungs as a route of excretion. Extreme care should be taken when working around hazardous wastes if you have had an injury or illness involving any vital organ.

Most Probable Health and

V. HEALTH AND ENVIRONMENTAL EFFECTS ASSOCIATED WITH THE DEPARTMENT OF TRANSPORTATION (DOT) HAZARD CLASSES

Environmental Effects DOT Hazard Class Explosives Physical damage Toxicity Compressed gases Explosions and fires Damage from rocketing cylinders BLEVE Flammable liquid Fire Explosion Toxicity Fire Flammable solid Combustible liquid Fire Toxicity Severe fire hazard Organic Peroxides Severe damage to tissue Fire Oxidizing material (Makes fires more difficult to extinguish) Severe damage to tissue

DOT Hazard Class

Poisons

Irritating material

Corrosive material

Etiologic agents

Radioactive material

Most Probable Health and Environmental Effects

Toxicity

Irritation

Severe damage to tissue

Disease

High levels: Radiation

burns and death

Low levels: Possible contributor to cancer, birth defects, genetic

mutations

Other regulated material

ORM-A (toxics not included in other hazard class-pesticides)

ORM-E (includes many hazardous wastes, PCBs, various pesticides) Toxicity

Toxicity

VI. LONG-RANGE IMPACTS.

Over the past few years, the public has been told that some of the chemicals and forms of radiation that they are exposed to in the workplace and in the general environment may cause such health problems as cancer, birth defects, genetic mutations, and sterility. As a result, there is public interest in how organizations manage these types of substances. There is also a growing concern by the people in the work force about the substances they are directly exposed to. Many people believe that, if they are exposed to a substance which will cause them harm they will be aware of it immediately. Many of the accidents which happen to people follow this format. However, in the case of carcinogens and mutagens, there may be as much as a decade or two between exposure and the time when the individual develops the symptoms. This time lag makes it extremely difficult to determine a cause—and—effect relationship.

A. Carcinogens--defined as substances which cause the development of a malignant tumor in man or experimental animals some time after exposure. Even though cancer's causes are not well understood, it is widely believed that environmental and workplace exposure can contribute to it. An example of a long-term carcinogen is circular tested smoking which has been shown to cause lung cancer but usually years after a person begins smoking.

- B. Mutagens. The term mutagen generally refers to a chemical or form of radiation that causes changes in the genetic structure of cells. Mutagens are chemicals or forms of radiation which increase the frequency of mutations. In man, there are two general areas of concern:
 - 1. Reproductive cells (egg and sperm cells). If a mutation occurs in a reproductive cell, then the genetic information possessed by the parents will not be accurately passed along. The new individual would either not survive, or would develop using this inaccurate genetic information. Human disorders such as hemophilia and mongolism are well-known examples of genetic mutations.
 - 2. Body cells. If a mutation occurs in body cells, future generations are not jeopardized. The results of reproduction of body cells are new body cells. For example, certain skin cells produce new skin cells. The mutation in a skin cell would result in future skin cells being abnormal. This may manifest itself as a cancer.
 - (a) Scientists disagree as to whether chemicals cause mutations in people. But, it is clear that chemical mutagens cause genetic changes in human tissue cultures in the same way they cause genetic changes in experimental microorganism.
 - (b) There is also a relationship between carcinogens and mutagens. Carcinogens are a type of mutagens, but not all mutagens are carcinogens.
- C. Teratogen. A substance which causes a developing fetus, which has been exposed, to be deformed. This happens without harming the mother. The result is the birth of a deformed child. Some of the best known examples of this type of problem are the thalidomide and mercury problems in England.
- D. Biological magnification. Persistent hazardous chemicals remain in the environment for long periods of time. These chemicals may be absorbed into the tissue of various organisms and be passed along in the food chain. The introduction of a small quantity of some hazardous chemical into a lower level of the food chain can cause significant harm due to biomagnification. This process occurs when chemicals bioaccumulate in low level organisms. When biomagnification occurs, a higher concentration of the chemical is found in an animal at the top of the food chain then was present in the organism lower on the chain. The human food chain is involved just as any other.

Almost everyone has heard of PCBs, the substance used in some electrical transformers and other electrical equipment. PCBs accumulate in the food chain as described above and have been found in the fat tissue of practically all humans tested. Since the regulation of PCB, studies have shown a definite decrease in the PCBs found in humans.

E. Resistance to the effects of chemicals.

- 1. One of the reasons chemicals have not been completely successful in the fight against insect pests is the tremendous reproductive powers of insects coupled with a mechanism which allows for the development of resistance. If a lethal dose of an insecticide is administered to an entire insect population, most will die. However, a few individuals will survive because they have a natural ability to render the insecticide harmless. This natural ability very likely has its basis in the surviving insects' genetic characteristics. These surviving insects reestablish a population resistant to the pesticide. Pest controllers then respond by applying more pesticides. This time, a larger percentage of the population possesses the genetic characteristics allowing them to survive the effects of the pesticide, so less of them die. More pesticide is then applied. Eventually, the entire population will be completely immune to the effects of this specific chemical. The common housefly is a good example of this mechanism in operation. There are populations of the housefly which are now immune to the three most frequently used groups of chemical pesticides.
- The resistance mechanism is observed in other applications. In the area of medicine, various baceteria which cause disease in humans are now resistant to some drugs used to control them. This requires the production of new drugs.
- 3. Resistance to the effects of chemicals can be either a negative result or a positive result. For example, the common housefly's resistance to pesticides is negative to humans trying to rid areas of flys but positive to the fly population. Human resistance to chemicals would be a positive result of contaminating a population, however, the price to pay for this resistancy is too high to be practical.
- F. Synergistic effects. Determining the health and environmental effects of a chemical can be very challenging. An organism in today's environment is not exposed to just one chemical foreign to its metobalism but to hundreds or perhaps thousands. There are three possible results.
 - 1. The effects of some of the potentially harmful chemicals may be <u>lessened</u> by the action of other chemicals in the mixture.
 - 2. The individual effects of each chemical may be felt.
 - 3. The effects of some chemicals may be <u>magnified</u> by the action of other chemicals. The first and last examples are described as synergistic effects—effects that are greater or less than the effects expected from the sum of the individual effects. This is an extremely complex area. Only a few synergistic effects have been studied. Examples include cigarette smoking and asbestos workers; cigarette smoking and alcohol drinking.

VII. ECOLOGY

Ecology is the study of the interrelationships of organisms to one another and to the environment.

- A. To understand ecology—and the present dilemma that man has created for himself—one must first understand the concept of "ecosystem." An ecosystem is the total of all the living and nonliving parts that support a chain of life within a given area. The four primary links in the chain are:
 - Nonliving matter: the sunlight, water, oxygen, carbon dioxide, and other nutrients used by plants for their growth.
 - 2. Plants: ranging in size from the microscopic plants that live in water (algae) up to the giant redwood trees. These organisms convert carbon dioxide and water, in a process called photosynthesis, into carbohydrates (food molecules) required by themselves and other organisms in the ecosystem.
 - 3. Consumers: those higher organism that feed on the producers. Herbivores, such as cows and sheep, are primary consumers. Carnivores, such as man and animals which feed upon the herbivores and are secondary consumers.
 - 4. Decomposers: these tiny creatures, such as bacteria, fungi, and insects—close the circle of the ecosystem when they break down the dead producers and consumers and return their chemical compounds to the ecosystem for reuse by the plants.
- B. Although growth and decay are going on simultaneously and continuously in an ecosystem, they tend to balance each other over the long run and thus the chain is said to be in equilibrium.

 Non-human environments have a remarkable resiliency; as many as 25 or even 50 percent of a certain fish or rodent population might be lost in a habitat during a plague or disaster, yet the species will recover its strength within a year or two. It is man-made interference, or pollution, that can deeply disturb the ecosystem and its equilibrium.

VIII. SUGGESTED REFERENCE MATERIAL

The health effects of a hazardous susbstance can be found in a number of references. The following is a listing of some of these references.

A. Material Safety Data Sheets (MSDS).

MSDSs are technical bulletins, generally two to four pages in length, which contain chemical information, such as chemical composition, chemical and physical characteristics, health and safety hazards, and precautions for safe handling and use. An example of a MSDS format is shown in Appendix A.

The MSDS was chosen by the Occupational Safety and Health Act (OSHA) to be the primary vehicle for providing specific, detailed information on the identities and hazards of the hazardous chemicals in a workplace. OSHA requires a MSDS for every hazardous chemical identified in the workplace. The MSDSs must be stored in a place accessible to the actual work area where employees may freely read or copy them.

Normally, MSDSs are completed by the manufacturer of the hazardous substance and provided to naval activities when the substance is procured through the supply system. If a chemical is being used in a workplace and the activity does not have the MSDS, there are many places to obtain a copy. The following list is some of the ways to obtain MSDSs.

- 1. Call the following:
- Activity fire department
- Activity Safety Officer
- Activity Environmental Coordinator
- Engineering Field Divisions (NAVFACENGCOM)
- Naval Energy and Environmental
- Support Activity, Port Hueneme, CA
 Hazardous Material Technical Center
 (HMTC)
- Substance Manufacturer
- Navy Environmental Health Center Norfolk, VA

2. Check:

- Hazardous Material Information System (HMIS) See Section B.
- Various microfiche and computer listings of MSDSs

B. The DOD Hazardous Material Information System (HMIS).

The DOD HMIS is a central system for the collection, maintenance, and dissemination of the data contained in the Material Safety Data Sheets and other sources of information. The information in the system can be used to help develop procedures to prevent mishaps in handling, storage, use, transportation, and disposal of hazardous material and waste. This system provides a mechanism by which information on hazardous materials can be collected, stored, updated, and made available to users in the field. Materials are listed according to their National Stock Number (NSN). Field personnel have access to the information through micofiche, usually located in Safety Offices at naval activities.

The Navy Energy and Environmental Support Activity (NAVENENVSA) has multiple sets of the HMIS microfiche.

Activities can attend a HMIS training course sponsored by the Navy Environmental and Preventive Medicine Units in Norfolk, VA, San Diego, CA, or Pearl Harbor, HI. Contact NAVENENVSA or the Navy Environmental Health Center in Norfolk, VA, for more information regarding this class.

C. NIOSH/OSHA Pocket Guide to Chemical Hazards.

This guide contains information on 380 hazardous chemicals including chemical names, formulas, synonyms, permissible exposure limits, chemical and physical properties, respiratory and personal protective equipment use recommendations, symptoms of overexposure, monitoring procedures, and procedures for emergency treatment.

This information is presented in tabular form containing many abbreviations. The definitions of these abbreviations are found in one of five tables in the front pages of the guide. This guide should be used as a quick reference for summary information on the various chemicals. Appendix B shows a typical entry for a given chemical.

- D. Dangerous Properties of Industrial Materials, 5th Edition, N. Irving Sax, Van Nostrand Reinhold Company. 1979. This book is designed for quick retrieval of hazard information on about 13,000 common industrial and laboratory materials. The majority of the book is a section which contains information on specific chemicals. The data is this section is categorized as follows:
 - General information such as synonyms, description, formula, and the physical properties of the substance.
 - Hazard analyses including a toxic hazard rating; a fire hazard rating; an explosion hazard rating; and a disaster hazard rating, to give an idea of the hazards produced when the material becomes involved in disasters such as fire, explosion or flood.

3. Countermeasures, or the things to be done to reduce the adverse effects of using a given material. For example, shipping regulations, storage and handling procedures, first aid measures, firefighting measures, ventilation controls, and personnel protection.

The brief section on each chemical in this part of the book usually refers back to a previous section for further explanation. For example, under Nitric Acid, Countermeasures—Storage and Handling, the reader is referred back to Section 7. This section goes into detail on what to do when storing or handling Nitric Acid. Appendix C demonstrates this.

E. The Merck Index, 9th Edition, Merck and Co., Inc., Rahway, NJ. This reference book is an encyclopedia of 9856 chemicals, drugs, and biological substances. Information on the chemical structure, properties, use, and toxicity of these substances is provided. This reference also contains miscellaneous information tables. Appendix D shows a typical entry for a given chemical.



Fisher Scientific Company

Chemical Manufacturing Division
P. O. Box 375, 1 Reagent Lane
Fair Lawn, NJ 07410

SECTION I. IDEN	TIFICATION OF PRODUCT	
CHEMICAL NAME Toluene	FORMULA C ₆ H ₅ CH ₃	
SYNONYM OR CROSS REFERENCE Methylbenzene		
SECTION II. HAZ	ARDOUS INGREDIENTS	
MATERIAL Toluene	NATURE OF HAZARD Flammable	
SECTION I	III. PHYSICAL DATA	
OILING POINT 110°C	MELTING POINT -95°C	
(APOR PRESSURE(mm Hg) 21.86	SPECIFIC GRAVITY 0.868	
(APOR DENSITY (AIR = 1)	PERCENT VOLATILE BY VOLUME (%	100%
VATER SOLUBILITY	EVAPORATION RATE	: 4 . t = 1 4.00 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
0.05% APPEARANCE Clear, Colorless liquid	(ether = 1)	greater than 1
	Note that the second se	
The Property of the Control of the C	D EXPLOSION HAZARD DATA	
LASH POINT (method used) •F) 40°F	FLAMMABLE LIMITS	Uel Lei
IRE EXTINGUISHING MEDIA	ical, alcohol foam	
PECIAL FIRE-FIGHTING PROCEDURES	And the National States of the	
NUSUAL FIRE AND EXPLOSION HAZARD		
SECTION V.	HEALTH HAZARD	
HRESHOLD LIMIT VALUE 375mg/M ³ as per	ACGIH 1983-84	
EALTH HAZARDS Vapors harmful. Avoi	id prolonged contact with	skin.

The above information is believed to be accurate and represents the best information currently available to us. However, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, with respect to such information, and assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for the particular purposes.

REV. NO. 0 DATE: March 26, 1980

A-14

Form No. 757

9242352 U S INDUSTRIAL CHEMICALS

346 00899

CH W- 75-1

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

MANUFACTURER'S NAME U. S. Industrial Chemicals Con	pany EMERGENCY TELEPH	ONENO
UlVISION Of National Distillers & Chemical Corne	ration One ASA on	
ADDRESS (Number, Street, City, State, and ZIP Code) 99 Park Avenu	E New York, New York	a transfer than the same of th
ether; ethyl oxide; ethoxyethanether; diethyl ethe	TRADE NAME AND SYNONYMS	- 4 34 44
CHEMICAL FAMILY Ether FORMUL	A L M UL M	

PAINTS, PRESERVATIVES, & SOLVENTS	*	TLV (Units)	ALLOYS AND METALLIC COATINGS	×	TLV (Units)
PIGMENTS		San C	BASE METAL		- m 311
CATALYST			ALLOYS		
VEHICLE TO A TO THE PROPERTY OF THE PROPERTY O	1.	20%	METALLIC COATINGS		S = 1, 4
SOLVENTS AND ASSESSMENT OF THE PROPERTY OF THE		1.4.4.12	FILLER METAL PLUS COATING OR CORE FLUX	1 10	
ADDITIVES TO THE PROPERTY OF T		13.45	OTHERS		
OTHERS TO THE STATE OF THE STAT		1 2 3 7 6	THE RESERVE OF THE PROPERTY OF THE PARTY OF		ACGIH
HAZARDOUS MIXTURES	OF (THER LIC	DUIDS, SOLIDS, OR GASES VOT.	*	TLV (Units)
· 产品的基础 2年 《新疆》(南部)	(14)	S-12-60 SA	Diethyl ether	100	400 p
of milestration and this desire of a	//\\.		Ethyl Alcohol	<5	1000 p
Conditions are also and the second		1000	Water Water	<5	N.A.
10000000000000000000000000000000000000		1.50		K.5	N.A.

BOILING POOF ethyl ether	94	SPECIFIC GRAVITY IN 2011 @ 25°C	0.707 -
VAPOR PRESSURE ENT ether @ 20°C		PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR-1) ether	2.56	(n-butyl acetate = 1)	6.9
socueicity in water ether @ 20°C		Server and State of the state of the	

SECTION IV	- FIRE AND	EXPLOSION HAZARD D	ATA	XXXII
ASTM D-56 Tag Closed C	up49°F	by volume		
EXTINGUISHING MEDIA Water, alci	chol foam, c	arbon diovide on dry	chamicale	79 75 75 750
SPECIAL FIRE FIGHTING PROCEDURES	V.A. 28 - 20 - 20	*** ** * * * * * * * * * * * * * * * *	Circuitcais	er jaren
	5		and the second section	773
UNUSUAL FIRE AND EXPLOSION HAZARDS				
了。在1777年,在2000年中的大学等的基础的。	· syrapia dada t		Control of the Contro	

SECTION V - HEALTH HAZARD DATA THRESHOLD LIMIT VALUE See Section II.	
Will cause drowsiness, stupor or unconsciousness on	
prolonged exposure	
EMERGENCY AND FIRST AID PROCEDURES Remove from exposure	_
of the strength of the Bell March Carlot Control and the strength of the stren	-

STABILITY	UNSTABLE	X	Conditi	ons favoring peroxide formation
	STABLE SANTE		The same of the sa	The second of the second second second second
HAZARDOUS DECO	(Materials to avoid)			materials - Company of the company o
	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
HAZARDOUS POLYMERIZATION	MAY OCCUR	A. A.		CONDITIONS TO AVOID
POCTMENIZATION	WILL NOT D	ccue	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Keep heat and ignition sources

away.

。在1985年中的1987年中,在1987年中,在1985年中的1985年中的1987年中的1985年中的1985年中的1985年中的1985年中的1985年中的1985年中的1985年中的1985年中的1985年中的19 waste disposal method For small quantities, absorb on paper towels and evaporate in a safe place (such as a fume hood or out of doors away from all ignition sources). Large quantities can be collected and disposed of in a suitable combustion chamber. Ethyl ether should not allowed to enter sewers because of the possibility of an explosion.

1000 PRE-1000	SECTION VIII - SPECIAL PI	ROTECTION IN	FORMATION
RESPIRATORY PRO	TECTION (Specify type) N.A.	- 44 CHARLES	
VENTILATION	and the state of t		SPECIAL
	MECHANICAL (General)	Legiogene III.	OTHER
PROTECTIVE GLOV	N.A.	EYE PROTECTION	ety glasses or googles
OTHER PROTECTIV	E EQUIPMENT N.A.	Selection in	

SECTION IX - SPECIAL PRECAUTIONS

Store away from heat or all ignition sources and oxidizing materials. Use adequate ventilation. May form peroxides during storage. If these are present, they must be decomposed before use in some applications. OTHER PRECAUTIONS

PAGE (2)

Ref: 1) Dangerous Properties of Industrial Materials, VanNostrand Reinhold Co., NY CONTRACTOR OF LINES WAY

2) NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards. DHSS (NIOSH) Publication No. 81-123, 1981

9452325 VELSICOL CHEMICAL CORP

33C 00400

QVELSICOL

MATERIAL SAFETY DATA SHEE

"Essentially Similar" to U.S. Department of Labor Form, OSHA-20, Rev. May '72

Revised 4/9/81

विस्तृतिय । विस्थानित्यांतिय विः मिल्पिल

MANUFACTURER'S NAME Velsicol Chemical Corporation EMERGENCY TELEPHONE NO.

(312) 670-4500

ADDRESS Chicago, Illinois

341 E. Ohio Street.

TRADE HAME AND SYNONYMS

COMPONENT

Chlordane, Technical Grade

CHEMICAL NAME AND STNONYMS Contains Technical Chlordane 60% Octachloro-4,7-methanotetrahydroindane and 40% related compounds.

MOLECULAR FORMULA CIOHCOLO

CHEMICAL FAMILY

Chlorinated Bicyclic Insecticide

HEGION II LIAVANDOUS COMPENENTS OF MISTUELS

THRESHOLD LIMIT VALUE

COMPONENT

THRESHOLD LIMIT

(ZTIMU)

"In October, 1977 a committee of the of Sciences found that: '

Acute oral LD₅₀ (rat) ca 500 mg/kg 'There are no adequate data to show that these comAcute dermal LD₅₀ (rabbits) >200<2000 mg/kg pounds are carcinoganic in humans, but because of
Acute inhalation LC₅₀ (rats) >2< 200 mg/L*
Not a skin irritant (DOT Method) 'There are no adequate data to show that these comtheir carcinoganicity in cartain souse strains and
the extensive similarity of the carcinogenic action
of chemicals in animals and in humans, the committee Extremely irritating to eye (FHSA Method) *Four hour exposure DOT - Dept. of Transportation

FHSA - Federal Hazardous Substances Act

the extensive similarity of the carcinogenic action of chemicals in animals and in humans, the committee concluded that chlordane, beptachlor, and/or their metabolites may be carcinogenic in humans. Although the magnitude of risk is greater than if no carcinogenicity had been found in certain mouse strains. in the opinion of the committee the magnitude of risk cannot be reliably estimated because of the uncertainties in the available data and in the extrapolat of carcinogenicity data from laboratory animals to

		ineight data	
BOILING POINT (°F.)	347.0	SPECIFIC GRAVITY (H ₂ O=1) @ 77°F	1.63
VAPOR PRESSURE (mm He) @ 770p		PERCENT VOLATILE BY VOLUME(%)	1.0
VAPOR DENSITY (AIR=1)	14.3	EVAPORATION RATE (Toluene =1)	>2.0
SOLUBILITY IN WATER Solubility in water	< 0.05pp	Mol. Wt.	409.80

POFARANCE AND COCK Amber, viscous liquid at room temperature, slightly pungent chlorine like odor.

SECTION DY GITE AND EXPLOSION GRAVARD DX. 3

PLASH POINT . Pensky-Martin 95°F. FLANMABLE LUMITS BY VOLUME (%)

LOWER

UPPER 30.5

FIRE EXTINGUISHING MEDIA

Fog or water spray, foam, carbon dioxide, dry chemical

SPECIAL FIRST-HONTING PROCEDURES Wet drums down with water to prevent overheating. First opportunity, remove. Note, decomposition products, hazardous to health, area may be entered with extreme care. Full protective clothing, including self contained breathing apparatus, coat pants sloves boots, and hands aroung legs, arms and waist should UNUSUAL FIRE AND EXPLOSION HAZARDS provided. No skin surface should be exposed.

> (SEE OTHER SIDE) F-5

9452325 VELSICOL CHEMICAL

The court of the c

0.5 mg/m (skin)

EFFECTS OF OVEREXPOSURE

Acts on the central nervous system. Nausea and/or diarrhes, weakness, convulsions.

EMERGENCY AND FIRST AND PROCEDURES INGESTION-Drink 1 or 2 glasses of water. Do not induce voniting. Transport to Emergency Room Immediately. Apply gastric lavage. INHALATION-Remove to fresh air. Apply artificial respiration if necessary. EYE CONTACT-Flush with water for at least 15 minutes. SKIN CONTACT-Wash with mild soap and water. In all emergency first aid situations, CALL A PHYSICIAN OR POISON CONTROL CENTER.

Mark Company	UNSTABLE AND A		CONDITIONS TO AVOID
TABIUTY	STABLE 1980 AND STABLE	I	Stable under normal conditions of storage.
INCOMPATIBILITY (M	eterials to evoid)	A STATE	16.45.5.45.16.16.16.45.45.45.45.45.45.45.45.45.45.45.45.45.
HCI, organi	POSITION PRODUCTS chloride produ	cts,	carbon monoxide and carbon dioxide.
121.0	MAY OCCUR	.5	CONDITIONS TO AVOID
HAZARDOUS			

SEGIION VIII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Contain spill. Absorb with clay granules, saw dust or the equivalent, followed by thoroughly washing down with detergent and water. Do not allow in sewers.

WASTE DISPOSAL METHOD Burial in a designated landfill or dispose of in accordance with applicable local, state or federal regulations.

	SECTION VIII SPECIAL PROTECTION INFORMATION
Twe levels	TION (Specify type) - MESA/NIOSH approved chemical cartridge respirator for pesticides.
LOW TEVELS	LOCAL EXHAUS REED CONCENTRATION below the
VENTILATION	MECHANICAL (General) OTHER
PROTECTIVE GLOVES	res or the equivalent Safety glasses, full protection
OTHER PROTECTION	

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Store in well ventilated area.

OTHER PRECAUTIONS

Self contained breathing apparatus should be available in case of severe fires.

The information presented herein, while not guaranteed, was propared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all-inclusive and the manner and o of use and handling may lavolve other or additional co







Fisher Scientific Company

Chemical Manufacturing Division P. O. Box 375, 1 Reagent Lane Fair Lawn, NJ 07410

MATERIAL SAFETY DATA SHEET (Adapted from USDL Form LSD-005-4) (201) 796-7100 See Disclaimer on reverse side.

SECTION I. IDENTIFICATION OF PRODUCT

CHEMICAL NAME

FORMULA

Toluene

C6H5CH3

SYNONYM OR CROSS REFERENCE

Methylbenzene

SECTION II. HAZARDOUS INGREDIENTS

NATURE OF HAZARD

Toluene

7 Flammable

SECTION III. PHYSICAL DATA

BOILING POINT

MELTING POINT

-95°C

VAPOR PRESSURE(mm Hg) 21.86

SPECIFIC GRAVITY

0.868

VAPOR DENSITY (AIR = 1)

PERCENT VOLATILE BY VOLUME (%)

100%

Lel

- 1.4

WATER SOLUBILITY 0.05%

EVAPORATION RATE (ether = 1) greater than 1

APPEARANCE Clear, Colorless liquid

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (method used) (°F) 40°F

FLAMMABLE LIMITS

Uel

FIRE EXTINGUISHING MEDIA

CO2, dry chemical, alcohol foam

SPECIAL FIRE-FIGHTING PROCEDURES

UNUSUAL FIRE AND EXPLOSION HAZARD

SECTION V. HEALTH HAZARD

THRESHOLD LIMIT VALUE

PART CONTRACTOR OF THE PART OF 375mg/M3 as per ACGIH 1983-84

HEALTH HAZARDS

Vapors harmful. Avoid prolonged contact with skin.

FIRST AID PROCEDURES

Inhalation: Remove to fresh air. Skin and eyes: flush with water for at least 15 minutes. For eyes, consult a physician

PROBLEM HARD COPY

	SECTION VI.	REACTIVITY DATA
STABILITY	UNSTABLE	CONDITIONS TO AVOID
	STABLE	x
INCOMPATABILITY (materials to avoid)	
HAZARDOUS DECOMPOSITION PRODU	UCTS	
HAZARDOUS	MAY OCCUR	CONDITIONS TO AVOID
POLYMERIZATION	WILL NOT OCCUP	
	TION VII. SPILL AN	D DISPOSAL PROCEDURES
STEPS TO BE TAKEN IN CASE MATERIA		LLED
	media such as v	ermiculite. Scoop up and place in
WASTE DISPOSAL METHOD	A PROPERTY OF STATE	er entre indeltigante e vangelik stjere met
DISPOSE OF BY MEANS AS TO COMPT OR CONTACT AN APPROVED AND LICE	Y WITH ALL LOCAL, STA	TE, AND FEDERAL REGULATIONS
	SECTION VIII. PRO	TECTION INFORMATION
RESPIRATORY PROTECTION (specify to	(pe)	
Gas mask with organic	vapor canister	
	otable	SPECIAL
MECHANICAL (gener	al)	OTHER
PROTECTIVE GLOVES	d. Vallance land in selection	EYE PROTECTION
The state of the s	er	safety glasses
rubbe		
OTHER PROTECTIVE EQUIPMENT		
OTHER PROTECTIVE EQUIPMENT		AND STORAGE PRECAUTIONS
OTHER PROTECTIVE EQUIPMENT		AND STORAGE PRECAUTIONS
OTHER PROTECTIVE EQUIPMENT		AND STORAGE PRECAUTIONS
OTHER PROTECTIVE EQUIPMENT SECTION STORAGE AND HANDLING	ON IX. HANDLING	AND STORAGE PRECAUTIONS LANEOUS INFORMATION
OTHER PROTECTIVE EQUIPMENT SECTION STORAGE AND HANDLING	ON IX. HANDLING	
OTHER PROTECTIVE EQUIPMENT SECTION STORAGE AND HANDLING	ON IX. HANDLING	

IN SOURCE AND

9242352 U S INDUSTRIAL CHEMICALS

346 00899

CH W-75-17.

Occupational Safety and Health Administration

Porm Approved OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SEC	CTION I
MANUFACTURER'S NAME U. S. Industrial Chem Division of National Distillers & Chemi	icals Company EMERGENCY TELEPHONE NO. 800-424-9300
ADDRESS (Number, Street, City, State, and ZIP Code) 99 P	ark Avenue New York, New York 10016
chemical name and synonyms Ethyl ether; die ether; ethyl oxide; ethoxyethane; sulfuri	thy) ether TRADE NAME AND SYNONYMS
CHEMICAL FAMILY Ether	FORMULA C2H50C2H5

PAINTS, PRESERVATIVES, & SOLVENTS	×	TLV (Units)	ALLOYS AND METALLIC COATINGS	×	TLV (Units)
PIGMENTS PARTY TO THE PARTY TO		***;.C	BASE METAL		
CATALYST THE THE PROPERTY OF THE			ALLOYS		
VEHICLE TO THE STATE OF THE STA		1:41	METALLIC COATINGS		
SOLVENTS CONTRACTOR OF THE STATE OF THE STAT			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES A WELL SO THE PROPERTY WAS		4.50	OTHERS THE PROPERTY OF THE PRO		or the
OTHERS न ते इस केर्रिकार्य क्रिकेट अपूर्व क्रिकेट अस्ति हैं			2007年的基本的基本的基本。		ACGIH
HAZARDOUS MIXTURES	OF (OTHER LIC	DUIDS, SOLIDS, OR GASES VOT.	*	TLV (Unit)
· 中国政治中中的公司的特别的	÷ .	4 - 190 Z.	Diethyl ether	100	400
COMPANY OF THE PARTY OF THE PROPERTY OF THE				<5	1000
。在中国的1995年,他们建立了广东美数数据的自己的	• • •		Water Water	<5	N.A.
。在"是不是一种的"人"的"企业"的 说是 等的证明		45.745	TARTE TO A STATE AND A STATE OF THE STATE OF	k.5	N.A.

- Carry definition definition SECT	10N III - P	HYSICAL DATA	
soiling Por ethyl ether	94	SPECIFIC GRAVITY ME 2010 0 25°C	0.707 -
VAPOR PRESSURE ENVIOLENT & ther @ 20°C	442	PERCENT, VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (ANT) ether	2.56	(n-butyl acetate = 1)	6.9
solubility in water ether @ 20°C	6.5	the all with a relation	
	uid; sweet	, pungent odor	N. 1 1

ASTM D-56	Tag Closed Cup,	-49°F	1 4 6	y volume	S	Lei	Uer
XTINGUISHING MEDIA	Water, alcoho					emicals	1 30
PECIAL FIRE FIGHTING	PROCEDURES N.A					The control of	Trop for
				1	2319		

PAGE (1)

(Continued on reverse side)

Form OSHA-20 Rev. May 72

346 00900 CH W-75-17 9242352 U S INDUSTRIAL CHEMICALS SECTION V - HEALTH HAZARD DATA THRESHOLD LIMIT VALUE See Section II. . EFFECTS OF OVEREXPOSURE Will cause drowsiness, stupor or unconsciousness on prolonged exposure EMERGENCY AND FIRST AID PROCEDURES Remove from exposure attack married and the same of the same of the SECTION VI - REACTIVITY DATA Conditions favoring peroxide formation STABILITY UNSTABLE to the second STABLE INCOMPATABILITY (Materials to avoid) Oxidizing materials HAZARDOUS DECOMPOSITION PRODUCTS the street of the state of CONDITIONS TO AVOID MAY OCCUR HAZARDOUS POLYMERIZATION . · X WILL NOT DCCUR **:** SECTION VII - SPILL OR LEAK PROCEDURES STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Keep heat and ignition sources . A away. The transfer of the state of the waste disposal method For small quantities, absorb on paper towels and evaporate in a safe place (such as a fume hood or out of doors away from all ignition sources). Large quantities can be collected and disposed of in a suitable combustion chamber. Ethyl ether should not allowed to enter sewers because of the possibility of an explosion. SECTION VIII - SPECIAL PROTECTION INFORMATION RESPIRATORY PROTECTION (Specify type) LOCAL EXHAUST SPECIAL SPECIAL VENTILATION MECHANICAL (General) - X PROTECTIVE GLOVES N.A. Safety glasses or goggles OTHER PROTECTIVE EQUIPMENT N.A. SECTION IX . SPECIAL PRECAUTIONS Store away from heat or all ignition sources and oxidizing materials. Use adequate ventilation. May form peroxides during storage. If these are present, they must be decomposed before use in some applications. OTHER PRECAUTIONS

PAGE (2) 670 12-140 Ref: 1) Dangerous Properties of Industrial Materials, Sax, N.I. 1979

VanNostrand Reinhold Co., NY

2) NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards. DHSS (NIOSH) Publication No. 81-123, 1981

to the said of the

9452325 VELSICOL CHEMICAL CORP

33C 00400 CH H-13-28 MATERIAL SAFETY DATA SH

"Essentially Similar" to U. S. Department of Labor Form, OSHA-20, Rev. May 72

OVELSICOL

MANUFACTUZER'S NAME

deciacola il ileiatantaconinoia (el: laterinueri EMERGENCY TELEPHONE NO. Velsicol Chemical Corporation (312) - 670-4500 Chicago, Illinois Chlordane, Technical Grade

TRADE NAME AND STHONTALS

. . . .

341 E. Ohio Street,

COMPONENT

CHEMICAL MAME AND STHONYMS Contains Technical Chlordane 60% Octachloro-4,7-methanotetrahydroindene and 40% related compounds.

CHEMICAL FAMEY Chlorinated Bicyclic Insecticide MOLECULAR FORMULA C10E6C18

विद्याल	2011	HAVANDOUS	COMPENENTS OF MIXTURES	
12 - V.	*	THRESHOLD LIMIT VALUE	COMPONENT	

In October, 1977 a committee of the Estional Act (ZTIMU) of Sciences found that:

Acute oral LD₅₀ (rat) ca 500 mg/kg

Acute dermal LD₅₀ (rabbits) > 200<2000 mg/kg

Acute inhalation LC₅₀ (rats) > 2< 200 mg/L*

Not a skin irritant (DOT Method) Extremely irritating to eye (FHSA Method) *Four hour exposure

DOT - Dept. of Transportation FHSA - Federal Hazardous Substances Act

There are no adequate data to show that these com pounds are carcinoquais in humans, but because of their carcinogenicity in certain mouse strains and the extensive similarity of the carcinogenic action of chemicals in animals and in humans, the committee concluded that chlordane, beptachlor, and/or their metabolites may be carminogenic in humans. Although the magnitude of risk is greater than if no carcinogenicity had been found in certain mouse strains, in the opinion of the committee the magnitude of risk cannot be reliably estimated because of the uncertainties in the svailable data and in the extrapolation of carcinogenicity data from laboratory animals to

BOILING POINT (°7)	347.0	SPECIFIC GRAVITY (H2O=1) @ 77°F	1.63
VAPOR PRESSURE (== He) @ 7707		PERCENT VOLATILE BY VOLUME(%)	1.0
VAPOR DENSITY (AIR=1)	14.3	EVAPORATION RATE (Toluene =1)	>2.0
SOLUBILITY IN WATER Solubility in water	< 0.05pp	Mol. Wt.	409.80

Amber, viscous liquid at room temperature, slightly pungent chlorine

SECTION IN CHE A ID EXPLOSION GYAVARD DIAVA

LOWER PLANMASLE LUAITS PLASH POINT . BY VOLUME (%) Pensky-Martin 95°F. 30.5

FIRE-EXTINGUISHING MEDIA

Fog or water spray, foam, carbon dioxide, dry chemical

SECIAL FIRE-FIGHTING PROCEDURES Wet drums down with water to prevent overheating. First opportunity, ramove. Note, decomposition products, hazardous to health, area may be entered with extreme care. Full protective clothing, including self contained breathing apparatus, coat pants, sloves, boors, and hands aroung legs, arms and waist should

unusual fire and exposion mazards provided. No skin surface should be exposed.

ISES OTHER SIDE

THEESHOLD

LUAST

THRESHOLD LIMIT VALUE

0.5 mg/m³ (skin)

EFFECTS OF CVEREUPOSURE

Acts on the central nervous system. Hauses and/or diarrhes, weakness, convulsions.

EMERGENCY AND FIRST AND PROCEDURES INGESTION-Drink 1 or 2 glasses of water. Do not induce vomiting. Transport to Emergency Room Immediately. Apply gastric lavage. INHALATION-Remove to fresh air. Apply artificial respiration if necessary. EYE CONTACT-Flush with water for at least 15 minutes. SKIN CONTACT-Wash with mild soap and water. In all emergency first aid situations, CALL A PHYSICIAN OR POISON CONTROL CENTER.

	UNSTABLE	1	CONDITIONS TO AVOID	
STABLE		I	Stable under normal conditions of storage.	
INCOMPATIBILITY (M	eterials to evoid)	10. W.	是是一个中国中国中国中国中国中国中国的中国中国的中国中国的中国中国中国中国中国中国中国	
		_		
HCI, organi	chloride products	cts,	carbon monoxide and carbon dioxide.	
HAZARDOUS DECOM	chloride produ	cts,	carbon monoxide and carbon dioxide.	

- REGION AN REIM ON REAL BLOGEDINES

STEPS TO ME TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

TOTAL SHEET CONTROLLED AND ALL YOUR Contain spill. Absorb with clay granules, saw dust or the equivalent, followed by thoroughly washing down with detergent and water. Do not allow in sewers.

WASTE DISPOSAL METHOD Burial in a designated landfill or dispose of in accordance with applicable local, state or federal regulations.

	SECTION VIII SPECIAL PROTECTION INFORMATION
Low levels	_ MESA/NIOSH approved chemical cartridge respirator for pesticides.
	LOCAL EXHAUS Whatever is sufficient to secus
VENTILATION	MECHANICAL (General) OTHER
Rubber gloves	res or the equivalent Safety glasses, full protection
OTHER PROTECTION	er apron or the equivalent, showers, daily change of clothing.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Store in well ventilated area.

过程的 出版的 化甲基甲基甲基苯甲基

OTHER PERCAUTIONS

Self contained breathing apparatus should be available in case of severe fires.

ared by technically knowledgeable person and to the best of our knowledge is true and excurate. It is not intended to be all-inclusive and the manner an conditions of use and handling may lavoive other or additional considerations.



OUIZ: MODULE III - HEALTH AND ENVIRONMENTAL EFFECTS

- The most effective means of reducing health and environmental effects due to hazardous wastes is: a. Wear safety equipment b. Provide ventilation c. Eliminate all unnecessary exposure d. Install berms in storage areas 2. A hazardous waste that changes the genetic structure of living cells is known as: Mutagen a. b. Acutely toxic c. Corrosive Synergistic d. 3. Repeated exposure to a substance over a long period of time is known 4. List the four major routes of entry in which hazardous wastes enter the body. 5. Which of the following health and environmental effects is most probably associated with corrosive materials? Severe damage to tissue a. Toxicity b. c. BLEVE Disease d. Vitamin C is important for the body to combat the common cold. Likewise, aspirin can help to relieve the headache that comes with the cold. However, when taken together, Vitamin C and aspirin cancel each other and no beneficial effect occurs. This is an example of:
 - a. Biological magnification
 - b. Teratogens
 - c. Equilibrium
 - d. Synergistic effects

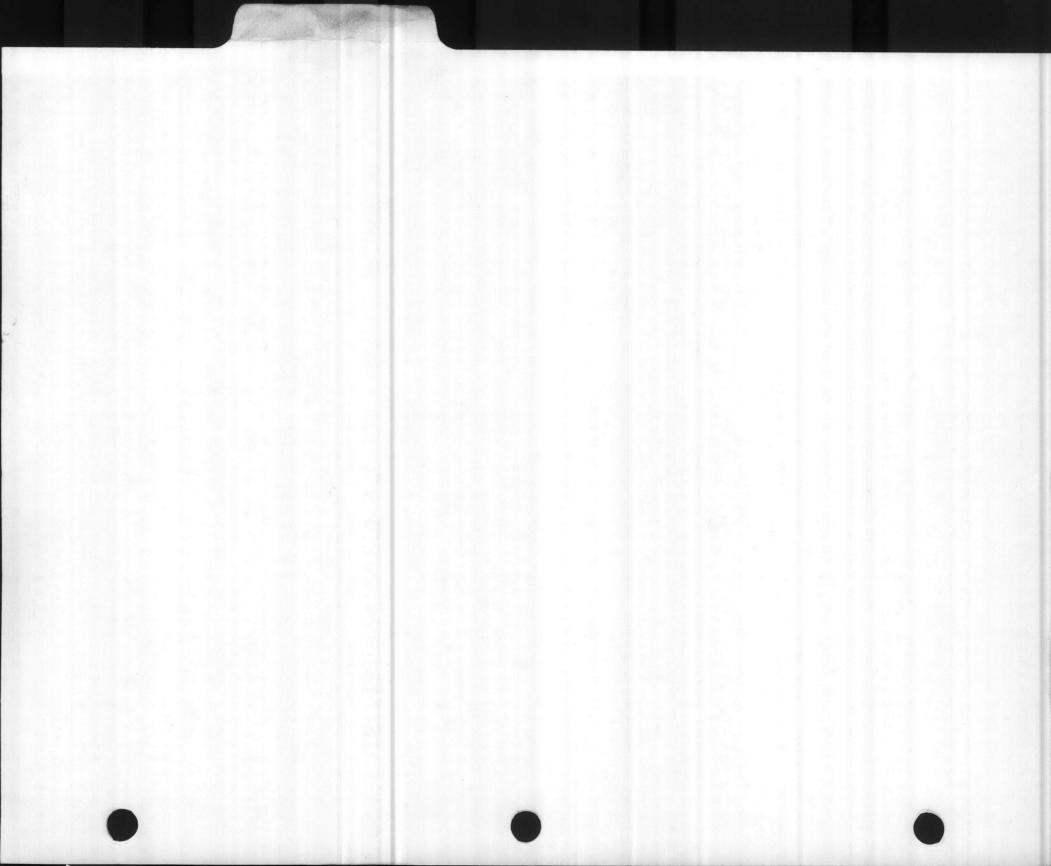
7.	Inhalation	of a chemical can injur	e:
		eys	
8.	the acute an	eferences listed at the nd chronic exposure eff e for the following che	end of module III (or equivalent), list ects (if any) and symptoms of micals:
	Ethylene:	Acute effects -	
		Chronic effects -	
		and properties the state of the	
		Symptoms -	
	Hydrazine:	Acute effects -	
		Chronic effects -	
		Symptoms -	
	Chlordane:	Acute effects -	
		Chronic effects -	
		Symptoms -	

TAB PLACEMENT HERE

DESCRIPTION: PERSONAL SAFETY Tab page did not contain hand written information Tab page contained hand written information

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08

*Scanned as next image



CHAPTER IV

PERSONAL SAFETY

LEARNING OUTCOMES DESIRED.

- A. At the completion of this unit of instruction, you should be able to:
 - Recognize and avoid the types of accidents likely to occur when handling hazardous wastes.
 - 2. Identify and report unsafe working conditions and procedures to your immediate supervisor.
 - Obtain and use safety equipment properly when handling hazardous wastes at your installation.
 - 4. Comply with local safety procedures during the handling, storage, and transportation of hazardous wastes.

II. INTRODUCTION.

Now that you have been introduced to some of the general health and environmental effects of the improper handling of hazardous wastes, let us consider the subject of personal safety. Most people do not really understand the harm that accidents involving hazardous wastes can do until it happens to them. During this unit of instruction, the most typical safety problems associated with handling and storing hazardous wastes at Navy facilities will be covered. More important, we will review the types of equipment that people need to have to handle hazardous wastes safely. In addition, the necessity for following specific applicable safety procedures at your activity will be stressed. We will also point out situations that require special attention in order to insure personal safety. Remember, although safety equipment is an important tool in preventing accidents, you must develop a personal interest in working safely. Hazardous waste accidents can cause a loss of property and loss of productivity (man-hours) to the Navy. They can also cause loss of life or serious injury to you or your fellow workers. Therefore, every effort should be made to prevent accidents.

III. HAZARDOUS WASTE ACCIDENTS.

A. There are a number of possible accidents that can occur that can damage materials, cause injuries to workers, and produce short-term/long-range environmental damage. While many of these accidents could be the result of improper handling of any substance, hazardous wastes require more care and attention than other items. People handling hazardous wastes must have knowledge of the potential hazards concerning the wastes under their control.

1051D Date of last revision: Jun 84

Only by understanding what happens when things go wrong can a worker avoid unsafe practices and procedures. There are a number of characteristics that cause certain items to be considered hazardous. These characteristics are flammability, corrosivity, reactivity, and toxicity. Workers can be injured or killed as a result of any one of these characteristics. Workers, for example, can be injured by being burned in a fire; having chemicals spilled on their skin; breathing certain toxic vapors or by being in the vicinity of an explosion. Most accidents can be prevented if proper procedures and equipment are used while handling hazardous wastes.

- B. Hazardous situations. In order to develop a greater awareness of why some methods of dealing with hazardous wastes are better than others, it is useful to consider a number of possible situations and the proper response. Reviewing this list should be helpful to assist you in identifying safety problems that could be encountered at your worksite and what you should do:
 - 1. Working at the storage facility, you notice that somehow a leaking container has been delivered.

Proper packaging is important because it prevents many problems from occurring. When a container is leaking hazardous waste, accidents (fires, chemical burns) are much more likely to occur. Corrective action:

 While walking through a storage facility you notice that a 5-gallon container is damaged to the point where it may become a leaker.

Discovering a problem early and doing something about it will prevent more serious problems in the future.

Corrective action:

3. In the storage area two barrels of something have been turned over and strange looking vapors are coming out from where the chemicals are mixing.

Some chemicals when mixed together produce very deadly vapors. You should avoid breathing these vapors. Leave the site and get help.

Corrective action:

4. While handling a piece of electrical equipment, you discover an oily liquid dripping out on the ground.

Many electrical items contain polychlorinated biphenyls (PCB). Be aware that the oil in many electrical items may contain PCBs. Corrective action:

5. While moving empty drums to make more room in your storage area, one of them tips over. Something is dripping on the ground.

Empty drums are not necessarily empty. Some chemicals that come in drums create very unpleasant consequences if spilled. Corrective actions:

6. You are a smoker working in an area with NO SMOKING signs posted but they have never enforced them before.

"No smoking" signs may have been violated for years but what happens if vapors from a very flammable chemical catch fire and you are standing in the middle of them? You never can tell when someone might move a flammable item to a no smoking area. Corrective action:

7. You notice that all the wastes received at your facility are stored in the same area in no particular order.

Some chemicals when mixed with others produce fires, toxic vapors, and explosions. If incompatible chemicals are stored close together, the risk of them mixing together and causing problems is very high. Your facility should have and follow a plan to avoid incompatible storage.

Corrective action:

8. You have just told a recent hire to go see if a drum is empty and you notice that person trying to get the top bung open.

Some empty drums still contain vapors under pressure. If someone is careless in opening drums (empty or full), that person may possibly breath toxic vapors or be hit by a bung. Corrective action:

9. You were lucky to get to a fire extinguisher in time to put out a very small fire. Now your supervisor has told you to do something before refilling the fire extinguisher.

It is good to know how to use fire extinguishers correctly, and someone must take steps to make sure they are refilled after use. Empty extinguishers do not help in putting out future fires. (The same thing applies to portable eye wash equipment.) Also note that certain types of fires require the use of different types of fire extinguishers. Do not wait until you have a fire before learning about the different types. Fires require thorough investigation to insure they are really out.

Corrective action:

10. It is the coldest day of the year and they have finally sent someone to fix your deluge shower. That person tells you that it should work now.

If you or your coworkers need to use a deluge shower (or eye wash facility), it must work right the first time. You should learn to use this equipment <u>before</u> an accident occurs. Corrective action:

11. You are moving a pallet of old batteries over rough ground with a forklift and you are told, "We don't have time to rearrange or tie down that stuff."

Sometimes it is easy to forget what can happen if things go wrong when handling hazardous waste, especially when you are busy. It is essential that correct handling procedures are always followed when handling this waste.

Corrective action:

12. You are going out to move some transformers and your boss yells out, "Be sure to wear gloves."

An important technique to avoid chemical burns and long-term health effects is to wear protective clothing. The obvious precaution is to wear gloves. However, not all gloves provide protection against all substances. You need to be sure that the type of gloves (or other protective equipment) that you wear is appropriate to the situation. Remember, the best protective equipment in the world is useless if it is not used. Corrective action:

12. At the bottom of the pile you are cleaning up, you find an old bottle of ETHYL ETH _ and your coworker says, "Oh just throw that out back with the battery acid."

Some chemicals are extremely hazardous because they degrade over time into very dangerous explosives. In this particular case, it is probable that you have a bottle of ETHYL ETHER which can degrade to an organic peroxide. If this is the case, and you shake the bottle, you have just set off an explosion equal to a stick of dynamite. The best rule is to treat old chemicals with respect; they do not just fade away. Corrective action:

The above list points out the wide variety of difficulties associated with handling hazardous waste safely. Workers need to know about: packaging, storage compatibility, item identification, vapors, fumes, fires, spills, explosions, and chemical burns. All of the situations discussed above are potential problems but by using proper safety procedures and equipment, you can get your job done in a safe, efficient way. Do you start to see the connections between following established procedures and avoiding accidents with hazardous waste? Think about conditions at your facility. Can you change the way you deal with hazardous waste to avoid the risk of accidents?

IV. SAFETY EQUIPMENT.

A. Safety Equipment. Ideally, each physical operation at a Naval facility could be analyzed by supervisory or safety personnel to predetermine inherent and manmade hazards. Operating procedures could then be developed to remove or control the hazards identified. Methods of control include substitution of safe procedures, isolation of hazardous operations or the redesign of

facilities. Realistically, there are limitations as to how much the Navy can change its methods of operations. For example, new buildings require long leadtimes before being built and the current space for compatible storage may be limited. Engineering design can eliminate some exposure, however, when a hazard still exists after all practical control methods have been taken (which will almost always be the case with hazardous wastes), workers must be given additional protective equipment or clothing. The type of equipment will depend upon the nature of the hazards involved. This equipment should not be used as a substitute for the control of unsafe conditions but rather as a supplemental safety measure. Personal protective equipment is classified in the following categories: head, eye/face, respiratory, body, hand/arm, and foot.

V. HEAD PROTECTION.

A protective hard hat will be worn for head protection against falling or flying objects in cramped places. A protective hat will always be worn when in areas where material is being lifted or hoisted or where gear could swing against the head.

VI. EYE AND FACE PROTECTION.

Eye protection should be worn wherever there is a potential risk of injury that can be prevented by this equipment. Specific eye and face protection is delineated in OSHA Regulation (29 CFR 1910.133). The following is a list of general practices:

- A. Rubber Goggles. These goggles will be worn for protection of the eye against smoke, gas, fine dust, mist, sprays and splashes of liquid substances, including acids and alkali solutions.
- B. <u>Safety Glasses</u>. Safety glasses with side shields will be worn for eye protection against flying particles of dust, chips and other material. The use of safety glasses is recommended in most operating areas.
- C. Contact Lenses. Contact lenses should never be worn where there is exposure to dust, corrosive or toxic chemicals and vapors. There is an increased risk of eye injury when these lenses are worn. Wearing contact lenses is prohibited when using a respirator in a contaminated atmosphere.
- D. <u>Face Shields</u>. Plastic face shields provide eye protection as well as full-face protection. Face shields are not equivalent to goggles for eye protection because when the head is turned away from a splash, the eyes become exposed.
- E. Ventilated Goggles. These should not be used if toxic or irritating vapors are possibly present.
- F. Decontamination. Eye protective equipment must be able to withstand thorough cleaning to remove any contaminates after use in a hazardous environment. Eye infections can be a problem if eye gear is not sanitized.

VII. RESPIRATORY PROTECTION

Respiratory protection is an extremely important part of personal protection. The body can only live a few minutes without oxygen. Therefore, the respiratory system meeds maximum protection. We are concerned about protection against a hazardous atmosphere which is defined as being deficient in oxygen or containing a toxic producing particulate, gas, or vapor in concentrations which are dangerous to life or health.

The use of proper respiratory equipment can prevent:

- Damage to the respiratory system (nose, throat, and lungs) due to irritation, inflammation, increased mucous secretions, etc.
- Permanent damage to other organs, including the heart, liver, spleen, kidneys and nervous system.
- Illnesses such as systemic poisoning, heart disease, blood disorders, and cancer.
- Disability or death resulting from any of the above.

The selection of the proper respiratory protective equipment involves, for the most part, three basic steps:

- Identification of the hazard;
- Evaluation of the hazard; and
- Selection of the proper respiratory protective equipment.
- A. Identification of the Hazard. Hazards may take many different forms. Since the selection of a respirator is based on the specific hazards to which you are exposed, JUST ANY RESPIRATOR WON'T DO. It is important to know something about the different kinds of hazardous materials which may exist within your facility requiring the use of respirators.
 - 1. Gaseous Contaminants. Gaseous contaminants add another invisible material to the air we already breathe. There are two types of gaseous contaminants:
 - a. Gases include substances, e.g., carbon dioxide, which are solids or liquids only at very low temperatures and/or high pressures. Carbon dioxide is a gas at room temperature, but it also occurs as a solid, dry ice at low temperatures, and as a liquid in presurrized tanks.
 - b. <u>Vapors</u> are exactly like gases except that they are formed by evaporation of substances, such as acetone or trichloroethylene, which ordinarily exist as liquids.

- 2. Particulate Contaminants. Particulate contaminants are made of tiny particles or droplets of a material. There are three types of particulates:
 - a. Dusts are solid particles produced by such processes as milling, drilling, grinding, crushing, and mixing of powder compounds. Examples are sand and plaster dust. They are especially hazardous when they contain asbestos, toxic chemicals, silica, lead, vegetable fibers, etc.
 - b. Sprays and mists are tiny liquid droplets given off whenever a liquid is sprayed, vigorously mixed, or otherwise agitated. Examples are: acid mists around diptanks used for metal cleaning, oil mists near newspaper printing presses, spray painting, etc.
 - c. Smoke and fumes are tiny metallic particles given off when metals are heated. Fumes are found in the air near soldering, welding, and brazing operations as well as near molten metal processes such as casting and galvanizing.
- 3. Oxygen Deficient Atmosphere. This condition is most commonly found in confined spaces with very poor ventilation. Examples are silos, petrochemical tanks, and the holds of ships. (In some situations an oxygen deficient atmosphere is purposely maintained. For instance, fruit is sometimes kept in warehouses with a lot of carbon dioxide and very little oxygen.) Oxygen deficient atmospheres occur in two different ways.
 - a. Oxygen is "used up" by a chemical reaction in which it is combined with other elements. This is what happens when fire burns or iron rusts.
 - b. Oxygen is "pushed out" by another gas. If a room with "normal" air (which contains about 21% oxygen) fills up with another gas, e.g., helium, there will be less oxygen in every breath you take because the oxygen is being steadily "displaced" by the helium.

The atmosphere usually contains about 21 percent oxygen. OSHA regulations state that when oxygen levels drop below 19.5 percent, the atmosphere is oxygen deficient. Other standards define this level as 18.0 percent, 16.5 percent, and 16.0 percent.

The effects of an oxygen deficient atmosphere depend on the actual oxygen level. Warning signs include confusion, reduced coordination, nausea, and dizziness. If the oxygen level is very low the immediate effect is unconsciousness and death.

4. Atmospheres Immediately Dangerous to Life or Health (IDLH). This is a term which is used to describe very hazardous atmospheres in which exposure will:

- a. Cause serious injury or death within a matter of minutes. Examples are exposure to high concentrations of carbon monoxide or hydrogen sulfide.
- b. Cause serious delayed effects. Exposure to critical levels of radioactive materials or cancer-causing agenst are examples.

B. Evaluation of the Hazard.

Once a potential hazard has been recognized and the hazardous substance or particulate identified, it is then necessary to determine the amount of contaminant (concentration) present. The measured concentration can be stated in various "units," depending on the form of the contaminant. The two most widely used units are (1) mg/M³-milligrams of contaminant in air per cubic meter of air and (2) ppm-parts of contaminant in air per million parts of air. The measured concentration (in appropriate units) is then compared with either the permissible exposure level (PEL), mandated in OSHA regulations, or the threshold limit value (TLV), recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). These values, as determined by these groups, are the maximum concentration to which a worker may be exposed day after day without adverse affects.

C. Selection of the Respiratory Protective Equipment.

After the hazard(s) has been recognized and measured, the other factors still need to be considered.

- Is the contaminant recognized as the only contaminant present?
- Does the contaminant have adequate warning properties?

 (Warning properties are especially important when air-purifying respirators are used against gases and vapors.)
- Will the contaminant irritate the eyes at the estimated concentration to which the user will be subjected?
- Can the contaminant be absorbed through the skin? If it can, will it result in a serious injury?

Now the proper respirator can be chosen.

- 1. Respirator types. Respiratory protective devices can be divided into two general categories:
 - a. Air-purifying respirators. These devices remove the contaminant from the breathing air before it is inhaled. For each model of air-purifying respirator, there are usually many air-purifying filters available for protection against specific contaminants. These filters fall into two subgroups: particulate removing filters and vapor and gas removing filters called cartridges or canisters. Combination filters for protection against both particulates and organic vapors are also available.

b. Atmosphere Supplying Respirators. These devices supply uncontaminated breathing air to the user from a source other than the surrounding atmosphere. These types are usually complex and come in many configurations.

Atmosphere Supply Respirators can be broken down into two subgroups.

Airline Respirators, in which breathable air is conveyed to the user via a compressed air line or hose, and Self-contained Breathing Apparatus (SCBA), in which the user carries the breathing air source which can be a compressed air tank or an oxygen generating device.

Selection Procedures.

Selecting the proper respirator must be based on the hazard present, its concentration, and the form of the hazard (vapor, particulate, etc.). Figure IV-1 outlines the respiratory equipment selection process.

3. Approved Respiratory Protective Equipment.

OSHA required that approved respirators be used if they are available. If only one brand of respirator on the market is approved for a particular hazard, then that brand is considered to be "available" and must be used.

An approved respirator is one that has been tested and found to meet minimum performance standards by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). An approved respirator (by NIOSH) contains the following:

- An assigned identification number placed on each unit, e.g., TC-21C-101. The TC designation will always precede the identification number.
- A label identifying the type of hazard the respirator is approved to protect against.
- Additional information on the label which indicates limitations and identifies the component parts approved for use with the basic unit.

In addition to the proper selection of respiratory equipment, a worker must consider the following issues in using a respirator:

- Physical and Mental Condition (Medical Monitoring)
- Proper Fit Testing
- Maintenance of Equipment
- Worker Responsibilities

The following section discusses these issues.

Outline for selecting respiratory protective devices. Hazard Oxygen Toxic Deficiency Contaminant Self-Contained Combination **Particulate** Gaseous Gaseous **Apparatus** Air-line and And Aux. SCBA Particulate Not Dust, Mist Abrasive-**Immediately** Air-Line **Immediately** Blasting or Fume Dangerous Respirator Dangerous Respirator Respirator To Life To Life Pos. Pres. Self-Gas Mask Hose Mask Chemical Pos. Pres. Air-Line Cartridge Without Respirator Air-Line Contained Escape Blower Respirator and SCBA **Apparatus** Only Not Immediately **Immediately** Dangerous Dangerous To Life To Life Gas Mask Chemical Cartridge Positive Pres. Hose Mask Positive Pressure With Special Air-Line Without Self-Contained Air-Line and Respirator Filter Respirator Blower **Apparatus** Self-contained With Special Filter **Apparatus** Escape Only

Figure IV-1

D. Medical Monitoring.

The use of any type of respirator imposes some physiological stress on the user. Air-purifying respirators, for example, make breathing more difficult because the filter or cartridge can reduce the flow of air. The special exhalation valve on an open circuit pressure demand SCBA can be a burden. If you are using an airline respirator, you might have to drag up to 300 feet of hose around. All of these factors can increase the "total" workload. If you have lung or heart problems, wearing a respirator could present an unacceptable risk. You should have some type of medical examination to determine if you are able to wear a respirator without it affecting your health.

A medical examination by a physician is the preferred screening mechanism. The following conditions may affect your ability to wear a respirator, and if they exist, you should get a medical opinion.

100	Lung	1. Do you have a history of asthma or emphysema?
		2. Do you have difficulty in breathing?
		3. Do you have any documented lung problems?
-	Heart	1. Do you have high blood pressure?
		2. Do you have artery diseases?
		3. Do you have documented heart problems?

1. Do you have missing or arthritic fingers?

2. Do you have facial scars?3. Do you have claustrophobia?

E. Fit Testing.

Other

Once a respirator has been selected for the contaminant to which you are exposed, and is appropriate for the airborne concentration, you are fully protected, right? Wrong! A respirator won't protect you unless the air you breathe goes through the "business end"—the canister, filter, or air supply system. If the face seal isn't tight or the connections are lose you may think you're breathing through it, but you will actually be breathing around it.

You may have to try on several different respirators before you find the one that fits properly. Your activity should have several types of respirators to choose from. Your supervisor or a safety officer must show you how to put the respirator on and how to adjust the straps for the best fit. The respirator should fit snugly, but it should not leave red marks, deep indentations on your face, of make it difficult to turn your head.

Beards and bushy sideburns may have to go, since respirator facepieces won't seal over them. Similarly, gum and tobacco chewing cannot be allowed since excess facial movement can break the faceseal.

If you wear prescription glasses, you must wear a respirator facepiece which will accommodate the glasses (this is especially critical for full facepiece respirators). Contact lenses should not be worn while wearing a respirator. A properly fitted respirator—primarily a full facepiece respirator—will stretch the skin at the temples slightly so that the contact lens might pop out. Also, contaminants that do leak in around the sealing surface may get underneath the contact lens thus causing severe discomfort. Your first reaction would be to remove the facepiece to remedy the situation—which would be fatal in a lethal environment.

Two types of fitting tests are used to determine the proper fit of respiratory protective equipment; qualitative tests and quantitative tests. Qualitative tests are fast, usually simple, but not as accurate an indicator for improper fit as the quantitative test. The quantitative test, though more accurate, requires the purchase of expensive equipment, requires a specially trained operator, and is of limited use due to its complexity and bulk.

Fit testing on Naval bases is normally done by the Base Safety Office.

F. Respiratory Equipment Maintenance.

If you wear a respirator routinely it should be cleaned, inspected and stored in a convenient location after each use.

Cleaning and Storage.

At the end of the workshift the respirator should be cleaned and stored in a convenient, clean location. If the respirator is shared, it should be cleaned and disinfected between users. In a large respirator program there may be a central facility for cleaning. In a small program, you may be expected to clean your own respirator. If so, the following method may be used.

- Wash with a detergent or a combination detergent and disinfectant, in warm water using a brush.
- Rinse in clean water, or rinse once with a disinfectant and once with clean water. (The clean water rinse is particularly important because traces of detergent or disinfectant left on the mask can cause skin irritation or dermatitis.)
- Dry on a rack or hang from a clothes line. In either case position the respirator so that the facepiece rubber won't "set" crooked as it dries.

Proper storage of a respirator is very important. The law requires that respirators be protected from dust, sunlight, heat, extreme cold, excessive moisture, and damaging or contaminating chemicals. A storage cabinet for air-purifying respiratory protective equipment is shown below.

Respirator Inspection.

Inspection of the respirator is an important part of usage. You can further safeguard your health by performing (as appropriate) the below listed checks.

- a. Disposable respirators, check:
 - Integrity of filter (for holes);
 - Straps for elasticity and deterioration;
 - Metal nose clip for deterioration (if applicable).
- b. Air-purifying respirators (quarter-mask, half-mask, full-facepiece, and gas mask):

Rubber Facepiece, check for:

- Excessive dirt;
- Cracks, tears, or holes;
- Distortion from improper storage;
- Cracked, scratched or loose fitting lens (full-facepiece);
- Broken or missing mounting clips.

Headstraps, check for:

- Breaks;
- Loss of elasticity;
- Broken or malfunctioning buckles or attachments;
- Excessively worn serrations of the head harness which might allow the facepiece to slip (full-facepiece only).

Inhalation Valve, Exhalation Valve, check for:

- Detergent residue, dust particles, or dirt on valve or valve seat;
- Cracks, tears, or distortion in the valve material, or valve seat;
- Missing or defective valve cover.

Filter Element(s), check for:

- Proper filter for the hazard;
- Approval designation;
- Missing or worn gaskets;
- Worn threads -- both filter threads and facepiece threads;
- Cracks or dents in filter housing;
- Deterioration of harness (gas mask canister);
- Service life indicator, or end of service date--for expiration (gas mask).

Corrugated Breathing Tube (gas mask), check for:

- Cracks;
- Missing or loose hose clamps;
- Broken or missing connectors.
- c. Atmosphere-Supplying Respirators. Check facepiece, headstraps, valves, and breathing tube as discussed previously.

Hood, Helmet, Blouse, or Full Suit (if applicable) check for:

- Rips and torn seams;
- Headgear suspension;
- Cracks or breaks in faceshield;
- Protective screen to see that it is intact and fits correctly over the faceshield (abrasive blasting hoods and blouses).

Air Supply System, check for:

- Breaks or kinks in air supply hoses and end fitting attachments;
- Tightness of connections;
- Proper setting of regulators and valves (consult manufacturer recommendations);
- Correct operation of air purifying elements and carbon monoxide or high-temperature alarms.

Self-contained Breathing Apparatus (SCBA):

- Consult manufacturer's literature.

If defects are observed in a respirator, it must be removed from use until adequately repaired, or it must be replaced.

3. Repair.

Sooner or later your respirator will need a new part or some other repair. The law requires that the people who repair respirators be well trained. And it is important for everyone to realize that respirator parts from different manufacturers are not interchangeable. The NIOSH approval will not hold if an air hose or a gasket or any other part has been replaced by one from a different brand of respirator. This is true even if the respirator seems to work just as well with the substitute part.

G. Worker Responsibilities.

As a user of respiratory protective equipment, you also have responsibilities.

- Use respiratory protective equipment as instructed.
- Guard against damaging the respirator.
- Go immediately to an area of "clean" air if your respirator malfunctions.
- Report any malfunctioning of respiratory protective equipment to your supervisor. This would include but not be limited to:
 - -- Discomfort;
 - -- Resistance to breathing;
 - -- Fatigue due to respirator usage;
 - -- Interference with vision or communication;
 - -- Restriction of movement.

It is impossible to cover briefly all the considerations that you should be familiar with because of the many types of respirators available. The manufacturer can supply much of the needed information. However, to be of value, it must be fully read and applied.

VII. BODY PROTECTION.

Protective clothing required will depend upon the particular contamination encountered. When hazardous wastes will damage the skin, protective suits must be used which will resist the particular waste.

Appendix A lists different chemicals and compares the resistive qualities of specific types of clothing. There are many of these comparative tables available. Care should be taken to confirm the accuracy of such tables. This table was specifically set up for gloves but may be used to compare materials for other clothing.

IX. HAND/ARM PROTECTION.

Various types of gloves are needed for different contaminants. See Appendix A.

- A. Synthetic rubber gloves. These gloves are worn for protection when handling ordinary commercial concentrations of harmful chemicals, petroleum products, or chlorinated solvents.
- B. Natural rubber gloves. These gloves are worn for protection when handling high concentrations of acids and alkalies; organic solvents, and other chemicals which are highly toxic or corrosive. Natural rubber gloves will not be used for protection against petroleum products and chlorinated solvents.
- C. General-purpose workmen's gloves. When performing general labor work, these gloves are used for protection of hands from cuts and abrasions.

X. FEET PROTECTION.

Safety toe footwear is worn while working in areas designated as being hazardous to feet. Wear rubber boots when floor is often wet with water or chemicals.

XI. MONITORING EQUIPMENT AND INSTRUMENTATION.

In the case of a hazardous material spill or if there is a chance of exposure to harmful gases or vapors in the workplace, it is necessary to monitor the area to warn if harmful levels are exceeded. There is a wide variety of equipment and instrumentation available for this purpose. This equipment could be used to determine the level of protection needed or to alert people to evacuate the area. It is

important that the type of equipment used be "direct reading." This means that the results of a measurement is known immediately, versus needing laboratory analysis or processing of some kind. Some examples of monitoring equipment are:

- A. Personal Indicator Badges. These small badges may be pinned to the lapel, and they change color when harmful levels are exceeded. They are also inexpensive and disposable. Unfortunately, badges are available only for a limited number of compounds and are useful in detecting only the specific compound it is designed for. Other drawbacks include the fact that the worker must regularly check it and that it provides protection for only one person.
- B. Colorimetric Tubes. These are small glass tubes filled with a compound that changes color as air is drawn through it. By drawing a specific amount of gas through the tube (with a small pump), the concentration of a gas or a vapor can be read directly by seeing how far up the tube the color change occurs. These units are relatively inexpensive but a different tube must be used for each compound you wish to measure. Colorimetric tubes also do not allow continuous protection and their accuracy ranges from 50 to 75 percent.
- C. Oxygen Indicators. These relatively inexpensive instruments are indispensable where oxygen deficiency is a possibility. They can provide a direct reading of oxygen concentration in the atmosphere and many include an alarm that sounds when concentrations drop below safe levels. They are also portable enough to be used as personal alarms and they provide continuous protection.
- D. Combustible Gas Indicators. These units can measure the concentration of many combustible gases. Measurements can be taken of percent volume of a gas, parts per million concentration or lower explosive limit. These instruments are accurate, but are expensive. They also require trained personnel to operate them. The operation of such devices should be left to a safety specialist, industrial hygienist, or members of the fire department.
- E. Photoionization Analyzers. These are the most "state-of-the-art" direct reading field instruments available today. They can be used for specific or multiple gas determinations and are extremely accurate, in some cases measuring down to parts per billion. These instruments are extremely expensive and must be operated by trained personnel as well. Photoionization analyzers should be used only if a high degree of accuracy is required.

XII. SUMMARY OF PROTECTIVE EQUIPMENT.

The previous chapters have explained various types of protective equipment. Determination of the proper equipment for any situation is critical. The Environmental Protection Agency (EPA) divided anticipated hazards into four categories depending on the level of protection necessary. These categories can be used as general guidelines for what equipment is necessary, however, specific guidelines for specific hazards should be prepared for each anticipated hazard.

The following sections explain the four levels of protection.

- A. <u>Level A.</u> Required when <u>highest level</u> of respiratory, skin, eye, and mucous membrane protection is necessary. Level A equipment includes:
 - Positive-pressure (pressure demand), self contained breathing apparatus (MSHA/NIOSH approved).
 - Fully-encapsulating chemical resistant suit.
 - Gloves, inner, chemical resistant.
 - Gloves, outer, chemical resistant.
 - Boots, chemical resistant, steel toe and shank; (depending on suit boot construction, worn over or under suit boot).
 - Underwear, cotton, long-john type.*
 - Hard hat (under suit).*
 - Coveralls (under suit).*
 - Two-way radio communications (intrinsically safe).
 - * Optional
- B. Level B. Required when highest level respiratory protection is necessary but lesser level of skin and eye protection is needed. Level B protection is the minimum level recommended on initial site entries until the hazards have been further identified and defined by monitoring, sampling, and other reliable methods of analysis, and personnel equipment corresponding with those findings utilized. Personal protective equipment for level B includes:
 - Positive-pressure (pressure-demand), self contained breathing apparatus (MSHA/NIOSH approved).
 - Chemical resistant clothing (overalls and long sleeved jacket, coveralls, hooded two piece chemical splash suit, disposable chemical resistant coveralls).
 - Coveralls (under splash suit).*
 - Gloves, outer, chemical resistant.
 - Gloves, inner, chemical resistant.
 - Boots, outer, chemical resistant, steel toe and shank.
 - Boots, outer, chemical resistant.*
 - Two-way radio communications (intrinsically safe).
 - Hard hat.*
 - * Optional
- C. Level C. Protection should be selected when the type of airborne substance is known, concentration measured, criteria for using air-purifying respirators met, and skin and eye exposure is unlikely. Periodic monitoring of the air must be performed. Personal protective equipment for level C includes:
 - Full-face, air-purifying respirator (MSHA/NIOSH approved).
 - Chemical, resistant clothing (one piece coverall, hooded two piece chemical splash suit, chemical resistant hood and apron, disposable chemical resistant coveralls).
 - Gloves, outer, chemical resistant.
 - Gloves, inner, chemical resistant.*
 - Boots, steel toe and shank, chemical resistant.
 - Boots, out, chemical resistant.*
 - Cloth coveralls (inside chemical protective clothing).*
 - Two-way radio communications (intrinsically safe).
 - Hard hat.*
 - Escape mask.*
 - * Optional

D. Level D. Level is primarily a work uniform. It should not be worn on any site where respiratory or skin hazards exist.

XIII. FIRST AID.

Your activity should establish a workable first aid program prior to the occurrence of an emergency. The minimum training required is the Basic American National Red Cross First Aid Course. Employees should know who has had this training at their facility. In addition, personnel handling hazardous wastes should know some minimum first aid procedures such as immediate action for acid burns. Assistance in obtaining first aid training can be obtained through local military medical facilities. Individuals injured on the job should be sent to the nearest medical facility immediately. This is especially important in the case of hazardous waste injuries since professional medical care is essential to prevent long-term damage to health.

XIV. SAFETY ATTITUDES.

Many times people tolerate unsafe conditions and practices because they believe that it's not important. Sometimes workers continue to do unsafe acts because "everyone does it that way" or "people will laugh at me if I take safety precautions." These attitudes are very strong obstacles to overcome in trying to insure worker safety. After all, enforcing "safety procedures" does upset some people. Ask yourself the following questions: Is personal safety really a matter of concern at my worksite? Does my supervisor use safety equipment and follow safety procedures? Are procedures to safely handle and store hazardous wastes at my facility enforced? Is it possible that attitudes towards safety (both mine, my fellow workers, and my supervisors) can influence whether or not my facility has a hazardous waste accident?

XV. SUMMARY.

During this block of instruction, we have pointed out some of the safety problems associated with handling hazardous waste. We will go into more details in later units of instruction but you should begin to understand why the proper labeling, handling, storage, and transportation of hazardous wastes is important from a safety viewpoint. We have reviewed the types of safety equipment available. We have reviewed the fact that emergency response to an accident should be practicied prior to an accident. You should begin to understand the connection between using proper procedures and worker safety; how to identify safety problems; and what to do when safety problems are identified. We have discussed some of the attitudes that exist regarding safety that can undermine an effective safety program. while these obstacles to safety may be large, they can be overcome.

XVI SUGGESTED REFERENCES

Information on the correct protective equipment to use for specific hazards can be found in numerous references. The following is a listing of these references.

A. Material Safety Data Sheets (MSDS).

MSDSs are technical bulletins, generally two to four pages in length, which contain chemical information, such as chemical composition, chemical and physical characteristics, health and safety hazards, and precautions for safe handling and use. An example of a MSDS format is shown in Appendix B.

The MSDS was chosen by the Occupational Safety and Health Act (OSHA) to be the primary vehicle for providing specific, detailed information on the identities and hazards of the hazardous chemicals in a workplace. OSHA requires a MSDS for every hazardous chemical identified in the workplace. The MSDSs must be stored in a place accessible to the actual work area where employees may freely read or copy them.

Normally, MSDSs are completed by the manufacturer of the hazardous substance and provided to naval activities when the substance is procured through the supply system. If a chemical is being used in a workplace and the activity does not have the MSDS, there are many places to obtain a copy. The following list is some of the ways to obtain MSDSs.

- 1. Call the following:
- Activity fire department
- Activity Safety Officer
- Activity Environmental Coordinator
- Engineering Field Divisions (NAVFACENGCOM)
- Naval Energy and Environmental Support Activity, Port Hueneme, CA
- Hazardous Material Technical Center (HMTC)
- Substance Manufacturer
- Navy Environmental Health Center Norfolk, VA

2. Check:

- Hazardous Material Information System (HMIS) See Section B.
- Various microfiche and computer listings of MSDSs
- B. The DOD Hazardous Material Information System (HMIS).

The DOD HMIS is a central system for the collection, maintenance, and dissemination of the data contained in the Material Safety Data Sheets and other sources of information. The information in the system can be used to help develop procedures to prevent mishaps in handling, storage, use, transportation, and disposal of hazardous

material and waste. This system provides a mechanism by which information on hazardous materials can be collected, stored, updated, and made available to users in the field. Materials are listed according to their National Stock Number (NSN). Field personnel have access to the information through micofiche, usually located in Safety Offices at naval activities.

The Navy Energy and Environmental Support Activity (NAVENENVSA) has multiple sets of the HMIS microfiche.

Activities can attend a HMIS training course sponsored by the Navy Environmental and Preventive Medicine Units in Norfolk, VA, San Diego, CA, or Pearl Harbor, HI. Contact NAVENENVSA or the Navy Environmental Health Center in Norfolk, VA, for more information regarding this class.

C. NIOSH/OSHA Pocket Guide to Chemical Hazards.

This guide contains information on 380 hazardous chemicals including chemical names, formulas, synonyms, permissible exposure limits, chemical and physical properties, respiratory and personal protective equipment use recommendations, symptoms of overexposure, monitoring procedures, and procedures for emergency treatment.

This information is presented in tabular form containing many abbreviations. The definitions of these abbreviations are found in one of five tables in the front pages of the guide. This guide should be used as a quick reference for summary information on the various chemicals. Appendix C shows a typical entry for a given chemical.

D. Manufacturer's Literature

Manufacturers of safety equipment will usually provide data on the applicability of their equipment to specific hazards. This is especially true with clothing and respirator manufacturers. Two. examples are given in Appendix A.

E. <u>Guidelines for the Selection of Chemical Protective Clothing</u>,
American Conference of Governmental Industrial Hygienists, Inc.
(ACGIH), 1983. This publication provides guidance in the selection of proper clothing for specific chemical hazards.

The guide contains numerous matrices that allow the user to easily choose the correct clothing material for a wide variety of chemical hazards. It also includes the names, addresses, and telephone numbers of manufacturers of specific types of clothing.

Appendix A

CHRIS Response Methods Handbook

Safety gloves and clothing for protection against chemical hazards are available in numerous materials. Many of the manufacturers of such protective clothing have published charts showing the suitability of their clothing materials for various chemical hazards. The following table is compiled from several such charts as a general-purpose guide to the selection of suitable chemical safety clothing materials. While the manufacturers' charts were intended primarily for the selection of chemical gloves, the data applies equally to chemical garments such as aprons, coats, hoods, trousers, coveralls, and suits.

It should be remembered that the thickness and specific formulation of a material can cause some variation in its resistance to individual chemicals. This variation is reflected in the occasional differences of ratings shown in the manufacturers' charts and will also be evident in the table presented here. In other words, a material rated as "Fair" by one manufacturer might be rated as "Good" by another. The table here will therefore show both "Fair" and "Good" for the material. It will also be noted that there are no ratings for some of the chemicals under specific materials. This absence of a rating means that manufacturers have given no indication of the material's suitability, or lack of it, for the specific chemical. The absence of a rating should not be interpreted as either a recommendation for its use or as a sign of its unsuitability.

CODE FOR CHART
P—Poor
F—Fair
G—Good
S—Excellent

Acetic Acid Glacial Acetic Acid Glacial Acetic Acid Glacial Acetic Anyloride Acetone A		M	MIE	IC M	CLOTHIN	- 1			CHEMICAL HAZARD			MAIL	CLOTHING	Man	ural	Matu	CHEMICAL HAZARD
Acetaldehyde G.E. E. E. F.G. E. Beet Sugar Liquors G.E. E. E. F.G. P. Benzaldehyde Acetic Acid Glacial Acetic Acid Glacial Acetonitrile G.G. G. G. G. G. G. G. G. Benzane Selfonic 10% Acetonitrile G.G. G. G. G. G. G. Benzane Selfonic 10% Acetone Acetophenone Acetophenone F. P. P. F. G. Benzane Selfonic 10% Acetone Acetyl Acetone P. P. F. G. Benzane Selfonic 10% Acetyl Acetone Acetyl Acetone P. P. F. G. Benzane Selfonic 10% Acetyl Acetone P. P. F. G. Benzane Selfonic 10% Acetyl Benzane Acetyl Benzane Acetyl Benzane Acetyl Benzane Acetyl Benzane Benzyl Chloride Acetylene Tetrachloride P. F. G. F. G. E. F. G. Benzane Acetylene Tetrachloride Acetylene Tetrachloride P. F. G. G. F. F. G. E. F. G. Benzane Acetylene Tetrachloride Acetyl Acetyl Acetyl Benzane Acetyl Benzane Acetyl Benzane Benzyl Acetylene G. G	-			-		Non	lened	Mat		yl Poly-	Polyvin		D W				
Acetic Acid Glacial Acetic Anhydride G G G F, G P Acetonitrile G G G G G G Bearsidelyde Acetonitrile G G G G G G Bearsidelyde Acetonitrile Acetonitrile G G G G G Bearsidelyde Acetonitrile Acetonitrile G G G G G Bearsidelyde Acetonitrile Acetylene Gas F, G, E, G, E,			-	W.	-	-	aber	Rub		il ethylene	Alcoho						Acetaldahuda
Acetic Acid Glacial Acetic Anhydride G G G F F G Benzale Byte Acetone Acetone G,E G,E G F F G Benzale Byte Acetone Acetophenone F P F G Benzale Benzal Common Comm	11-		-7.	- 6		-		6		6	F		1	5,6			
Acetic Anhydride Acetonitrile Acetone G.E. G.E. G.				-		6		6	Beet Sugar Liquors		P,G		E	-		6,2	
Acetonitrile G G G G G F F F G Benzama (Benzor) Acetone G,E G,E G F F F G Benzama Sullonic 10% P G E E E E E E E E E E E E E E E E E E					•						P			!		1	
Acetone P P F Benryal Acohol F, E Benryal Chloride P, F, E Benryal Chloride Acetylene Tetrachloride Acetylene Tetrachloride Acetylene Tetrachloride F, G, E C G G G G G G G G G G G G						6.0			Benzane (Benzol)		P			6			Acetic Annyange
Acetophenone Acetophenone Acetyl Chloride Acetyl Chloride F P P P P F G G F F F G G G F F F G G G G			,	.,3	•	-		•			6	G				6	
Acetyl Chloride Acetyl Chloride Acetylene Gas Acetylene Gas Acetylene Gas Acetylene Tetrachloride Acetylene Gas Alkanis Acetylene Gas Acetylene Ga							22			6	F	F	6	G,E		G,E	
Acetyl Chloride Acetylene Gas F,G,E, F,G,E, E, F, E,											F	P		P		F	
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F						3.5					F	P		P		P	
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F		E 6	•	7,5		27.8		17			6	F		P		F	
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F		•		E		CL .			Black Salists Ligaria	C	F	F	E	F.G.E.	E	F.G.E	
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F				E		E.E					-	F				P	
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F				E		C.E		6				Ė	200	6		G	Acids & Alkalis
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F		6		E		E.E	4	6		•		5.0	C	GF	. (FGE	Acrylonitrile
Aluminum Chloride Aluminum Chloride Aluminum Nitrate G G G G F Butsans Aluminum Nitrate G G G G F Butsans Aluminum Nitrate Aminon Hardeners P F G G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F Butyl Acatyl Ricinolasts F G F F G F F G F F G F F G F F G F F G F F F F F G F F F F F G F		Salt Par		6		6	-	6				,,,		F		6	Alcohols
Aluminum Chloride Aluminum Nitrate Aluminum Nitrate Aluminum Sulfate Aluminum Su		•		Ē		6		F						c		c	
Aluminum Nitrate Aluminum Sulfate Aluminum Sulfate G G G G G F Better Amine Hardeners P F G G E Bettyl Acetyl Richelests F G G F Bettyl Acetyl Richelests F G G F F Bettyl Acetyl Richelests F G G F F F G G F F F F G G F F F F F				6		2.5	-	F					-			G	Aluminum Chlorida
Aluminum Sulfate Amine Hardeners P F G G G E Butyl Acetste F G G F Ammonia 100% Ammonium Carbonate F Ammonium Hydroxide G,E E F Ammonium Hydroxide G,E E E F C Ammonium Hydroxide F G G G G G G G G G G G G G G G G G G							2	P.F.								C	
Amine Hardeners P F G G E Butyl Acatyl Ricinelests F G G E F Ammonia 100% G G G E F Butyl Alcohol G E G E F E F E Ammonium Nitrate P F G G G G G G G G G G G G G G G G G G				6	•	•		P				6			,		
Ammonium Carbonate F Ammonium Hydroxide G,E E E E F Butyl Alcohol G,E G,E F E F F E Ammonium Hydroxide G,E E E E F F E Inc-Butyl, N-Butyrate F P,F G E Ammonium Phosphate F G G G G G G G G G G G G G G G G G G					2			F	Betyl Acetate			6		9		9	
Ammonium Carbonate F Ammonium Hydroxide G,E E E E P E Ino-Butyl, N-Butyrate F P,F G E Ammonium Phosphate F G G G G Butyl Stearate F P,F G F E Ammonium Sulfate G G G G Butyl Stearate F P,F G G G F E E E E E E E E E E E E E E E				63					Bertyl Acetyl Ricinolegte	6	E	6	6			-	
Ammonium Hydroxide G,E E E E P E Iso-Butyl, M-Butyrate F P.F. G E Ammonium Phosphate F G G G G Butyl Staarate F P.F. G E E E E E Butyl Staarate F P.F. G F E Ammonium Sidate G G G G G Butyl Staarate F P.F. G F E Ammonium Sidate F G G G G G G G G G G G G G G G G G G						25		22	Butyl Alcohol		P	E	6	6	(6	
Ammonium Nitrate P.F. G. G. G. Butyl Staarate F. P.F. G. E. Ammonium Distate P.F. G. G. G. Butyl Staarate F. P.F. G. F. E. Ammonium Sulfate G. G. G. G. G. Butylaidelyde P.F. G. G. G. F. E. Amyl Acatate F. G. G. P.F. G. G. Butyme G. E. E. E. G. Amyl Alcohol G.E. E. E. E. G. F. F. Butyme G. G. G. E. E. G. G. F. E. G. G. F. E. G. G. F. E. G. G. F. E. G. G. G. E. E. G. G. F. E. G. F. Butyme G. G. G. E. E. G. G. F. E. G. G. F. E. G. G. F. E. G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. G. E. E. G. G. F. Butyme G. G. G. G. E. E. G. G. F. Butyme G. G. G. E. E. G. G. F. F. G. G. G. F. F. F. G. G. G.			4	1,00				-				F		He was		1.	
Ammonium Sulfate G G G G G Burylens G E E E E G G Amyl Alcohol G,E E E E E G G Burylens G G G G G G G G G G G G G G G G G G G		1				-	175				•	E	1	100			
Ammonium Sulfate G G G G G Burylens G E E E E G G Amyl Alcohol G,E E E E E G G Burylens G G G G G G G G G G G G G G G G G G G									Butvi Stearate				6	6		P,F	
Amyl Alcohol G,E E E E G G Butying G E E E E G Amyl Alcohol G,E E E E E G G Butying G G G E E E G G E E E G G E E E G G E E E G G E E E G G E E E G G E E E G G E E E E G G E E E E G G E E E E G G E E E E G G E E E G G E E E E E G G E E E E E G G E E E E E G G E E E E E G G E E E E E G G E E E E G G E E E E E G G E E E E E G G E E E E E G G E E E E E G G E E E E E E G G E E E E E E E E E E E G E				*		4,6	. :		Rutvialdelmie			G	6	6	6	F	
Amyl Alcohol G,E E E E G F Butwin And		E				200		23,0	Remiene			6	6 1	6	6		
Const to the second sec					-			:	Burtoma	C	G	P.F	G	3	G		
Armyl Borste P C C C Datylic Acid P F.E.F. E PF.E. C		6	Ka-01				2.3		Butteria Anid	F	6		E		E	G,E	
To delice A -14			3	P.F.S	6				Code: Acid	•	5				F	P	Armyl Borate
Amyl Borate PFGEPF. GECadmium Cyanide GEGE E Amyl Maphthalene PFGEEEE Amyl Maphthalene PFGEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE				E	6	T.		6	Comium Cyanas		Ē				F	P	
Army Raphthalene P G E E	100			E		E							ì		G	P	
Aniline FC CF C CF C CF C CF C CBicium Chloride G GF C F				Ē	6	F				•				E I	6	F.G	
Aniline Hydrochloride F F F F F F F F F F F F F F F F F F F					E	E	EG	F, G, E				,-			-	F	Aniline Hydrochloride
Aniline Dres F F C Calcium Hypochiorite 6 G C				è.		100		6			•				F	F	
Lalicha I Imme		The second		-		E	6	6				23.00			Ė	P	Aniline Oil
Animal Fats P.F.G. G.E. E. E. F. F. Cane Sugar G. G.E. E.				-		F	-	6		6					ć	PEC	Animal Fate
Animal City Carbolic Acid (diluta) F F				-	Sec. 4			F	Carbolic Acid (diute)	E .		100		-			
Animal Dils F,G G,E E E E E Carbolic Acid (high temp.) P,F,G F,G,E E F P, G		. 6		5			2 2	PFG	Carbolic Acid (high temp.)						6,	0,0	
Aromatic Fuels P.F. F. E. P.F. F. G. Carbon Diazide G.E. G.E. E. E. F. F.			- 1	:					Carbon Dioxide	6		.6				0.5	
		E		š					Carbon Dissiffide	E	E	F			7	r,r	
Carbonic Acid		E	5	7,1,8				6					E			6	
Carbon Manualdo			- 1	3	100								E		F	P	The state of the s
DEICOSUITE													E		6	P	
Cartor Oll						3,1,									F	P	
		E	- 1	6	E (-		The state of the state of			6		6	6	
And the same of th			100		200	1		-					Ğ	100	F	6	
Barium Mitrato G G G G G Chlorian F.G F.G F G G.F G				6		6 1	F,	5,6						6	6	G	
DOTTON SETTALD C C C CONTINUE WATER P C			1	E	1		6	F						uma il	C	6	
Bettary Acid e e e		7		6		\$		•							E	6	Bettary Acid
Chieracette Add P &E			-	Ē		E			Caveraecatic Acid		-				-	-	
BEST'S SAPETY DIRECT	7000	MITY DUPS	5 SA	MTS		7											

TYPE OF MAT'L	A	В	C	D		A	В	C	D		A	B	C	T
-Acetaldehyde	E	G	F		F-Fatty Acids	E	P	E	G	Petroleum Spirits	Ε	F	E	
Acetate	G	F	G	P	Ferrocyanide Fluoric Acid	F	G	F	F	Phenoi	E	F	G	
Acetic Acid Acetone	E	E	E	E	Fluorine	G	F	G	F	Phenylene Diamine Phenyl Hydrazine	G	G	F	
Acetylene Gas	E	E	E	G	Fluorine Gas	G	F	G	F	Phil-solv	E	F	G	
Acetylene Tetrachloride	F	NR	G	P	Formaldehyde	E	E	E	F	Phosphoric Acid	E	G	Ē	
Acrylonitrile	G	F	F	F	Formic Acid	E	E	E	E	Pickling Solution	G	G	G	
Amidol	G	E	G	E	Freon 11	G	P	F	F	Pierie Acid	E	G	E	
Amine Hardeners	F	F	G	F	Freon 12 Freon 21	G	P	F	F	Pine Oil	E	9	. E	
Ammonium Hydroxide Amyl Acetate	E	E	E	E	Freon 21	G	P	F	F	Pitch Plating Solutions	E	E	E	
Amyl Alcohol	E	E	E	G	Furtural	G	G	F	F	Potassium Alum	G	G	E	
Annydrous Ammonia	G	Ē	Ğ		G-Gasoline, Leaded	G	P	G	F	Potassium Bromide	G	G	Ğ	
Aniline	G	F	G	G	Gasoline, Unleaded	F	P	E	F	Potassium Chrome Alum	G	G	G	
Aniline Hydrochloride	F	P	F	F	Glycerine	E	E	E	E	Potassium Dichromate	F	F	F	
Aniline Oil	F	P	F	G	Glycerol	E	E	E	Ε	Potassium Ferrocyanide	G	G	G	
Animal Fats Animal Oils	Ē	F	E	G	Glycol Gold Fluoride	G	Ē	E	E	Potassium Hydrozide Printing Inks	E	EG	E	
Anodex	G	É	G	E	Grain Alcohol	E	Ē	G	Ğ	Propane Gas	Ē	E	E	
Anthracene	F	P	G	F	H-Halogens	G	F	G	F	Propanoi-iso	Ē	Ē	E	
Aromatic Fuels	P	NR	G	F	Hexamethylene Tetramine	F	G	F	G	Propyl Acetate	G	F	G	
-Banana Oil	F	P	G	F	Hexane	F	P	E	F	Propyl Alcohol	E	E	E	
Benzaldehyde	F	F	G	F	Hexyl Acetate	F	P	F	F	Propyl Alcohol Iso	E	E	E	
Benzene Benzyi Alcohol	P	NR	G	G	Hydraulic Oil: Petroleum Base	G	P	E	F	Propylene Gas Propyne Gas	E	F	E	
Benzyl Benzoate	Ğ	F	Ğ	F	Ester Base	E	P	G	P	R-Red Fuming Nitric Acid	P	P	E	
Benzyi Chloride	F	P	G	G	Hydrazine	F	G	G	E	S-Silver Nitrate	E	G	G	
Biacosoive	G	P	G	F	Hydrochloric Acid	E	E	G	G	Skydrol 500	P	G	P	
Butane	E	F	E	P	Hydrofluoric Acid	Ε	E	G	F	Sodium Carbonate Metol		G	G	
Butyl Acetate	G	F	F	.b	Hydrogen Gas	E	E	E	G	Sodium Hydroxide	E	E	E	
Butyl Alcohol	E	E	E	G	Hydrogen Peroxide - 30%	G	G	G	F	Sodium Sulphite Sodium Thiosulphide	G	GG	G	
Butylaidehyde Butylene	E	G	E	E	Hydro-Quinone Hydrafluosilic Acid	G	G	G	F	Solvarsol	E	F	GE	
-Calcium Hydroxide	Ē	E	Ē		1— Inorganic Salts	E	E	E	G	Solvessos	P	P	É	
Carboire Acid	E	E	E	G	Iso-ociane	F	G	÷p ·	P	Slearic Acid	E	E	E	
Carbon Dioxide	E	E	E	E	Isopropanol	E	E	E	G	Stoddards Solvent	E	F	E	
Carbon Disulphide	F	F	G	F	Isopropyl Alcohol	E	E	E	G	Styrene	P	P	F	
Carbon Tetrachioride Castor Oil	F	P	G	F	K-Kerosene	E	E	F	F	Styrene 100% Sulphuric Acid	G	PG	F	
Cello-Solve	F	G	E	G	Ketones	G	F	E	F	T - Tannic Acid	E	E	GE	
Cello-Solve Acetate	G	F	G	F	L-Lacquer Thinners	G	G	F	F	Tetra Hydro Borane	F	P	F	
Chlorophenylene Diamine	G	P	F	F	Lactic Acid Lauric Acid	E	E	F	G	Tetraethyl Lead	E	F	E	
Chlorine	G	F	G	F	Lineoleic Acid	E	Ē	P	G	Tetrahydrofuran	P	F	P	
Chlorine Gas	G	F	G	F	Linseed Oil	Ē	E	P	F	Toluene Di-isocyanate	F	G	F	
Chloro Benzene	F	P	P	P	M - Maleic Acid	E	E	E	G	Toluol	F	P	E	
Chloroscetone	G	E	F	F	Mercuric Chloride	G	G	E	F	Trichlor Trichlorethylene	F	P	G	
Chloronaphithalene	F	6	F	F	Mercury	G	PE	G	F	Trichloroetnane	P	P	F	
Chloropicrin	P	P	P	G	Methane Gas Methanol	E	G	E	G	Tricresyl Phospha:e	G	F	F	
Chlorothene	P	NR	F.	P	Methyl Acetate	G	G	F	P	Tridecyl Alcohol	G	F	E	
Chromic Acid	F	P	F	G	Methyl Alcohol	E	G	E ·	G	Triethanolamine	E	G	E	
Chromotex	G	G	G	G	Methylamine	F	G	F	F	Trinitrotoluene	G	P	Ε	
Citric Acid Cotton Seed Cil	E	E	E	E	Methyl Bromide	G	G	F	P	Trinitrotoluol Triotane	E	P	E	
Creosote	G	G	G	G	Methyl Cellosoive	G	E	G	P	Tung Oil	E	P	E	
Cresol	Ğ	G	Ğ	Ğ	Methyl Chloride Methyl Ethyl Ketone	G	·F	G	NR	Turco No 2998	P	P	P	
Cupric Nitrate	G	G	G	G	Methyl Formate	G	F	F	F	Turpentine	G	F	E	
Cyclonexane	G	F	G	F	Methylene Bromide	Ğ	G	G	P	U - Unsymmetrical				
Cyclonexanol	G	F	G	F	Methylene Chloride	G	G	F	P	Dimethyl Hydrazine	F	P	G	
Cyclonexanone -Decaborane	G	E	G	P	Methyl Isobutyl Ketone	G	F	G		V - Varnoline Gas Varsol	E	F	E	
Degreasing Fluids	F	P	G	P	Methyl Methacylate	G	G	G	F	Vegetable Oils	E	G	EGE	
Diacetone Alconol	E	E	E	P	Mineral Oils Monochlorbenzene	E	E	F	G	W-Wood Alcohol	Ē	E	Ğ	
Diethyltiamine	G	F	E	F	Monoethanolamine	E	E	G	G	Wood Preservatives	G	F	G	
Di-Isocyanate	G	P	F	F	Morpholine	Ē	Ē	E	G	Woodyouth	F	P	E	
Diborane	F	P	F	P	Muriatic Acid	. E	E			X - Xylene	P	P	E	
Dibenzyl Ether Dibutyl Phinaiate	G	G	G	F	N-Naphthalene	G	F	G	GG	Xylidene	E	F	E	
Dibutyl Phinalate Dichlorethane	G	NR	G	P	Naphthas, Aliphatic	E	F	E	P	Z - Zinc Chloride	-	Ε	E	
Dichloroporopene	P	P	G	F	Naphthas, Aromatic	G	P	G	P					
Diesel Fuel	G	P	G	F	Nitric Acid Nitric Acid. Red &	G	F	F	F					
Dietnanoiamine	E	G	E	E	White Fuming	P	P	P	P	PHYSI	CAL			
Diethylamine	E	G	E	F	Nitrobenzene	F	P	F	P	CHARACT		CS		
Disobutyi Ketone	P	F	P	P	Nitroethane	F.	P	F	P	·				
Dimethyl Formamide	F	F	P	G	Nitrogen Gas	E	E	E	G	Tensile Strength	E	E	E	
Dioctyl Phthaiate Diosane	GE	G	G	P	Nitromethane	F	P	F	P	Elongation	E	E	F	
- Emulsifying Agent	Ğ	-	G	F	Nitropropane Nitrous Oxide	G	G	F	F	Tear Resistance	G	G	F	
Emuithogene	G	F	G	F			1	1	F	Abrasion Resistance Heat Resistance	G	G	E	
Epichioro	G	P	P	F	O-Octyl A'conol	E	E	E		Ozone Resistance	E	G	G	
Epoxy Resins Dry	E	E	E	E	Oleic Acid	E	F	E	FG	Sunlight Aging	E	F	G	
Esters	F	P	F	P	Oxalic Acid	-	P	F	P	Shelf Life Aging	Ē	E	E	
Ethane Gas	E	G	E	G	Oxygen Liquid	G	F	G	F					
Ethanol	=	E	G	G	P-Paint Thinners	G	-	0						
Etners Etnyl Acerale	E	G	E	P	Paint and Varnish Removers	G	F	G	P			-		_
Ethyl Alcohol	E	E	G	G	Palmitic Acid	E	E	E	G	KEY E-Excellent G	-Goo	d	F-F	
Einyi Einer	=	G	E	9	Paradichioropenzene	E	F	G	E	P-Poor NR-N				-
Einyl Formate	G	F	G	P	Parathione	P	F	F	P	P-POOL NH-N	OI HEC	.omr	ende	d
Ethylandine	F	F	F	P	Penta Borane	F	P	F	P	TYPE OF MATIL	VE	٧.		
Elnylenediamine	E	G	E	F	Pentachioraphenoi	F	G	F	F	TYPE OF MAT'L	KE,	4+1	ri	10
Einylene Dichloride	F	P	F	P	Pentane	E	G	E	P	A-Neoprene	C -	VII C	11	. 6
Ethylene Gas	E	G	E	G	Perchloric Acid	E	F	F	P	H-Meont elle	C-	RI	ına-	- N
Ethylene Giycol -	E	E	E	G	Perchiorethylene	F	NR	E	NR	B-Nat. Rubber	The second	L	1110	

This "Comparative Use Chart" shows the relative resistance ratings of various glove materials to solutions commonly used in industry. When selecting gloves for applications not shown on the "Comparative Use Chart", call your local Vallen office giving as much detailed information as possible including the following points:

1. Chemical composition of the solution

4. Abrasive effects of materials being handled

5. Time cycle of usage

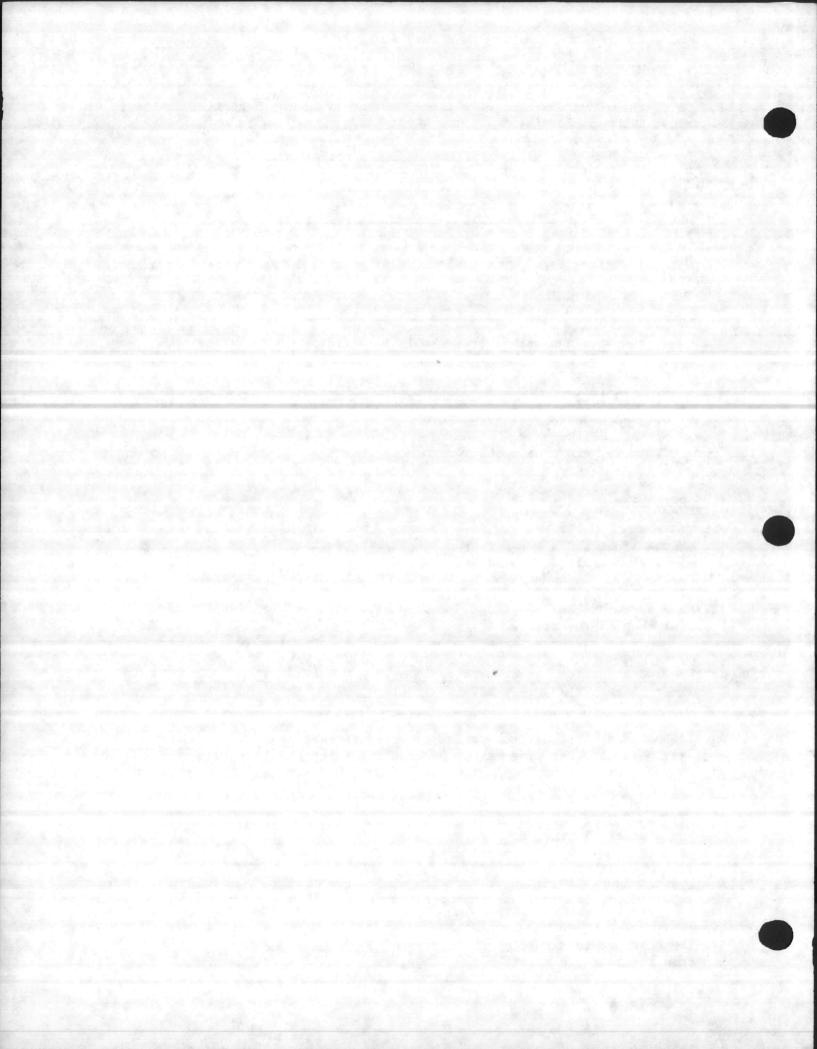
3. Temperature Conditions

QUIZ: MODULE IV - PERSONAL SAFETY

1.	List the two categories of respirators.							
	a							
	b.							
2.	Which type of eye protection is best for liquid splashes?							
	a. Face shield							
	b. Safety glasses							
	c. Goggles							
	d. Contact lenses							
3.	What problem does facial hair cause when wearing a respirator?							
4.	List at least one restriction which would prevent you from selecting an air							
	purifying respirator for use in a hazardous environment.							
5.	For the greatest amount of skin and respiratory protection the EPA recommends:							
	a. Level A							
	b. Level B							
	c. Level C							
	d. Level D							
6.	Selection of the correct protective clothing should:							
	a. Primarily be based on comfort							
	b. Be based on cost							
	on chemical resistance to all contaminants present							
	 d. Be based on the most toxic contaminant present only e. Always be the same regardless of the contaminant present 							
	-, o the same regardless of the contaminant present							
7.	Which type of environmental monitoring device listed is the most sensitive:							
	Total alialy Zel							
	b. Colorimetric tubes							

d. Combustible gas indicator

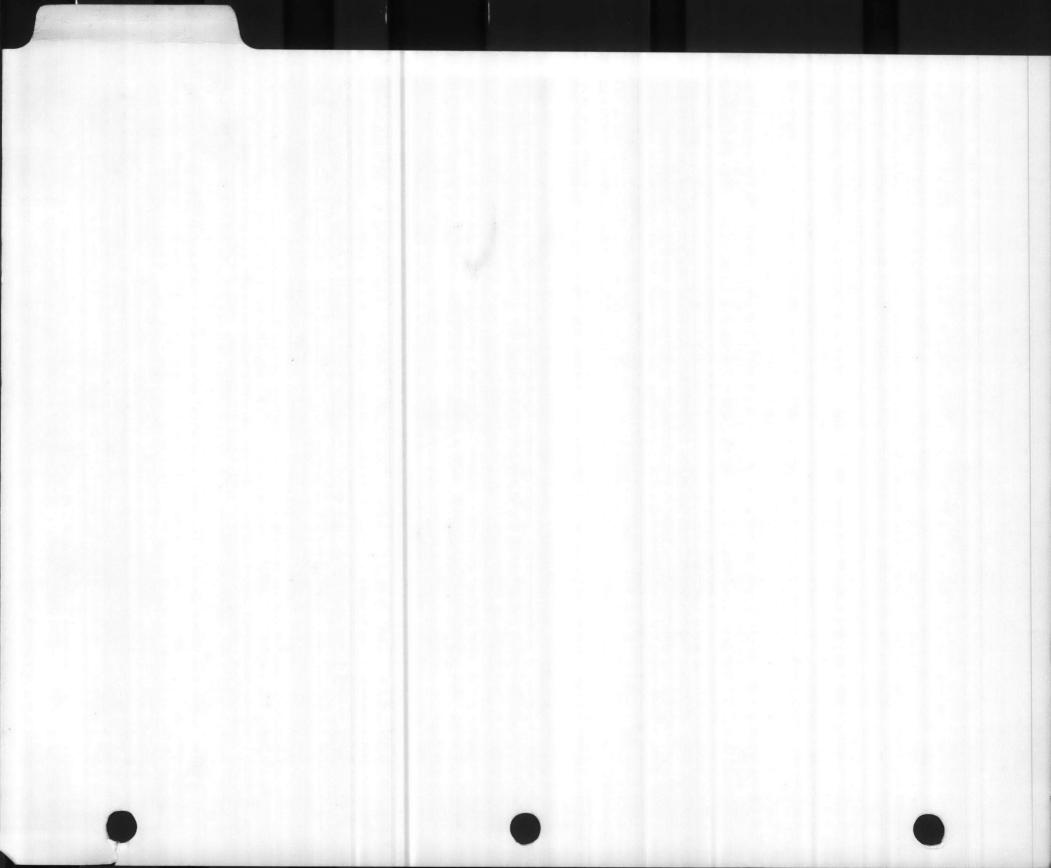
8.	Using the glove chart on page IV-A-2 (or equivalent), a glove material for the following chemicals:	determine	the bes
	a. Phenol -		
	b. Ethanol -		
	c. Esters -		
9.	Using the same chart, which type of glove material has resistance?	the best	abrasio
10.	Chemical cartridge respirators should be:		
	a. NIOSH approved		
	b. Fit tested		
	c. Regularly inspected		
	d. Assigned to one person only		
	e. All of the above		
	f. a, b, and c only		
TRU	or FALSE		i i
11.	A SCBA provides more respiratory protection than a chemical cartridge respirator.		
12.	As a worker becomes more experienced, less safety equipment is required.	_	
	By OSHA standards, an atmosphere is oxygen deficient if it contains less than 19.5% oxygen.	<u>-</u>	
14.	If the correct respirator cartridges are not readily		
	available, another type may be used, because any kind is better than none.		
15.	Any Level A protective outfit will protect against all known chemical hazards.		
16.	Contact lenses should never be worn where there is exposure to airborne hazardous chemicals.		
17.	The best way to determine the contents of a drum is to		



TAB PLACEMENT HERE

DE	SCRIPTION:
	HW CLASSIFICATION
X	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



MODULE V

HAZARDOUS WASTE CLASSIFICATION

I. LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should:

- A. Be able to determine which wastes are hazardous according to EPA's definition.
- B. Be able to determine the proper shipping name, the hazard class (DOT), and the identification number (DOT) required to properly label hazardous wastes.
- C. Have an understanding of the chemical and physical characteristics, and the hazards of each class of hazardous waste to prevent handling and storage problems.
- D. Be familiar with the reference materials available to determine the physical and chemical properties of various hazardous wastes.

II. INTRODUCTION

Proper hazardous waste (HW) management begins with properly identifying and classifying all of an activity's HWs. This process begins with identifying all the waste streams generated throughout the Base. The RCRA regulations define a waste as follows:

- A useless by-product of an operation.
- Any material which is to be disposed.
- Any material which can no longer be used.

III. EPA HAZARDOUS WASTE DEFINITION.

- A. Once the waste streams are identified, they must be classified hazardous or non-hazardous according to the EPA definition. The following is a simplification of the EPA definition of hazardous wastes:
 - A waste which is listed as hazardous in the RCRA regulations (40 CFR 261).
 - A mixture that includes a listed hazardous waste.
 - A waste which exhibits any of four characteristics (ignitability, corrosivity, reactivity, or EP toxicity) listed in the RCRA regulations.
- B. There is currently some disagreement concerning the definition of hazardous waste versus hazardous materials. The disagreement stems from the Defense Logistic Agency's (DLA's) operating procedures. In general, a substance that cannot be used by an activity is turned over to a DLA Defense Property Disposal Office (DPDO). The DPDO determines if it can be reutilized, transferred to a government user, donated or sold. If none of these options exists the substance is

1145D Date of last revision: May 85

classified by DPDO to be a waste. The problem is that EPA will not acknowledge DLA/DPDOs as the generator unless DLA/DPDO has the HW Permit. As more DLA/DPDOs get their own permits the legal responsibilities of the Navy facility, as a generator, will decrease. Be aware of the controversy and protect against liabilities as the generator.

IV. EPA IDENTIFICATION PROCEDURE.

The following procedures should be used to apply the EPA definition to a waste to determine if a waste is hazardous and if it is, this procedure will identify the appropriate EPA HW Number for each waste. Appendix A contains excerpts from 40 CFR 261 to use with this procedure.

- Step 1 Determine Proper Name of waste and specific source of waste.
- Step 2 Check 40 CFR 261 Subpart D, HW Lists in the following order:
 - ° "U" List (40 CFR 261.33e)
 - ° "P" List (40 CFR 261.33f)
 - ° "K" List (40 CFR 261.32) using specific source of waste
 - "F" List (40 CFR 261.31) using non-specific source of waste
- Step 3
 If not listed in Subpart D, determine if the wastes exhibit any of the four characteristics defined in Subpart C. The four characteristics are:

ignitable (40 CFR 261.21) corrosive (40 CFR 261.22) reactive (49 CFR 261.23) EP toxic (40 CFR 261.24)

The specific properties for each characteristic are defined in the paragraphs specified. In order to complete Step 3, the physical and the chemical properties of the wastes must be determined. In this chapter, we will discuss some of the important properties of wastes and some of the reference materials available to determine these properties.

This hazardous/non-hazardous determination is the responsibility of the generator. A generator is responsible for proving that all wastes generated are not hazardous using the currently available technology. Wastes can be declared hazardous without testing. But wastes cannot be determined non-hazardous without testing or without verifiable proof.

For each hazardous waste, a generator must specify the EPA HW Identification number (EPAHW Number) on manifests and on the EPA HW reports.

V. DOT CLASSIFICATION SYSTEM.

Now that all the waste streams have been identified as hazardous or non-hazardous, the next step is to properly package and label the hazardous wastes.

RCRA regulations require HW to be labeled and packaged according to the Department of Transportation (DOT) regulations for the Hazardous Material Transportation Act (HMTA), 49 CFR 100-199. The HMTA was originally established to regulate the transportation of <u>hazardous materials</u>. It specifies required packaging, labeling and transportation procedures for hazardous materials.

To use this DOT system, a waste must be classified in to one of the nine DOT hazardous classes. Table V-1 shows the nine DOT classes. The DOT classes have a corresponding UN Class Number (1-9) to be used for identification in non-English speaking countries. The following sections define each DOT class.

A. Class 1--Explosives. Explosives are defined in 49 CFR 173.50 as any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, i.e., with substantially instantaneous release of gas and heat, unless such compound, mixture, or device is otherwise specifically classified.

Four classes of explosives exist:

Explosive A - detonates readily (explodes with suddeness and violence) - Dynamite

Explosive B - rapid combustion rather than detonation - fireworks

Explosive C - small quantities of Explosive A and/or Explosive B - sparkler fireworks

Blasting Agent - design for blasting but not so sensitive that it will explode accidentally - Ammonium Nitrate

B. Class 2--Gases. Any material or mixture having a container pressure exceeding 40 psia at 70°F or a pressure exceeding 104 psia at 130°F, or a liquid flammable material having a vapor pressure exceeding 40 psia at 100°F.

Compressed gas is further defined as flammable or non-flammable depending on the ignition temperature and limits of flammability.

Compressed gases may be stored in cylinders in various ways as shown below.

1. Non-liquified compressed gas - gas exists in vapor phase only.

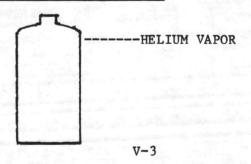
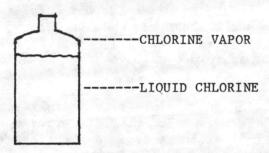


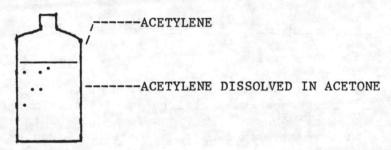
TABLE. V-1
Table of DOT Classes

N Class	DOT Class
1	Explosives (Class A, Class B, Class C, Blasting Agents)
2	Compressed Gases (Flammable, Non-Flammable)
3	Flammable Liquids
4	Flammable Solids
5	Oxidizing Material or Organic Peroxide
6	Poisonous (Class A, Class B, Irritating Material) includes infectious substances
7	Radioactive Material
8	Corrosive Material
9	Other Regulated Material (ORM-A through ORM-E)

2. Liquified compressed gas. A liquid and the vapors of the liquid under pressure (see drawing).



2. Compressed gas in solution. Containers which contain a gas dissolved in another material. As the gas is used, more dissolved gas comes out of solution (see drawing).



C. Class 3--Flammable Liquids.

- 1. Flammable liquids are any liquid having a flashpoint below 100°F. Examples include acetone, benzene and rubber cement.
- Combustible liquids are any liquids having a flashpoint at or above 100°F and below 200 °F. An example is kerosene.
- 3. Pyrophoric liquids are liquids that ignite spontaneously in dry or moist air at or below 130°F. An example is pentaborane.
- D. Class 4--Flammable Solids or Substances. These are materials which may be ignited and that continue to burn once ignited. These include substances capable of spontaneous combustion. Examples include wood, paper, carbon, and metallic calcium.

E. Class 5--Oxidizing Substances.

- Oxidizers are substances that yield oxygen readily to stimulate combustion. Examples include chemicals containing chlorates, permanganates, and nitrates. These substances present an extreme fire hazard. Normal firefighting procedures may not be effective because the burning material is supplying its own oxygen.
- Organic peroxides are derivatives of hydrogen peroxide (H₂O₂)
 with one or more of the hydrogen atoms replaced by organic
 radicals.
 - (a) The organic peroxides are potentially dangerous because they are considered unstable chemicals. Unstable chemicals may react with themselves or decompose, producing a violent

reaction. Heat, shock, or friction may stimulate the reaction. The degree of violence of the reaction depends on the specific chemical and the temperature. Methyl ethyl ketone peroxide, for example, may detonate. The organic peroxides are combustible and, therefore, increase the intensity of a fire. In cold weather, solutions of organic peroxides may form sensitive crystals which may explode when disturbed.

(b) The following ethers form ether peroxides which pose a hazard: diethyl ether, ethyl tertiary butyl ether, ethyl tertiary amyl ether, and diisopropyl ethers. So far, there seems to be no way to completely eliminate peroxide formation, although proper containers and storage help. Organic peroxides should be stored in separate buildings away from all sources of heat including direct sunlight.

F. Class 6--Poisonous and Infectious Substances.

- 1. Poisonous materials.
 - (a) Poison A--extremely dangerous poisons. These include poisonous gases or liquids of such a nature that a very small amount of the gas ior vapor of the liquid when mixed with air, is dangerous to life. Examples: phosgene, nitrogen peroxide, and nitric oxide.
 - (b) Poison B--less dangerous poisons. These substances are liquids or solids (other than class A poisons or irritating materials) which are known to be so toxoc to man that they present a hazard to health. Examples: tetraethyl lead, aldrin, calcium arsenate, arsenic sulfide, and nicotine (liquid).
- 2. Irritating material. These are liquid or solid substances which, upon contact with fire or exposure to air, give off dangerous or intensely irritating fumes. These do not include any poisonous materials. Example: tear gas.
- Infectious substances and etiologic agents. Viable microorganisms, or their toxins, which may cause human disease.
- G. Class 7-Radioactive Substances. These are materials that spontaneously emit ionizing radiation, and have a specific activity greater than 0.002 microcuries per gram. Examples include: Cesium 137, cobalt 60, and uranium 233. Radioactive substances are classified according to the strength of their radioactive emissions. They are divided into 3 levels with I being the weaker emitters and III being the stronger emitters.
- H. Class 8--Corrosives. Any gas, liquid or solid that causes visible destruction of human skin tissue, or a liquid that has a severe corrosion rate on steel.
 - 1. The corrosivity of a substance is determined by its pH (acidity or alkalinity).

The RCRA definition of corrosivity is pH less than 2.0 or greater than 12.5. Or it corrodes steel at a rate greater than .25 inch per year at 130°F. Examples of corrosive compounds include:

Inorganic Acids	Organic Acids	Organic Solvents	Caustic (Bases)
Nitric	Acetic	Dicholorethylene	Ammonia
Sulfuric	Butyric	Ethylene chlorohydrin	Sodium Hydroxide
Hydrochloric Chromic Hydrofluric	Formic	Methyl ethyl ketone Perchloroethylene	Potassium Hydroxide

- 2. Corrosive liquids. These are the most frequently encountered corrosives. They may include acids, bases, and organic materials. The skin and eyes are the most frequently affected. Corrosives can cause irritation and actual destruction of tissue, depending on concentration and length of time of exposure. Some corrosives produce vapors which are particularly harmful to the lungs. Caustics (bases) are particularly damaging to the eyes.
- 3. Corrosive solids (sodium hydroxide, phenol, elemental sodium, and phosphorous). The dusts of these materials are particularly dangerous to skin, eyes, and respiratory system.
- 4. Corrosive gases (formaldehyde, ammonia, sulfur dioxide, chlorine, ozone, and nitrogen dioxide). These are particularly hazardous to the respiratory system. Those which are very soluble (such as ammonia) affect the upper respiratory tract. Less soluble materials (such as sulfur dioxide) affect the bronchial tubes. The least soluble material (such as ozone) affect the air sacs (alveoli) deep in the lungs where oxygen enters the bloodstream.
- I. Class 9--Miscellaneous dangerous substances. Any material that may pose an unreasonable risk to health, safety, or property when transported in commerce and that does not meet any of the definitions of the other hazard classes specified. These substances are generally known as Other Regulated Materials (ORM).

There are five ORM categories, ORM-A, ORM-B, ORM-C. ORM-D, and ORM-E.

- ORM-A. Anesthetic, toxic, noxious, or irritating materials (other than class 6) that can cause discomfort to personnel in the event of leakage. Examples include: Acetaldehyde, ammonia, aldrin, and bone oil.
- ORM-B. Corrosive materials which may cause damage to transport vehicles (other than class 8). Examples include: metallic mercury, barium oxide, calcium oxide, and ferric chloride.
- 3. ORM-C. Materials with characteristics which make them unsuitable for shipment unless properly packaged, for example: excelsior (must not get wet), feed (wet, mixed - must stay clean) and fish scrap (very odorous).
- 4. ORM-D. Small quantities of hazardous materials that meet the definition of consumer commodity, such as: hair spray and shaving cream.

- 5. ORM-E. Material that is not included in any other hazard class, but is subject to the requirements of the DOT subchapter because it is a hazardous "waste or substance," for example PCBs.
- J. DOT Class Determination.

The DOT class is determined by using the DOT Hazardous Material Table (49 CFR 172.101). The proper name of the waste is compared with the items listed alphabetically in column two. If the proper name is found in the table the following information can be found:

- DOT Hazard Class (1-9) Column 3
- DOT Identification Number (UN/NA) Column 3A

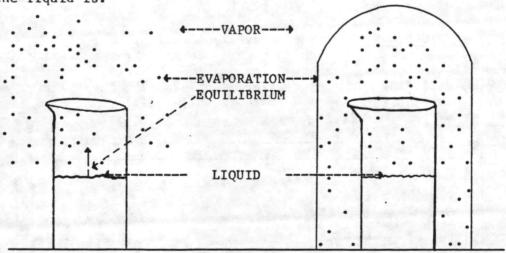
If the proper name is not listed in the table, check to see if there is a generic category (eg. hazardous waste n.o.s. or flammable liquid n.o.s.) which best describes the waste. The most specific category should be use. For example, do not use hazardous waste liquid, n.o.s. for every waste.

- K. Description of Hazardous Material (Waste) on Shipping Papers
 - 1. The basic description of a hazardous material must include:
 - i.) The proper shipping name for the material in the HMT (172.101) eg. "Acetone".
 - ii.) The hazard class prescribed in the HMT eg. "Acetone, Flammable liquid.
 - iii.) The Identification number prescribed in the HMT eg. "Acetone, Flammable liquid, UN 1090".
 - iv.) If an "E" in column 1, add RQ eg. "Acetyl chloride, Flammable liquid, UN 1717", RQ 5000/2270.
 - 2. If the Hazardous Material is a waste, the following changes must be made:
 - i.) To the proper shipping name of a material, the word "Waste" is added preceding the name of the material eg. "Waste Acetone, Flammable liquid, UN 1090".
 - ii.) The proper shipping name "Hazardous Waste, n.o.s." has been added to the HMT with a hazard class of ORM-E for use where no other HMT listing or hazard class is appropriate.
 - iii.) When a hazardous waste is described by other than its technical name, the EPA designated name is to be included in parenthesis following the proper shipping name, eg. "Hazardous Waste, Solid, n.o.s., (Metal hydroxide sludge) ORM-E NA 9189

VI. DEFINITIONS OF HAZARDOUS PROPERTIES.

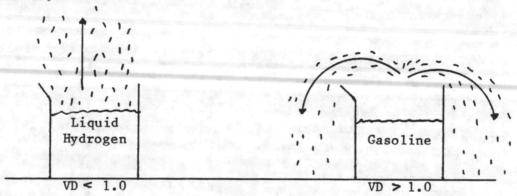
In order to use the EPA identification system and the DOT classification system, the physical and chemical properties of a substance must be identified. Some of the important properties are defined in the following sections.

A. Vapor pressure. Molecules of a liquid are in constant motion. Some leave the liquid and enter the atmosphere above it. At the same time, some molecules come back into the liquid. If the liquid is not enclosed, more molecules may leave the liquid than return to it. This is defined as evaporation. When the liquid is enclosed, eventually an equilibrium will be reached between the molecules 'eaving and those returning. This vapor which is in the atmosphere above the liquid exerts a pressure on the liquid which is defined as vapor pressure. A liquid's vapor pressure can tell you how readily a liquid will vaporize and what the concentration of the vapor above the liquid is.



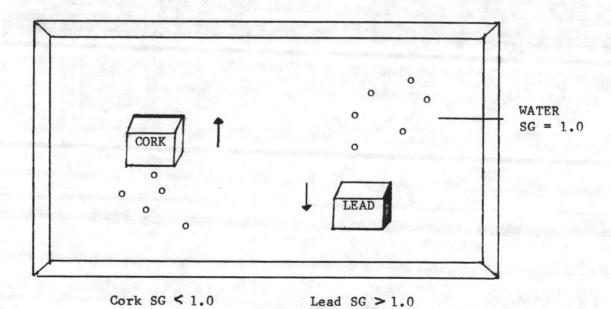
VAPOR PRESSURE

- B. Boiling point. The temperature of a liquid at which its vapor pressure equals the surrounding pressure.
- C. Vapor density. The density (mass per unit volume) of dry air equals 1.0. The density of a specific vapor may then be compared with that of dry air. A vapor with a density of less than 1.0 indicates that the vapor is lighter than air and, when released into the atmosphere, will move upward. A density greater than 1.0 indicates that the vapor is heavier than air and will move downward through the atmosphere to the lowest possible point. Flammable substances with a vapor density greater than 1.0 are of concern because they accumulate in low areas and can pose a very significant fire hazard. For example, gasoline has a vapor density that is 3 to 4 times heavier than dry air.



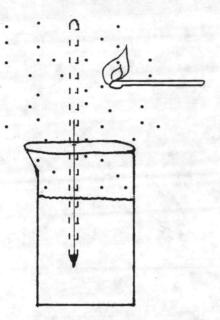
VAPOR DENSITY

D. Specific gravity. The density of a liquid compared to that of water (defined as 1.0). Liquids with a specific gravity greater than 1.0 will sink through water. Liquids with a specific gravity less than 1.0 will float on top of water. For example, the specific gravity of gasoline is 0.8. Therefore, gasoline will float on water.

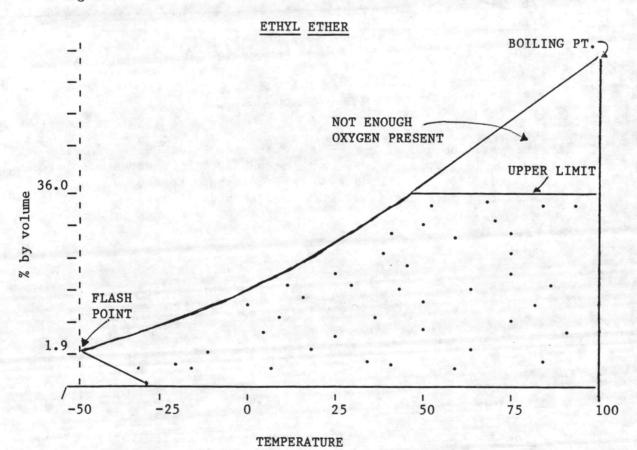


SPECIFIC GRAVITY

E. <u>Flashpoint</u>. The lowest temperature at which a liquid will give off sufficient vapor to ignite when exposed to a flame.

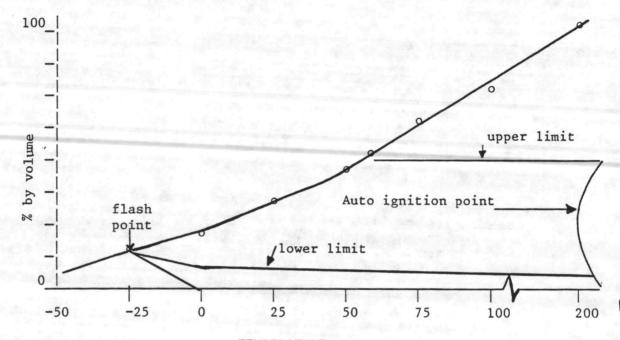


F. <u>Limits of flammability</u>. The range of concentrations (% by volume) of a mixture of air and vapor, that will burn upon exposure to an ignition source.



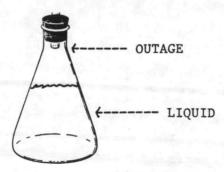
LIMITS OF FLAMMABILITY

- G. <u>Ignition Temperature</u>. The minimum temperature required to ignite a specific air and vapor mixture.
- H. Auto Ignition Temperature. The minimum temperature of an air/vapor mixture that will cause the mixture to ignite spontaneously (with no exposure to an ignition source). The limits of flammability graph for carbon disulfide shows the auto ignition temperatures (points) for various mixtures of air and carbon disulfide.



TEMPERATURE LIMITS OF FLAMMABILITY

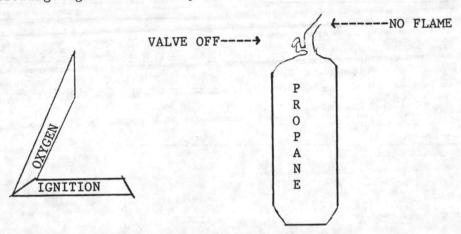
I. Outage. The amount by which a container falls short of being full of liquid. This is important because as temperatures rise, liquids expand. If there is no room for the liquid to expand, the container will rupture since liquids are not compressible.



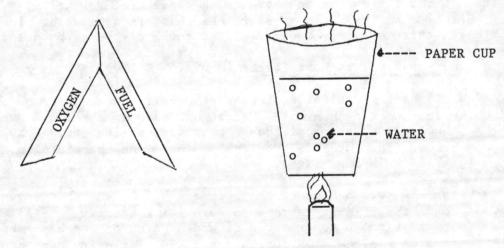
J. Spontaneous combustion. This is a fire which is started by the accumulation of heat produced by the slow oxidation of materials such as oily rags, olive oil, peanut oil, roofing paper, wastepaper,

and whale oil. Under normal conditions, heat is generated slowly, providing ample time for it to transfer to the surrounding environment. However, when these types of materials are stored in such a way as to prevent this heat transfer, the heat resulting from slow oxidation builds up and may ignite the substance involved.

K. The fire triangle. The biggest problem with flammable materials is the danger of fire. In order to have a fire, all three elements of the fire must be present: fuel, ignition, and oxygen. The following figures are examples of the use of the fire triangle.



In the above example the fuel side of the fire triangle is missing. The valve of the propane tank is turned off and therefore the torch will not light. In this case the flame is the ignition source and the surrounding air provides the oxygen.



BOILING WATER IN A PAPER CUP

In this example the ignition side of the fire triangle is missing. The paper cup will not burn because the boiling water keeps the paper at 212°F which is below the ignition temperature for the paper. In this case the paper is the fuel and the surrounding air provides the oxygen.

L. The pH scale. A solution's pH is a measure of its acidity of alkalinity. Strictly speaking, it is a measure of the concentration of free hydrogen ions (H⁺). A solution with a pH of 7 is neutral. An example of a solution with a pH of 7 is pure water. A pH of less than 7 signifies an acidic solution and a pH of greater than 7 signifies a basic (alkaline) solution.

						Ne	eutr	al S	olut	ions						
			Ac	id S	olut	ion				<u> </u>	Basic	Solu	tions			
		More	str	ong1	y ac	idic		1		Mon	re st	rong1	y bas:	ic		
pH=	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Some examples of acids and bases with their associated pH's are listed below. Note that the pH scale is a log scale. Therefore a solution with a pH of 4 is 10 times more acidic than a solution with a pH of 5 and 100 times more acidic than a solution with a pH of 6, etc.

Item	pH
Concentrated Nitric Acid	1
Vinegar	3.0
Saliva	6.5-7.5
Sea Water	8.3
Runoff from the Norfolk fire	13.5

VII. SUGGESTED REFERENCE MATERIALS

The chemical and physical properties of a hazardous substance can be found in many references. The challenge is to determine which references have which substances and have which types of information. The following sections describe various references that are available. In addition to these, there are many new references currently being produced.

A. Material Safety Data Sheets (MSDS).

MSDSs are technical bulletins, generally two to four pages in length, which contain chemical information, such as chemical composition, chemical and physical characteristics, health and safety hazards, and precautions for safe handling and use. An example of a MSDS format is shown in Appendix B.

The MSDS was chosen by the Occupational Safety and Health Act (OSHA) to be the primary vehicle for providing specific, detailed information on the identities and hazards of the hazardous chemicals in a work place. OSHA requires a MSDS for every hazardous chemical identified in the workplace. The MSDSs must be stored in a place accessible to the actual work area where employees may freely read or copy them.

Normally, MSDSs are completed by the manufacturer of the hazardous substance and provided to Naval activities when the substance is procured through the supply system. If a chemical is being used in a workplace and the activity does not have the MSDS, there are many places to obtain a copy. The following list is some of the ways to obtain MSDSs.

- Call the following:
- Activity fire department
- Activity Safety Officer
- Activity Environmental Coordinator
- Engineering Field Divisions (NAVFACENGCOM)
- Naval Energy and Environmental Support Activity, Port Hueneme, CA
- Hazardous Material Technical Center (HMTC)
- Substance Manufacturer
- Navy Environmental Health Center Norfolk, VA

2. Check:

- Hazardous Material Information System (HMIS) See Section B.
- Various microfiche and computer listings of MSDSs
- B. The DOD Hazardous Material Information System (HMIS).

The DOD HMIS is a central system for the collection, maintenance, and dissemination of the data contained in the Material Safety Data Sheets and other sources of information. The information in the system can be used to help develop procedures to prevent mishaps in handling, storage, use, transportation, and disposal of hazardous material and waste. This system provides a mechanism by which information on hazardous materials can be collected, stored, updated, and made available to users in the field. Materials are listed according to their National Stock Number (NSN). Field personnel have access to the information through micofiche, usually located in Safety Offices at naval activities.

The Navy Energy and Environmental Support Activity (NAVENENVSA) has multiple sets of the HMIS microfiche.

Activities can attend a HMIS training course sponsored by the Navy Environmental and Preventive Medicine Units in Norfolk, VA, San Diego, CA, or Pearl Harbor, HI. Contact NAVENENVSA or the Navy Environmental Health Center in Norfolk, VA, for more information regarding this class.

C. The Consolidated Hazardous Items List (CHIL), NAVSUP Publication 4500, Navy Fleet Material Support Office, Mechanicsburg, PA 17055. This publication provides storage requirements and disposal methods for many hazardous items in the Navy Supply System.

The CHIL is divided into five sections as follows:

- Section A: A list of hazardous standard stock items in National Item Identification Number (NIIN) sequence. This is a numerical sequence using the last nine digits of the national stock number (NSN) of an item.
- Section B: A list of items in alphabetical order, then in NIIN sequence if there is more than one listing of the same item.

 (The items in this section are also in Section A.)
- Section C: A list of items in alphabetical storage code sequence, and then in NIIN sequence within the same storage code. (The items in this section are also in Section A.)
- Section D: A list of hazardous non-NSN items in Manufacturer's Part Number sequence.
- Section E: A list of hazardous asbestos material purged from the supply system. These items are listed in NIIN sequence.

The disadvantage with CHIL is that much of the information is out of date. CHIL was last printed in 1977. Care should be taken in using data obtained from CHIL.

d. The Chemical Hazardous Response Information System (CHRIS)--The Hazardous Chemical Data Handbook.

This is a U.S. Coast Guard manual for use during water transportation emergencies which is designed to provide Coast Guard personnel with information about hazardous chemicals. The information in this manual can also be useful in other applications.

The CHRIS handbook is an excellent reference for hazardous chemical information. The format is similar to the MSDS format. However, it is difficult for Navy activities to obtain. The Coast Guard conducts classes to train their personnel in using this handbook. They will not give out the handbook to persons not attending the class and the enrollment in the class is difficult.

Fire Protection Guide on Hazardous Materials. 7th Edition, National Fire Protection Association (NFPA), Batterymarch Park, Quincy, MA 02269. This guide contains a tremendous amount of information on the hazardous properties of chemicals. This information can be used to prevent fires and other emergencies during the handling of these chemicals. The data and recommendations in this guide can also be used in making decisions on the procedures to be followed in hazardous chemical emergencies. (When using this guide, keep in mind that some of the information is specifically geared to fire fighters.)

The guide is divided into five sections as follows:

- Flash Point Index of Trade Name Liquids.
- Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids.
- Hazardous Chemicals Data.
- Manual of Hazardous Chemical Reactions.
- Recommended System for the Identification of the Fire Hazards of Materials.

Appendix C shows a typical entry in the NFPA guide for a given chemical.

F. NIOSH/OSHA Pocket Guide to Chemical Hazards.

This guide contains information on 380 hazardous chemicals including chemical names, formulas, synonyms, permissible exposure limits, chemical and physical properties, respiratory and personal protective equipment use recommendations, symptoms of overexposure, monitoring procedures, and procedures for emergency treatment.

This information is presented in tabular form containing many abbreviations. The definitions of these abbreviations are found in one of five tables in the front pages of the guide. This guide should be used as a quick reference for summary information on the various chemicals. Appendix D shows a typical entry for a given chemical.

- G. Dangerous Properties of Industrial Materials, 5th Edition, N. Irving Sax, Van Nostrand Reinhold Company. 1979. This book is designed for quick retrieval of hazard information on about 13,000 common industrial and laboratory materials. The majority of the book is a section which contains information on specific chemicals. The data is this section is categorized as follows:
 - 1. General information such as synonyms, description, formula, and the physical properties of the substance.
 - 2. Hazard analyses including a toxic hazard rating; a fire hazard rating; an explosion hazard rating; and a disaster hazard rating, to give an idea of the hazards produced when the material becomes involved in disasters such as fire, explosion or flood.
 - 3. Contermeasures, or the things to be done to reduce the adverse effects of using a given material. For example, shipping regulations, storage and handling procedures, first aid measures, firefighting measures, ventilation controls, and personnel protection.

The brief section on each chemical in this part of the book usually refers back to a previous section for further explanation. For example, under Nitric Acid, Countermeasures—Storage and Handling, the reader is referred back to Section 7. This section goes into detail on what to do when storing or handling Nitric Acid. Appendix E demonstrates this.

- H. The Merck Index, 9th Edition, Merck and Co., Inc., Rathway, NJ.
 This reference book is an encyclopedia of 9856 chemicals, drugs,
 and biological substances. Information on the chemical structure,
 properties, use, and toxicity of these substances is provided.
 This reference also contains miscellaneous information tables.
 Appendix F shows a typical entry for a given chemical.
- I. Hazardous Substance Hotlines.

In addition to these references, there are several hotlines available to assist Naval activities in hazardous substances management:

RCRA/Superfund Hotline (EPA) 800-424-9346 TSCA/PCB Hotline 800-424-9065 DOT (Dept of Transportation) Hotline 202-426-1724 HMTC Hotline 800-638-8958

Appendix A

Excerpts from Resource Conservation and Recovery Act Regulations (40CFR261 Subpart C and Subpart D)

UNLISTED (CHARACTERISTIC) HAZARDOUS WASTES (40 CFR PART 261, SUBPART C)

AND

LISTED HAZARDOUS WASTES
(40 CFR PART 261, SUBPART D)

Subpart C—Characteristics of Hazardous Weste

§ 261.20 General.

(a) A solid waste, as defined in § 261.2, which is not excluded from regulation as a hazardous waste under § 261.4(b), is a hazardous waste if it exhibits any of the characteristics identified in this Subpart.

[Comment: § 262.11 of this chapter sets forth the generator's responsibility to determine whether his waste exhibits one or more of the characteristics identified in this Subpart]

(b) A hazardous waste which is identified by a characteristic in this subpart, but is not listed as a hazardous waste in Subpart D, is assigned the EPA Hazardous Waste Number set forth in the respective characteristic

in this Subpart. This number must be used in complying with the notification requirements of Section 3010 of the Act and certain recordkeeping and reporting requirements under Parts 262 through 265 and Part 270 of this chapter.

(c) For purposes of this Subpart, the Administrator will consider a sample obtained using any of the applicable sampling methods specified in Appendix I to be a representative sample within the meaning of Part 260 of this chapter.

[Comment: Since the Appendix I sampling methods are not being formally adopted by the Administrator, a person who desires to employ an alternative sampling method is not required to demonstrate the equivalency of his method under the procedures set forth in §§ 260.20 and 260.21.]

[45 FR 33119, May 19, 1980, as amended at 48 FR 14294, Apr. 1, 1983]

§ 261.21 Characteristic of ignitability.

(a) A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

(1) It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has flash point less than 60°C (140°F'), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79 or D-93-80 (incorporated by reference, see § 260.11), or a Setaflash Closed Cup Tester, using the test method specified in ASTM Standard D-3278-78 (incorporated by reference, see § 260.11), or as determined by an equivalent test method approved by the Administrator under procedures set forth in §§ 260.20 and 260.21.

(2) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that is creates a hazard.

(3) It is an ignitable compressed gas as defined in 49 CFR 173.300 and as determined by the test methods described in that regulation or equivalent test methods approved by the Administrator under §§ 260.20 and 260.21.

(4) It is an oxidizer as defined in 49 CFR 173.151.

(b) A solid waste that exhibits the characteristic of ignitability, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D001.

[45 FR 33119, May 19, 1980, as amended at 46 FR 35247, July 7, 1981]

§ 261.22 Characteristic of corrosivity.

(a) A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

(1) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, as determined by a pH meter using either an EPA test method or an equivalent test method approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21. The EPA test method for pH is specified as Method 5.2 in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11).

(2) It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55°C (130°F) as determined by the test method specified in NACE (National Association of Corrosion Engineers) Standard TM-01-69 as standardized in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11) or an equivalent test method approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21.

(b) A solid waste that exhibits the characteristic of corrosivity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D002.

[45 FR 33119, May 19, 1980, as amended at 46 FR 35247, July 7, 1981]

§ 261.23 Characteristic of reactivity.

(a) A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

(1) It is normally unstable and readily undergoes violent change without detonating.

§ 261.24

- (2) It reacts violently with water.
- (3) It forms potentially explosive mixtures with water.
- (4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.
- (5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.
- (6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.
- (7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.
- (8) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88.
- (b) A solid waste that exhibits the characteristic of reactivity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D003.

§ 261.24 Characteristic of EP toxicity.

- (a) A solid waste exhibits the characteristic of EP toxicity if, using the test methods described in Appendix II or equivalent methods approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21, the extract from a representative sample of the waste contains any of the contaminants listed in Table I at a concentration equal to or greater than the respective value given in that Table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering, is considered to be the extract for the purposes of this section.
- (b) A solid waste that exhibits the characteristic of EP toxicity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number specified in Table I which corresponds to the toxic contaminant causing it to be hazardous.

Title 40-Protection of Environment

TABLE I—MAXIMUM CONCENTRATION OF CON-TAMINANTS FOR CHARACTERISTIC OF EP TOXICITY

EPA hazardous waste number	Contaminant	Maximum concentra- tion (milligrams per liter)
D004	Arsenic	5.0
D005	Barium	
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin (1,2,3,4,10,10-hexach- loro-1,7-epoxy- 1,4,4a,5,6,7,8,8a-octahydro- 1,4-endo, endo-5,8-dimeth- ano-naphthalene.	0.02
D013	Lindane (1,2,3,4,5,6-hexa- chlor- ocyclohexane, gamma isomer.	0.4
D014	Methoxychlor (1,1,1-Trichloro- 2,2-bis [p-methoxy- phenyl]ethane).	10.0
D015	Toxaphene (C _{1e} H _{1e} Cl _e , Technical chlorinated camphene, 67-69 percent chlorine).	0.5
D016	2,4-D, (2,4-Dichlorophenoxyace-tic acid).	10.0
D017	2,4,5-TP Silvex (2,4,5-Trichlo- rophenoxypropionic acid).	1.0

Subpart D—Lists of Hazardous Wastes

§ 261.30 General.

- (a) A solid waste is a hazardous waste if it is listed in this Subpart, unless it has been excluded from this list under §§ 260.20 and 260.22.
- (b) The Administrator will indicate his basis for listing the classes or types of wastes listed in this Subpart by employing one or more of the following Hazard Codes:

Ignitable Waste	(1)
Corrosive Waste	(C)
Reactive Waste	(R)
EP Toxic Waste	(E)
Acute Hazardous Waste	(H)
Toxic Waste	(T)

Appendix VII identifies the constituent which caused the Administrator to list the waste as an EP Toxic Waste (E) or Toxic Waste (T) in §§ 261.31 and 261.32.

(c) Each hazardous waste listed in this Subpart is assigned an EPA Haz-

ardous Waste Number which precedes the name of the waste. This number must be used in complying with the notification requirements of Section 3010 of the Act and certain recordkeeping and reporting requirements under Parts 262 through 265 and Part 270 of this chapter. (d) The following hazardous wastes listed in § 261.31 or § 261.32 are subject to the exclusion limits for acutely hazardous wastes established in § 261.5: [Reserved]

[45 FR 33119, May 19, 1980, as amended at 45 FR 74892, Nov. 12, 1980; 48 FR 14294, Apr. 1, 1983]

§ 261.31 Hazardous wastes from non-specific sources.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard
Generic:		
F001	The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations.	m
F002	The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane; and the still bottoms from the recovery of these solvents.	(T)
F003	The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; and the still bottoms from the recovery of these solvents.	(1)
F004	The following spent non-halogenated solvents: cresqls and cresylic acid, and nitrobenzene; and the still bottoms from the recovery of these solvents.	m
F005	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, and pyridine; and the still bottoms from the recovery of these solvents.	(I. T)
F008	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.	m
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum	m
F007	Spent cyanide plating bath solutions from electroplating operations (except for precious metals electroplating spent cyanide plating bath solutions).	(R, T)
F008	Plating bath sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process (except for precious metals electroplating plating bath sludges).	(R, T)
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (except for precious metals electroplating spent stripping and cleaning bath solutions).	(R, T)
F010	Ouenching bath sludge from oil baths from metal heat treating operations where cyanides are used in the process (except for precious metals heat-treating quenching bath sludges).	(R, T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations (except for precious metals heat treating spent cyanide solutions from salt bath pot cleaning).	(R, T)
F012:	Quenching wastewater treatment sludges from metal heat treating operations where	m
Staganna za 🚅 🚉	cyanides are used in the process (except for precious metals heat treating quenching wastewater treatment sludges).	

[46 FR 4617, Jan. 16, 1981, as amended at 46 FR 27477, May 20, 1981]

§ 261.32 Hazardous wastes from specific sources.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Wood preservation: K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.	m

Title 40—Protection of Environment

§ 261.32

Industry and EPA hazardous waste No.	Hazardous waste	code
accessis pigments:		
norganic pigments: , K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.	m
K003	Wastewater treatment sludge from the production of molybdate orange pigments	m
K004	Wastawater treatment sludge from the production of zinc yellow pigments	m
K005	Wastewater treatment sludge from the production of chrome green pigments	E
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).	E .
K007	Wastewater treatment sludge from the production of iron blue pigments	93
K008	Oven residue from the production of chrome oxide green pigments	(,)
Organic chemicals:	Distillation bottoms from the production of acetaldehyde from ethylene	(D)
K009	Distillation side cuts from the production of acetaldehyde from ethylene	m
K010		(A, T)
K011		(A. T)
K013	Bottoms from the acetonitrile purification column in the production of acrytonitrile	
K014		m
K015	Heavy ands or distillation residues from the production of carbon tetrachloride	m
K016	Heavy ends (still bottoms) from the purification column in the production of	m
K018	Home ands from the fractionation column in ethyl chloride production	m
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride	m
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer	m
	production. Aqueous spent antimony catalyst waste from fluoromethanes production	m
K021		m
K022		m
K023		m
K024		m
K093		(T)
K094		m
K025		m
K026	Centrifuge and distillation residues from toluene disocyanate production	(R. T)
K027		m
ко29	Waste from the product steam stripper in the production of 1.1.1-trichloroethane	1;1
K095	Distribution bottoms from the production of 1.1.1-trichloroethane	m
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroeth-	m
козо	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.	m
K083	Distillation bottoms from aniline production	m
K103		(m)
K104		(T)
K085	Distillation or tractionation column bottoms from the production of chlorobenzenes	(T)
K105	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.	(T)
Inorganic chemicals:		
К071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used.	m
К073	Chlorinated hydrocarbon waste from the punfication step of the diaphragm cell process using graphite anodes in chlorine production.	m
K106	Wastewater treatment sludge from the mercury cell process in chlorine production	(T)
Pesticides:	나는 이 이 경험에 있다면 어떻게 되었다면 하는 것은 사람들이 되었다면 하는 것이 없는 것이다. 그렇게 하는 사람들이 없는 이 것은	1
K031	By-product salts generated in the production of MSMA and cacodylic acid	(T)
K032	Wastewater treatment studge from the production of chlordane	(T)
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the	(1)
K034	production of chlordane. Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane.	m
К097	Vacuum stripper discharge from the chlordane chlorinator in the production of	(T)
коз5	Wastewater treatment studges generated in the production of creosole	. (T)
K036	Still bottoms from toluene reclamation distillation in the production of distillation	1111
K037	Wastawater treatment studges from the production of disulfoton	110
K038	Wastawater from the washing and stripping of phorale production	1 (1)
K039	Filter cake from the filtration of diethylphosphorodithioic acid in the production of	1
K040	Wastewater treatment studge from the production of phorate	(T)
K041	Wastewater treatment studge from the production of toxaphene	1111
***** ********************************	Untrealed process wastewater from the production of toxaphene	I (T)

Industry and EPA hazardous waste No.	Hazardous waste	Hazard
K042	Heavy-ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T.	(T)
K043	2.6-Dichlorophenol waste from the production of 2.4-D	(T)
K099	Untreated wastewater from the production of 2.4-D	(T)
xplosives:		
K044	Wastewater treatment sludges from the manufacturing and processing of explosives	(A)
K045	Spent carbon from the treatment of wastewater containing explosives	(A)
K046	Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds.	(T)
K047	Pink/red water from TNT operations	(R)
Petroleum refining:		()
K048	Dissolved air flotation (DAF) float from the petroleum refining industry	(T)
K049	Slop oil emulsion solids from the petroleum refining industry	
K050	Heat exchanger bundle cleaning sludge from the petroleum relining industry	(T)
K051	API separator sludge from the petroleum refining industry	
K052	Tank bottoms (leaded) from the petroleum relining industry	(T)
on and steel:		1.,
K061	Emission control dust/sludge from the primary production of steel in electric furnaces.	(T)
K062	Spent pickle liquor from steel finishing operations	(C, T)
econdary lead:		(0. 1)
K069	Emission control dust/sludge from secondary lead smelting	(T)
K100	Waste leaching solution from acid leaching of emission control dust/sludge from	(T)
eterinary pharmaceuticals:	secondary lead smelting.	(1)
K084	Wastewater treatment sludges generated during the production of veterinary pharma- ceuticals from arsenic or organo-arsenic compounds.	(T)
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	(T)
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	(T)
k formulation: K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead.	(T)
oking:		
K060	Ammonia still lime sludge from coking operations	(T)
K087	Decanter tank tar sludge from coking operations	

[46 FR 4618, Jan. 16, 1981, as amended at 46 FR 27476-27477, May 20, 1981]

§ 261.33 Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded:

(a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section.

(b) Any off-specification commercial chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

(c) Any residue remaining in a container or an inner liner removed from a container that has held any commercial chemical product or manufactur-

ing chemical intermediate having the generic name listed in paragraph (e) of this section, unless the container is empty as defined in § 261.7(b)(3) of this chapter.

[Comment: Unless the residue is being beneficially used or reused, or legitimately recycled or reclaimed; or being accumulated, stored, transported or treated prior to such use, re-use, recycling or reclamation, EPA considers the residue to be intended for discard, and thus a hazardous waste. An example of a legitimate re-use of the residue would be where the residue remains in the container and the container is used to hold the same commerical chemical product or manufacturing chemical product or manufacturing chemical intermediate it previously held. An example of the discard of the residue would be where the drum is sent to a drum reconditioner who reconditions the drum but discards the residue.1

§ 261.33

(d) Any residue or contaminated soil, water or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water, of any off-specification chemical product and manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

[Comment: The phrase "commercial chemical product or manufacturing chemical intermediate having the generic name listed " refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not: refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f). Where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraphs (e) or (f), such waste will be listed in either §§ 261.31 or 261.32 or will be identified as a hazardous waste by the characteristics set forth in Subpart C of this part.]

(e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in § 261.5(e).

TComment: For the convenience of the reguflated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Title 40—Protection of Environment

	Hazardous waste No.	Substance
	P023	Acetaldehyde, chloro-
	P002	Acetamide, N-(aminothioxomethyl)-
	P057	Acetamide, 2-fluoro-
	P058	Acetic acid, fluoro-, sodium salt
	P066	Acetimidic acid, N-[(methylcar-
	teda - Al Aud P ^A	bamoyl)oxy]thio-, methyl ester
	P001	3-(alpha-acetonylbenzyl)-4-hydroxycoumarin and salts
	P002	1-Acetyl-2-thiourea
	P003	Acrolein
	P070	Aldicarb
	P004	Aldrin
	P005	Allyl alcohol
	P006	Aluminum phosphide
	P007	5-(Aminomethyl)-3-isoxazolol
	P008	4-aAminopyridine
	P009	Ammonium picrate (R)
	P119	Ammonium vanadate
	P010	Arsenic acid
	P012	Arsenic (III) oxide
	P011	Arsenic (V) oxide Arsenic pentoxide
	P012	Arsenic trioxide
	P038	Arsine, diethyl-
	P054	Aziridine
	P013	Barium cyanide
	P024	Benzenamine, 4-chloro-
	P077	Benzenamine, 4-nitro-
	P028	Benzene, (chloromethyl)-
	P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methyl- amino)ethyl]-
*	P014	Benzenethiol
	P028	Benzyl chloride
	P015	Beryllium dust
	P016	Bis(chloromethyl) ether
	P017	Bromoacetone
	P018	Brucine
	P021	Calcium cyanide
	P123	Camphene, octachloro- Carbamimidoselenoic acid
	P022	Carbon bisulfide
	P022	Carbon disulfide
	P095	Carbonyl chloride
	P033	Chlorine cyanide
	P023	Chloroacetaidehyde
	P024	p-Chloroaniline
	P026	1-(o-Chlorophenyl)thiourea
	P027	3-Chloropropionitrile
	P029	
	P030	Cyanides (soluble cyanide salts), not else-
		where specified
	P031	Cyanogen
	P033	Cyanogen chloride
	P036	
	P037	
	P038	Diethylarsine
	P039	O,O-Diethyl S-[2-(ethylthio)ethyl] phosphoro- dithioate
	P041	Diethyl-p-nitrophenyl phosphate
	P040	O.O-Diethyl O-pyrazinyl phosphorothicate
	P043	Disopropyl fluorophosphate
	P044	Dimethoate. 3,3-Dimethyl-1-(methylthio)-2-butanone. O-
	P045	3,3-Dimethyl-1-(methylthio)-2-butanone. O- [(methylamino)carbonyl) oxime
	0071	O.O-Dimethyl O-p-nitrophenyl phosphoro-
	P071	thioate
	P082	Dimethylnitrosamine
	P046	alpha, alpha-Dimethylphenethylamine
	P047	4,6-Dinitro-o-cresol and salts 4,6-Dinitro-o-cyclohexylphenol
	P034	2.4-Dinitro-o-cyclonexylphenol
	P020	Dinoseb

waste No.	Substance	Hazardous waste No.	Substance
P085		P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
	2,4-Dithiobiuret	P089	
	Dithiopyrophosphoric acid, tetraethyl ester	P034	
	. Endosultan	P048	
088		P047	
051		P020	
	Epinephrine	P009	
	Ethanamine, 1,1-dimethyl-2-phenyl-	P036	
	Ethenamine, N-methyl-N-nitroso-	P092	
2101	Ethyl cyanide	P093	
	Ethylenimine	P094	
097		P095	
056		P096	
057			
058	Fluoroacetamide	P041	
		P044	
065		0040	(methylamino)-2-oxoethyl]ester
059	Heptachlor	P043	
051	1,4,4a,5,6,7,8,8a-octahydro-endo,endo-	P094	
037	1,4 5.8-dimethanonaphthalene 1,2,3,4,10, i0-Hexachloro-6,7-epoxy-	P089	(ethylthio)methyl ester Phosphorothioci acid, O,O-diethyl O-(p-nitro-
	1,4,4a,5,6,7,8,8a-octahydro-endo,exo- 1,4 5,8-demethanonaphthalene	P040	phenyl) ester
060	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-	P097	ester
	hexahydro-1,4:5,8-endo, endo-dimeth- an- onaphthalene		methylamino)-sulfonyl)phenyl]ester
004	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-	P110	
	hexahydro-1,4:5,8-endo,exo-	P098	
	dimethanonaphthalene	P099	
060	Hexachlorohexahydro-exo,exo- dimethanonaphthalene	P070	Propanal, 2-methyl-2-(methylthio)-, 0- [(methylamino)carbonyl]oxime
062	Hexaethyl tetraphosphate	P101	Propanenitrile
116	Hydrazinecarbothioamide	P027	Propanenitrile, 3-chloro-
068	Hydrazine, methyl-	P069	
063	Hydrocyanic acid		1,2,3-Propanetriol, trinitrate- (R)
063	Hydrogen cyanide		2-Propanone, 1-bromo-
096		P102	Propargyl alcohol
064	Isocyanic acid, methyl ester	P003	
007	3(2H)-Isoxazolone, 5-(aminomethyl)-		2-Propen-1-ol
092			1,2-Propylenimine
065		P102	
016			. 4-Pyridinamine
112	Methane, tetranitro- (R)	P075	
118	Methanethiol, trichloro-	10/5	salts
059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-hep-	P111	. Pyrophosphoric acid, tetraethyl ester
nee	tachloro-3a,4,7,7a-letrahydro-	P103	
066	Methomyl		. Silver cyanide
067			. Sodium azide
068		P106	
064	Methyl isocyanate		. Strontium sulfide
069			. Strychnidin-10-one, and salts
071		P018	. Strychnidin-10-one, 2,3-dimethoxy-
72			. Strychnine and salts
73			. Sulfuric acid, thallium(I) salt
)74	Nickel cyanide		. Tetraethyldithiopyrophosphate
74		P110	. Tetraethyl lead
73	Nickel letracarbonyl	P111	Tetraethylpyrophosphate
75	Nicotine and salts	P112	
76	Nitric oxide	P062	Tetraphosphoric acid, hexaethyl ester
77	p-Nitroaniline	P113	
78	Nitrogen dioxide	P113	
76	Nitrogen(II) oxide	P114	
78	Nitrogen(IV) oxide	P115	
81	Nitroglycerine (R)	P045	
82	N-Nitrosodimethylamine	P049	
84	N-Nitrosomethylvinylamine	P014	
	5-No/bornene-2,3-dimethanol, 1,4,5,6,7,7-hex-	P116	
050			
	actiloro, cyclic sulfite	P026	
85	Octamethylpyrophosphoramide	P072	Thiourea, 1-naphthalenyl-
87	Osmium oxide	P093	
387	Osmium tetroxide	P123	Toxaphene

Title 40—Protection of Environment

Hazardous waste No.	Substance	
P118	Trichloromethanethiol	
P119	Vanadic acid, ammonium salt	
P120	Vanadium pentoxide	
P120	Vanadium(V) oxide	
P001	Warfann	
P121	Zinc cyanide	
P122	Zinc phosphide (R.T)	2000

(f) The commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products referred to in paragraphs (a) through (d) of this section, are identified as toxic wastes (T) unless otherwise designated and are subject to the small quantity exclusion defined in § 261.5 (a) and (f).

[Comment: For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous Waste No.	Substance	
U001	Acetaldehyde (I)	
U034	Acetaldehyde, trichloro-	
U187	Acetamide, N-(4-ethoxyphenyl)-	
U005	Acetamide, N-9H-fluoren-2-yl-	
U112	Acetic acid, ethyl ester (I)	
U144	Acetic acid, lead salt	
U214	Acetic acid, thallium(I) salt	
U002	Acetone (I)	
U003		
U004	Acetophenone	
U005	2-Acetylaminofluorene	
U006		- 9
U007		
U008		. 9
U009		
U150		
	phenyl-, L-	
J011	Amitrole	re 6
J012	Aniline (I,T)	
J014	Auramine	
J015	Azaserine	-
J010	Azirino(2',3':3,4)pyrrolo(1,2-a)indole-4,7-dione,	2
	6-amino-8-[((aminocarbonyl) oxy)methyl]-	-
	1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-	1
	methyl-,	1
J157	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-	- 1
J016	Benz(c)acridine	- 1
J016	3,4-Benzacridine	-
J017	Benzal chloride	
J018	Benz(a)anthracene	. 1
J018	1,2-Benzanthracene	
J094	1,2-Benzanthracene, 7,12-dimethyl-	
U012	Benzenamine (I,T)	ı

Waste No.	Substance
U014	Benzenamine, 4,4'-carbonimidoylbis(N,N-di-methyl-
U049	Benzenamine, 4-chloro-2-methyl-
U093	Benzenamine, N,N'-dimethyl-4-phenylazo-
U158	Benzenamine, 4,4'-methylenebis(2-chloro-
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro
U019	Benzene (I,T)
U038	Benzeneacetic acid, 4-chloro-alpha-(4-chloro-
0000	phenyi)-alpha-hydroxy, ethyl ester
U030	Benzene, 1-bromo-4-phenoxy-
U037	
U190	1,2-Benzenedicarboxylic acid anhydride
U028	1,2-Benzenedicarboxylic acid, [bis(2-ethyl-
	hexyl)] ester
U069	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	1,2-Benzenedicarboxylic acid, diethyl ester
U102	1,2-Benzenedicarboxylic acid, dientifi ester
U107	
U070	Benzene, 1,2-dichloro-
U071	
U072	Benzene, 1,4-dichloro-
U017	
U223	
U239	Benzene, dimethyl-(I,T)
U201	
U127	
U056	
U188	
U220	
U105	
U106	
U203	
U141	
U090	Benzene, 1,2-methylenedioxy-4-propyl-
U055	Benzene, (1-methylethyl)- (I)
U169	Benzene, nitro- (I,T)
U183	Benzene, pentachloro-
U185	
U020	Benzenesulfonic acid chloride (C,R)
U020	Benzenesulfonyl chloride (C,R)
U207	Benzene, 1,2,4,5-tetrachloro-
U023	Benzene, (trichloromethyl)-(C,R,T)
0234	Benzene, 1,3,5-trinitro- (R,T)
U021	Benzidine
U202	1,2-Benzisothiazolin-3-one, 1,1-dioxide
U120	
	Benzo(j,k]fluorene
U022	Benzo[a]pyrene
U022	3,4-Benzopyrene
U197	p-Benzoquinone
U023	Benzotrichloride (C,R,T)
U050	1,2-Benzphenanthrene
U085	2,2'-Bioxirane (I,T)
U021	(1,1'-Biphenyl)-4,4'-diamine
U073	
U091	
U095	
U024	Bis(2-chloroethoxy) methane

Bis(2-chloroisopropyl) ether Bis(dimethylthiocarbamoyl) disulfide Bis(2-ethylhexyl) phthalate

Bromotorm

4-Bromophenyl phenyl ether

1.3-Butadiene, 1,1,2,3,4,4-hexachloro
1-Butanamine, N-butyl-N-nitrosoButanoic acid, 4-{Bis(2-chloroethyl)amino}

Bromine cyanide

benzene1-Butanol (I)
2-Butanone (I,T)
2-Butanone peroxide (R,T)
2-Butenai

Chapter I—Environmental Protection Agency

Waste No.	Substance	Waste No.	Substance
U074 U031		U240	2,4-Dichlorophenoxyacetic acid, salts and esters
U136		U083	
U032		U084	
U238		U085	
		U108	
U178		U086	
U176		U087	
U177		U088	
J219		U089	
J097		U148	
J215		U090	
J156			
033		U091	
	. Carbon tetrachloride	U092	
J033		U093	
J034		U094	
J035		U095	
J036	. Chlordane, technical	U096	
J026		U097	
J037			. 1,1-Dimethylhydrazine
J039		U099	. 1,2-Dimethylhydrazine
J041			. 2,4-Dimethylphenol
042		U102	
J044		U103	
J046			. 2,4-Dinitrotoluene
			2,6-Dinitrotoluene
J047		U107	
J048			
J049			. 1,4-Dioxane
J032		U109	
J050		U110	
J051		U111	
J052	Cresols	U001	
J052	Cresylic acid	U174	. Ethanamine, N-ethyl-N-nitroso-
J053	Crotonaldehyde	U067	. Ethane, 1,2-dibromo-
J055		U076	. Ethane, 1,1-dichloro-
J246		U077	Ethane, 1,2-dichloro-
J197			. 1,2-Ethanediylbiscarbamodithioic acid
J056		U131	
J057		U024	
J130			Ethanenitrile (I, T)
J058		U117	
J240		U025	
			Ethane, pentachloro-
059			
J060		U208	
061		U209	
J142	cyclobuta(c,d)-pentalen-2-one	U218 U247	Ethane, 1,1,1,-trichloro-2,2-bis(p-methox
J062		11007	phenyl).
J133			Ethane, 1,1,2-trichloro-
J221		U043	
J063		U042	
J063			Ethene, 1,1-dichloro-
J064			Ethene, trans-1,2-dichloro-
J064	Dibenz(a,i)pyrene	U210	
J066	. 1,2-Dibromo-3-chloropropane	U173	
J069	Dibutyl phthalate		Ethanone, 1-phenyl-
J062		U006	Ethanoyl chloride (C,R,T)
J070		U112	Ethyl acetate (I)
J071	m-Dichlorobenzene	U113	Ethyl acrylate (I)
J072		U238	
J073		U038	
J074	1,4-Dichloro-2-butene (I,T)	U114	
J075		U067	
J192		U077	
	benzamide	U115	
J060	Dichloro diphenyl dichloroethane	U116	
J061		U117	
J078		U076	
J079	1.2-Dichloroethylene	U118	
U025		U119	
U081		U139	
	2.6-Dichlorophenol	U120	

§ 261.33

Title 40—Protection of Environment

Hazardous Waste No.	Substance	Waste No.	Substance
U122	Formaldehyde	U226	Methylchloroform
U123		U157	
U124		U158	
J125		U132	
U147		U068,	
U213		U080	
U125		U122	
U124		U159	
U206		U160	
0200	soureido)-	U138	
U126		U161	Methyl isobutyl ketone (I)
U163		U162	
J127		U163	
U128			
U129		U161	
U130		U164	
U131		U010	
U132		U059	5,12 Naphthacenedione. (8S-cis) 8 acetyl-10
	Hexachloropropene		[(3 amino-2,3,6 trideoxy-alpha t lyxo-
	Hydrazine (R,T)		huxopyranosylloxyll-7.8.9,10 totrahydro-
			6,8,11-trihydroxy-1-methoxy-
U086		U165	
	Hydrazine, 1,1-dimethyl-	U047	
	Hydrazine, 1,2-dimethyl-	U166	1,4-Naphthalenedione
	Hydrazine, 1,2-diphenyl-	U236	2,7-Naphthalenedisulfonic acid. 3,3'-[(3,3'-c
	Hydrofluoric acid (C,T)		methyl-(1,1'-biphenyl)-4,4'diyl)]-bis
U134			(azo)bis(5-amino-4-hydroxy)-,tetrasodium
U135			salt
	Hydroperoxide, 1-methyl-1-phenylethyl- (R)	U166	. 1,4,Naphthaquinone
	Hydroxydimethylarsine oxide		. 1-Naphthylamine
U116		U168	
U137		U167	
U139			beta-Naphthylamine
U140		U026	
U141	Isosafrole		Nitrobenzene (I,T)
U142	Kepone		
U143	Lasiocarpine	U170	
U144	Lead acetate	U171	
U145	Lead phosphate	U172	
U146	Lead subacetate	U173	
U129	Lindane		N-Nitrosodiethylamine
	Maleic anhydride	U111	
U148			. N-Nitroso-N-ethylurea
U149		U177	
U150		U178	N-Nitroso-N-methylurethane
U151		U179	N-Nitrosopiperidine
U152	Methacrylonitrile (I,T)	U180	N.Nitrosopyrrolidine
U092		U181	. 5-Nitro-o-tolindine
U029			1,2-Oxathiolane, 2,2-dioxide
U045			2H-1,3,2-Oxazaphosphorine. 2-[bis(2-chlor
U046			ethyl)amino)tetrahydro-, oxide 2-
U068		U115	
U060	Methane, dichloro-	11041	Cyrana 2-(chloromethyl)-
	Methane, dichlorodifluoro-	U182	Paraldehyde
		U183	
U138		U184	
	Methanesulfonic acid, ethyl ester		
	Methane, tetrachloro-	U185	
U121			Pentachlorophenol
	Methanethiol (I,T)	U186	
	Methane, Inbromo-	U187	
U044	Methane, tnchloro-	U188	
J121	Methane, trichlorofluoro-	U048	
J123	Methanoic acid (C.T)	U039	
J036	4,7-Methanoindan, 1,2,4,5,6,7,8,8-octa-	U081	
description of the	chloro-3a,4,7,7a-tetrahydro-	U082	Phenol, 2,6-dichloro-
J154	Methanol (I)	U101	
J155	Methapyrilene	U170	
J247	Methoxychior.	U242	
J154	Methyl alcohol (I)	U212	
J029	Methyl bromide	U230	
U186	1-Methylbutadiene (I)	U231	
J045	Methyl chloride (I,T)		
	MOUNT CHICKOG (I, I)	U137	1,10-(1,2-phenylene)pyrene

Chapter I—Environmental Protection Agency

Part 261, App. I

Waste No.	Substance
U087	Phosphorodithioic acid, 0,0-diethyl-, S-methylester
U189	Phosphorous sulfide (R)
U190	Phthalic anhydride
U191	2-Picoline
U192	Pronamide
U194	1-Propanamine (I,T)
U110	1-Propanamine, N-propyl- (I)
U149	Propane, 1,2-dibromo-3-chloro- Propanedinitale
U171	Propane, 2-nitro- (I)
U027	Propane, 2,2'oxybis(2-chloro-
U193	1,3-Propane suitone
U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U126	1-Propanol, 2,3-epoxy-
U140	1-Propanol, 2-methyl- (I,T)
U002	2-Propanone (I)
U007	2-Propenamide
U084	Propene, 1,3-dichloro-
U243	1-Propene, 1,1,2,3,3,3-hexachloro-
U009	2-Propenenitrile
U152	2-Propenenitrile, 2-methyl- (I,T)
U008 U113	2-Propenoic acid (I) 2-Propenoic acid, ethyl ester (I)
U118	2-Propenoic acid, ethyl ester (i) 2-Propenoic acid, 2-methyl-, ethyl ester
U162	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U233	Propionic acid, 2-(2,4,5-trichlorophenoxy)-
U194	n-Propylamine (I,T)
U083	Propylene dichloride
U196	Pyridine
U155	Pyridine, 2-{(2-(dimethylamino)-2-thenyla- mino}-
U179	Pyridine, hexahydro-N-nitroso-
U191	Pyridine, 2-methyl-
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-
U180	thioxo- Pyrrole, tetrahydro-N-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Sacchann and salts
U203	Satrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium disulfide (R,T)
U015	L-Serine, diazoacetate (ester)
U233	Silvex
U089	4,4'-Stilbenediol, alpha,alpha'-diethyl-
U206	Streptozotocin
U103	Sulfur hydnde Sulfunc acid, dimethyl ester
U189	Sulfur phosphide (A)
U205	Sulfur selenide (R,T)
U232	2.4.5-T
U207	1,2,4,5-Tetrachlorobenzene
U208	1.1.1.2-Tetrachloroethane
U209	1.1.2,2-Tetrachloroethane
U210	Tetrachloroethylene
U212	2,3,4,6-Tetrachlorophenol
U213	Tetrahydrofuran (i)
U214	Thallium(I) acetate
U215	Thallium(I) carbonate
U216	Thallium(i) chloride
U217	Thailium(I) nitrate
U218	Thioacetamide Thiomethanol (I,T)
U219	Thiometriano (i, i)
U244	Thiram
U220	Toluene
U221	Toluenediamine
U223	Toluene disocyanate (R,T)
U222	O-Toluidine hydrochloride
U011	1H-1,2,4-Triazol-3-amine

Hazardous
Waste No.

U226

1,1,1-Trichloroethane
U227

1,1,2-Trichloroethane
U228

Trichloroethene
U228

U230

1,1,2-Trichloroethane
U228

Trichloroethylene
U231

1,1,2-Trichloroethylene
U231

1,2,3-Trichlorophenol
U231

2,4,5-Trichlorophenol
U232

2,4,5-Trichlorophenol
U232

2,4,5-Trichlorophenol
U234

2,4,5-Trichlorophenol
U235

Trinitrobenzere (R,T)
1,3,5-Trioxane, 2,4,5-trimethylU235

Tris(2,3-dibromopropyl) phosphate
Trypan blue
U237

Uracil, 5[bis(2-chloromethyl)amino}U237

Uracil mustard
U433

Viryl chlonde
U239

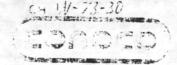
Xylene (I)
U200

Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxy-benzoyl)oxy]-,
methyl esler.

[45 FR 78529, 78541, Nov. 25, 1980, as amended at 46 FR 27477, May 20, 1981]

2343742 CONOCO CHEMICALS CO

35C 00285



Conoco Chemicais 5 Greenway Pleza East P.O. Box 2197 Houston, Texas 77001

MATERIAL SAFETY DATA SHEET

	計構等 SPROUGEID ELII	ALMANIA STATE	
MANUFACTURER'S NAME	Conoco Chemicals	REGULAR TELEPHONE NO. EMERGENCY TELEPHONE NO.	318/491-5403 318/491-5070
ADDRESS	P.O. Box 727, Westlake, LA	70669	
TRADE NAME	Ethylene		
SYNONYMS	Ethylene, Ethene		

%	HAZARD DATA
99	
4	
	31.35

BOILING POINT (°F.)	-155	SPECIFIC GRAVITY (H,0 = 1)	0.56 (liquid)
VAPOR PRESURE (mm Hg.)	400 psia @ 0°F	PERCENT VOLATILE BY VOLUME (%)	100
VAPOR DENSITY (AIR = 1)	.98 @ 0°c	EVAPORATION RATE (= 1)	
SOLUBILITY IN WATER	Negligible	MELTING POINT	-169.2°C
APPEARANCE AND COOR	Colorless, Sweet	Odor .	

FLASH POINT (TEST METHOD)	-213°F		AUTOIGNITION TEMPERATURE		842°F
FLAMMABLE LIMIT	IN AIR. % BY VOL.	LOWER	3.1	UPPER	32.0
ETTINGUISHING MEDIA	Carbon Dioxide,	dry chemic	cal or fine	spray	
SPECIAL FIRE PROCEDURES	Stop flow of gas	s - cool ex	sposed conta	iners with w	ater spray
			A STATE OF THE STATE OF		

HEALTH HAZARD INFORMATION

FIRST AID

EYES:

Wash with copious amounts of water for 15 minutes. Seek physician's aid.

SKIN:

Wash with copious amounts of water. Seek physician's aid.

Remove to fresh air; Eliminate any airway obstruction. Administer INHALATION: artificial respiration or oxygen if breathing has stopped and cardio-pulmonary resuscitation if indicated. Seek physician's aid.

INGESTION:

NATURE OF HAZARD

EYES:

If exposed to liquid form, burns could occur. Excessive exposure to gas may cause irritation.

If exposed to liquid form, burns could occur.

INHALATION: Simple asphyxiant; exposure to high concentrations could cause anesthesia and unconsciousness.

INGESTION: Ethylene is a gas at room temperature and should not be a significant health hazard via ingestion.

EFFECTS OF OVEREXPOSURE:

ACUTE OVEREXPOSURE:

Anesthesia progressing to unconsciousness

CHRONIC OVEREXPOSURE: Unknown

THRESHOLD LIMIT VALUE (TLV)

None established

TOXICITY DATA

SKIN CONTACT: No specific data available.

EYE CONTACT:

No specific data available.

INHALATION:

Two year exposure to 300, 1,000, and 3,000 ppm produced no

signs of toxicity in rats.

INGESTION:

No specific data available

SPECIAL PRECAUTIONS:

V-B-2

DEACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY

INCOMPATIBILITY

ALCL3, CCL4, CL2, NO2

HAZARDOUS DECOMPOSITION PRODUCTS

None

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION

Extremely high temperature and pressure

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

Remove all sources if ignition. Dissipate vapor with water spray.

NEUTRALIZING CHEMICALS

WASTE DISPOSAL METHOD

Incineration or venting under approved conditions.

VENTILATION REQUIREMENTS

SPECIAL PROTECTION INFORMATION

Mechanical ventilation should be used in confined spaces.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL):

Air supplied equipment.

EYE: Face shield or goggles if there is a possibility to be in contact

with liquid.

GLOVES: Rubber gloves if there is a possibility to be in contact with

liquid.

OTHER CLOTHING AND EQUIPMENT:

Three Sections from the NFPA Fire Protection Guide Appendix C on Hazardous Materials

Fire Hazard Properties of Flammable Liquids, Gases, Volatile Solids

	FLASH	IGNITION	LIA	MABLE MITS by Vol.	Sp. Gr.	Vapor	BOILING		Page 100)	1	JGGESTED HAZARD ITIFICATION	
	POINT	TEMP.			(Water	(Air	°F(°C)	Water Soluble	METHOD See Intro.	Health	Flamma- bility	Reac-
N—Ethyldiethanolamine C ₂ H ₅ N(C ₂ H ₄ OH) ₂	280 (138) (oc)				1.0+		(253)	Yes	Water or foam may cause frothing. "Alcohol" foam.	2	1	0
Ethyl Dimethyl Methane	See Isope	entane.						1.15			1.1.	
Ethylene H _Z C:CH _Z (Ethene)	Gas Note: See	842 (450) Hazardous C	2.7 hemicals (36.0 Data.		1.0	-155 (-104)	Yes	Stop flow of gas.	1	1	2
Ethylene Acetate	See Glyc	ol Diacetate.		To the	ADRING TO		a - proper			Arte de la companya dela companya dela companya dela companya de la companya de la companya de la companya dela companya de la companya dela com		

Hazardous Chemical Data (Section 49 Page 147)

ETHYLENE CH,: CH, Aluminum Chloride Benzoyl Peroxide and Carbon Tetrachloride Bromo

trichloromethane Carbon Tetrachloride

Chlorine Chlorine Dioxide Nitrogen Dioxide Nitromethane and

Aluminum Chloride

Ozone

See ALUMINUM CHLORIDE plus Ethylene. See BENZOYL PEROXIDE plus Carbon Tetrachloride and Ethylene.

See BROMOTRICHLOROMETHANE plus Ethylene

See CARBON TETRACHLORIDE plus Eth-

ylene. See CHLORINE plus Ethylene.. See CHLORINE DIOXIDE plus Butadiene.

See NITROGEN TETROXIDE plus Olefins. A mixture of ethylene with nitromethane-aluminum chloride catalyst in an autoclave exploded at a temperature below 40°C. F. M. Cowen and O. Rorso, Chem. Eng. News 26: 2257 (1948).

See also ALUMINUM CHLORIDE plus Nitromethane and Organic Matter. See OZONE plus Ethylene.

Manual of Hazardous Chemical Reactions (491M-16)

ETHENE CH2:CH2

DESCRIPTION: Colorless gas; sweet odor and taste.

FIRE AND EXPLOSION HAZARDS: Flammable gas. Forms flammable mixtures with air over a wide range. Flammable limits, 2.7% and 36%. Ignition temperature, 914° F. Vapor density is approximately the same as air. Spontaneously explosive in sunlight with chlorine. Can react vigorously with oxidizing materials.

LIFE HAZARD: Medical anesthetic, moderate concentration in air causes unconsciousness.

Personal Protection: Wear self-contained breathing apparatus.

FIRE FIGHTING PHASES: Stop flow of gas. Use water to keep fire-exposed containers cool and to protect men effecting the shut-off. If a burning cylinder is mounted on an anesthetic machine or truck, move the cylinder to a safe place.

USUAL SHIPPING CONTAINERS: Steel pressure cylinders, tank

STORAGE: Protect against physical damage. Isolate from oxygen chlorine, combustible, organic and oxidizing materials. Store in cool, well-ventilated area, of noncombustible construction, away from possible sources of ignition. Protect against static electricity and lightning. Outside or detached storage is preferred.

REMARKS: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code. If exshould be in accordance with Article 501 of the Code. It explosion proof electrical equipment is necessary, it shall be suitable for use in Group C. See Standard for the Use of Inhalation Anesthetics (NFPA No. 56A), Explosion Venting Guide (NFPA No. 68), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), and Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M) 325M).

Chemical Name and Formula	Syrionyms	Permissible Exposure Limit	Level	Physical Description	Chemical an Proper	d Physical rties	Incompatibilities	Measurement Method and		Respirator Selection			Health	Hazards	
Nickel carbonyl	None	0.001 ppm	0.001	611.				Set (See Table 1)	Personal Protection and Sanitation (See Table 2)	Upper Limit Devices Permitted (See Table 3)	Rout	Symptoms (See Table 4)	First A	id (See Table 5)	Target Organi
Ni(CO),		(0.007 mg/m²) (NIOSH) 0.001 ppm	ppm Ca	Colorless liquid with a musty odor	MW: 171 BP: 109 F Sol: 0.018% FLP: < -4 F	VP: 321 mm MP: -13 F UEL: ? LEL: 2%	Nitric acid, chlorine, other oxidizers, combustible vapors		Clathing: Any poss Goggles: Any poss Wash: Immed upon wet Change: N.A. Remove: Any wot immed (tlamm)	Above 0 001 ppm, only SCBAF-PD,PP,CF or SAF-PD,PP,CF with aux SCBA:PD,PP should be used. Escape: GMS/SCBA	Inh Ing Con	Head, verti; nau, epigastric pain; substernal pain; cough, hyperpnea; cyan; leukocytosis, pneuitis; ca lungs, paranasal sinus; dolfruin, convul	Eyo: Skin: Breath: Swallow	irr immed Soap wash immed Art resp Water, vomit	Lungs, paranasai sinus, CNS
soluble compounds	Synonyms vary depending upon specific compound	1 mg/m² (NIOSH) 0.015 mg/m² 10 hr TWA	N.A.	Appearance and odor vary depending upon specific compound	Properties vary depending upon specific compound		Strong acids, sulfur, Ni(NO ₃)s, wood, other combustibles	Filter; acid; AA; N	Clothing: Repeat prolong Goggles: N.A. Wash: Promptly upon contam Change: Alter work it may be contam Remove: Promptly contam non-impery	SEE APPENDIX Q	inh ing Con	Sens derm; cancer lungs, nasal cavities; pneumonitis; allergic asth	Breath	Water flush immed Art resp Water, vomit	Nasal cavities, lungs, skin
Micotine G ₁₄ H ₁₄ N ₈	3-(1-Mathyl-2-pyrrolidyl) pyridine	0.5 mg/m*	35 mg/ m*	Pale yellow to dark brown liquid with a slight, fishy odor when warm	MW: 162 BP: 511 F Sci: Miscible <140 F FLP: 203 F	VP: 0.0425 mm MP: -110 F UEL: 4% LEL: 0.7%	Strong oxidizers, strong acids	Resin; ethyl acetate; GC; T	Clothing: Any poss Goggles: Any poss Wash: Immed upon contam Change: New Anderson Change: Any Provide: Epwash, quick drench	5 mg/m*: SA/SCBA 25 mg/m*: SAF/SCBAF 35 mg/m*: SA-PD/PP, CF Escape: GMOVPPest/SCBA	Inh Abs Ing Con	Nau, salv, ahdom pain, vomit, diarr; head, dizz; disturb hearing, vision, confusion, weak, inco; paroxysma/atrial fibrl; convul, dyps	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed Att resp Water, vomit	CNS, CVS, lungs,
Nitric acid	Aqua fortis; White funing natric acid (WFNA); Red luming natric acid (RFNA); Hydrogen natrate	2 ppm (5 mg/m²) (N:OSH) 2 ppm/ 10 hr TWA	100 ppm	Colorless, yellow, or red furning liquid with an acrid, suffocating odor	MW: 63 BP: 183 to 251 F Sol: Miscible Not combustible	VP: 2.6 to 103 mm MP: -42 to -61 F	Combustible organics, oxidizable matter: wood, turpentine, metal powder, hydrogen sulfide, etc.; strong bases		Clothing: AP pH<2.5/RP pH>2.5 Goggles: Any poss Wash: Investigate upon contam Change: N.A. Romove: Immed contam non-imperv Provide: pht<2.5 eyewash, quick drench	250 mg/m*: CCFS/GMOVS/SAF/SCBAF/ SA-PD/PP,CF Escape: GMS/SCBA NOTE: DO NOT USE OXIDIZABLE SORBENTS	Con	Irrit eyes, muc memb, skin; delayed pulm edema, pneutis, bron, dental erosion	Eye: Skin: Breath: Swallow:	Irr immed Water flush immed All resp Water, NO VOMIT	Eyes, resp sys, lungs, skin, teeth
Nitric oxide NO	Nitrogen monoxide	25 ppm (30 mg/m²) (NIOSH) 25 ppm	100 ppm	Colorless gas with a sharp, sweet odor; brown at high concentrations in air	MW: 30 BP: - 241 F Sol: Reacts Not combustible	VP: 26,000 mrn MP: -263 F	Combustible matter, chlorinated hydrocarbons, ammonia, carbon disultide, metals, fluorine, ozone	NIOSH 77-157A	Clothing: N.A. Goggles: N.A. Wash: N.A. Change: N.A. Remove: N.A.	100 ppm: CCRS/GMS/SA/SCBA Escape: GMS/SCBA NOTE: DO NOT USE OXIDIZABLE SORBENTS	Inh Con	Irrit eyes, nose, throat; drows; unconscious	Breath.	Art resp	Resp sys, lungs

2. HOW TO USE THIS HANDBOOK

This handbook has been designed as a pocket-sized publication that can be utilized to provide chemical-specific data to supplement general industrial hygiene knowledge. In order to maximize the amount of data provided within a limited amount of space, extensive use has been made of abbreviations and symbolic codes. These concise communicative mechanisms have been designed to permit rapid comprehension by the regular handbook user. The following sections discuss the codes and abbreviations employed in this handbook.

Name and Formula

The substance name employed is that found in 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3, OSHA regulations on toxic materials (as of 1977). The chemical formula is also provided.

Synonyms

Several common synonyms are listed.

Permissible Exposure Limit

The permissible exposure limit (PEL), as found in 29 CFR 1910.1000 as of 1 January 1977, has been utilized. Where NIOSH has published a recommended revision to the OSHA regulation, the NIOSH recommended level is also noted. Where the American Conference of Governmental Industrial Hygienists (ACGIH) has recommended revision of the OSHA regulation and NIOSH has not, the ACGIH revised threshold limit value (TLV) is also noted.

Except where otherwise noted, the PEL's are work-shift time-weighted average (TWA) levels. Ceiling levels and TWA's averaged over other than full work-shifts are noted.

IDLH Level

The 'Immediately Dangerous to Life or Health' (IDLH) concentration defined by the SCP for the purpose of respirator selection is listed in either ppm or mg/m³. This concentration represents a maximum level from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. The basis of these values is described in 'Respiratory Protection Reference Document for Chemical Hazards.' Where the notation 'Ca' appears, NIOSH has recommended that the substance be treated as an occupational carcinogen.

Physical Description

A brief description of the appearance and odor of each substance is provided.

Chemical and Physical Properties

A number of important chemical and physical properties are given for each substance:

MW: Molecular weight

BP: Boiling point at 1 atm*, F

Sol: Solubility in water, g/100 g water at 20 C*

FI.P: Flash point, closed cup, F (or open cup if annotated (oc))

VP: Vapor pressure at 20 C* mm Hg

MP: Melting point, F

UEL: Upper explosive limit in air, % by volume

LEL: Lower explosive limit in air, % by volume

MEC: Minimum explosive concentration for a dust in air, g/l

* — These properties may be reported at other conditions, if so noted after a specific entry.

Incompatibilities

Important, potentially hazardous incompatibilities of each substance are listed.

Measurement Method

A brief, key-word description of the suggested sampling and analysis method is provided. Each description is comprised of four components: 1) collection, 2) work-up, 3) analysis, and 4) set code for ordering a description of the analytical method. The codes employed are listed in Table 1a.

Where the annotation 'NIOSH 77-157A' appears, a measurement method has been published in the 'NIOSH Manual of Analytical Methods,' which is available from the U.S. Government Printing Office, Washington, D.C., 20402 (Publication number 1977-757-057/5752).

For other methods appearing in this handbook, a full description may be found in the 'NIOSH Analytical Methods from the Standards Completion Program' series of publications, available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The NTIS publication number within which the method for each chemical is found may be determined from Table 1b.

Where a dash appears in this column, no method has been suggested by NIOSH.

Personal Protection and Sanitation

This item presents a summary of recommended practices specific to each toxic substance. These recommendations supplement general work practices (e.g., no eating where chemicals are used).

There are five primary categories of information, each of which refers to a recommended work practice for use conditions, and a final category ('PROVIDE') for any item special to that substance.

CLOTHING: Personal protective clothing use.

GOGGLES: Eye protection use.

WASH: Cleaning spilled chemical from the body (supplements normal washing before eating, etc.).

CHANGE: Routine changing of work clothing.

REMOVE: Frequency and immediacy of clothing removal upon accidental contamination.

PROVIDE: Information specific for a substance such as providing quick drench facilities (e.g., emergency showers) and facilities for the emergency washing of the eyes.

Table 2 lists the meaning of the codes utilized in Item 9.

Respirator Selection

A condensed table of allowable respirator use is provided. Each line of this item lists a maximum use concentration (in ppm, mg/m³, µg/m³, or mppcf) or condition (e.g., escape) followed by a series of codes representing classes of respirators. Individual respirator codes are separated by slanted lines (/). The recommendations for respirator use are based upon the OSHA permissible exposure level.

Any approved respirator of a given category can be utilized at any concentration equal to, or less than, the category's listed maximum use concentration for the toxic substance of interest

Codes employed for the various categories of respirator are defined in Table 3.

Route of Entry

The toxicologically important routes of entry of each substance are listed. Abbreviations employed are:

Inh Inhalation

Abs Skin absorption

Ing Ingestion

Con Skin and/or eye contact

Symptoms

Symptoms following human exposure are listed. Abbreviations are defined in Table 4.

First Aid

Simple first aid procedures are listed for response to eye contact, skin contact, inhalation, and ingestion of the toxic substance. Abbreviations are defined in Table 5.

Target Organs

The organs which are affected by each substance are listed.

Table 1a Codes for Measurement Methods

COLLECTION.	
Ads	
Bag	
Bub	
Bub (xxxx)	
Char	
Filter	Particulate filter
Filt/bub	· — ··································
	Filter plus bubbler
Imp	Impinger
Imp (xxxx)	Impinger containing xxxx
Resin	Resin-filled adsorption tube
SiO ₂	Silica gel adsorption tube
Tenax	Tenax-filled adsorption tube
WORK-UP	
These codes	
are	
self-explanate	orv
	[편집] 20 전 12 전
ANALYSIS	
AA	Atomic absorption spectrometry
Color	Colorimetric spectroscopy
Fluorospectro.	Fluorescence spectrometry
GC	Gas chromatography
GL	Gas-liquid chromatography
Gravimetric	Self-explanatory
HGA	Flameless atomic absorption in a
	high-temperature graphite analyzer
HPLC	High-pressure liquid chromatography
ISE	Ion-specific electrode
Titrate	Self-explanatory

Table 2 Personal Protection and Sanitation C

Wear appropriate equipment to prevent						
Any possibility of liquid contact and						
repeated or prolonged vapor contact						
with skin						
Any possibility of skin contact						
Any possibility of skin becoming wet						
with contaminant						
Any possibility of skin contact with						
liquids containing more than x% of						
contaminant, and repeated or						
prolonged skin contact with liquids						
containing y%						
Self-explanatory						
Skin contamination or freezing						
Skin becoming wet or frozen						
Repeated or prolonged skin contact						
Reasonable probability of skin contact						
Wear eye protection to prevent:						
Any possibility of eye contact						
Any possibility of substance xxx						
contacting the eyes						
Reasonable probability of eye contact						
Employees should wash:						
Immediately when skin is contaminated						
with liquids containing > x%						
contaminant, and promptly when skin						
is contaminated with y%						
At the end of each work shift						
At the end of each work shift when						
there was a reasonable probability of						
contact with the contaminant						
Immediately when skin becomes						
contaminated						
Immediately when skin becomes						
contaminated, and at the end of each						
work shift						
Immediately when skin becomes wet						
Immediately when skin becomes wet,						
and promptly when skin becomes						

Promptly upon contam.	work shift Promptly when skin becomes
	contaminated
Promptly upon contam/daily.	Promptly when skin becomes contaminated and at the end of each work shift
Promptly upon wet	Promptly winen skin becomes wet
pH < 3 immed contam/ pH > 3 pro wet.	Immediately when skin becomes contaminated with liquid of pH < 3, and promptly when skin becomes wet with liquid of pH≥ 3
Soap wash promptly	Promptly wash with soap when skin becomes contaminated
CHANGE	Work clothing should be changed daily:
After work if any poss contam.	If there is any possibility that the clothing may be contaminated
After work if may be contam.	If it is reasonably probable that the clothing is contaminated
REMOVE	Remove clothing:
Any contam immed	Immediately remove any clothing that becomes contaminated
Any wet immed	Immediately remove any clothing that becomes wet
Any wet immed (flamm).	Immediately remove any clothing that becomes wet to avoid flammability hazard
Any wet/contam non-imperv immed.	Immediately remove any clothing that becomes wet and any non-impervious clothing that becomes contaminated
Immed any wet/ contam non- imperv.	Immediately remove any clothing
Immed contam non-imperv.	Immediately remove non-impervious clothing that becomes contaminated
Immed wet/pro contam non-imperv.	Immediately remove any non-impervious clothing that becomes wet, and promptly remove any non-impervious clothing that becomes contaminated
Promptly contam	Promptly remove non-impervious
non-imperv.	clothing that becomes contaminated
Promptly contam/ immed wet	Promptly remove non- impervious clothing that becomes contaminated.
non-imperv.	and immediately remove non-impervious clothing that becomes
	wet
Promptly wet non-imperv.	Promptly remove non-impervious clothing that becomes wet
Non-imperv >x%	Immediately remove non-impervious
immed/y% pro.	clothing that becomes contaminated
	with liquids containing >x% contaminant, and promptly remove clothing contaminated with y%
PROVIDE	The following equipment should be available:
Eyewash Eyewash, quick drench	Self-explanatory Self-explanatory
Eyewash (xxx)	Eyewash if substance xxx is present Eyewash if liquids containing > 5%
p d / p d /	contaminant is pressent
OTHER CODES	
Liq	
Molt	Molten
Sol	No recommendation applies in this category
	Solutions containing the contaminant
Vap	

Table 3 Respirator Codes

· (1) : 주변화 공급 하시 (***********************************	
CCRCCRAG	Chemical cartridge respirator Chemical cartridge respirator with
CCRAGF	an acid gas cartridge(s) CCRAG with a full facepiece CCRAG with a full facepiece and
CCROV	with a high-efficiency filter Chemical cartridge respirator with
CCROVAG	an organic vapor cartridge(s)
CCROVAGF	cartridge(s)
CCROVD	cartridge(s) and a full facepiece
CCROVDM	CCROV with a dust and mist filter
CCROVDMF	and a full facepiece
CCROVDMFuPest	CCROV with a dust, mist, and fume filter, including pesticide respirators meeting these
CCROVDMPest	requirements CCROV with a dust and mist
	filter, including pesticide
CODOVER	respirators meeting these requirements
CCROVDPest	 CCROV with a dust filter, including pesticide respirators
CCROVF	. CCROV with a full facepiece
CCROVFD	high-efficiency filter
CCHOVED	a dust filter
CCROVFDM	CCROV with a full facepiece and a dust and mist filter
CCROVFDMFuPest	CCROV with a full facepiece and a dust, mist, and fume filter,
CCROVFDMPest	including pesticide respirators meeting these requirements CCROV with a full facepiece and
	a dust and mist filter, including pesticide respirators meeting
CCROVFDPest	
	full facepiece, including pesticide respirators with a full
CCROVFFuHiE	The state of the s
CCROVFHIEP	a fume or high-efficiency filter CCROV with a high-efficiency
	particulate fiiter and a full facepiece
CCROVHIEP	CCROV with a high-efficiency
CCROVHiEPest	particulate filter CCROV with a high-efficiency
	filter, including pesticide respirators meeting these
CCROVFS	requirements
	CCROV with a full facepiece providing protection against the specific compound of concern
CCROVS	CCROV providing protection against the specific compound
D D	of concern ust mask
DM	ust and mist respirator
DMFu Di	ust, mist, and fume respirator DM, except single-use respirators
DMXSPest	DM, except single-use respirators, including pesticide respirators
DMXSQ	DM, except single-use and
DMXSQPest	quarter-mask respirators DM, except single-use and
	quarter-mask respirators. including pesticide respirators
DXS Du	ust mask, except single-use
the second of th	ust mask, except single-use, including pesticide respirators
DXSQ Du	ust mask, except single-use and

FuHiEP	quarter- mask respirators Fume or high-efficiency particulate
FuHiEPS	respirator FuHiEP providing protection against the specific compoun-
	of concorn
GMAG	. Gas mask with an acid gas caniste (chin-style or front- or
	back-mounted canister)
GMAGHIE	. GMAG with a high-efficiency filter
GMAGPGMAGS	. GMAG with a particulate filter . GMAG providing protection
	against the specific compound
GMOV	of concern Gas mask with an organic vapor
GIVIOV	as mask with an organic vapor
	canister (chin-style or front- or back-mounted canister)
GMOVc	Chin-style GMOV
GMOVfb	Front- or back-mounted GMOV
GMOVAG	GMOV providing protection
0110111-	against acid gases
GMOVAGF	GMOV, with a full faceniece.
	providing protection against
GMOVAGHIE	acid gases
amo v Adrii E	GMOV with a high-efficiency filter and acid gas canister
GMOVAGP	GMOV with an acid gas canister
	and particulate filter
GMOVD	GMOV with a dust filter
GMOVDFuMPest	GMOV with a dust, fume, and
	mist filter, including pesticide
	respirators meeting these
GMOVDM	requirements
GMOVDMPest	GMOV with a dust and mist filter GMOV with a dust and mist filter,
	including pesticide respirators
GMOVF	GMOV with a full facacione
GMOVFFuHiE	GMOV with a full facepiece and a
	fume or high-efficiency filter
GMOVFHIE	GMOV with a full facepiece and a
GMOVFP	a high-efficiency filter
GIVIOVEP	GMOV with a full facepiece and a particulate filter
GMOVHIEP	GMOV with a high-efficiency
	particulate filter
GMOVP	GMOV with a particulate filter
GMOVPPest	GMOV with a particulate filter,
GMPest G	including pesticide respirators
Givir est G	as mask with a pesticide canister
	(chin-style or front- or back-mounted canister)
GMS Gi	as mask with a canister providing
	protection against the
	compound of concern (chin-
	style or front- or back-mounted
GMSc	canister)
	GMS with a chin-mounted canister
GMSfb	GMS with a front- or
and the second second	back-mounted canister
GMSF	GMS with a full facepiece
GMSHiE	GMS with a high-efficiency filter
GMSOVPPest	GMS with an organic vapor
	canister and particulate filter,
	including pesticide respirators meeting these requirements
GMSP	GMS with a particulate filter
HiEP Hic	h-efficiency particulate respirator
HIEPAG	HiEP with an acid gas cartridge
HIEPF	HIEP with a full facepiece
HiEPFu	HiEP or a fume filter respirator
HiEPFPest H	HiEP with a full facepiece,
	including pesticide respirators
LUEDO	meeting these requirements
HiEPPest H	HIEP, including pesticide
	respirators meeting these
MXS Mis	requirements
AXSO MIS	t respirator, except single-use
MXSQ Mis	and quarter-mask respirator
	dia qualter-mask respirator

TABLE 3 Continued

PAPCCROVHIEP	Powered air-purifying respirator with an organic vapor cartridge and a high-efficiency particulate filter
PAPCCROVFHIEP	PAPCCROVHIEP with a full facepiece
PAPCCROVFHiEPPest	
PAPHIE	Powered air-purifying respirator with a high- efficiency filter
PAPHIEF	PAPHiE with a full facepiece
PAPHIEOV	
	cartridge
PAPHIFOVE	PAPHiE with an organic vapor
1741112011	cartridge and a full facepiece
PAPHiEPest	PAPHiE, including pesticide respirators meeting these
	requirements
SA	Supplied-air respirator
SA:PD,PP,CF	Type C SA operated in
	pressure-demand or other
	positive pressure or
SAF	continuous-flow mode SA with a full facepiece, helmet,
	or hood
SAF:PD.PP.CF	Type C SA with a full facepiece
	operated in pressure-demand
	or other positive pressure mode
	or with a full facepiece, helmet,
	or hood operated in
	continuous-flow mode
SCBA	Self-contained breathing apparatus
SCBAF	SC3A with a full facepiece
SCBAF:PD,PP	SCBA with a full facepiece
	operated in pressure-demand
	or other positive pressure mode
Some Respirator Codes Ap but Not Specifical	prearing in the Chemical Listing lly Identified in Table 3
CCFS	CCR providing protection against
CCRFPest	compound of concern
CCRFPest	CCR with full facepiece and pesticide cartridge
CROVHIEF	CCROVFHIEP
CCRPest	CCR with pesticide cartridge
CCRS	CCR providing protection against
	compound of concern
CCRSF	CCRS with full facepiece
CCRSFD	CCRSF with dust filter
DDROVF	CCROVF
DMXSF	DMXS with full facepiece
GWAGINET	GMAG with a high efficiency particulate filter
GMOC	GMOV
GMOVHIE	GMOVHIEP
GMCVPest	GMOVPPest
GMOVS	GMOV providing protection against specific compound of concern
GMXS	GM except single use
PPFPest	PAPCCROVFHIEPPest
PAPHIEPF	PAPCCROVFHIEP
PAPOVF	PAP with organic vapor cartridge
PAPOVFHIEPPEst	and full facepiece
PAPOVHIEP	PAPCCROVFHIEPPest PAPCCROVHIEP
PAPOVHIEPPest	PAPCCROVHIEP, including pesti-
	cide respirators
PAPPest	PAP with pesticide canister
Past Rest	Pesticide Respirator
SCBA/PD/PP/CF	SCBA operated in PD,PP,CF
SAD:PD/PP/CF	SA:PD,PP,CF

Table 4

Symptom of Exposure Abbreviations

abdomabdominal	hemathematoma
albumalbuminuria	hematohematopoietic
ANSautonomic nervous system	hemoghemoglobinuria
anemanemia anesanesthesia	hemorrhemorrhage
anoranorexia	hephepatic
anosanosmia	hyperhyperemia
apatapathy	hypoxhypoxemia icticterus
appreapprehension	incoincoordination
arrhyarrhythmias	inflamminflammation
asphyasphyxia	
asthasthma	injinjury insominsomnia
ataxataxia	intoxintoxication
bilirubilirubinuria	irritirritation
blurblurred	irrityirritability
breathbreathing	jaunjaundice
bronbronchitis	kerakeratitis
bronspas broncospasm	kidkidney
BUNblood urea nitrogen	lablabored
cacancer	laclacrimation
cachexiasevere generalized weakness, emaciation	larlaryngeal
carccarcinogenic/carcinogen	lassassitude
cardcardiac	leucytleukocytoses
cerecerebral	leukJeukemia
cholcholinesterase	leupenJeukopenia
chorchorea	li- headlightheadedness
cirrcirrhosis	livliver
CNScentral nervous system	lo-apappetite loss
 collcollapse	low-wgtweight loss
confconfusion	lymplymphocytosis
conjconjunctivitis	malmalaise
constipconstipation	malnutmalnutrition
constricconstriction	monocymonocytosis
convulsconvulsions	muc membmucous membrane
corncornea	muscmuscle
cor acute right heart strain or chronic right ventricular	myomyotonia
pulmonale. hypertrophy	narcnarcotic
CVScardiovascular system	narconarcosis
cyancyanosis	nasnose/nasal
defatdefatting degdegeneration	naunausea
dentdental	necnecrosis
depresdepressant/depression	nephnephritis
dermdermatitis	nernervousness
dildilated	neurneurologic
diarrdiarrhea	numbnumbness
distdisturbance	opacopacity
dizzdizziness	palpallor palppalpitations
drowdrowsiness	paraparalysis
dysdysuria	paresparesthesias
dysartdysarthria	paresisincomplete loss of muscular power; weakness of
dyspdyspnea	limb
eczeczema	paroxparoxysmal
emphyemphysema	perfperforation
enlenlargement	peri neurperipheral neuropathy
eosineosinophilia	peri neuritperipheral neuritis
episepistaxis	periorbperiorbital
epitepithelium	photophotophobia
equiequilibrium	pigpigmentation
ery cholerythrocyte cholinesterase	plasplasma
eryterythemia	pleurpleurisy
eupheuphoria	PNSperipheral nervous system
extremextremities	pneupneumonia
fascfasiculation	pneuitispneumonitis
fibfibrosis fibrlfibrillation	polyneur polyneuropathy
ftgfatigue	prosprostration
fvrfever	protproteinuria
frostfrostbite	psypecpsychialopecia
gaspgasping	pulmpulmonary
GIgastrointestinal	
giddgiddiness	the first of the control of the cont
glauglaucoma	
gluglucose	
haluhallucinations	
headheadache	
neadleadache	

TABLE 4 Continued

-	- Company	
	pulsus a pulse pattern in which beats occur at regular alternans. intervals, but with alternating weak and strong beats	
	puppupil	
	RBCred blood cell	
	resprespiratory	
	resp arrespiratory arrest	
	retsterretrosternal	
	rhinrhinorrhea	
	salvsalivation	
	scotomaan area of absent or depressed vision in the visua field	al
	senssensitization	
	sezseizure	
	sleepsleepiness	
	sneezsneezing	
	somsomnolence	
	spasspasm	
	strabismusabnormality of the eyes in which the visual axes of not meet at the desired point	ot
	subssubsternal	
	sweatsweating	
	swellswelling	
	tacartachycardia	
	tendtenderness	
	trachbronctracheobronchitis	
	vasconstvasoconstriction	
	venfibventricular fibrillation	
	vertivertigo	
	vesicvesiculation	
	vis distvisual disturbance	
	vomitvomiting	
	weakweakness	
	wheezwheezing	
	보다 하나야 하다 이번 사람들이 되었다. 그런 사람들이 가장 하는 것이 되었다.	

Table 5 Codes for First Aid Data

EYE	
Irr immed	If this chemical gets into the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
Irr immed (15 min)	If this chemical gets into the eyes, immediately wash the eyes with large amounts of water and continue flushing for 15 minutes, occasionally lifting the lower and upper lids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
Irr promptly	If this chemical gets into the eyes, promptly wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention if any discomfort continues. Contact lenses should not be worn when working with this chemical.
Medical attention	Self-explanatory
SKIN	
Dust off solid; water flush.	If this solid chemical gets on the skin, dust it off immediately and then flush the contaminated skin with water. If this chemical or liquids containing this chemical penetrate through the clothing, promptly remove the clothing and flush the skin with water. Get medical attention immediately.
Medical attention for frostbite.	If this chemical comes in contact with the skin or mouth, immediately stop the exposure. If frostbite has occurred, get medical attention.
Molten: flush immed; sol/liq wash.	If this molten chemical gets on the skin, immediately flush the skin with large amounts of water. Get medical attention immediately. If this chemical or liquids containing this chemical get on the skin, promptly wash the contaminated skin with soap or mild detergent and water. If this chemical or liquids containing this chemical penetrate through the clothing, immediately remove the clothing and wash the skin with soap or mild detergent and water. If irritation persists after washing, get medical attention.
Petro product rinse	If this liquid chemical or strong concentrations of this chemical's vapors get on the skin, immediately rinse the contaminated skin with kerosene or similar petroleum products, if readily available, then wash the skin with soap or mild determent and water.

if readily available, then wash the skin with soap or mild detergent and water. If this liquid chemical or strong concentrations of this chemical's vapors penetrate through the clothing, immediately remove the clothing and first rinse the skin with kerosene or similar petroleum products, if readily available, then wash the skin with soap or mild detergent and water Set

or mild detergent and water. Get medical attention immediately.

Soap flush immed	If this chemical gets on the skin, immediately flush the contaminated skin with soap or mild detergent and water. If this chemical soaks through the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
Soap flush promptly	If this chemical gets on the skin, promptly flush the contaminated skin with soap or mild detergent and water. If this chemical soaks through the clothing, promptly remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
Soap promptly/flush immed molten.	If this solid chemical or liquids containing this chemical get on the skin, promptly wash the contaminated skin with soap or mild detergent and water. If irritation persists after washing, get medical attention. If this molten chemical gets on the skin or non-impervious clothing, immediately flush the affected area with large amounts of water to remove heat. Get medical attention immediately.
Soap wash	If this chemical gets on the skin, wash the contaminated skin with soap or mild detergent and water.
Soap wash immed	If this chemical gets on the skin, immediately wash the contaminated skin with soap or mild detergent and water. If this chemical soaks through the clothing, immediately remove the clothing and wash the skin with soap or mild detergent and water. Get medical attention promptly.
Soap wash promptly	If this chemical gets on the skin, promptly wash the contaminated skin with soap or mild detergent and water. If this chemical soaks through the clothing, promptly remove the clothing and wash the skin with soap or mild detergent and water. Get medical attention promptly.
Water flush immed	If this chemical gets on the skin, immediately flush the contaminated skin with water. If this chemical penetrates through the clothing, immediately remove the clothing and flush the skin with water. Get medical attention promptly.
Water flush promptly	If this chemical gets on the skin, flush the contaminated skin with water. If this chemical soaks through the clothing, immediately remove the clothing and flush the skin with water. If irritation persists after washing, get medical attention.
	If this chemical gets on the skin, immediately wash the contaminated skin with water. If this chemical soaks through the clothing, immediately remove the clothing and wash the skin with water. If symptoms occur after washing, get medical attention immediately.
Water wash promptly.	If this chemical gets on the skin, promptly wash the contaminated skin with water. If this chemical soaks through the clothing, promptly remove the clothing and wash the skin with water. If irritation persists after washing, get

medical attention.

BREATH	
Art resp	If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical
Fresh air	attention as soon as possible. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once. Other measures are usually unnecessary.
Fresh air; 100% O ₂	
SWALLOW Medical attention	When this chemical has been swallowed get medical attention.
Milk; if N.A., water, NO VOMIT.	when this liquid chemical has been swallowed and the person is conscious, immediately give the person large quantities of water to dilute the chemical. Do not attempt to make the person vomit. Get medical attention immediately. (If milk is immediately available, give the person milk instead of water).
TIMOV CM	If this chemical has been swallowed, do not induce vomiting. Get medical attention immediately.
Syrup of Ipecac,	When this chemical has been swallowed, immediately get medical attention. If medical attention is not immediately available, get the affected person to vomit by having him touch the back of the throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug should be kept with emergency medical supplies in the workplace and is available at most drug stores and drug counters. Do not make an unconscious person vomit.
USE AMYL NITRITE PEARLS.	Self-explanatory
Water, NO VOMIT	If this chemical has been swallowed and the person is conscious, immediately give him large quantities of water to dilute the chemical. Do not attempt to make the exposed person vomit, Get medical attention immediately.
Water, vomit	When this chemical has been swallowed and the person is conscious, immediately give the person large quantities of water. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.
Water, voinit; If petroleum base, NO VOMIT.	When this chemical has been swallowed, immediately get medical attention. If the swallowed chemical was dissolved in a petroleum-based material, do not make the exposed person vomit. If medical attention is not immediately available and the swallowed chemical was a powder or was in a water base, get the person to vomit by having him touch the back of the throat with his finger or by giving him large amounts (one pint or more) of warm salt water (two tablespoons of salt per pint of water). Do not make an unconscious person vomit.

person vomit.

Appendix E

Dangerous Properties of Industrial Materials, N. Irving Sax

ETHYLENE. Syns: ethene, elayl, etherin. Colorless gas, sweet odor and taste. CH₂CH₂, mw: 28.05, bp: -103.9°, mp: -169.4°, lel = 2.7%, uel = 36%, d: 0.610 @ 0°, autoign. temp.: 914° F, vap. d: 0.98, fp: -181°. THR = MOD via inhal route. High conc cause anesthesia. A simple asphyxiant. A common air contaminant. It is phytotoxic.

Fire Hazard: Very dangerous, when exposed to heat or flame; can react vigorously with AlCl₃, (CCl₄ + benzoyl peroxide), (bromtrichloro methane + AlCl₃), O₃. [19]

Explosion Hazard: Mod, when exposed to flame.

Disaster Hazard: Dangerous! Flam gas!

To Fight Fire: Stop flow of gas, CO₂, dry chemical or fine water spray.

Appendix F

The Merck Index, An Encyclopedia of Chemicals and Drugs

ETHYLENE. Syns: ethene, elayl, etherin. Colorless gas, sweet odor and taste. CH2CH2, mw: 28.05, bp: -103.9°, mp: -169.4°, lel = 2.7%, uel = 36%, d: 0.610 @ 0°, autoign. temp.: 914°F, vap. d: 0.98, fp: -181°. THR = MOD via inhal route. High conc cause anesthesia. A simple asphyxiant. A common air contaminant. It is phytotoxic.

Fire Hazard: Very dangerous, when exposed to heat or flame; can react vigorously with AlCl3, (CCl4 + benzoyl peroxide), (bromtrichloro methane + AlCl₃), O_{3. [19]}

Explosion Hazard: Mod, when exposed to flame. Disaster Hazard: Dangerous! Flam gas! To Fight Fire: Stop flow of gas, CO2, dry chemical or

fine water spray.

EXERCISE: MODULE V - HAZARDOUS WASTE CLASSIFICATION

CLASSIFICATION EXERCISE

OBJECTIVE: Learn to use available resources to properly classify hazardous wastes.

SITUATION: You have been assigned to classify a number of hazardous wastes generated by your production shop. In order to assist you in this task, you have been given a DOT Table (49 CFR 172.101), RCRA regulations excerpts (40 CFR 261 Subparts C and D, see Appendix A), and the references listed in section VII of this module. MSDSs for the chemicals have been included in this exercise.

REQUIRED TASK: Determine the physical characteristics, EPA classifications, and DOT classifications of three hazardous wastes.

PROCEDURE:

- 1. Using the MSDSs and the references, determine the physical characteristics of the waste.
- 2. Using the procedure outlined in section IV of the module, along with Appendix A, determine the correct EPA hazardous waste identification number.
- Using the DOT Table, determine the DOT class (column 3), the correct DOT Identification Number (column 3A), and the UN Class Number (see Table V-1).

HAZARDOUS WASTE 1: TOLUENE

Solubility in Water

hysical Characteristics:		
Vapor Pressure	@	
Boiling Point		
Vapor Density		
Specific Gravity		
Flashpoint		
Flammable Limits -	Lower	
	Upper	%
Ignition Temp.		
Autoignition Temp.		

	Hazardous Waste Identificati	of Namber.	
. DOT	Class		
DOT	Identification Number		
UN	Class Number :		
AZARD	OUS WASTE 2: GASOLINE		
. Phy	sical Characteristics:		
	Vapor Pressure		
	Boiling Point		i sta - i
	Vapor Density	@	
	Specific Gravity		
	Flashpoint		
	Flammable Limits - Lower		7/2
	Upper		7.
	Ignition Temp.	_	
	Autoignition Temp.		
	Solubility in Water		
EPA	Hazardous Waste Identification	on Number:	
	Class		
DOT	Identification Number		

HAZARDOUS WASTE 3: ETHYL ETHER

. Ph	ysical Characteristics:	
	Vapor Pressure	@
	Boiling Point	_
	Vapor Density	
	Specific Gravity	_
	Flashpoint	
	Flammable Limits - Lower _	T z
	Upper _	X
	Ignition Temp.	_
	Autoignition Temp.	<u> </u>
	Solubility in Water	
2. EP.	A Hazardous Waste Identificatio	n Number:
3. DO	T Class	
DO	T Identification Number	
UN	Class Number	



Fisher Scientific Company

Chemical Manufacturing Division P. O. Box 375, 1 Reagent Lane Fair Lawn, NJ 07410

MATERIAL SAFETY DATA SHEET (Adapted from USDL Form LSD-005-4)

(201) 796-7100

SECTION I. IDENTIFICATION OF PRODUCT	
CHEMICAL NAME Toluene	FORMULA C6H5CH3
SYNONYM OR CROSS REFERENCE Methylbenzene	
SECTION II. HAZAF	RDOUS INGREDIENTS
MATERIAL	NATURE OF HAZARD
Toluene	Flammable
SECTION III.	PHYSICAL DATA
BOILING POINT	MELTING POINT -95°C
VAPOR PRESSURE(mm Hg) 21.86	SPECIFIC GRAVITY 0.868
VAPOR DENSITY (AIR = 1)	PERCENT VOLATILE BY VOLUME (%)
WATER SOLUBILITY 0.05%	EVAPORATION RATE (ether = 1) greater than 1
APPEARANCE Clear, Colorless liquid	
SECTION IV. FIRE AND E	EXPLOSION HAZARD DATA
FLASH POINT (method used) (°F) 40°P	FLAMMABLE LIMITS Uel Lel . 6.7 1.4
FIRE EXTINGUISHING MEDIA CO. dry chemica	al, alcohol foam
SPECIAL FIRE-FIGHTING PROCEDURES	
UNUSUAL FIRE AND EXPLOSION HAZARD	
SECTION V. H	EALTH HAZARD
그들은 그리기 하는 그는 그는 그 사람들이 되었다면 하는 그래요? 하는 이 나를 모양하는 이 가는 그를 모양하는 이 사람들이 되었다.	CGIH 1983-84

Inhalation: Remove to fresh air. Skin and eyes: flush with water for at least 15 minutes. For eyes, consult a physic PI

DATE: March 26, 1980

particular purposes.

REV. NO.

assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for the

11-79



MATERIAL SAFETY DATA SHEET

Shell

7002 REV 1-83

MSDS NUMBER > 51,161-2

PAGE 1 OF

SECTION		24 HOUR EMERGENÇY ASSISTANCE
PRODUCT	Shell Super Unleaded Gasoline	SHELL 713-473-9461 CHEMTREC 800-424-9300 CHEMTRE 2
CHEMICAL/ SYNONYMS	Petrol	HAZARD RATING FIRE 4
CHEMICAL	P Hydrocarbon	O SLIGHT DE REACTIVITY O
SHELL CODE	04352 CAS NUMBER Mixture	MODERATE HIGH EXTREME LA

SECTION II	VGREDIEN	NTS
COMPOSITION	1 4	TOXICITY DATA
Shell Super Unleaded Gasoline	100	Not Determined
A complex combination of hydro- carbons largely C-4 through C-12.		
Benzene content typically from 0.5% to 2.5%. May contain up to		
low of various oxygenated hydro- carbons, such as aliphatic		
alcohols and ethers. Also contains small amounts of other		
additives which are not con- sidered to be hazardous at the		
concentrations used.		

SECTION III HEALTH INFORMATION

Inhalation: WARNING. Minimize breathing vapors. Repeated or prolonged exposures to high concentration of vapor may cause pulmonary irritation, headache, dizziness, nausea, incoordination, loss of consciousness or even death

Ingestion: Harmful or fatal if swallowed resulting in nausea, vomiting, diarrhea and restlessness. Aspiration of vomitus and/or gasoline may lead to severe lung damage and even death.

Skin Contact: Prolonged and repeated liquid contact can cause defatting and drying of the skin resulting in skin irritation and dermatitis. Some components of gasoline may be absorbed through the skin.

NOTE: (1) It has been reported that chronic inhalation exposure to an unleaded motor gasoline, which was fully vaporized, has produced kidney and liver cancers in some laboratory rodents. The studies were sponsored by the American Petroleum Institute. The API test material used was blended to represent a typical unleaded motor gasoline. Shell unleaded gasoline has not seen evaluated in this type of animal test. (2) Repeated high level benzene exposure may produce injury of the blood-forming tissues causing blood abnormalities and possibly leukemia; however, exposures to such high levels are not likely to be encountered in gasoline vapor due to the low benzene content.

SECTION IV OCCUPATIONAL EXPOSURE LIMITS

No OSHA limits have been established.

ACGIH/TLV = 300 ppm (8-hours TWA); TLV-STEL = 500 ppm

NOTE: THE ACGIH/TLV limit of 300 ppm is under review. In the interim, minimize exposure to a level which is practical and attainable.



SECTION V

MATERIAL SAFETY DATA SHEET

MSDS NUMBER > 51,161-2

97003 11-811

EMERGENCY AND FIRST AID PROCEDURES

Remove victim to fresh air and provide oxygen if breathing INHALATION: is difficult. Give artificial respiration if not breathing.

Get medical attention

SKIN CONTACT: Flush with water while removing contaminated clothing and

shoes. Follow by washing with soap and water. Do not reuse clothing or shoes until cleaned. If irritation persists,

get medical attention.

Flush with water far Flush with water for 15 minutes while holding eyelids open.

Get medical attention.

in the factor of Do not induce vomiting. If vomiting occurs spontaneously, INGESTION:

keep head below hips to prevent aspiration of liquid into

the lungs. Get medical attention.

*NOTE TO THE PHYSICIAN: If more than 2.0 ml per kg has been ingested and vomiting has not occurred, emesis should be induced with medical supervision. Keep victim's head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered.

SECTION VI	PHYSICAL DATA	
BOILING POINT	100-425 MELTING POINT N.A.	VAPOR PRESSURE 7-14.5 PSI (mmHg) (Reid)
SPECIFIC GRAVITY (H ₂ 0=1)	0.72-0.76	VAPOR DENSITY 3.5 (AIR=1)
SOLUBILITY IN WATER	Negligible EVAPORATION RATE N.A. (BUTYL ACETATE=1)	N.A.= Not Available

Red color; clear and bright liquid. Characteristic petroleum-hydrocarbon

SECTION VII	FIRE AND EXPLOSION HAZARDS		
FLASH POINT AND METHOD USED	FLAMMABLE LIMITS ".	VOLUME IN AIR	LOWER UPPER
-40°F Tag Closed Tester			1.3 7.6
EXTINGUISHING MEDIA	and the second s		

Use water fog, foam, dry chemical or CO2. Do not use a direct stream of water. Product will float and can be reignited on surface of water.

SPECIAL FIRE FICHTING PROCEDURES AND PRECAUTIONS

Danger. Extremely Flammable. Clear fire area of unprotected personnel

and isolate. Do not enter confined fire space without full bunker gear including a positive pressure NIOSH approved self-contained breathing apparatus. Cool fire exposed containers with water. EDUSTRIAL DE FRONTES DE PORTO DE PORTO

UNUSUAL FIRE AND EXPLOSION HAZAROS

11.72. - 1.324.

Vapors are heavier than air accumulating in low areas and traveling along the ground away from the handling site.

Do NOT weld, heat or drill on or near container. However, if emergency situations require drilling, only trained emergency personnel should drill.

39C 05247

0200	SUICEE OFF CO	
STATE OF THE PARTY	MATERIAL	SA
Beris		13 3

FETY DATA SHEET

MODE NUMBER & ST 161-

97004 (10-79)	13 f. 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		MODO HOMBE	PAGE 3 OF
SECTION VIII		REACTIVITY		
STABILITY D UNSTABLE	X STABLE	HAZARDOUS POLYMERIZATION	MAY OCCUR	X WILL NOT OF
COMDITIONS AND MATERIALS TO	VOID	and the state of t		
Avoid heat, sparks	, open flam	mes and strong oxidi:	zing agents.	Prevent
vapor accumulation	•			

Carbon monoxide and other unidentified organic compounds can be formed

SECTION IX

EMPLOYEE PROTECTION

RESPIRATORY PROTECTION Under conditions of potential high exposure, the use of a NIOSH-approved respirator is recommended (see Section X). Per 29 CFR 1910.134 use either an atmosphere-supplying respirator or an air-purifying respirator for organic vapors. For service station personnel protection, see Section XI PROTECTIVE CLOTHING

As required to minimize skin and eye contact, wear impervious gloves, eye protection, and other protective clothing.

ADDITIONAL PROTECTIVE MEASURES

Use explosion-proof ventilation as required to control vapor concentrations.

ENVIRONMENTAL PROTECTION

SPILL OR LEAK PROCEDURES DANGER! EXTREMELY FLAMMABLE. Eliminate all ignition sources. Handling equipment must be grounded to prevent sparking.

Large spills: Isolate hazard area; deny entry to unnecessary personnel. Wear appropriate respirator and protective clothing. Shut off source of leak if safe to do so; dike and contain. Water fog may be useful in suppressing vapor cloud; contain run-off. Remove with vacuum trucks or pump to storage/salvage vessels. Soak up residue with an absorbent such as clay, sand or other suitable material; place in D.O.T. authorized non-leaking containers for proper disposal. Flush area with water only if flush solutions can be contained and gasoline is recoverable.

Small spills: Take up with an absorbent material such as sand or clay and WASTE DISPOSAL

Recovered product should be recycled. Waste generated during cleanup which is discarded as a solid waste should be disposed of at a facility approved under RCRA regulations for hazardous waste (See Sec. XIII).

This product is an "oil" under the Clean Water Act. KEEP CUT OF SURFACE WATERS AND ANY WATER COURSES OR SEWERS ENTERING OR LEADING TO SURFACE WATERS. See Section XIII.





MATERIAL SAFETY DATA SHEET

MSDS NUMBER

51.161-2

	_	_	-	3700
SE	CT	ON	XI	

SPECIAL PRECAUTIONS

EXTREMELY FLANHABLE. Avoid heat, sparks, open flames, including pilot lights, and strong oxidizing agents. Use explosion-proof ventilation to prevent vapor accumulation. All handling equipment must be grounded to prevent sparking. Harmful or fatal if swallowed. Do not siphon gasoline. by mouth.

FOR USE AS A MOTOR FUEL ONLY. Do not use as a cleaning solvent or for other non-motor fuel uses.

Wash with soap and water before eating, drinking, smoking or using toilet facilities. Launder contaminated clothing before reuse. Under normal working conditions at service stations, a respirator is not warranted. a major spill occurs, get upwind and notify local emergency personnel. Remember explosion and fire is the most immediate danger.

SECTION XII	TRANSPORTATION REQUIREMENTS	
TRANSPORTATION FLA	MMABLE LIQUID COMBUSTIBLE LIQUID OXIDIZING MATERIAL MMABLE SOLID POISON CLASS A CORROSIVE MATERIAL MMABLE GAS POISON CLASS B IRRITATING MATERIAL	NON-FLAMMABLE GAS NOT HAZARDOUS BY D.O.T. REGULATIONS OTHER-Specify below
O.O.T. PROPER SHIPPING NAME Gasoline OTHER REQUIREMENTS		
ם.ס.ד. ו.ם. # נואט	203, Guide No. 27	

SECTION XIII

OTHER REGULATORY CONTROLS

EPA.FDA.OSHA.USDA.CPSC.etc. EPA - Resource Conservation and Recovery Act (RCRA) Regulations As produced, this material is a product and not a waste. If discarded or intended to be discarded as is, it is a liquid ignitable hazardous waste as defined in RCRA (40 CFR 261.21). The EPA hazardous waste number is DOOL. Free liquid ignitable wastes are banned from disposal by landfilling bulk or in containers. Product recovery and recycling are recommended where possible.

EPA - Clean Water Act (CWA)

1912 3 6 This product is classified as an oil under Section 311 of the Clean Water Act. Spills entering (a) surface waters or (b) any watercourses or sewers entering/leading to surface waters that cause a sheen MUST be reported to the National Response Center, 800-424-8802.

The information contained herein is based on data considered accurate, lowever, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from 1.... the use thereof.

Vendor assumes no resnonsibility for injury to vendee or third persons proximetally coused by the material if reasonable safety procedures are not achered to as stigulated in the data sheet Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the meterial even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

ALUE TO THE TOTAL PROPERTY OF

BE SAFE

READ OUR PRODUCT SAFETY INFORMATION ... AND

PASS IT ON

PRODUCT LIABILITY LAW HE CUIRES IT!

SHELL OIL COMPANY PRODUCT SAFETY AND COMPLIANCE OIL AND CHEMICAL PRODUCTS P.O. EOX 4320 HOUSTON, TEXAS 77210

DATE PREPARED

Nay 05, 1983

U.S. DEPARTMENT OF LABOR Occupational Safety and Health Administration

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for

		Shipbreaki	ng (29 CFR 1915, 1916, 1917)		
1. " 我们也有这种一种是主义的现在分词的现在分词。"		SEC	TION I		
MANUFACTURER'S NAME U. S. Indust	ria	1 Chemi	cals Company EMERGENCY TELEPHON	E NO.	
Division of National Distiller ADDRESS (Number, Street, City, State, and ZIP Co	S &				
		99 Pa	rk Avenue New York, New York	1001	6
ether; ethyl oxide; ethoxyethane	, SI	furic	ether trade name and synonyms	40.0	
Ether	•	· iz · i	C2H5OC2H5		
SECTION	11 -	HAZAI	RDOUS INGREDIENTS	i.h :	in the
PAINTS, PRESERVATIVES, & SOLVENTS	×	TLV (Units)	ALLOYS AND METALLIC COATINGS	×	TLV
PIGMENTS	4	Tomas.	BASE METAL	+	(Units)
CATALYST			ALLOYS		74.
VEHICLE NEWS TO THE TOTAL		751	METALLIC COATINGS	-	
SOLVENTS THE THE PARTY OF THE P		***	FULLED METAL	-	1352.1
ADDITIVES			PLUS COATING OR CORE FLUX	-	
OTHERS - The ALL STATE OF THE S					
		100000000000000000000000000000000000000			ACGIH
HAZARDOUS MIXTURES	OF (THER LIC	Diethyl ether	*	(Units)
		201	Diethyl ether	100	400 p
Constitution and the second se		e entre de la companya de la company	Ethyl Alcohol	<5	1000 p
	***		Water	<5	N.A.
	-1467		Inhibitor	K.5	N.A.
SEC.	TION	V III - P	HYSICAL DATA	ergenisiere	and the state of
BOILING PORT ethyl ether	1	94	SPECIFIC GRAVITY HAPPIN @ 25°C	0.7	
vapor pressynethy tother @ 20°C		442	PERCENT, VOLATILE BY VOLUME (%)	10	
VAPOR DENSITY (AIR-1) ether			EVAPORATION RATE (n-butyl acetate = 1)	-	6.9
SOLUBILITY IN WATER ther @ 20°C		6.5	the second state of the second state of		
를 살았다. 이번 프랑스 나는 자기의 작가는 요즘이 그렇게 되었다면 하는 것이 되었다.			, pungent odor		
			XPLOSION HAZARD DATA		
ASTM D-56 Tag Closed Cup,		1008		1.5	
AT INGUISHING MEDIA			1 85 VOTUME	3	5
			rbon dioxide, or dry chemicals		1
		100			
INUSUAL FIRE AND EXPLOSION HAZARDS			No with water	4.4.	

PAGE (1)

0.05.

(Continued on reverse side)

Form OSHA-20

SECTION V -	HEALTH HAZARD DATA
THRESHOLD LIMIT VALUE See Section I	I.
EFFECTS OF OVEREXPOSURE Will cause dr	owsiness, stupor or unconsciousness on
prolonged exposure	
EMERGENCY AND FIRST AID PROCEDURES REMOV	e from exposure
The state of the s	Marcher of 2 and and a second

STABILITY	UNSTABLE	X	Conditions favoring peroxide formation
	STABLE	-	
INCOMPATABILITY	(Materials to avoid)	- (Oxidizing materials to see the second of the
HAZARDOUS DECO	MPOSITION PRODU	ств (CO ₂
HAZARDOUS	MAY OCCU	a 7	CONDITIONS TO AVOID
POLYMERIZATION	WILL NOT	CCUR .	X

SECTION VII . SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED . Keep heat and ignition sources away.

(4) 数据的数据 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4) 10 (4

WASTE DISPOSAL METHOD
For small quantities, absorb on paper towels and evaporate in a safe place (such as a fume hood or out of doors away from all ignition sources). Large quantities can be collected and disposed of in a suitable combustion chamber. Ethyl ether should not allowed to enter sewers because of the possibility of an explosion.

· · · · · · · · · · · · · · · · · · ·	SECTION VIII - SPECIAL PROTECTION INFORMATION
RESPIRATORY PRO	TECTION (Specify type) N.A. N.A.
VENTILATION	
	MECHANICAL (General)
	N.A. Safety glasses or goggles
OTHER PROTECTIV	E EQUIPMENT N.A.

SECTION IX - SPECIAL PRECAUTIONS

Store away from heat or all ignition sources and oxidizing materials. Use adequate ventilation. May form peroxides during storage. If these are present, they must be decomposed before use in some applications. If these are present, they must be

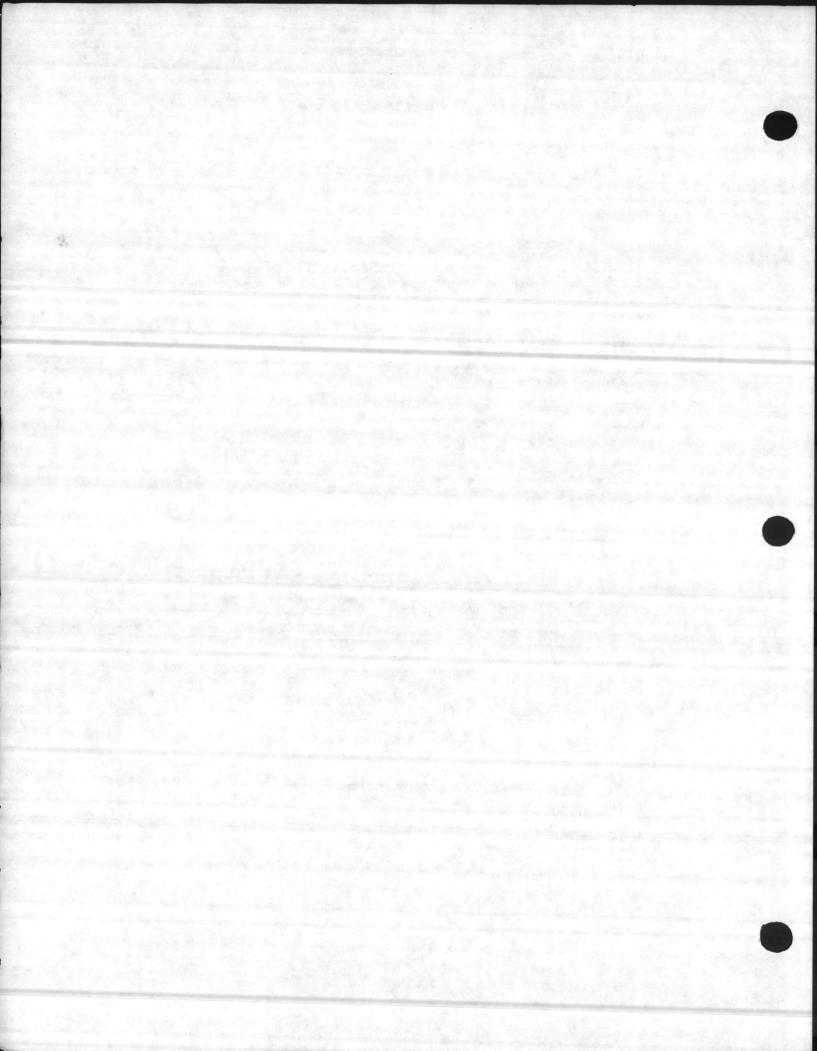
Ref: 1) Dangerous Properties of Industrial Materials, Sax, N.I. VanNostrand Reinhold Co., NY

2) NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, DHSS (NIOSH) Publication No. 81-123, 1981

QUIZ: MODULE V - HAZARDOUS WASTE CLASSIFICATION

TRU	E or F	ALSE:
1.		s cannot be determined as non-hazardous without ng or without verifiable proof.
2.	Of the	e corrosive liquids, bases are the most damaging
3.	non-ha	the EPA identification method, a waste is azardous if it is not on the "U", "P", "K", or ists (40 CFR 261 subpart D).
4.	Sodiu	n hydride is an example of a flammable solid.
5.		e in drums should be zero in order to conserve
Fil	l in th	ne Blank
	What a	are the three sides (requirements) of the fire triangle?
7.	A liqu	uid with a pH of 7 is:
	a.	Acidic
	ь.	
	The state of the s	Alkaline
		Neutral
	e.	Caustic
8.	A soli	d with a specific gravity of 1.5 will:
	a.	Sink in water
	ъ.	Float in water
	c.	Move upward in air
	d.	Spontaneously combust
	е.	Neither sink nor float, since the specific gravity of water is 1.5.
9.	A liqu	id with a flashpoint of 175°F is:
	a.	Flammable
	b.	Pyrophoric
	c.	Pyrophobic
	d.	Combustible
	e.	Explosive

10.		in is a consumer commodity ystem as:	y and therefore	e would be classifie	ed by the
	a.	ORM-A			
	b.	ORM-B			
	c.	: 1 - [T. T. T			
	d.	ORM-D			
	e.	ORM-E			
11.	(Apper	the DOT Table (49 CFR 17: ndix A), and the example of e (Appendices B-F), determinene).	of the reference	es listed at the en	
	a. Phy	ysical Characteristics:			
		Vapor Pressure	<u> </u>		
		Boiling Point			
		Vapor Density	@		
		Specific Gravity			
		Flashpoint			
		Flammable Limits - Lov	wer	%	
		Upı	per	%	
		Ignition Temp.			
		Autoignition Temp.			
		Solubility in Water		_	
	b. EPA	A Hazardous Waste Identif	ication Number		
	c. DOT	r Class			
	DOT	T Identification Number		The state of the s	
	UN	Class Number			



TAB PLACEMENT HERE

DE	SCRIPTION:
	LABELING
	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



NSN REFERENCE LIST

ITEM	U/I	NSN
LABELS		
Hazardous Waste	EA	7690-01-241-0508
ORM-E (liquid)	PG	7690-01-C00-0062
ORM-E (solid)	PG	7690-01-C00-0061
ORM-C	PG	7690-01-C00-0068
Flammable Liquid	PG	7540-01-054-7241
Flammable Solid	PG	7540-01-054-7242
Corrosive	PG	7540-01-054-7251
Oxidizer /	PG	7540-01-054-7243
Radioactive	PG	7690-01-054-7248
Non-Hazardous Was	ste PG	7690-00-C00-0063
CONTAINERS		
55 Gal Drum w/bu	ng	8110-00-292-9783 *
55 Gal Drum, Remo		8110-01-C00-0438 *
		8110-00-030-7780
30 Gal Drum w/bu	ng	8110-01-C00-9917 *
30 Gal Drum, Remo	ovable Head	8110-00-030-7779 *
		8110-01-030-7779
85 Gal Overpack,	Steel	8110-01-101-4056/4055
85 Gal Overpack,	Poly	8110-01-C00-0277 *
55 Gal Poly Drum	w/bung	8110-01-C00-9919 *
5 Gal Metal Can		8110-00-400-5748
5 Gal Poly Can	(Light water con	tainer) Crash Crew

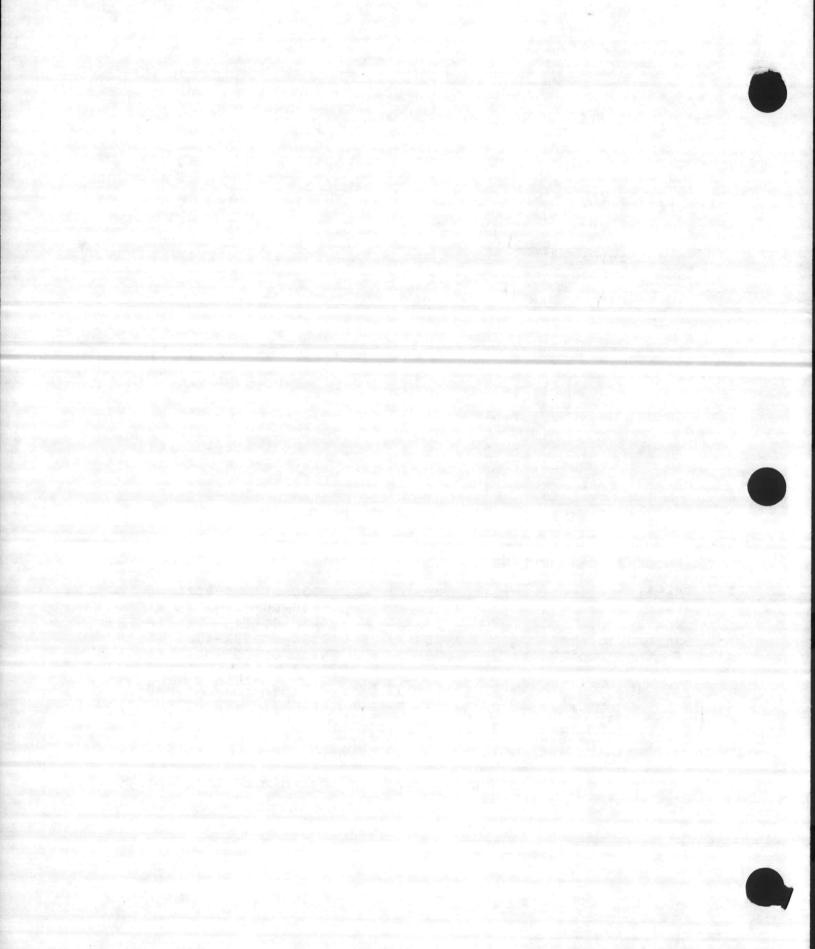
SPILL RESPONSE SUPPLIES

Matting	BE	9330-01-C00-9924	**
Vermiculite	BG	5640-00-801-4176	**
Speedy Dry	BG	7930-01-145-5795	*
Safe Step	BG	9390-00-282-4161	*
Sorbent Boom (4's)	BE	9330-00-C00-0293	**

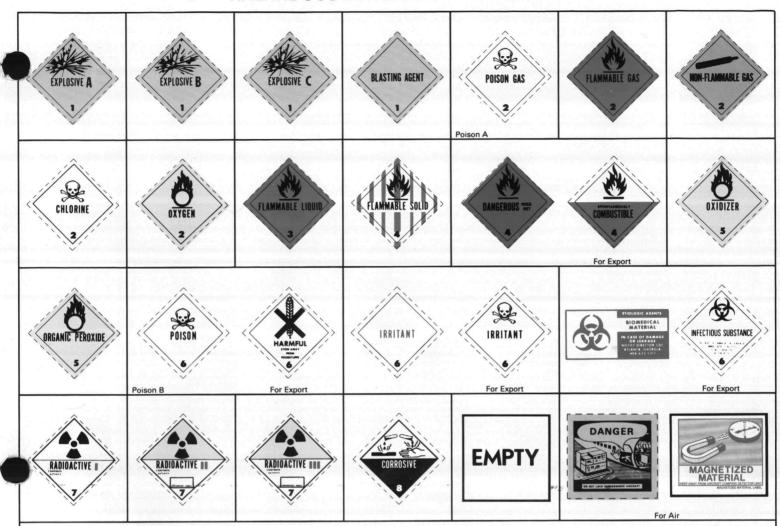
Indicates item is available at Shop Stores, Camp Lejeune Indicates item is available at Shop Stores, Camp Lejeune and MCAS, New River

Labels are available at Self Service (ServMart), Ext. 1667/3497 Containers are available at Lot 201, Camp Lejeune, Ext. 1625

Stock numbers are subject to change at the whim of the Supply Department!!

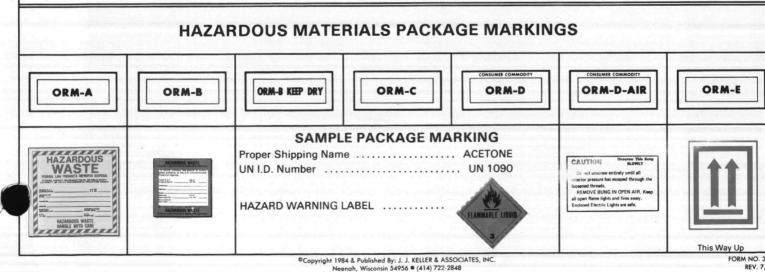


HAZARDOUS MATERIALS LABEL CHART



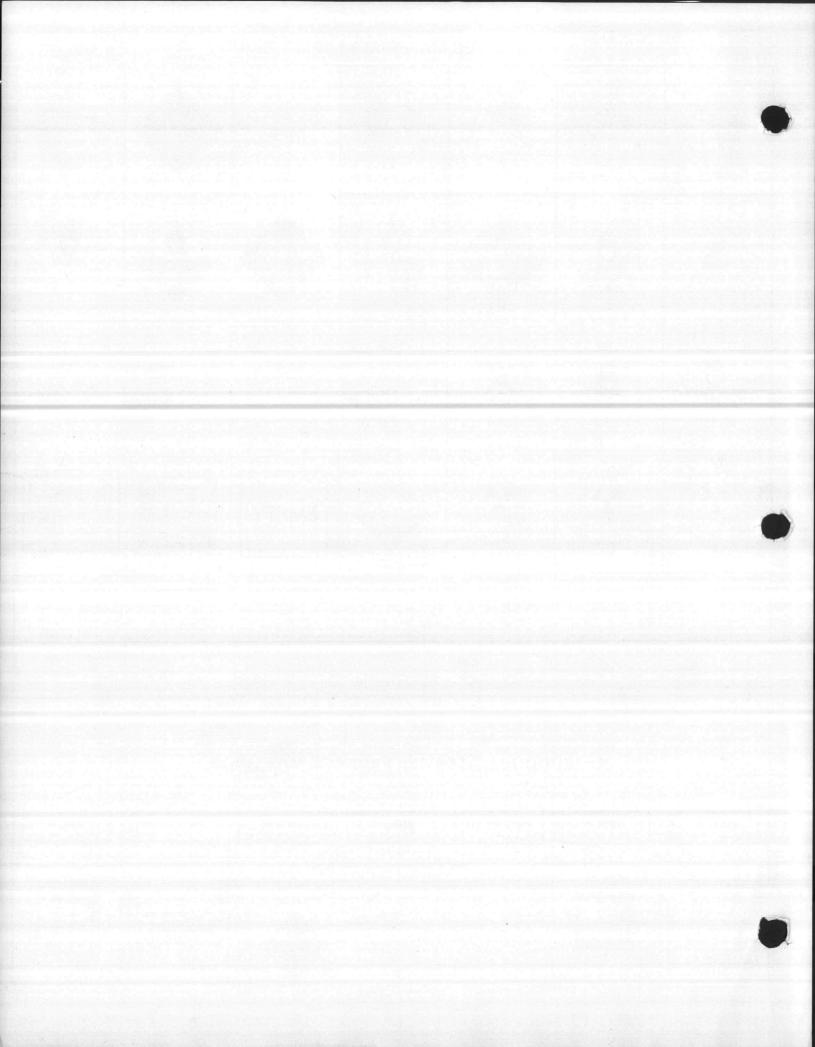
D.O.T. GENERAL GUIDELINES ON USE OF WARNING LABELS

- Shipper must furnish and attach appropriate label(s) to each package of hazardous material offered for shipment unless exempted from labeling requirements. (Ref. Title 49, CFR, Sec. 172.400).
- If the material in a package has more than one hazard classification, one of which is Class A explosives, Class A poison, or Radioactive Materials, the package must be labeled for each hazard. (Ref. Title 49, CFR, Sec. 172.402(a)).
- When two or more hazardous materials of different classes are packed within the same packaging or outer enclosure, the outside of the package must be labeled for each material involved. (Ref. Title 49, CFR, Sec. 172.404(a)).
- Radioactive materials requiring labeling, must be labeled on two opposite sides of the package. (Ref. Title 49, CFR, Sec. 172.403(f)).
- Labels must not be appplied to a package containing only material which is not subject to Parts 170 189 of this subchapter or which is exempted therefrom. This does not prohibit the use of labels in conformance with U.N. recommendations ("Transport of Dangerous Goods" (1970)), or with the IMCO requirements ("International Maritime Dangerous Goods Code") (Ref. Title 49, CFR, Sec. 172.401).



International Publishers of Transportation Guides and Forms

FORM NO. 34-F



LITHIUM BATTERIES

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T.
SHIPPING NAME LITHIUM BATTURIES FOR DISPOSAL UN OR NA# NONE

GENERATOR INFORMATION:

NAME YOUR UNIT, YOUR GROUP

ADDRESS MCAS NOW RIVER

CITY JACKSONVILLE STATE NC ZIP 28545

EPA ID NO. N.C. 8170022570

WASTE NO. DOGS

ACCUMULATION APPROPRIATE
START DATE

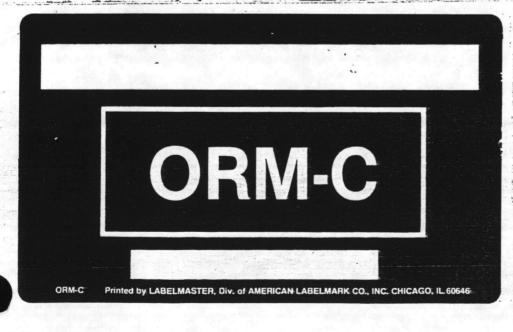
MANIFEST ASSIGNOS
DOCUMENT NO. BY SEA

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

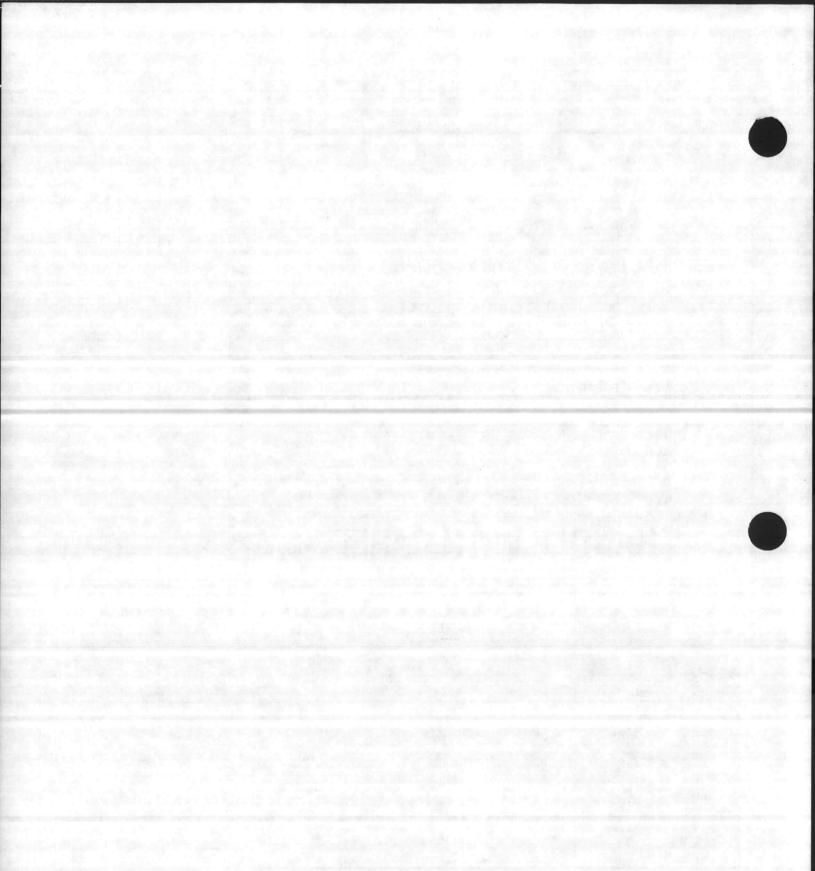
STYLE WM-6

Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., INC., CHICAGO, IL 60646



STENCIL ON CONTAINER:

- 1. NSN
- 2. NOMENCLATORE
- 3. QUAPTITY OF BATTERIES

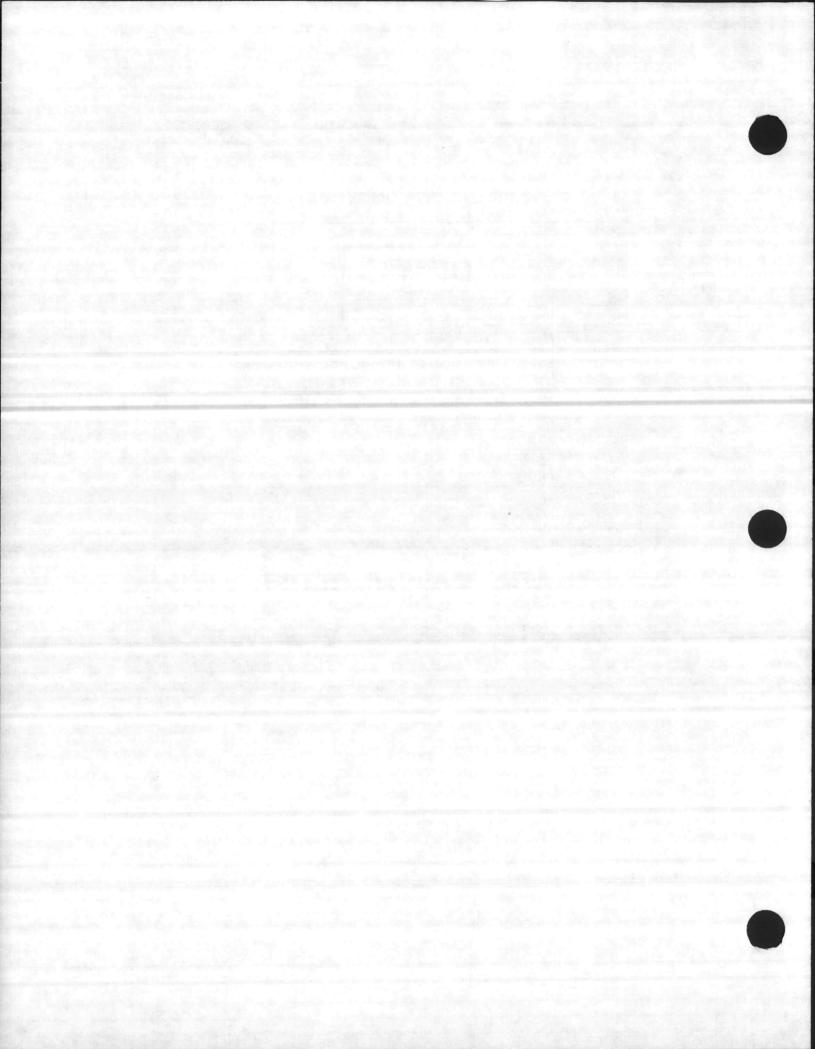


FLIGHTLING WASTE OIL BOWSER

PROPER D.O.T. SHIPPING NAME AND I.D. NUMBER HAZARDOUS WASTE, LIQUID, N.O.S. RICHLOROTRIFLUOROETHANE TECHNICAL NAMES NA9189 ORM-E FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. GENERATOR INFORMATION: YOUR UNIT, YOUR GROUP ADDRESS MCAS NOW RIVER CITY JACKSONVILLE STATE NC EPA ID NO. NC. 8170022570 EPA WASTE NO. FOO2 ACCUMULATION LEAVE BLANK SLANK **HANDLE WITH CARE!**

Printed By: Lab Safety Supply, Inc., Janesville, WI 53547

Reorder No. 435



PROPER DOT SHIPPING NAME

HAZARDOUS WASTE, SOLID N.O.S. NA9189

ORM-E

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL.

IF FOUND CONTACT THE NEAREST POLICE OR
PUBLIC SAFETY AUTHORITY OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY.

GENERATOR INFORMATION:

NAME YOUR UNIT, YOUR GROWP

ADDRESS MCAS Now RIVER

CITY JACKSONULLE STATE NC ZIP 28545

EPA ID NO. NCX170022570 EPA WASTE NO. FOO5

ACCUMULATION APPROPRIATE MANIFEST ASSIGNED

THIS CONTAINER HOLDS HAZARDOUS OR TOXIC WASTE.

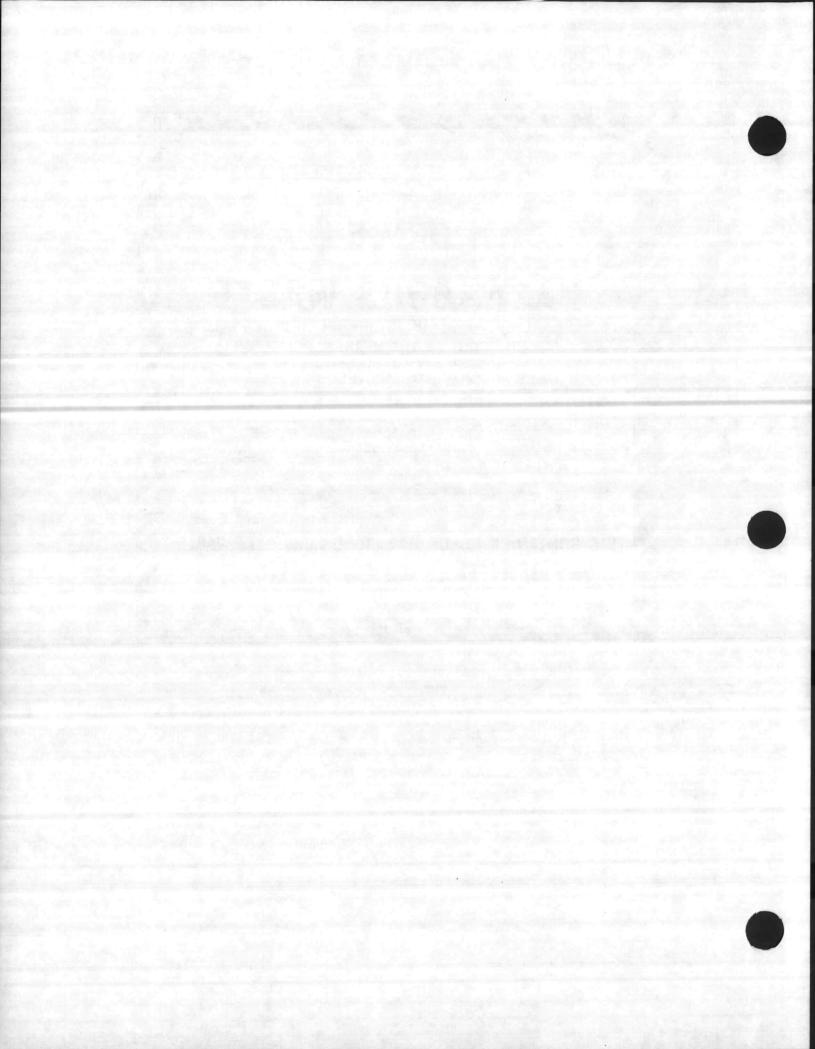
HANDLE WITH CARE!

© Copyright Science Related Materials Inc., Janesville, WI 53547

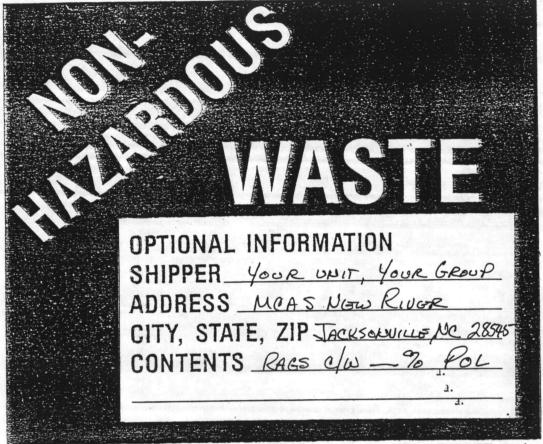
788888

STENCIL ON BONTAINER:

- 1. 9999 00 SPILRES
- 2. RAGS C/W _ % (NAME OF SOLVENT)



GREEN AND WHITE LABEL



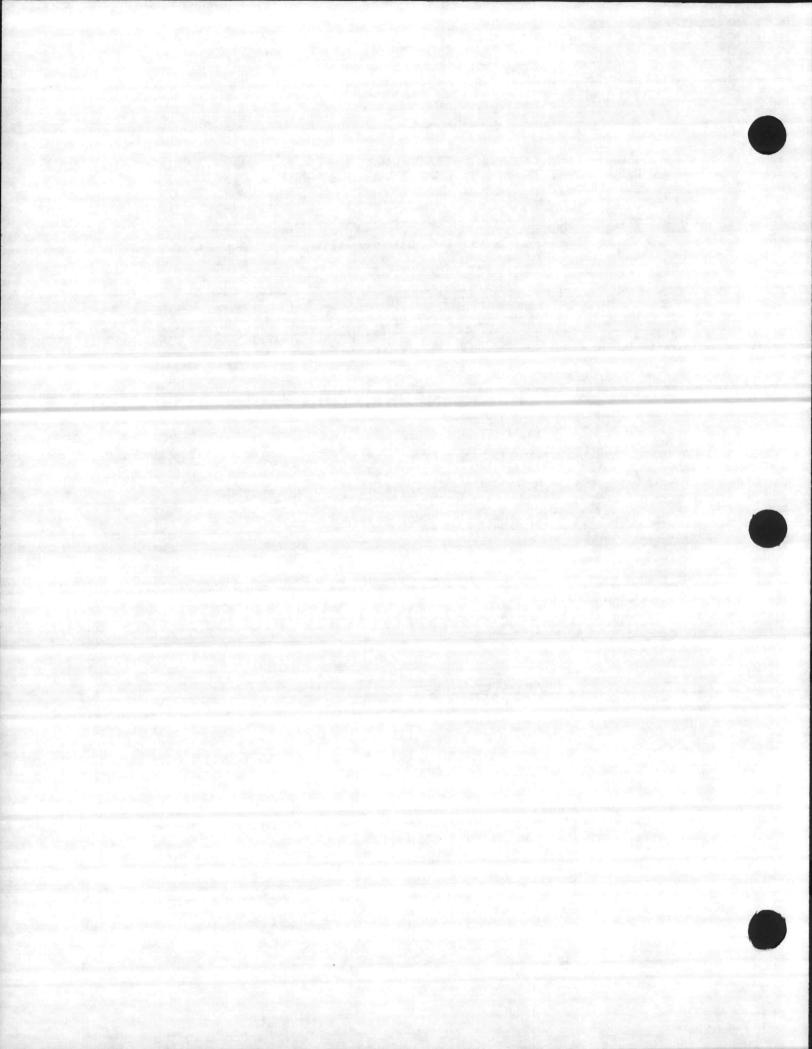
NON-HAZARDOUS WASTE

©Copyright Lab Safety Supply, Janesville, WI 53546

STENCIL ON CONTAINER.

1. 9999 00 SPILRUS

2. RAGS C/W _ 2 POL



ALODING

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPERD.O.T. WASTE COMPOUND (CHROKIUM)
SHIPPING NAME RUST PREVENTING UN OR NA# NA 1760

GENERATOR INFORMATION:
NAME YOUR -UNIT, YOUR GROUP

ADDRESS MOAS NEW RIVER

CITY JACKSONVILLE STATE NC ZIP 28545

ACCUMULATION APPROPRIATE MANIFEST DOCUMENT NO. BY SEA

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM-6

Printed by LABELMASTER, Dw. of AMERICAN LABELMARK CO., INC., CHICAGO, IL 60646

POLYGTHYLENG CONTAINGR CORROSIUG LABET

STEPPELL ON CONTAINER.

D. NSN 2. Nomeroclatures





PAINT THINNER

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERATOR INFORMATION:

NAME YOUR UNIT, YOUR GROUP

ADDRESS MCAS NEW RIVER PHONE (919) 457-6143

CITY TACKSONVILLE STATE NC ZIP 28545

EPA / MANIFEST ID NO. / DOCUMENT NO. NC8/70022570 / BY SUFF

ACCUMULATION APPROPRIATE EPA
START DATE WASTE NO. F003/F005

(TOLOGNE / XYLENG) NA 1760

D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX 3.

HANDLE WITH CARE!

STYLE WM

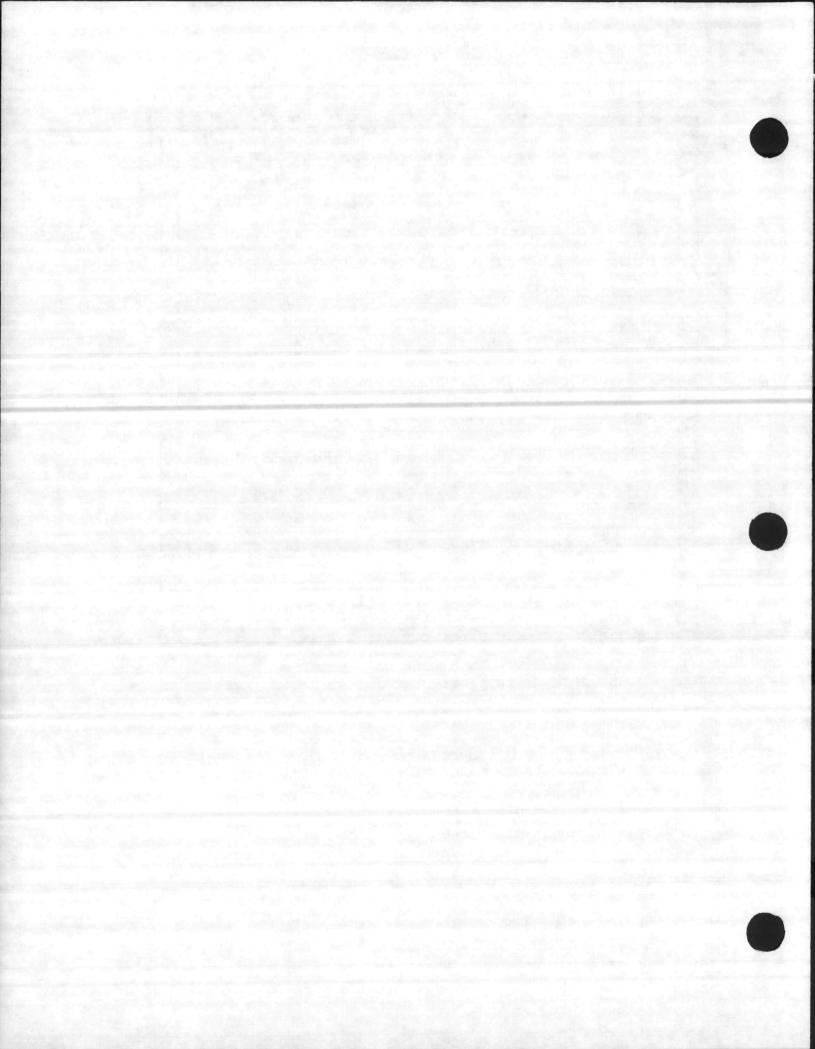
Printed by LABELMASTER, Div. of AMERICAN LABELMARK CO., CHICAGO, IL 60646

METAL CONTAINER

FLAMMABLE LABEL

STENCIL ON CONTAINER

- 1. NSN
- 2. NOMENCLATURE



PAINT STRIPPER

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T. WASTE PAINT SHIPPING NAME MATERIAL	RELATED UN OR NA# NA 1760
NAME HOAS DOTALE	WER GROWP
CITY JACKSONVILLE	STATE NC ZIP 28575
EPA NC8170022570	WASTE NO. D002/0007/0008
ACCUMULATION APPROPRIATE START DATE	MANIFEST ASSIGNED DOCUMENT NO. BY SEA
	TILOADE

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM-6

A DEL MASTER DIV OF AMERICAN LABELMARK CO., INC., CHICAGO, IL 60646

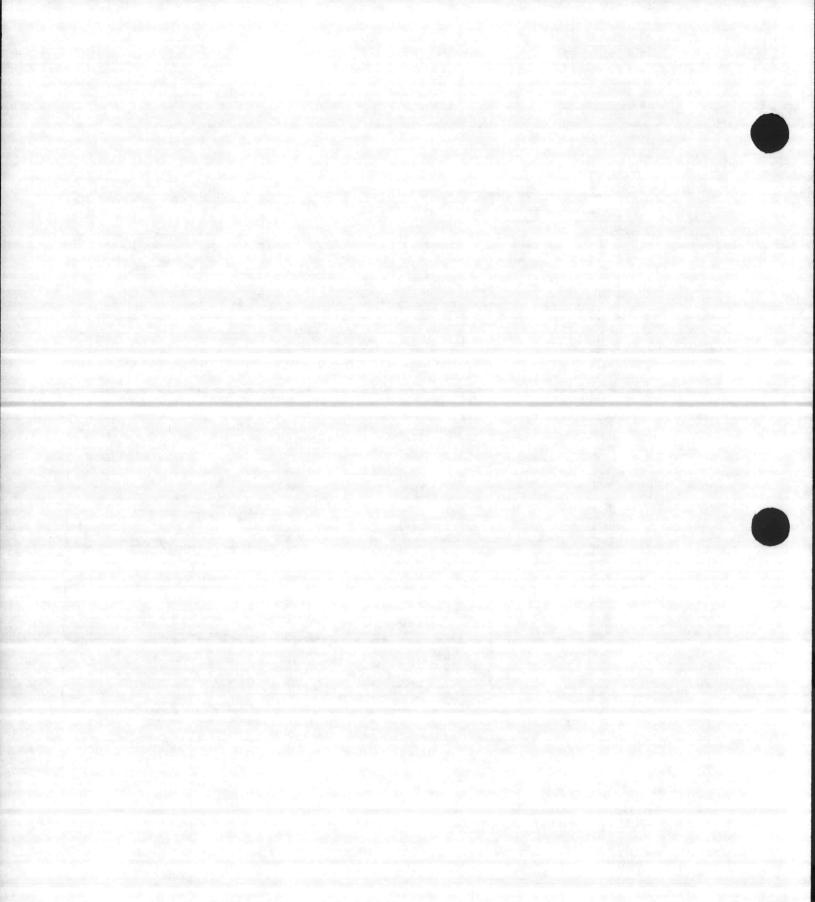
POLYETHYLENE CONTAINER.

CORROSIUS LABEL

STENCIL ON CONTAINER:

1. NSN

2. NONENCLATURE



BATTURY ACID

AZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T. WASTE BATTERY FLUID, ACID UNDAMI 2796

GENERATOR INFORMATION:

YOUR UNIT, YOUR GROUP

ADDRESS MCAS NOW RIVER

CITY JACKSONVILLE

STATE ALC ZIP 28545

EPA DC8170022570

ACCUMULATION APPROPRIATE START DATE

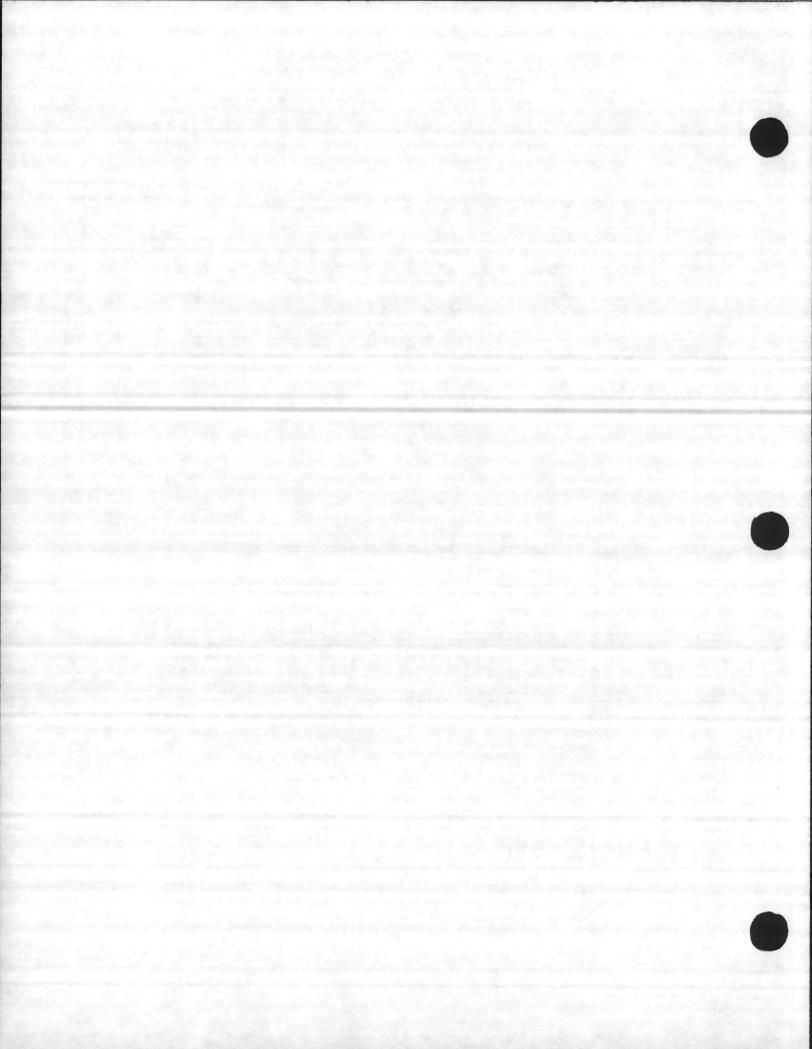
WASTE NO DOOZ/DOOS MANIFEST

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

CONTAINER

Scandir on Comunicas NSN BATTERY ACID CIARROSIUG LIQUID



NICKEL - CADMIUM BATTORIUS
(NICAD)

POTASSIUM HYDROKIDE AZARDOUS VASTE FEDERAL LAW PROHIBITS IMPROPER DISPOSAL IF FOUND, CONTACT THE NEAREST POLICE, OR PUBLIC SAFETY AUTHORITY, OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY BATTERY, ELECTRIC STORAGE, SHIPPING NAMEWET, FILLED WITH ALKALI UNDAME \$795 GENERATOR INFORMATION: YOUR GROUP NAME YOUR - UNIT ADDRESS MCAS NOW RIVER STATE AUC ZIP 28545 CITY TACKSOPULLE WASTE NO DO02/0003/0006 IDNO NC 8170022570 MANIFEST ASSIGNAD DOCUMENT NO BY SEA ACCUMULATION APPROPRIATE

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WALL

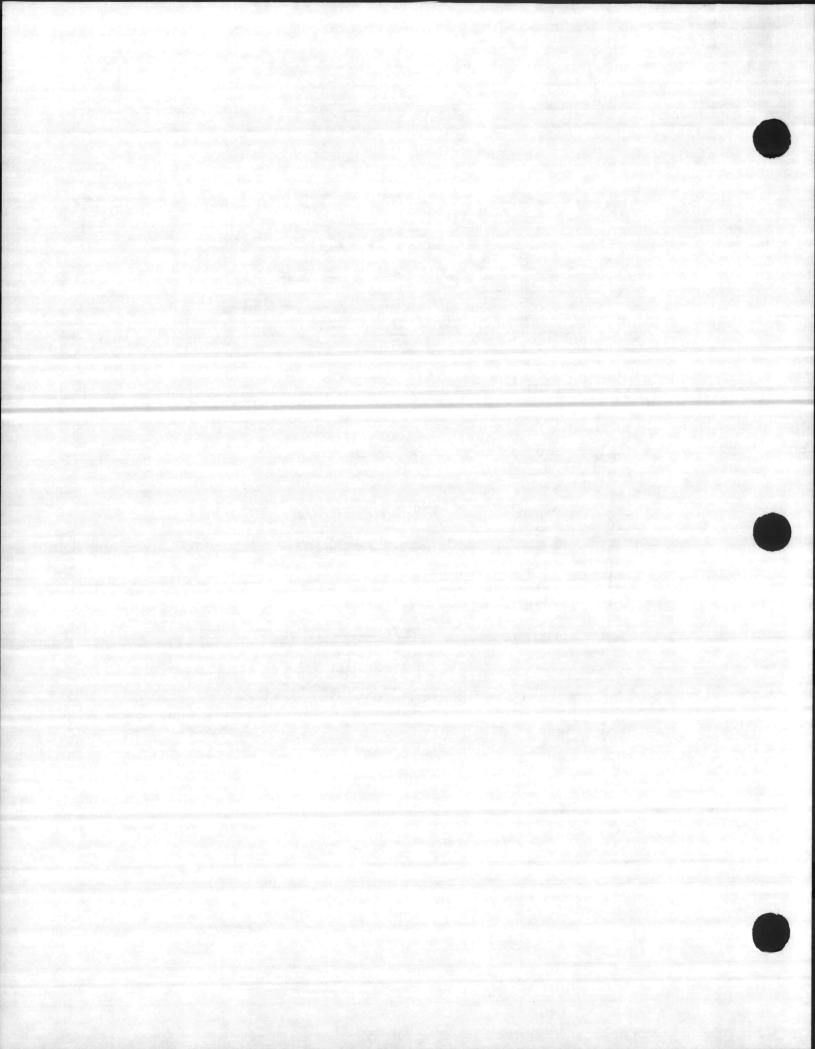
Private by LABELMASTER DIV of AMERICAN LABELMARK CO. INC. CHICAGO E BONNE

STONUL ON BOX:

NSN NOMENCIATURE

CORRESIUG

NOTE: NO MORE THAN 5 BATTERIES



(MERCURY) HAZARDOUS WASTE, SOLID N.O.S. NA9189 ORM-E IF FOUND CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. GENERATOR INFORMATION: YOUR UNIT ADDRESS CITY JACKSONVILLE ZIP_28545 EPA ID NO. NC 8170022570 EPA WASTE NO. 0009 ACCUMULATION APPROPRIATE
START DATE ASSIGNAD THIS CONTAINER HOLDS HAZARDOUS OR TOXIC WASTE.

ON DRUM. STENCIL

NSN

NOMENCLATURG

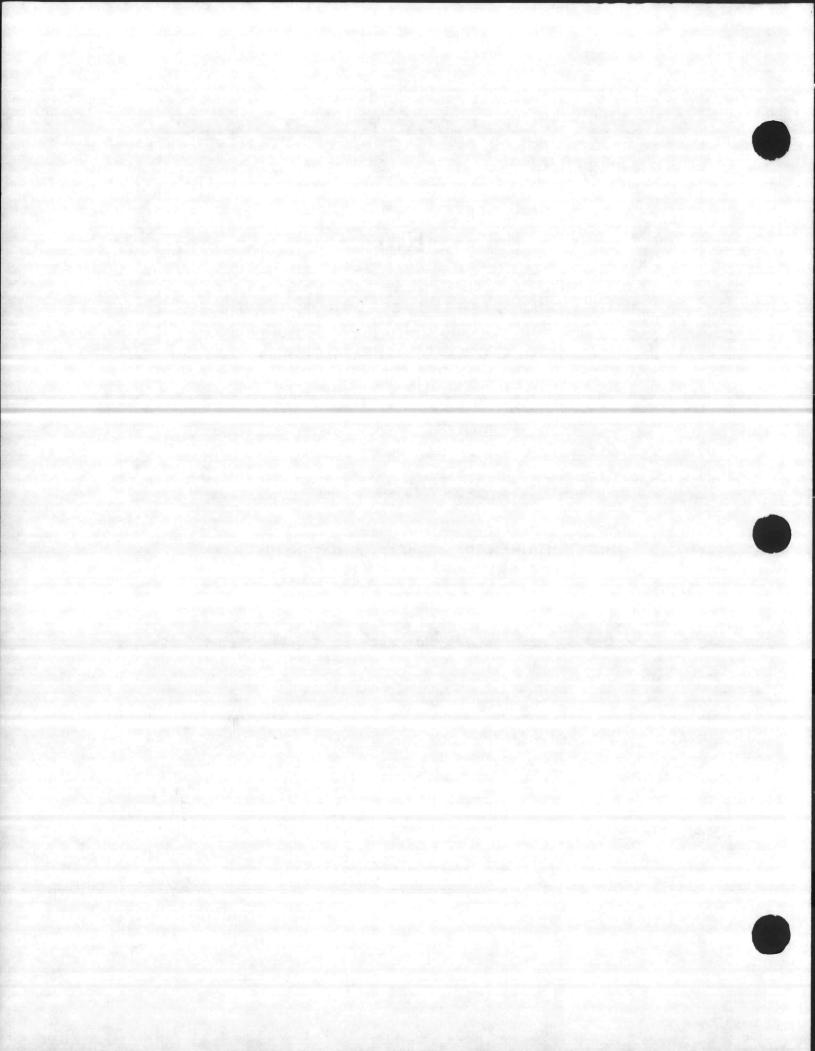
QUANTITY (FOR GACH DIFFERENT BATTERY)

EXAMPLE.

6135-00-073-8939 6135-00-838-0706

MGREURY BATTERY MERCURY BATTERY BA 1574/0 BA 1568/0

24



Contents of a partially filled container can be determined by "sticking" the drum or can and using the following tables:

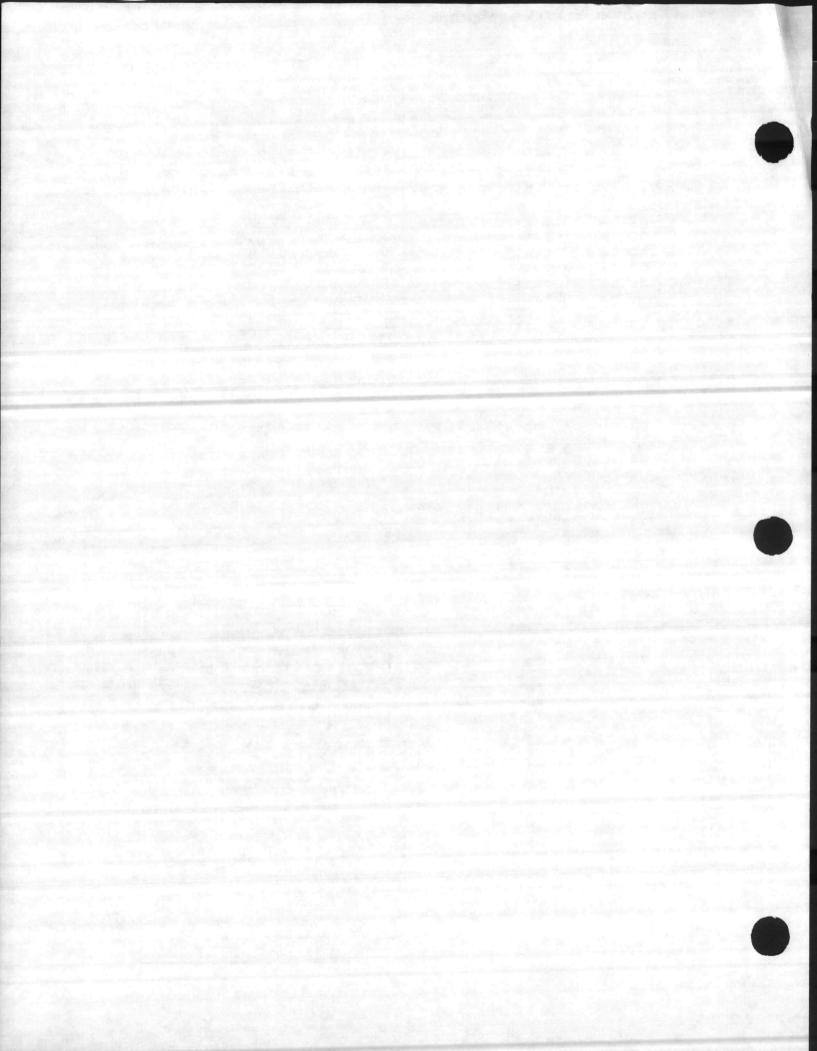
5	Gallon	Can			55	5 Gallo	on	Dru	ım	
2.6	inches	= 1	gal		3	inches	=	5	gal	
5.2	inches	= 2	gal		6 :	inches	=	10	gal	
7.8	inches	= 3	gal		9 :	inches	=	15	gal	
10.4	inches	= 4	gal	1	2 :	inches	=	20	gal	
	inches			1	5 :	inches	=	25	gal	
				1	8	inches	=	30	gal	
				2	1 :	inches	=	35	gal	
				2	4 :	inches	=	40	gal	
				2	7 :	inches	=	45	gal	
						inches				

Empty weight of containers can be approximated as follows:

5 gallon plastic = 2 lbs 5 gallon metal = 5 lbs 20 gallon metal = 20 lbs 30 gallon metal = 30 lbs 55 gallon metal = 50 lbs

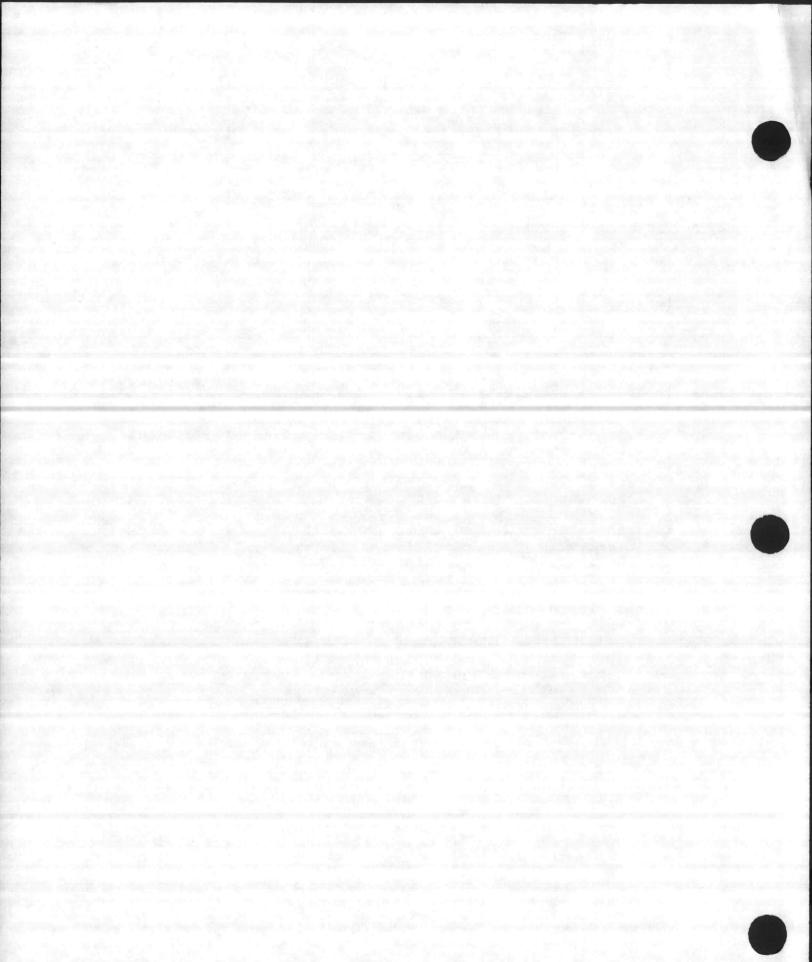


33 inches = 55 gal



HAZARDOUS WASTE INSPECTION CHECKLIST

- 1. Training records up-to-date
- 2. Weekly inspections and daily bowser inspections up-to-date
- 3. Containers: Condition Appropriately labeled Properly closed (bungs tight) No evidence of spills or leaks Flammable/Corrosive lables, as required If stored outside, ensure that no rain water has collected on top Spill response materials readily available Empty containers are capped or bungs in place to keep out water
- 3. Bowsers
 Spill contengency plan posted
 No debris inside funnel (safety wire, etc.)
 No rain water collected in the containment
 Drain valve is closed tightly
 Hazardous waste label present and legible
 Check for contaminated soil around the containment
 Evidence of spills within the containment
 Funnel closed and locked
 No debris inside the containment
- 4. Flammable storage buildings
 Servicable fire extinguisher
 Evidence of spills or leaks
 Spill contingency plan posted



HAZARDOUS WASTE DISPOSAL WORKSHEET

UNIT	POC	EXT_	DATE
NOMENCLATURE		NSN	
MANUFACTURER		ACCUMULATION STAF	RT DATE
KIT COMPONENTS:		MILSPEC	
CONTAMINANTS:		V na	
1. NOMEN_	NSN	MFG	 *
2. NOMEN_	NSN	MFG	8
3. NOMEN	NSN	MFG	
TOTAL QUANTITY	WEIGHTNO. CO	ONTAINERSSTORA	GE LOCATION
CONTAINER: 5 GAL METAL	CAN () 55 GAI () PLASTIC ()	DR () BOX () C	OTHER OOD ()
REASON FOR DISPOS	AL: ()SPENT () EXPIRED SHELF LI	FE () EXCESS
CLASSIFIED, DESCR PROPER CONDITION REGULATIONS OF DO	IBED, PACKAGED, FOR TRANSPORTATI	ION ACCORDING TO T	D AND ARE IN
		L AFFAIRS USE ONLY	
DATE RECEIVED:			EST #
DOT SHIPPING NAME	·		
NA/UN #:	EPA ID#		
HAZARD CLASS:		LABEL	
HAZARDOUS WASTE C	OMPOSITION:		
TREATMENT STANDAR	D (CONC. mg/L):_		
CLIN: PRI	CE: \$ (COST: \$	DOT GUIDE#:

FSC	

Container #___

NIIN	SIZE	QTY	NOMENCLATURE	MILSPEC	MANUFACTURER
	400	10/20/20			
		, , , , , , , , , , , , , , , , , , ,			
To the state of th					
		17.00 - 12.00 1.00 - 1.			
	100				
		agus san kar Yarasan	Lange of the Lange		
1					
				All or	

HAZARDOUS WASTE DISPOSAL WORKSHEET

UNI	ľ	POC	EXT_	
NOM	ENCLATURE		NSN	
MAN	UFACTURER		ACCUMULATION STAP	RT DATE
KIT	COMPONENTS:	A company of the comp	MILSPEC	
CON	FAMINANTS:			
1.	NOMEN	nsn	MFG	8
2.	NOMEN	NSN	MFG	8
3.	NOMEN	NSN	MFG	8
TOT	AL QUANTITY	WEIGHTNO. CO	NTAINERSSTOR	AGE LOCATION
CON	FAINER: 5 GAL METAL	CAN () 55 GAL () PLASTIC ()	DR () BOX () C FIBERGLASS () W	OTHER
REAS	SON FOR DISPOS	AL: ()SPENT (EXPIRED SHELF LI	FE () EXCESS
PRO	PER CONDITION DELICATIONS OF DO	FOR TRANSPORTATION	MARKED AND LABELE ON ACCORDING TO 1	
	F	OR ENVIRONMENTAL	AFFAIRS USE ONLY	
	E RECEIVED:		MANIF	FEST #
NA/I	JN #:	EPA ID#		
HAZA	ARD CLASS:		LABEL	
HAZ	ARDOUS WASTE CO	OMPOSITION:		
TREA	ATMENT STANDAR	O (CONC. mg/L):_		
CLIN	V: PRI	CE: \$C	OST: \$	DOT GUIDE#:

FSC		

Container #____

NIIN	SIZE	QTY	NOMENCLATURE	MILSPEC	MANUFACTURER
				F 19 50 50 5	
					ALC: N
		7 1962			
	10.25		and the second second second second		
	1.0-				
		2004			Land Affiliation

	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
	Roman Brown				· · · · · ·
					8 3.74

HAZARDOUS WASTE DISPOSAL WORKSHEET

UNIT	POC	EXT	DATE
NOMENCLATURE		nsn	
MANUFACTURER		ACCUMULATION STAR	T DATE
KIT COMPONENTS:	J	MILSPEC	
CONTAMINANTS:			
1. NOMEN	NSN	MFG	
2. NOMEN	NSN	MFG	8
3. NOMEN	NSN	MFG	8
TOTAL QUANTITYW	EIGHTNO. CO	NTAINERSSTORA	GE LOCATION
CONTAINER: 5 GAL	CAN () 55 GAL	DR () BOX () O'	THER
CONTAINER: 5 GAL METAL	() PLASTIC ()	FIBERGLASS () W	OOD ()
REASON FOR DISPOSA	L: () SPENT ()	EXPIRED SHELF LI	FE () EXCESS
THIS IS TO CEPT	דבע המאה המב אפנ	OVE NAMED MATERIA	C ADE DOODEDIS
CLASSIFIED, DESCRI			
PROPER CONDITION F	OD TOXISDODENTI	N ACCORDING TO THE	D AND AKE IN
REGULATIONS OF DOT		on according to the	HE APPLICABLE
			170
SIGNAT	URE OF HMDO/ALT		DATE
		AFFAIRS USE ONLY	
		======================================	
DATE RECEIVED:	DOC#:	MANIF	EST #
DOT SHIPPING NAME:			
NA/UN #:	_EPA ID#		
HAZARD CLASS:	J	LABEL	
HAZARDOUS WASTE CO	MPOSITION:		
TREATMENT STANDARD	(CONC. mg/L):_		
OI TN.	P. 6	Om. A	OR OHTE #
CLIN: PRIC	E: 5 CC	JST: \$	OT GUIDE#:

FSC			
-----	--	--	--

Container #____

NIIN	SIZE	QTY	NOMENCLATURE	MILSPEC	MANUFACTURER
	100				The second secon
	3000				MATERIAL PROPERTY OF THE RESERVE OF THE PROPERTY OF THE PROPER
			and the second second second		
100					·
			16 1 3 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
	entra Service				
100					THE STATE OF THE S
A Parameter Control			and the second second		
	254.06				
			100 m		

CHAPTER VI

LABELING

I. LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Properly label hazardous wastes in accordance with the applicable labeling systems.
- B. Use the Department of Transportation (DOT) Hazardous Materials
 Table to determine labeling requirements for hazardous wastes.
- C. Examine labels and other markings to properly identify and classify hazardous waste.

II. INTRODUCTION.

Once an item has been determined hazardous (RCRA-40 CFR 261) and classified according to the Department of Transportation (DOT)
Hazardous Material Transportation Act (HMTA 49 CFR 171) regulations, the generator is required to "properly" mark and label the item prior to transportation. The Resource Conservation Recovery Act (RCRA) regulations define "properly" to be in accordance with the DOT marking and labeling requirements as specified in HMTA. The following sections describe the DOT Labeling System, give examples of the DOT labels and explain how to select the proper label. In addition, this chapter describes and shows various other labels (labeling systems) used.

III. DOT SYSTEM

The DOT system is the most widely used labeling system. This system was designed for transporting hazardous materials. Federal regulations also required that this system be used for the identification of hazardous wastes. Therefore, hazardous wastes being transported to or from Naval activities over public highways must comply with DOT requirements. The identification requirements are in two categories, marking and labeling.

- 1. Selected marking requirements for hazardous waste are listed below.
 - (a) The shipper must mark packages containing hazardous wastes (as defined by RCRA 40 CFR 262) with the proper shipping name as it appears in the DOT Hazardous Materials Table 49 CFR 172.101. (49 CFR 172.301)

1255D Date of last revision: Sep 84

- (b) The identification number (column 3A of the DOT Hazardous Materials Table) must be displayed
- (c) Radioactive substances must be marked as such in addition to the above requirements. (49 CFR 172.301)
- (d) Packages which contain inner containers of liquid hazardous wastes must be marked with the "This End Up" designation. (49 CFR 172.312)
- (e) The package will have the <u>ORM</u> designation if it contains materials designated as "Other Regulated Materials."
- (f) The letters RQ (for reportable quantity) must be displayed in association with the proper shipping name on a package having a capacity of 110 gallons or less that contains a hazardous substance (49 CFR 172.324). Hazardous substances are identified in these regulations by the letter "E" in column 1 of the Hazardous Material Table 49 CFR 172.101. The actual reportable quantity (RQ) is shown in column 3 of the same table for each hazardous substance.
- 2. Selected labeling requirements are listed below.
 - (a) In general, packages must be labeled with the proper DOT label as shown in column 4 of the DOT Hazardous Materials Table 49 CFR 172.101. (49 CFR 172.400)
 - (b) Exemptions: Military ammunition handled by DOD personnel; hazardous materials handled by DOD personnel and escorted by DOD personnel in a separate vehicle.
 - (c) Multiple Hazard Labeling. Some substances have more than one hazardous characteristic. The DOT regulations require that some of these be labeled with more than one label to reflect the multiple hazard. Section 172.402 of 49 CFR explains the specific requirements for multiple hazard labelings.
 - (d) Mixed and Consolidated Packaging. When hazardous wastes which have different hazard classes are packed in the same container or overpack, the outside packaging must be labeled as required for each class of waste in the container. (49 CFR 172.404)
 - (e) Radioactive materials that also meet the definition of one or more additional hazards must be labeled as radioactive material and also for each additional hazard. (49 CFR 172.403)

- (f) Label may not be modified unless authorized in 49 CFR 172.405.
- (g) Labels must be printed on or affixed to the surface of the package near the proper shipping name. (49 CFR 172.406)
- (h) The actual labels must meet the criteria listed in 49 CFR 407.
- (i) United Nations (UN) Classification System. DOT labels may have the UN hazard class number stamped in the lower corner of the rectangle. These numbers are required by some foreign governments. The UN hazard class numbers and their corresponding DOT classification are listed below along with a citation for the definition in the HMTA regulations.

CLASSIFICATION CLASSIFICATION	UN
Class A Explosives (49 CFR 173.50)	. 1
Class B Explosives (49 CFR 173.50)	. 1
Class C Explosives (49 CFR 173.50)	. 1
Blasting Agents (49 CFR 173.50)	. 1
Flammable Compressed Gas (49 CFR 173.300)	. 2
Nonflammable Compressed Gas (49 CFR 173.300)	. 2
Flammable Liquid (49 CFR 173.115)	. 3
Flammable Solid (49 CFR 173.150)	. 4
Oxidizing Material (49 CFR 173.150)	. 5
Poisonous Gas, Class A (49 CFR 173.325) 2	or 6
Poisonous Liquid, Class A (49 CFR 173.325)	. 6
Poisonous Liquid or Solid, Class B (49 CFR 173.32	5) 6
Irritating Material (49 CFR 173.325)	. 6
Etiologic Agent (49 CFR 173.325)	. 6
Radioactive Materials (49 CFR 173.325)	. 7
Corrosive Material (49 CFR 173.240)	. 8

These classes are explained in more detail in the classification chapter.

This labeling information is designed as an overview. Prior to labeling an item, the complete labeling regulations should be consulted. Refer to 49 CFR 100-177.

The individual DOT labels are shown on the following pages along with a brief definition of the hazard classification and an example.



EXPLOSIVE A (BLACK PRINTING ON ORANGE)

Definition—The maximum hazard explosive. These materials detonate readily (explodes with suddeness and violence).

Examples--commercial dynamite, hand grenades, bombs and torpedoes.

EXPLOSIVE B (BLACK PRINTING ON ORANGE)

Definition—Explosives characterized by rapid combustion rather than deton ation. These materials are considered to be a flammable hazard.

Examples--Special fireworks.





EXPLOSIVE C (BLACK PRINTING ON ORANGE)

Definition—Manufactured articles which contain class A, or class B explosives, or both, but in small quantities.

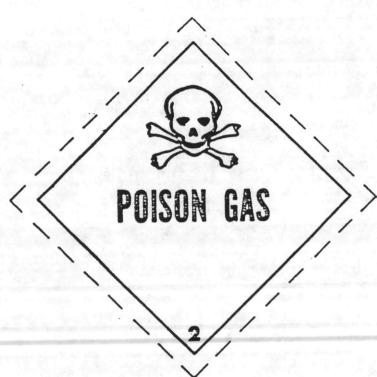
Examples--Certain types of fireworks, such as, sparklers, and caps for toy guns.

BLASTING AGENT (BLACK PRINTING ON ORANGE)

Definition--A material designed for blasting but not so sensitive that it will explode accidentally.

Examples--Ammonia nitrate.





COMPRESSED GAS
FLAMMABLE COMPRESSED GAS
(WHITE OR BLACK PRINTING ON RED)

Definition—Any compressed gas (a mixture of 13% or less by volume) that when mixed air forms a flammable mixture or for which the flammability range with air is greater than 12 percent.

Examples--Hydrogen, methane, acetylene, carbon monoxide.



POISON
POISON CLASS A
(BLACK PRINTING ON WHITE)

Definition--Gas or vapors of liquids which in small amounts, and when mixed with air, are dangerous to life.

Poison A--immediately dangerous to life.

Examples--Germane, cyanogen gas, phosgene.



COMPRESSED GAS
NONFLAMMABLE COMPRESSED GAS
(WHITE OR BLACK PRINTING ON GREEN)

Definition--Any compressed gas that will not ignite under certain test requirements.

Examples--Chlorine, helium, helium-oxygen mixture, carbon dioxide.



FLAMMABLE LIQUID (WHITE OR BLACK PRINTING ON RED)

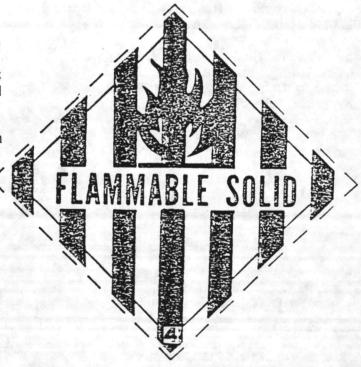
Definition—Any liquid having a flash point below 100°F.

Examples--benzene, acetone, and rubber.

FLAMMABLE SOLID (RED STRIPPED ON BLACK PRINTING ON WHITE)

Definition—Any solid material which might cause fires or which can be ignited readily and will burn vigorously.

Examples--calcium (metallic) and uranium metal (also requires radioactive label).





OXIDIZER (BLACK PRINTING ON YELLOW)

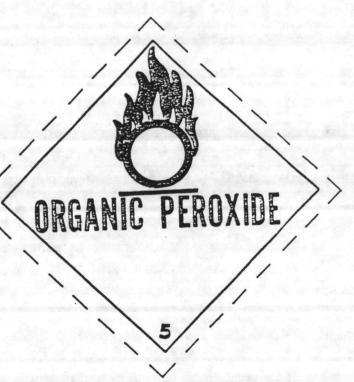
Definition—A substance that yields oxygen readily to stimulate the combustion of organic matter.

Examples--Calcium hypochlorite, chlorate, permanganate, and nitrate compounds.

ORGANIC PEROXIDE (BLACK PRINTING ON YELLOW)

Definition--Generally considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals.

Examples—Benzoyl peroxide, cyclohexanone/peroxide.





POISON (BLACK PRINTING ON WHITE)

Definition—Less dangerous than class A poisons. Substances, liquids, or solids other than class A poisons or irritating materials, which are known to be so toxic to man as to be a hazard to health.

Examples--Arsenic bromide, arsenic sulfide, liquid nicotine.

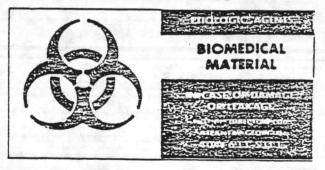
IRRITANT (RED OR BLACK PRINTING ON WHITE)

Definition—A liquid or solid substance which gives off dangerous or irritating fumes, but not including any Class A poisonous materials.

Examples--Tear gas.



ETIOLOGIC AGENTS



ETIOLOGIC AGENTS (RED PRINTING ON WHITE)

Definition—A viable microorgan ism, or its toxin, which may cause disease.

Examples--Any viable bacteria or virus.



Definition—Any material which spontaneously emits ionizing radiation. The different labels refer to the amount of radiation involved, with #I least radioactive and #III most radioactive.

Examples--Uranium 233, barium 140, cobolt 60.

UN #7



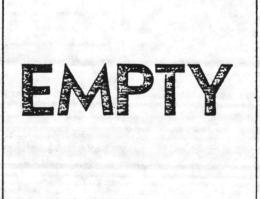
CORROSIVE (BLACK AND WHITE)

Definition--Any liquid or solid that causes visible destruction of human skin tissue or a liquid that has a severe corrosion rate on steel.

Examples--Hydrofluoric acid, sulfuric acid, hydrochloric acid, sodium hydroxide.

EMPTY (BLACK PRINTING ON WHITE)

Definition--Used to cover a hazard class label when an empty container is to be transported.



OTHER REGULATED MATERIAL (ORM) UN #9

As mentioned earlier, the DOT system includes marking requirements in addition to labeling requirements. One of the required markings is for items designated as "Other Regulated Materials" (ORM). There are five categories of ORM. These five classes are explained below with an example of the actual marking required, a definition, and examples. ORM-E is particularly important to this course. Items that have been identified as hazardous wastes by RCRA procedures explained in the classification chapter that are not listed in the DOT Hazardous Material Table 49 CFR 172.101 should be marked ORM-E. This ORM category also includes items that a generator feels are hazardous but are not covered by the RCRA regulations or those items classified hazardous by other regulations, for example PCB, which are covered under the Toxic Substance Control Act but not specifically by RCRA or the DOT regulations.

ORM-A Label:

ORM-A

Definition: Anesthetic, toxic, noxious, or irritating material that

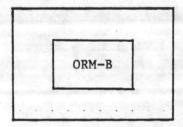
can cause discomfort to personnel in the event of a

leakage.

Examples: Acetaldehyde ammonia

Aldrin Bone Oil

ORM-B Label:



Definition: Corrosive materials which may cause damage to transport

vehicles.

Examples: metalic mercury

barium oxide calcium oxide ferric chloride ORM-C Label:

ORM-C

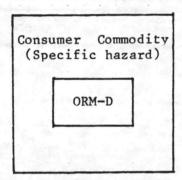
Definition: Materials with characteristics which make them unsuitable

for shipment unless properly packed.

Examples: Excelsion

Feed, wet, mixed fish scrap

ORM-D Label:



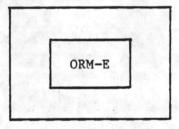
Definition: Small quantities of hazardous materials that meet the

definition of consumer commodity.

Examples: hair spray

shaving cream

ORM-E Label:



Definition: A material that is not included in any other hazard

class, but is subject to the requirements of this subchapter because they are Hazardous 'Wastes or

Substances."

Examples: Polychlorinated Biphenyls (PCB)

Potassium chromate Ferric Fluoride Ferrous Sulfate

C. Other DOT Labels. The following labels are special labels. They are used in conjunction with the standard DOT labels, not in place of.



SPONTANEOUSLY COMBUSTIBLE (RED AND BLACK PRINTING ON WHITE)
USED ONLY IN ADDITION TO A HAZARD LABEL

Definition—(Used only in addition to a hazardous label). Substances which may undergo spontaneous or self-ignition or which may, upon contact with the atmosphere, undergo an increase in temperature and ignite. (This label is used for materials to be exported only).

Examples -- Oily rags.

DANGEROUS WHEN WET
(BLACK OR WHITE PRINTING ON BLUE)
USED ONLY IN ADDITION TO A HAZARD LABEL

Definition--(Used only in addition to a hazard class label). A solid which is likely to become spontaneously flammable or give off flammable or toxic gases when mixed with water.

Examples -- Sodium metal.



D. Resource Conservation and Recovery Act (RCRA) Labeling
Requirements. In addition to the DOT labels required before a
generator releases a hazardous waste for transportation offsite,
he must display the following information:

Hazardous Waste--Federal law prohibits improper disposal.

If found, contact nearest police or public safety authority or the US Environmental Protection Agency. Generators name and address

Manifest Document Number

The following is an example of a commmercial version of this requirement:

	ARDOUS
M	ASTE
FEDERAL LAW PR	OHIBITS IMPROPER DISPOSAL
PUBLIC SA	TACT THE NEAREST POLICE, OR FETY AUTHORITY, OR THE MENTAL PROTECTION AGENCY
PROPER D.O.T. SHIPPING NAME	UN OR NA#
GENERATOR INFORMATION	
NAME	
ADDRESS	
CITY	STATE ZIPZIP
504	EPA WASTE NO.
EPA ID NO.	
The state of the s	MANIFEST
ID NOACCUMULATION START DATE	

E. Labeling Requirements for PCBs.

The Department of Transportation (DOT) sets forth the labeling requirements for the transportation of PCBs. The required label for PCBs is ORM-E (class 9) and the DOT Identification Number is UN 2315.

The Toxic Substance Control Act (TSCA) requires some PCB items to be marked (as opposed to labeled). The following items must be marked with approved TSCA labels as containing PCBs:

<u>Item</u>	Label Requirement
PCB Transformers "posing a risk to food/feed"	A11
PCB or PCB-contaminated dielectric fluid (transformer oil)	If concentration is 500 or more ppm PCB
PCB containers	If concentration is 500 or more ppm PCB
PCB electromagnets, switches, and voltage regulators	If concentration is 500 or more ppm PCB
PCB large, high and low voltage capacitors	If weight of capacitor is greater than 9 lbs.
Circuit breakers, reclosers and cable	If concentration is 500 of more ppm PCB

Other PCB articles

The marking required by TSCA regulations consist of black letters on yellow background. The label is required to be 6-inches on items large enough to display them. For smaller items, labels as small as 2 inches are appropriate. For extremely small items, labels as small as .4 inch by .8 inch are authorized. Whenever possible, use permanent markers to complete the bottom lines of the label. Below is an example of a commercial label satisfying this requirement.



(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761—For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800:424-8802

Also Contact Tel. No.

PC-4 LABELMASTER, CHICAGO, IL. 60626

- F. Pesticide Labels. Pesticide labeling requirements are stated in 40 CFR Section 162.10. Navy activities requiring pesticide labels should contact the product manufacturer for them. The only time an activity should use pesticide labels is to replace missing or deteriorated labels. To avoid liability, specific pesticide label requirements should be determined by the pesticide manufacturer. When a label becomes inaccurate because certain uses have been suspended, whoever is accountable for the pesticide must change the label.
- G. The National Fire Protection Association (NFPA) Recommended System for the Identification of the Fire Hazards of Materials. This hazard identification system consist of a diamond-shaped diagram for each chemical which, at a glance, provides information on the hazards of the chemical and the order of severity of these hazards. The system is intended for use under emergency conditions such as spills, leaks and fires to safeguard the lives of personnel who may be exposed. The system is also used to identify hazardous wastes and the storage areas of these wastes. This system is not required by federal law but may be required by local or Base authorities. Note: This label does not meet DOT requirements for wastes being transported on public highways.

The NFPA Diamond. (See Figure VI-1). This diagram provides information on health, flammability, and reactivity, as well as special hazards associated with the chemical. Numbers from 0 through 4 are placed in the three upper squares of the diamond to show the degree of hazard present. The 0 indicates the lowest degree of hazard, the 4, the highest. In the diamond-shaped diagram health hazards are identified in the left square, flammability hazards in the top square, and reactivity hazards in the right square. The bottom square is used for special information on the chemical. The symbol that is primarily used here is the letter W with a bar through it to indicate that a material may have a hazardous reaction with water. Another symbol could be the "radioactive pinwheel" for radioactive materials. The NFPA diamond symbol is intended to provide quick identification at some sacrifice of completeness. The five degrees of hazard, have these general meanings to firefighters:

- 4-Too dangerous to approach with standard firefighting equipment and procedures. Withdraw and obtain expert advice on how to handle.
- 3-Fire can be fought using methods intended for extremely hazardous situations, such as unmanned monitors or personal protective equipment which prevents all bodily contact.
- 2-Can be fought with standard procedures, but hazards are present which require certain equipment or procedures to handle safely.
- 1-Nuisance hazards present which require some care, but standard firefighting procedures can be used.
- 0-No hazards which require special measures.

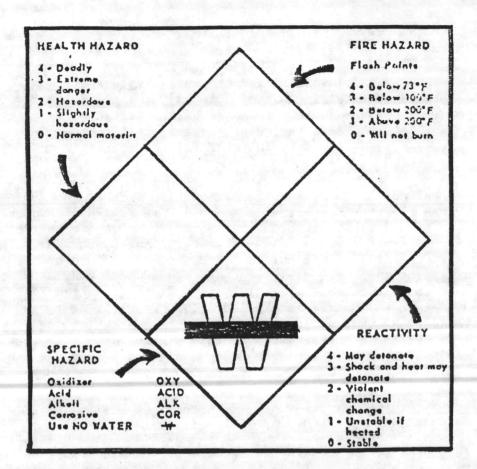


Figure VI-1. National Fire Protection Association label (FED-STD-313A).

Health Hazards.

In general, health hazards for firefighting result from a single exposure which may vary from a few seconds up to an hour. In assigning degrees, local conditions must be considered. The following explanation is based upon protective equipment normally used by firefighters.

4-Materials too dangerous to health to expose firefighter. A few whiffs of the vapor could cause death, or the vapor or liquid could be fatal on penetrating the firefighter's normal protective clothing. Protective clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials.

3-Materials extremely hazardous to health but areas may be entered with extreme care. Full protective clothing, self-contained breathing apparatus, rubber gloves, boots, and bands around legs, arms, and waist should be provided. No skin surface should be exposed.

- 2-Materials hazardous to health but areas may be entered freely with self-contained breathing apparatus.
- 1-Materials only slightly hazardous to health.
- O-Materials which on exposure under fire conditions would offer no health hazard beyond that of ordinary combustible material.

2. Flammability Hazards.

Susceptibility to burning is the basis for assigning degrees within this category. The method of attacking the fire is influenced by this susceptibility factor.

- 4-Very flammable gases or very volatile flammable liquids. If possible, shut off flow and keep cooling water streams on exposed tanks of containers. Withdrawal may be necessary.
- 3-Materials which can be ignited under almost all normal temperature conditions. Water may be ineffective because of the low flashpoint of the materials.
- 2-Materials which must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flashpoint.
- 1-Materials that must be preheated before ignition can occur. Water may cause frothing if it gets below the surface of the liquid and turns to steam.

However, water fog gently applied to the surface will cause a frothing which will extinguish the fire.

0-Materials that will not burn.

3. Reactivity (Stability) Hazards.

The assignment of degrees in the reactivity category is based upon the susceptibility of materials to releasing energy either by themselves or in combination with other materials. Fire exposure is one of the factors considered, along with conditions of shock and pressure.

- 4-Materials which are so susceptible to detonation that it is too dangerous for fire-fighters to approach the fire. Vacate the area.
- 3-Materials which when heated and under confinement are capable of detonation. These materials are too dangerous to fight with handlines, but may be kept from detonating if unmanned portable monitors or hoseholders can be set up from behind explosion-resistant locations.

- 2-Materials which will undergo a violent chemical change at elevated temperatures and pressures.

 Use portable monitors, hoseholders, or straight hose streams from a distance to cool the tanks and the material in them. Use caution.
- 1-Materials which are normally stable but may become unstable in combination with other materials or at elevated temperatures and pressures. Normal precautions in approaching any fire should suffice.
- 0-Materials which are normally stable and, therefore, do not produce any reactivity hazard to firemen.

4. Special Information.

When W appears in 4th space:

- 4-W is not used with reactivity hazard 4.
- 3-In addition to the hazards above, these materials can react explosively with water. Explosion protection is essential if water in any form is used.
- 2-In addition to hazards above, these materials may react violently with water or form potentially explosive mixtures with water.
- 1-In addition to hazards above, these materials may react vigorously but not violently with water.
- 0-W is not used with reactivity hazard 0.

Assigning Degrees of Hazard. Numbers (degrees of hazard) for use in the diamond are assigned on the basis of the worst hazard expected in the area, whether it be from hazards of the original material or of its combustion or breakdown products. The effects of local conditions must be considered.

Advantages of the NFPA System. The NFPA 704 system can warn against hazards under fire conditions. For example, edible tallow produces toxic and irritating combustion products. It would be given a "2" degree of health hazard, indicating the need for air-supplied respiratoray equipment. NFPA 704 also can warn against overall fire hazards in an area. On the door of a laboratory or storage room, it can warn of the worst hazards likely in a fire situation. Such information is useful both in preplanning and in actual fires. NFPA 704 can be used without a supplementary manual. Because of its simplicity, the general meanings of the numbers can be memorized easily and the whole symbol read and interpreted quickly on the spot and in poor light.

Disadvantages of the NFPA 704 System. The NFPA 704 system makes no provision for oxygen-donor type oxidizers. It gives only minimum information on the hazards themselves. Since the system gives information about protective measures, the same number may be used for different types of hazards so that, for instance, a

Health Hazard number 3 means "No contact" without saying whether the hazard is corrosiveness to the skin or toxicity by absorption through the skin. Thus, the symbol is useful only to trained or informed persons.

Labels. NFPA labels may be obtained through the Federal supply system (NSN 7690-00-152-0030 for 4-inch by 4-inch size label) or may be printed locally in sizes to suit the container dimensions. Symbols may also be applied with rubber stamps, silk screens, stencils, or any other suitable process.

Each standard symbol format (NSN 7690-00-152-0030) requires the application of numerals and symbols to describe the degree of hazard with respect to health, fire, reactivity, and the specific hazard of the packaged product, as applicable. NSNs for numerals (degree of hazard) and symbols (specific hazard) are listed below:

SYMBOL (BLACK)	NSN	NUMERAL (WHITE)	NSN
ОХУ	7690-00-152-0031	0	7690-00-857-9697
COR	7690-00-152-0032	1	7690-00-857-9688
ACID	7690-00-152-0033	2	7690-00-857-9689
ALK	7690-00-152-0034	3	7690-00-857-9690
W	7690-00-152-0035	4	7690-00-857-9691

Examples of combinations of specific hazard symbols follow:

OXY	OXY	OXY	OXY	ACID	ALK	COR
ACID	AKL	COR	W	W	W	W
	W					

H. Naval Sea Systems Command (NAVSEASYSCOM) Labels NAVSEASYSCOM has developed its own labels for shipboard hazardous waste. The label, NAVSEA Form 5100/4 (9-80), is available in the stock system by Stock No. 0116-LF-051-0020. The label was designed to be simple and brief so that all concerned could easily identify the exact nature of each hazardous waste. This label is shown below.

Note: This label does not meet DOT requirements for wastes being transported on public highways, it would be used for shipboard wastes only.

MARNING

NAME OF MATERIAL	
CONCENTRATION	
SHIP	DEPARTMENT
SPECIAL STORAGE REQ'Ts	
SPECIAL HANDLING REQ'Ts	
SIGNATURE OF DEPT. HEAD	DATE
HAZARDOU NAVSEA 5100/4 (9-80)	S WASTE

VI-22

I. Manufacturers' Labels. These can provide valuable information about hazardous ingredients in products, safety precautions, and storage and disposal information. An example is shown below. A manufacturers label, however, is not a substitute for a DOT approved hazardous waste label.

AM Multigraphics Multilith

Electrostatic Solution

Warning: Do not take Internally. Contains Ferrocyanide and trace amounts of Hydrogen Cyanide.

Reorder No. 83-1-104054 (Formerly 200-1050-4A) Keep out of reach of children.

For Industrial/Commercial Use Only For dilution as a fountain solution always use distilled water.

Use with adequate ventilation. Avoid eye contact and repeated skin contact. If contacted, flush with water. If swallowed, induce vomiting immediately and get medical aid. DO NOT USE chlorinated bleach to clean up solution or its crystals since DANGEROUS chlorine gas may be released. Dispose according to local ordinances relating

to ferrocyanide disposal.

Storing conditions: 40° - 100°F.

Contents: 1 Gallon (3.78L)

AM Multigraphics
1800 West Central Rd.
Mt. Prospect, IL 60056

J. Color Coding of Compressed Gas Cylinders. The color coding of compressed gas cylinders can be an indication of what substance is contained in the cylinder; however, you should never determine chemical contents of a container by color code alone.

- 1. Military compressed gas cylinders should all be color coded in accordance with Military Standard-101.
- 2. The basic color of the cylinder indicates the hazard of the gas it contains. This is the most important part of the code. The color and indicated hazard are as follows:

Brown--poison.

Gray -- inert (Helium, etc.).

Yellow--flammable.

Green--oxidizer (oxygen, etc.)

Red--firefighting chemicals (used to extinguish fires).

(Compressed gas cylinders owned by industry are also colored but the color indicates ownership and not hazard.)

3. This system also uses colored bands on cylinders and colored tops of cylinders. These markings provide additional information about the nature of the contents.

Examples:

Acetylene cylinders. Totally yellow with no markings.

Welding oxygen. Totally green with no additional markings.

Medical oxygen. Green with a white top.

Aviation oxygen. Green with one white band.

4. The color coding system should not be used alone to identify the contents of a cylinder since color coding systems are not uniformly followed at this time.

IV. SOURCES OF LABELS.

Activities may obtain hazardous waste warning labels through the Navv supply system or:

Label Master 7525 N. Wolcott Ave. Chicago, IL 60626 (312) 973-5100

V. SUMMARY.

In summary, a generator of a hazardous waste is responsible for properly labeling the waste prior to transportation. Items are required to be labeled in accordance with:

- 1. DOT Hazardous Material Transportation Act Regulations 49 CFR 171-177.
- 2. The RCRA hazardous waste labeling requirements.
- Other federal state or local regulations that apply, for example Toxic Substance Control Act regulation in the case of PCBs.
- 4. Special Navy or activity labeling requirements. For example the NAVSEA labeling requirements for shipboard hazardous waste or the NFPA diamond if used at the generator's facility.

These labeling systems were designed to protect workers, the general public and the environment. They can only be useful if the items labeled are properly identified. This goes back to establishing a system to keep unknown, unidentifiable wastes from being generated.

In emergencies, these various labels and markings can be used to make initial assessments of the situation. You should understand the importance of and the information provided by each label or marking normally seen in your shop. This will prepare you for quick and safe action in case of an emergency.

EXERCISE: MODULE VI - LABELING

LABELING AND MARKING EXERCISE

OBJECTIVE: Determine labeling and marking requirements for a variety of hazardous wastes.

SITUATION: You have been told to prepare a number of 55-gallon drums for shipment as hazardous waste.

To assist you in this assignment, you have been given the following:

- A list of the drums and their contents
- The DOT Hazardous Materials Table (49 CFR 172.101)
- A hazardous waste labeling chart

REQUIRED TASK: Determine which labels and markings (if any) are required on each of the drums listed.

PROCEDURE:

- Using the selected marking requirements beginning on page VI-1 of module VI, determine which marking(s) should be on each hazardous waste container.
- 2. Using the DOT Table, determine the correct DOT label(s) to be used on each hazardous waste container.
- 3. Using the requirements on page VI-25, determine the RCRA label for each hazardous waste container.
- 4. If a NFPA Fire Protection Guide on Hazardous Materials is available, determine the numbers or symbols that belong in the four squares of the NFPA Diamond for each hazardous waste container.

```
DRUM 1: 50 gallons of methyl ethyl ketone.
    Marking(s):
    DOT Label(s):
    RCRA Label:
    NFPA Diamond:
DRUM 2: 1 Drum of sodium hydride.
    Marking(s):
    DOT Label(s):
    RCRA Label:
    NFPA Diamond:
DRUM 3: 50 gallons of Nitric Acid (less than 40%).
    Marking(s):
    DOT Label(s):
    RCRA Label:
    NFPA Diamond:
DRUM 4: 50 gallons of Nickel Carbonyl.
    Marking(s):
    DOT Label(s):
    RCRA Label:
```

NFPA Diamond:

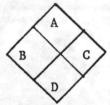
TRUE	or	FALSE	:
	_		

 If a number of packages contain the same kind of waste, only one package must be labeled completely.

 If one package contains wastes which have more than one hazard class, it should be labeled for the most hazardous item.

3. The letters "RQ" are a marking requirement and are an abbreviation for "reportable quantity".

- 4. For a material classified as corrosive in the DOT system, describe or sketch the following:
 - a. Color of label and printing:
 - b. Figure and lettering on label:
- 5. List the type of information found in each of the four squares of the National Fire Protection Association (NFPA) 704 Diamond.



C: ______

6. How many DOT labels are required for a container of solid lithium hydride?

What label(s) are these?

,		
7.	Determine all the marking and labeling requirements for a 55-gallon dof methylhydrazine (draw or print the appropriate markings and labels	rum
	Marking(s):	
	DOT Label(s):	
	RCRA Label:	
	NFPA Diamond:	

TAB PLACEMENT HERE

DE	SCRIPTION:
	HW PACKAGING
X	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



CHAPTER VII

HAZARDOUS WASTE PACKAGING

LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Determine whether or not an item is properly packaged.
- B. Identify those items which, because of inadequate packaging, may result in spills or other storage, transportation, and disposal problems.
- C. Determine what action should be taken once a problem is identified using local procedures and guidelines.
- D. Use the Department of Transportation's Hazardous Materials Table to determine how a specific hazardous waste must be packaged in order to be transported over public highways.
- E. Identify DOT-approved containers.
- F. If required, repackage, mark, and label hazardous wastes so that spills or other incidents are prevented.

II. INTRODUCTION.

Much of the difficulty that a Naval facility has with handling, storing, and transporting hazardous waste could be reduced if the importance of packaging was recognized. It's more likely that leaks will be prevented and worker injuries and environmental damage reduced if an item is packaged with an understanding of its hazardous characteristics. During this unit of instruction, we will review common packaging deficiencies encountered and how to recognize a hazardous waste packaging problem; proper packaging procedures; Department of Transportation (DOT) regulations on labeling, marking, and packaging hazardous material prior to transportation; types of DOT-approved containers available; and the importance of understanding local procedures for handling hazardous waste packaging problems.

III. POLICY CONSIDERATIONS.

There are specific DOT regulations governing the transportation of hazardous material over the public highways (as well as other modes of transportation). These regulations, although developed for the transportation of hazardous material, are referenced in the RCRA regulations and therefore are applicable to hazardous waste also. These regulations will be discussed in more specific detail later, but generally are concerned with insuring that hazardous waste is packaged, labeled, marked, and placarded in ways so that transportation-related accidents and spills can be avoided. Obviously, the basis of these regulations is that some methods of packaging, labeling, marking, and placarding are better than others. If an item is packaged in accordance with DOT regulations, it's less likely to leak, spill, or

1099D Date of last revision: Jun 1984

react with other items to cause a serious safety problem. If this is true, shouldn't all items to be stored be packaged in accordance with DOT regulations? After all, this could reduce safety and environmental problems. A realistic consideration is that money for materials and manpower is in short supply. However, if no attention is paid to the packaging of hazard items, there can be serious safety and environmental problems. Therefore, some cost effective mode must exist to reduce the problems caused by the packaging of hazardous waste yet still be practical in terms of available resources.

IV. PACKING CONCEPTS.

In order to assist you in determining whether or not an item is properly packaged, it's necessary to have some understanding of the packing process that should be used for any item. With this knowledge, it's easier to evaluate if some step has been overlooked or done incorrectly which will cause difficulty later on. Developing an understanding of packaging concepts can also help if you have to evaluate the adequacy of packaging of a hazardous waste already in storage.

- A. Sequence of packing operations. The general sequence of packing is divided into a series of basic operations which may include some or all of the following steps, not necessarily in the order given below. Think about how the hazardous characteristics of certain items could affect each of these steps.
 - Determine the packing requirements. Study the item's characteristics to determine the protection required and the best way to provide it through the use of an adequate container, suitable blocks, braces, and cushions and appropriate barrier materials. This study should include the item's size, shape, fragility, and hazards; the types of loads (easy, average, difficult); the mode of transportation; storage facilities (covered/uncovered); the destination (domestic or overseas in the arctic, temperate, or tropic zones); and legal requirements.
 - 2. Select the container. Select and use an exterior container that will meet all identified requirements. This selection should consider all factors relevant to giving adequate protection at a minimum cost to include such things as the characteristics and limitations of the container; its initial cost and upkeep expenses; its weight and cube; its availability or obtainability in appropriate quantities; its reusability; and its non-reactivity with the material to be contained.
 - 3. Prepare protective barriers. Prepare an appropriate barrier to give weatherproofing protection not obtainable from the container alone. Remember, certain hazardous wastes need additional protection to prevent accidental reactions with moisture or noncompatible chemicals.

- 4. Insert and secure the item to the container. Insert the item and secure it to the container to control or prevent movement by means of adequate cushioning, blocking, and bracing. The distinction between cushioning, blocking, and bracing is that cushioning permits controlled movement of the item within the container, while blocking and bracing are designed to prevent movement of the item within the container.
- 5. Seal the barrier, if used. Seal the barrier material by means of adhesives, heat seals, pressure seals, or sealing tape to provide weatherproofness of the seams, joints, and closures equal to that of the barrier material itself.
- Close the container. Close the container correctly. Exact procedures will vary depending upon the container selected.
- 7. Reinforce the container. Reinforce the container with metal strapping or reinforced tape, as appropriate, for the container selected.
- 8. Mark the shipping container. Mark the container to identify its contents and to insure movement to its destination.
- B. Item characteristics. Given that the first step in a successful packing operation is a clear understanding of the item, following are several important factors that should be considered:
 - Shape. The shape of an item to be packed is an important factor to consider in designing blocking and bracing. A regular-shaped item with rectangular surfaces requires a minimum of blocking, while an irregular-shaped item with uneven projections often requires an elaborate blocking system.
 - 2. Size and weight. A large item may require more extensive blocking and larger amounts of cushioning than a smaller one. Since the impact force developed by the abrupt stopping of a moving object is directly proportioned to its weight, the weight of an item is very important in considering the blocking and cushioning.
 - 3. Strength and fragility. Some items are rugged enough to withstand greater stacking loads and handling forces than their containers. On the other hand, there are many items that require the maximum protection given by packing materials. The degree of fragility of an item determines the amount of cushioning required to protect it from damage during handling and shipment.
 - 4. Special packing requirements. Reusable and other special purpose containers usually require special consideration when packing the contents into the container. For

instance, in reusable containers, the blocking and cushioning must be arranged so that it may be easily removed and when replaced still adequately protect the contents.

- C. Realistic concerns. All of the things discussed above should be considered in packing any item, therefore, it is important that even more care be taken with hazardous waste. Yet there are a number of factors that can lead to less attention being given this area. For example:
 - 1. Does the generator understand why proper packaging is important?
 - Packing something correctly takes more time and effort initially than just doing enough to get by. If you do not understand why proper packaging is important and think it takes resources that could be spent elsewhere, you will probably choose not to follow proper packing procedures.

V. COMMON PACKAGING PROBLEMS.

If an important method of preventing safety and environmental problems is early identification of potential packaging problems, then it is necessary for workers to be able to recognize such problems. They can then take action in accordance with local policy to prevent spills from occurring. There are both obvious and not so obvious things to look for when evaluating the packaging of hazardous waste. Some of these areas of concern are reviewed below:

- A. DOT checklist. DOT has published a checklist of things to be reviewed to check compliance with DOT hazardous waste regulations. The list can be helpful to raise questions regarding the adequacy of labeling, packaging, and marking of waste. It can also be useful when trying to determine if waste being transported is being done so legally. The checklist is useful in identifying the following problems:
 - 1. Packaging (containers in general).
 - (a) Use of DOT specification containers which are not authorized for the commodity being shipped.
 - (b) Use of containers that are leaking.
 - (c) Manufacturing and marking containers as meeting a DOT specification when it does not meet the specification.
 - (d) Containers improperly marked.
 - (e) Offering for shipment improperly packaged waste.
 - 2. Containers (miscellaneous).

- (a) Steel containers.
 - Labeled containers (without further overpack) with no DOT specification marking.
 - Containers of hazardous wastes with temporary repairs (damaged, sealed with tape, putty, chewing gum, or screws) or shipped upside down.
 - Labeled containers that are dented, rusted, or corroded.

(NOTE: These are judgmental decisions.)

- Labeled containers on which specification markings are illegible.
- Labeled reused containers marked STC and/or 17C, 17E, and 17H with no reconditioner's marking.
- (b) Corrugated fiberboard.
 - Boxes with no DOT specification marking when inside containers are larger than the limited quantity exception for the commodity.
 - Boxes marked with DOT specification markings which are poorly constructed (gaps, uneven closures, seams, and joints separating).
 - Boxes damaged by water.
 - Improperly closed boxes (look for masking tape, cellophane tape, and string).
 - Leaking containers.
 - Non-DOT specification fiberboard box used in lieu of using specification container when required.
- (c) Polyethylene containers.
 - Illegibly marked containers.
 - Leaking containers offered for shipment.
- (d) Fiber drums.
 - Non-DOT specification fiber drums.
 - Fiber drums constructed of materials weaker than required by the specification.
 - Use of fiber drum marked DOT-21A without inside polyethylene liner.

- Using fiber drum marked STC more than once for hazardous wastes.
- Fiber drum damaged by forklift truck.
- Improper markings on containers for the commodity being shipped.

(e) Cylinders.

- Reuse of single-use cylinders such as DOT Specification 39.
- Cylinders beyond test date.
- Cylinders in improper conditions (no valve protection, bulge in side, dented or corroded, defective valve).
- Cylinders improperly marked (duplication of serial numbers).
- Cylinders offered for transportation without proper identification of contents.
- Illegible cylinder markings.

(f) Portable tanks.

- Name of owners or lessee omitted on tank.
- No labels and/or placards displayed on container containing hazardous wastes.

3. Labeling.

- (a) No labels on outer container to represent mixed packages of hazardous wastes.
- (b) Label on the container not consistent with the hazard class on the shipping papers.
- (c) Use of obsolete labels.
- (d) Color and/or size of label does not meet the standards of title 49, CFR, section 172.407.

4. Marking of containers.

- (a) No commodity description (proper shipping name) on the container.
- (b) No DOT exemption number on containers shipped under DOT exemptions.

- (c) Container markings not in a contrasting color.
- (d) Container of liquid hazardous waste not marked on outside THIS END UP or THIS SIDE UP.
- (e) Reconditioned drums improperly marked.
- (f) Portable tanks not marked with proper name of the hazardous waste.
- B. Common observations. Anyone walking through an area where waste is stored or reviewing reports of accidents/spills will notice certain common problems associated with the packaging of hazardous wastes. Personnel should be especially alert to these problems and correct them as soon as possible. These include:
 - 1. Pallets made of defective material-weak, broken boards.
 - 2. Fiberboard containers weakened by water or spills of other waste.
 - 3. Incompatible wastes packaged together.
 - 4. Use of incompatible cushioning material with packaged item.
 - Improper stacking of containers--overhang on pallets; containers stacked too high; crushing of packages on bottom; stacks leaning.
 - 6. Package not labeled when waste is hazardous.
 - 7. Package incorrectly labeled.
 - 8. Drums overfilled -- no room for expansion (outage).
 - 9. Leaking containers.
 - 10. Corroded, rusty drums.
 - 11. Drums not closed correctly; damaged chimes.
 - 12. Incompatible packages of hazardous waste stored together (we will talk more about this problem in another unit of instruction).
- C. Local procedures. Assuming that you have observed one or more of the above problems, what action should you take next? Again, realistically, you may be restriced by resource constraints but you should realize that some ways of handling the situation are better than others. Ideally, steps should be taken to upgrade the packaging of the waste so that it can

be safely handled, stored, and eventually transported. This implies that a capacity to do this should be available at your facility.

You should also identify procedures that need to be changed to minimize similar future problems. This could include improved storage procedures (do not put boxes in locations where they can get wet and do not stack so that containers are damaged). These changes will not be easy; it will require hard work on the part of all workers. It may not cause immediate benefits that higher management can measure and praise but it will, in the long run, increase productivity and reduce accidents and spills.

VI. OVERPACK DRUMS.

Overpack drums are used to store or dispose of leaking containers. Rather than completely repackage leaking hazardous waste containers, they can be placed in overpack drums, thereby, eliminating health and environmental problems. These drums are slightly larger than a standard 55-gallon drum and can be used to hold leaking drums, other leaking containers, and spill or other contaminated materials.

Procurement. Overpack drums are now in the Federal supply system. There are two types available. Both types meet DOT standards and are 16-gage steel. Type 1 is a one-trip drum designed for disposal purposes. It has no lining and is not suitable for long-term storage. Type 2 is a reusable drum. It has a sprayed on epoxy phenolic lining designed for long-term storage and disposal purposes. It can be triple-rinsed for reuse.

- 1. NSN 8110-01-101-4055, 85-gallon disposal drum.
- 2. NSN 8110-01-101-4056, 85-gallon recovery drum.

VII. LABELING AND MARKING.

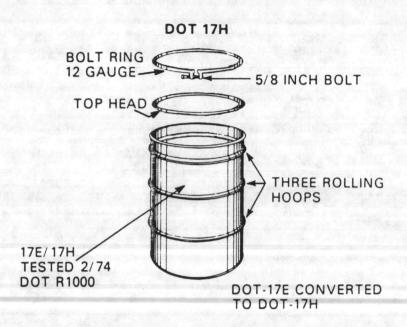
A. Labeling. As explained in a previous unit of instruction, one of the key requirements under the DOT system of hazardous material regulations is that proper labels be used to identify the hazards of the item being shipped. Understanding what these labels mean is very important to workers because it lets them know what the dangerous characteristics of an item are. With this information, it's possible to identify storage and waste handling problems and, therefore, reduce the chance of a spill or accident. If there is a spill or fire, it is imperative the workers be able to quickly identify the contents of the containers. Without proper labels/markings this may be impossible. In addition proper labels/markings assist in determining whether wastes are stored compatibly. As packages are moved about, it becomes increasingly difficult to keep track of where everything is and in many cases you may

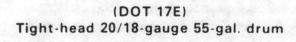
not have time to look it up; therefore, each package must be able to be identified quickly and easily. All facility personnel should, therefore, develop and use an understanding of labeling requirements to identify potential packaging problems.

- B. Marking. If hazardous waste is transported in accordance with the DOT hazardous material regulations, it must contain specific markings to include such things as the shipping names, technical names, consignee's name/address; gross weight; "this side up" and ORM (other regulated material) designations. You should have an understanding of the DOT markings since this information can help you in determining:
 - What hazards are associated with the item (by enabling you to use technical information sources such as the DOT Commodity List or the Hazardous Materials Information System).
 - 2. If the packaging is adequate.
 - 3. If the waste is stored properly.

VIII. DOT SPECIFICATION CONTAINERS.

You should be able to recognize DOT specified containers. If you can tell if a container meets DOT requirements, you can predict whether or not packaging or storage problems are likely. You can also tell if your facility is storing hazardous wastes correctly under RCRA regulations. Since DOT containers are required for storing or transporting hazardous wastes, you can also determine if hazardous waste is being shipped in accordance with DOT regulations. While actual specifications for approved DOT containers are complex (see appendix A for an example), they must be followed by manufacturers to meet DOT requirements. Look at the pictures in figures 1-4 to see some typical examples of containers meeting DOT regulations. A table cross referencing DOT container specifications with DOD container specifications is on pages 15 and 16.





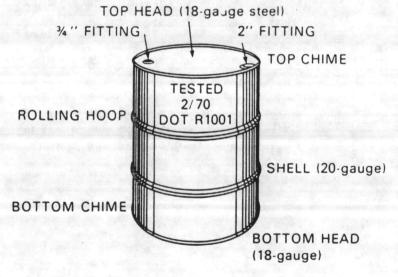
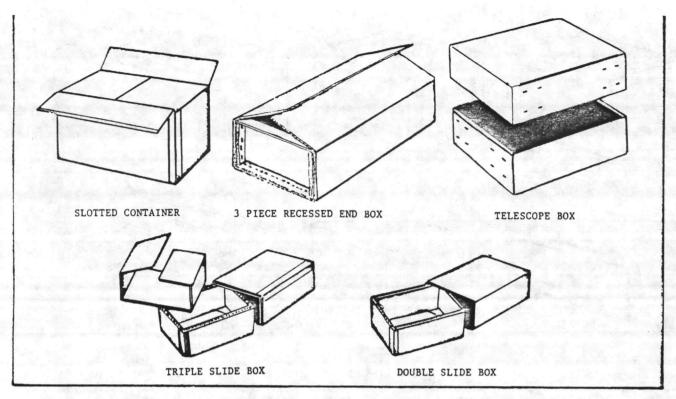


Figure 1. Typical DOT specification drums.



EXAMPLES OF FIBERBOARD BOX STYLES MENTIONED IN THE HAZARDOUS MATERIALS REGULATIONS - TITLE 49-C F R

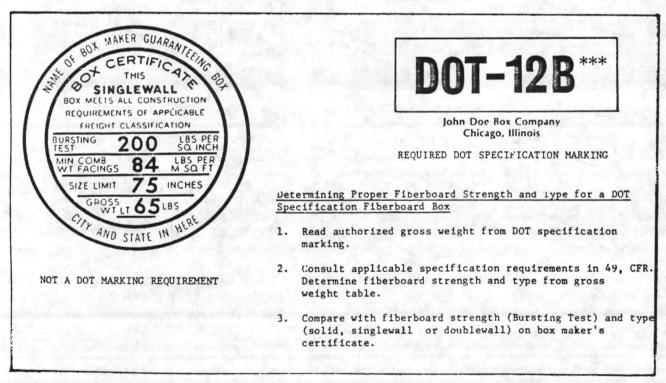


Figure 2. Typical DOT specification fiberboard boxes.

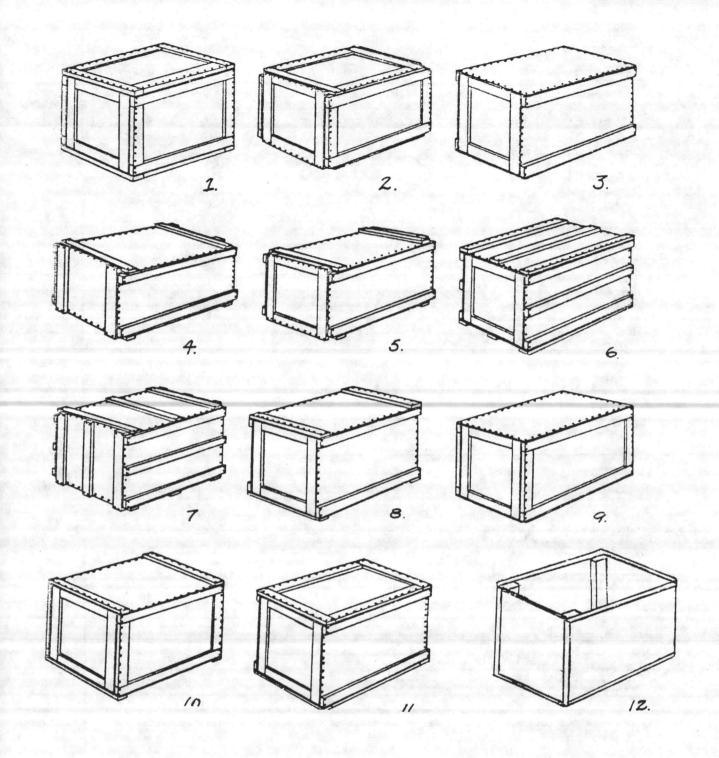
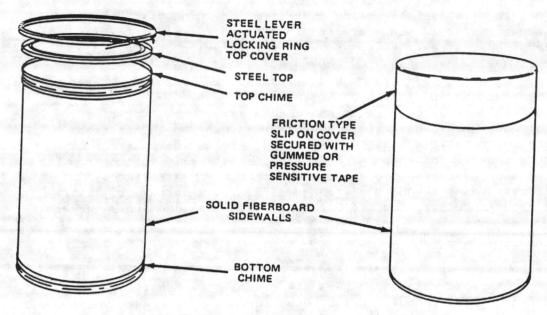
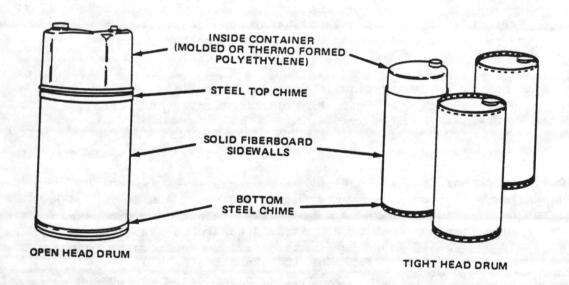


Figure 3. Typical DOT specification wooden boxes.



FOR DRY PRODUCTS
DOT SPECIFICATION 21-C (Ref. Title 49 CFR Sec. 178.224)



FOR LIQUID PRODUCTS

DOT SPECIFICATION 21-P (Ref. Title 49 CFR Sec. 178.225) Composite fiber Overpacks for DOT inside Specification 2SL or 2U inside polyethylene container.

Figure 4. Typical DOT specification fiber drums.

IX. DOT HAZARDOUS MATERIALS TABLE.

The use of this table is necessary to determine what the DOT packaging requirements are for the transportation of various hazardous wastes. While you will not be using this table everyday, you should know how to use it. If you do, you will then be able to determine what package DOT considers necessary to transport various types of hazardous waste safely. Column 5 in the table gives you exceptions and specific packaging required for each hazardous waste listed. By turning to the sections of the DOT regulations cited, you can determine the general requirements for shipment and packaging as well as shipping container specifications for each hazardous waste listed. Understanding these requirements gives you a better ability to evaluate whether or not a hazardous waste is adequately packaged.

X. TRAINING AVAILABLE.

As you have probably realized by now, packaging hazardous waste is a complex business. There are a number of Department of Defense (DOD) schools that conduct courses in this area. Some of the courses identified in the Defense Management Education and Training Catalog (DOD 5010.16-C) include:

- A. Defense Packaging of Hazardous Materials for Transportation (8B-F7/822-F7(JT)), Joint Military Packaging Training Center, Aberdeen Proving Ground, MD (7 days).
- B. Transportation of Hazardous Materials (Air and Surface), J3AZR 60000 002 (AF), Sheppard Air Force Base, TX (8 days).
- C. Transportation and Storage of Hazardous Materials, A-8C-0023(NV) Naval School, Transportation Management, Oakland, CA (2 weeks).
- D. Technical Transportation of Hazardous Materials, DACS AMMOMTMC-2 (JT) USA Defense Ammunition Center and School, Savanna, IL.

XI. SUMMARY.

During this unit of instruction, we have reviewed common packaging deficiencies encountered; talked about how to recognize a potential/actual hazardous waste packaging problem; discussed DOT regulations on labeling and marking hazardous waste, viewed several types of DOT-approved containers and practiced using the DOT Hazardous Materials Table as it relates to packaging requirements. You should now be able to determine whether an item is properly packaged. You should now realize why proper packaging is important for the safe handling, storing, and transporation of hazardous wastes.

TABLE VII-1

DOT,	FEDERA	L/MIL	ITARY (CONTAIN	IER	SPE	CIFICATIONS	
NOTE:	Refer	to Al	R 71-4	, Atch	2	for	Changes	
	CUD	Ti+1	0 40			Ec	down I Milita	

DOT NOTE: Re	efer to AFR 71-4, A CFR Title 49	Federal/Military	DOT	CFR Title 49	Federal/Military
Specifications	Part:	Specification	Specification	Part:	Specification
ΙΛ	178 1	PPP-B-585, PPP-B-621	4	178.48	none
1B	178.2		4A	178.49	none
1C	178.3		4AA 480	178.56	MIL-C-11733
10		PPP-B-621, PPP-B-601			
11:		MIL-D-112	4B	178.50	RR-C-910
11:X		MIL-D-112	4BA	178.51	none
111		none			
	170.13	none	4B-240-ET	178.55	none
1K	178.14	none	4B-240-FLW	178.54	none
1X	178.5	PPP-B-601, PPP-B-621	4BW	178.61	none
2Λ	178.20	M1L-C-38756	4C	178.52	none
			4D	178.53	none
2C	178, 22	PPP-B-636, Type CF-DW 275	4υ	1/8.53	none
20	178.23	UU-S-48	4DA	178.58	none
21		PPP-C-96			
2(i		MIL-C-3955, MIL-C-12804	4DS	178.47	none
2.1		PPP-B-1055			
			4E	178.68	RR-C-910
2K	178.29	none	4L	178.57	none
1,	178.30	none	5	178.80	PPP-P-704, Type I, Class 8 and 12
2M	178.31	none	5A	178.81	PPP-D-700, Type I
N	178.32		5B	178.82	PPP-D-729, Type I; PPP-D-705,
P	178.33				Type I; Class 8 and 12.
20	178.33A	none	5C	178.83	PPP-D-700, Type II
2R	178.34	none	5D	178.84	PPP-D-700, Type III
S	178.35		5F	178.85	none
SI	178.35a	PPP-C-569	5H	178.87	none
			5K	178.88	none
TL	178.27	none	5L	178.89	MIL-C-1283, 5 gal cans
T	178.21	none	5M	178.90	none
U		none	5P	178.92	none
			5X	178.91	none
δΛ	178 36	MIL-C-7905, MIL-C-11732	6A	178.97	PPP-D-736
		HILL C 7505, HILL C 17752	6B	178.98	PPP-D-736
3AA	178 37	RR-C-901, MIL-C-11732, MIL-	6C	178.99	none
		C-7905.	6D	178.102	none
SB	178.38	none	6.J	178.100	none
BBN	178.39	none	6K	178.101	none
(;	178.40	none	6L	178.103	none
D	178.41	none			
li	178.42	none	7A	178.350	none
5A 480X	178.43	none	8	178.59	MIL-C-3701
	178 11	none			
Sirr	178.44	none	8AL	178.60	MIIC-3701

DOT Specification	CFT Title 49 Part:	Federal/Military Specification	DOT Specification	CFT Title 49 Part:	Federal/Military Specification
10A	178.155	none	21C	178.224	
10B	178.156	none	· 22A	178.196	none
10C	178.157	none	22B		none
11A	178.160	NN-K-231	22C	178.197	none
11B	178.161	NN-K-231	23F	178.198	none
12A	178.210	none	23G	178.214	PPP-B-636, Type CF and SF
12B	178.205	PPP-B-636, Type CF or SF	236	178.218	none
12C	178.206	PPP-B-636, Type CF or SF	23H	178.219	DDD B 676 Time CC
12D	178.207	none	28	178.8	PPP-B-636, Type SF
12E	178.208	none	28A	178.9	none
1211	178.209	none	29	178.226	none
12P	178.211	none	31	178.15	PPP-T-495, Type I
12R	178.212	none	32A	178.146	none
			32B		MIL-C-3082, Style C
13	178.140	none	32C	178.147	none
13A	178.141	none	32D	178.149	none
14	178.165	none	320	178.148	none
15A	178.168	PPP-B-621, Styles 1,2,2½,3,6,	33A	178.150	none
		and 7.	34	178.19	none
15B	178.169	PPP-B-621, Styles 1,2,2½,3,6,	348	178.12	
	(100 Head of the Control of the Con	and 7.	36A		none
15C	178.170	PPP-B-621, Styles 1,2,21,3,6,	36B	178.230	PPP-B-35
		and 7.	36C	178.233	PPP-B-35
15D	178.171	PPP-B-621, Styles 1,2,2½,3,6, and 7.	37A	178.234 178.131	PPP-B-35PPP-D-705; PPP-P-704, Type II,
15E	178.172	none			Class 1, 3, and 5.
15L	178.176	none	37B	178.132	none
			37C	178.135	none
15M	178.177	none	37K	178.130	none
			37M	178.134	none
15P	178.182	none	37P	178.133	PPP-P-1337
15X	178.181	none	40	178.66	none
16A	178.185	PPP-B-585		170.00	none
16B	178.186	PPP-B-585	41	178.67	none
16D	178.187	PPP-B-585		1,0.0,	Holle
100	178.187	FFF-B-303	42B	178.107	none
17C	178.115	DDD D 704: Type I Class 4 and 11	42C	178.108	none
17E	178.116	PPP-P-704; Type I, Class 4 and 11 PPP-D-729; PPP-D-705, Type I	420	178.109	none
		and II; PPP-P-704, Type I,	42E	178.136	
		Class 3 and 9.	42F		none
17F	178.118	none	42G	178.110	none
1711	178.118	PPP-D-729, Type IV; PPP-D-705, Type V; PPP-P-704, Type II,	42H	178.111 178.112	none
		Class 8.	43A	178.18	none
17X	178.119	none	44B	178.236	none
18B	178.193	none	44C	178.237	none
19A	178.190	PPP-B-601	44D	178.238	none
19B	178.191	none	44E	178.239	
21P	178.225	none	44P	178.241	none
			45B	178.240	none
			100	1/0.240	none

APPENDIX A

SAMPLE DOT CONTAINER SPECIFICATIONS

Subpart D-Specifications for Metal Barreis, Drums, Kegs, Cases, Trunks, and Boxes

Source: The provisions of this Subpart D appear at 29 F.R. 18893, Dec. 29, 1964, except as otherwise noted, Redesignated at 32 F.R. 5606, Apr. 5, 1967.

§ 178.80 Specification 5; steel barrels or drums.

Removable head containers which will pass all required tests are authorized.

- § 178.80-1 Compliance.
 - (a) Required in all details.
- § 178.80-2 Rated capacity.
- (a) Rated capacity as marked, see \$ 178.80-11(a)(3). Actual capacity of straight-sided containers shall be not less than rated (marked) capacity plus
- 2 percent, nor greater than rated capacity plus 2 percent plus 1 quart, except that for containers over 30 gallons marked capacity actual capacity shall be not less than rated capacity plus 2 percent, nor greater than rated capacity plus 2 percent plus 2 quarts; actual capacity of bilge-type containers must be not less than rated capacity, nor greater than rated capacity plus 2 percent plus 2 quarts.

§ 178.80-3 Composition.

- (a) Sheets for body and heads to be low carbon, open hearth or electric steel Stainless steel, when used, must be, except for rolling hoops and chime reinforcement, an austenitic 18 and 8 chrome nickel alloy with carbon content not over 0.08 percent, or other equivalent grades.
- § 178.80-5 Seams.
 - (a) Body seams welded.
- § 178.80-6 Chime reinforcement.
- (a) Containers over 25 gallons capacity, with flanged head secured to body, to have chime reinforcement adequate for its protection.
- § 178.80-7 Parts and dimensions.
 - (a) Parts and dimensions as follows:

	The second second	Minimum thickness, uncoated sheets (gauge)		1	Rolling boops	
Marked capacity not	Type of container			Tes	Minis	Minimum
over (gallons)		Body sheet	Head sheet	Type .	Size (gauge or inch)	Weight (pounds per foot)
6	Straight side	22	22	None		
10	do	20	20	do		
33	do	14	14	do		
\$5	do	18	18	Ü	16	
10	do	16	16	U 1	14	
3	do	14	18	I-bar	141	
8	do	16	16	I-bar	11114	1. 2
10	do	14	14	I-bar	I I I IV	1. 2
3	do	16	16	(1)	. 4 4 174	1.2
5	do	14	14	(11)	1	
3	Buge	14	16	None		
5	do	13	14	do	1	

¹Rolling hoops may be of pliable solid rubber, metal, or other suitable material provided that equivalent protection to drum integrity is afforded. [44 FR 66197, November 19, 1979]

Rolled or swedged in hoops.

In addition to the normal rolling hoops, the body of each removable head drum must have a rolled or swedged in hoop the center-line of which shall be not more than 3 inches from the top curl.

(b) Steel sheets of specified gauges shall comply with the following:

Gauge No.	Nominai thickness (inch)	Minimum thickness i (inch)
13	0. 0897	0. 0817
16	. 0747	. 0677
18	. 0478	. 0428
30	0359	0324
22	. 0299	. 0269

Thickness shall be measured at any point on the sheet not less than 1/4 inch from an edge.

§ 178.80-8 Rolling hoops.

(a) Separate hoops to have tight fit on shell and be firmly secured in place. Beading under rolling hoops not permitted. Attachment to drum body by spot welding, except for continuous resistance method, not permitted. Welding of I-bar type directly to body of drum in any manner not permitted.

§ 178.80-9 Closures.

- (a) Adequate to prevent leakage; gaskets required.
- (b) Closing part (plug, cap, plate, etc., see Note 1) must be of metal as thick as prescribed for head of container; this not required for containers of 12 gallons or less when the opening to be closed is not over 2.7 inches in diameter. If unthreaded cap is used it must be provided with outside sealing devices which cannot be removed without destroying the cap or sealing device.

NOTE 1: This does not apply to cap seal over a closure which complies with all requirements.

(c) For closure with threaded plug or cap, the seat (flange, etc.) for plug, or cap, must have 3 or more complete threads; two drainage holes of not over Ma-inch diameter are allowed. Plug, or cap, must have sufficient length of thread to engage 3 threads when screwed

home with gasket in place.

(d) Full removable head drums over 5 gallons capacity must be closed by means of 12 gauge bolted ring with drop forged lugs, one of which is threaded, and having % inch bolt and nut for drums not over 30 gallons capacity and 5/8 inch bolt and nut for drums over 30 gallons capacity. Five gallon drums must be of lug type closure with cover having at least 16 lugs. Other types of closures are authorized if they perform without failure under the tests required by this section and a record of the tests is retained during the period the closure is in

[44 FR 66197, November 19, 1979]

(a) Leaks and other defects to be repaired by method used in constructing container, not by soldering.

§ 173.80-11 Marking.

(a) Marking on each container by embossing on head, except that such embossment must be on the permanent head for drums having removable heads. with raised marks, or by embossing or die stamping on footring on drums equipped with footrings, or on metal plates securely attached to drum by brazing or welding not less than 20 percent of the perimeter, as follows:

(1) DOT-5. In addition, when the container is of stainless steel, the type of steel used in body and head sheets as identified by American Iron and Steel Institute type number, and also the letters HT following steel designation on containers subjected to stress relieving or heat treatment during manufacture (for example, DOT-5-304 or DOT-5-304 HT as applicable), shall be shown.

(2) Name or symbol of person making the marks specified in paragraph (a) (1) of this section. Symbol, if used. must be registered with the Associate Di-

rector for OE.

[43 FR 36445, August 17, 1978; 44 FR 55577, September 27, 1979]

(3) Gauge of metal in thinnest part, rated capacity in gallons, and year of manufacture (for example, 14-55-50). When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first (for example 14/12-55-50 for body 14 gauge and head 12 gauge).

§ 178.80-12 Size of markings.

(a) Size of markings (minimum): 1/2" high for 33-gallon or less, 34" for over 33 and not over 55 gallons, and 1" for over 55 gallons.

§ 178.80-13 Type tests.

(a) Samples taken at random and closed as for use, shall withstand prescribed tests without leakage. Tests to be made of each type and size by each company starting production and to be repeated every 4 months. Samples last tested to be retained until further tests are made or for 1 year, whichever period is shorter. The type tests are as follows:

(1) Test by dropping, filled with water to 98 percent capacity, from height of 4 feet onto solid concrete so as to strike diagonally on chime, or when without chime seam, to strike on other circumferential seam; also additional drop test on any other parts which might be considered weaker than the chime. Closing devices and other parts projecting beyond chime or rolling hoops must also be capable of withstanding this test.

(2) Hydrostatic pressure test of 40 pounds per square inch sustained for 5 minutes: except that full removable head drums must sustain 20 pounds per square inch.

(3) Periodic drop and hydrostatic tests are not required when containers fabricated of stainless steel have satisfactorily withstood prescribed tests at the original start of production. Satisfactory test

results must be obtained on samples of subsequent containers that have been altered in design or construction. In instances where manufacturers have suspended production for an interval of 12 months or more, drop and hydrostatic tests must be again conducted as prescribed in subparagraphs (1) and (2) of this paragraph as for original start of production. Samples last tested to be retained until further tests are made or for one year, whichever period is shorter.

§ 178.80-14 Leakage test.

(a) Each container shall be tested, with seams under water or covered with soapsuds or heavy oil, by interior air pressure of at least 15 pounds per square inch. Equally efficient means of testing may be authorized upon approval by the Associate Director for OE. Leakers shall be rejected or repaired and retested without failure. Removable head containers need not be tested with heads in place except that samples taken at random and closed as for use. of each type and size, must be tested at start of production and repeated every 4 months. Samples last tested must be retained until further tests are made or for 1

TAB PLACEMENT HERE

E	SCRIPTION:
	HW HANDLING
X	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



ARTHUR M. STEVENS Justrite Mfg. Co. Des Plaines, IL

Handling Flammable Liquids Safely

Classification and Storage Guidelines

andling flammable liquids in the plant presents numerous hazards. A drum of flammable solvent arriving at the receiving dock is potentially a powerful bomb that careless handling or storage can detonate. Pound for pound, flammable liquids can explode with more force than dynamite. For example, 5 gal of gasoline is estimated to explode with a force equal to 415 lb of dynamite.

Flammable or combustible liquid vapors ignite first in 22 percent of all fires in industrial plants. Because flammable liquids are so obviously hazardous, plant procedures must include the safety factors necessary to keep flammables protected, if not isolated, from exposure to fire. This series of three articles discusses the safe control of flammable liquids in the plant, from storage to transfer and use, to disposal. The first article defines flammable liquids, and reviews safe storage practices and the equipment available to maximize safety. Future articles will outline the procedures to follow and the equipment to use for transferring, using, and disposing of flammables.

Definition and classification—What is a flammable liquid? A flammable liquid is defined by the Occupational Safety and Health Administration (OSHA) and by National Fire Protection Association (NFPA) standard 30*, "Flammable and Combustible Liquids Code," as any liquid with a flash point below 100 F (37.8 C) and a vapor pressure not exceeding 40 psia at 100 F.

Flash point is the lowest temperature at which a liquid gives off sufficient vapor to form an ignitable mixture with air. In a flammable liquids fire, the vapors from the liquid ignite. Vapor pressure is the pressure exerted by the evaporation of vapor above the surface of a liquid in a closed container. Vapor pressure of a liquid increases with temperature. Properties of some common flammable liquids are listed in Table I.

*NFPA 30, "Flammable and Combustible Liquids Code." may be ordered from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269; 617-770-3500.

Flammable liquids are called Class I liquids and are divided into three groups—Class IA, IB, and IC—according to the degree of the hazard. Liquids with flash points above 100 F are called combustible. The classification system is outlined in Table II.

Many plants using several classes of flammable and combustible liquids have found it practical to store and handle all classes as Class IA liquids. This approach simplifies training and minimizes compliance problems. It also is safer.

Storage—A fire requires fuel, oxygen, and heat. The safety equipment and methods used to handle flammable liquids must control one or more of these essentials from the time flammable liquids arrive until they are spent or disposed of as waste and removed from the plant. Safe storage of flammables is best discussed by following a drum of flammable liquid from arrival at the plant through dispensing and use.

Before the drum is moved from the receiving dock, a drum vent should be installed. The 2 in. bung cap is simply removed and the vent is screwed in. A vent should be installed, even if the drum will be stored temporarily, before a pump or a faucet for dispensing the contents is put in place.

The safety drum vent prevents pressure from building up inside the drum if it is exposed to heat. It also prevents a vacuum from forming if the drum is subjected to sudden cooling. Increased pressure in a drum is the major cause of the explosion of flammable liquids. Both pressure and vacuum can cause a drum to fail or leak.

After an approved drum vent is installed, the drum can be moved safely to a drum storage room or secured in a safety storage cabinet near the area it will be used, and set



Drums must be prepared for dispensing flammable liquids. This horizontally-stored drum is equipped with a self-closing safety faucet, a safety vent, and grounding and bonding wires. The drum rests on a cradle; a drip can has been placed under the faucet



Storing drums vertically, and pumping the flammable liquids, is generally faster and safer than using a faucet. This method does not require all the accessory equipment needed for faucet-draining. Most pumps include fill hoses and have built-in pressure relief vents, vacuum breakers, and drip-proof spouts. Integral bonding wire in the hoses minimizes static electricity, and counters on the pumps accurately measure the volume of liquid dispensed.

up for dispensing. In most plants, bulk supplies of flammables are stored in drum rooms in 30 and 55 gal drums. Smaller quantities are held more conveniently in safety cans with capacities of 5 gal or less in cabinets close to the point of use.

The flammable liquids storage room is probably the first place an OSHA inspector would check for violations. Many problems can develop here because storage rooms are not usually well-patrolled by management. The people using them often are hurried and not as careful as they should be.

Nonetheless, OSHA has issued numerous safety requirements to which drum rooms must conform from the type of construction, light-

ş.,	A		and the same of th
4	TADIEL DOODE	DTIECOECOM	MON FLAMMABLE LIQUIDS
-	MOLE I. PRUPE	HILES OF COM	VION FLAWWABLE LIQUIDS

COMMON NAME	FLASH POINT, F*	BOILING POINT, F	FLAMMA	BLE LIMITS UFL, percent
Acetone	0 c.c.	134	2.6	12.8
Benzene (Benzol)	12 c.c.	176	1.4	8.0
Ethyl Alcohol (Ethanol)	61 o.c.	173	3.3	19
Heptane	25 c.c.	209	1.2	6.7
Isopropyl Alcohol	59 o.c.	180	2	12
Methyl Alcohol (Methanol)	54 o.c.	149	6	36.5
Naphtha, V,M,&P	20 c.c.	200-400	0.9	6.0
Toluene	40 c.c.	231	1.27	7.0

	TABLE II. CLASSIFICATI	ON OF
-	FLASH POINT, F	
	below 73	below 100
	below 73	above 100
	at least 73, but below 100	
	at least 100, but below 140	
	at least 140 but below 200	

ing, switches, and ventilation to the protection systems that are installed. Approved methods of equipping a drum and dispensing liquids from it must be followed. Aisle widths, stacking heights, and maximum storage capacities, also are indicated. The OSHA regulations—Subpart H, section 1910.106—should be consulted for specific measures.

200 and above

CLASS

IIIA

NFPA 30, "Flammable and Combustible Liquids Code," especially chapter 4, also is an excellent guide to proper drum room construction and should be studied before a storage room is built. It reviews the use of fire doors, sills, and ramps; shelving materials; wiring; and the installation of either gravity or continuous mechanical exhaust ventilation systems. The standard also outlines the need for and application of automatic fire protection systems in storage rooms. However, as state and local codes may vary from national standards, they also should be reviewed before the drum room is planned.

Once the drum of flammable liquid is in place in an adequately constructed storage room, it should be connected by a grounding wire to the room's grounding system. Grounding allows static electricity charges to drain off before they can build up to spark-producing potential. Any earth ground that permits good metal-to-metal contact to the grounding-wire clamping mechanism is acceptable. Cold water pipes are commonly used; however, care must be taken to assure that plastic piping does not interrupt conductivity between the points at which the earth ground is established and the drums are grounded.

Dispensing—Each drum must also be prepared for dispensing using one of two approved methods, depending on storage position. Horizontally-stored drums are faucetdrained and depend on gravity flow for dispensing. In addition to being equipped with a safety vent and grounding wire, drums stored in this way must be outfitted with a safety faucet, drip can, and bonding wire. The bonding wire connects a container being filled to the drum.

Use of a drum cradle simplifies moving a drum in cramped areas and allows for easier shifting from the vertical to the horizontal position. The cradle also serves as a sta-

The Care and Handling of Barrels and Drums

Drums and barrels could be thought of as having a life of their own, especially if they are filled with hazardous materials. When they are stored in the wrong place, are handled roughly or become damaged, they can become dangerous and unpredictable. A drum on-the-loose and rolling could explode or knock down equipment or people, causing severe damage or injury. So handle with care and do not underestimate the power of a drum for injury or destruction.



Ask yourself: can you handle the drum alone or should you get assistance?; do you have enough room to safely lems? what problems could you possibly encounter?; what can I do to avoid these problems?

Use safety gloves, shoes and any other protective clothing given to you by your supervisor.

Use any special handling equipment given to you to lift the drums or barrels. Remember: a full 55-gallon drum could weigh as much as 800 lbs.

Only bring to the operations area enough materials in drums and barrels for one shift.

Barrels and drums should be stored in nonhazardous areas, with proper ventilation and fire safety systems. Stored, filled drums should not be placed in direct sunlight. Always store drums off the ground with the large closure upward.

Check labels on containers before stacking. Different materials should be stored separately with wide aisles between.

When stacking barrels and drums, make sure the ends of the bottom row are blocked.

Loosen closure vents above the liquid level at frequent intervals to relieve possible internal pressure. After venting, retighten the closure.

Never strike drums with tools or other metal objects.

Check barrels and drums for projecting nails, jagged hoops and metal bands, loose or protruding wire ends, and splinters and slivers.

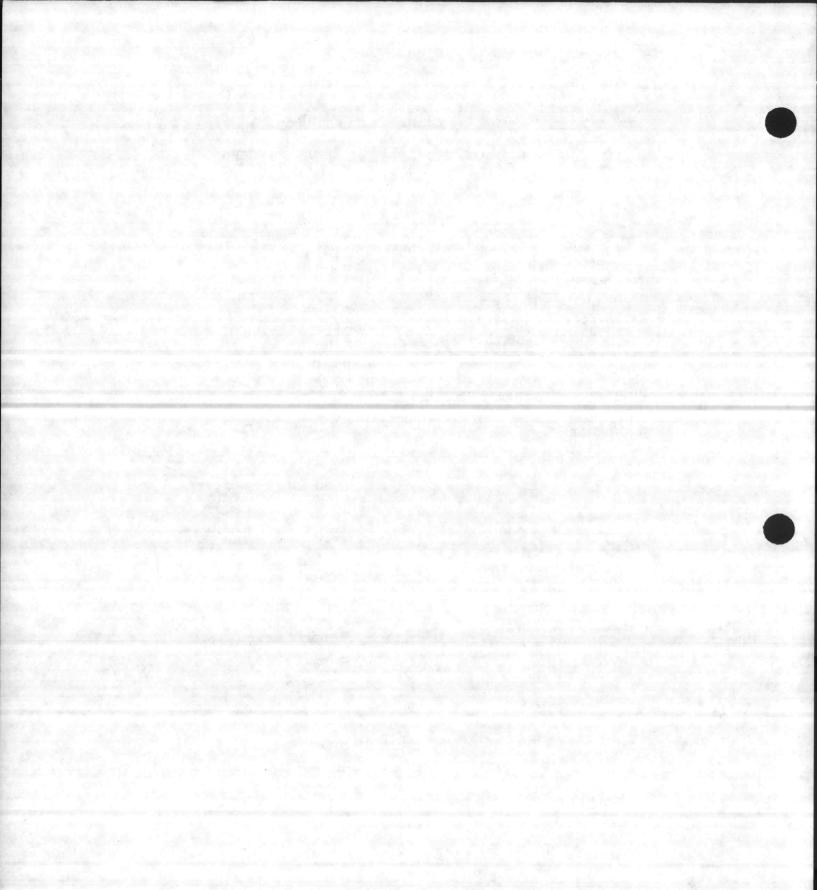
Do not attempt to make repairs on any damaged drums, especially filled drums. Only drum owners or manufacturing plants should make repairs on empty drums.

Do not smoke when filling, handling, testing or emptying drums.

Never put water or other liquids foreign to the original contents in the drum. Return the drum to the supplier when empty.

Products spilled on the outside of the drum should be stetled well water. Tes and feel P. H. Level

After the contents have been removed, drums should be completely drained and the closure securely replaced.



.

.



Hazardous Materials Technical Center

Hazardous Materials Technical Center P.O. Box 8168 Rockville, MD 20856-8168

> PLACE STAMP HERE

Hazardous Materials Technical Center P.O. Box 8168 Rockville, MD 20856-8168

About HMTC

The Hazardous Materials Technical Center (HMTC), established in June 1982 by the Defense Logistics Agency (DLA), is operated by the Dynamac Corporation of Rockville, Maryland. The U.S. Army Environmental Hygiene Agency is the technical monitor for the Center.

The purpose of HMTC is to provide technical expertise to DOD personnel involved with the handling, storage, transportation, and disposal of hazardous materials. This expertise will be furnished through access to a technology database and availability of handbooks, reports, bibliographies, abstracts, and newsletters. In addition, HMTC will provide technical support to the DOD Hazardous and Solid Waste Management Committee.

HMTC Activities

HMTC will conduct the following major activities related to hazardous materials technology and regulations:

- Develop and operate a database incorporating technical literature, regulations, and current research
- Develop handbooks, state-of-the-art reports, technology reviews, and related products
- Publish a newsletter, compendium of abstracts of current literature, and bibliographic index
- Provide a response service to technical and bibliographic inquiries
- Provide environmental and disposal information for incorporation into the Hazardous Materials Information System operated by DLA.

Database Development

HMTC staff will research published and unpublished materials and enter relevant information into the HMTC database. This database, consisting of a computer-indexed physical repository, will contain the latest information on:

- Chemical/physical properties of hazardous materials
- · Safety and health data
- Storage, handling, and transportation procedures
- · State-of-the-art disposal methods
- Pertinent Federal, State, and local laws and regulations.

Product Development

HMTC staff will prepare technical products that will include handbooks, comprehensive monographs, state-of-the-art reports, technology assessments, abstracts, indexes, and critical reviews. These products will be tailored to fulfill your needs for specific, detailed, authoritative, and usable information for solving hazardous materials problems.

Current Awareness

You will be able to keep abreast of current information through the HMTC newsletter and compendium of HMTC abstracts and bibliographic indexes. As a part of the current awareness program, HMTC staff will evaluate your response to HMTC services and products to ensure that they fit your needs.

Inquiry Processing

HMTC has been established for your use. For additional information or to discuss your hazardous materials problems, contact HMTC.

Call

800-638-8958 In Maryland, call collect 301-468-8858 FTS No. 202-468-8858

HMTC newsletter, please For additional information and a free copy of the complete this form and return to HMTC.

Name	Position	Address	City
			State
			Zip

(Area Code) Telephone

CHAPTER VIII

HAZARDOUS WASTE HANDLING

I. LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Identify and avoid safety hazards caused by improper use of material handling equipment (MHE).
- B. Anticipate potential spill/release problems that could be caused by improper waste handling procedures.
- C. Identify and comply with any special handling requirements for hazardous waste.

II. INTRODUCTION.

If you are going to be handling hazardous wastes, it is important that you understand some of the problems that can occur if you fail to take certain precautions. Of course, you can have difficulty in handling any item, but the special characteristics of hazardous wastes can really give you trouble. Although many common problems are associated with having to move improperly packaged items, it is important to realize that packaging techniques alone will not necessarily prevent spills or accidents. During this unit of instruction, we will cover the use of materials handling equipment, explain why proper handling procedures are necessary, describe some of the common hazardous waste handling problems you may face, and talk about the importance of following local safety procedures in handling hazardous waste at your worksite.

III. MATERIALS HANDLING EQUIPMENT.

The following examples of MHE used at Naval facilities are familiar to most personnel. The safety precautions described for this equipment should be observed at all times but special care must be taken with hazardous wastes because of the serious consequences of a mistake or accident. Damaged packaging, spills (especially those in which two or more hazardous wastes are mixed), or other accidents caused by misuse of MHE can cause major problems.

A. Forklift trucks.

1. General. Forklift trucks are designed to pick up, carry, and stack unit loads of supplies and equipment. Standard forklift trucks are available with lifting capacities of 2,000 to 20,000 pounds and lifting heights of 100 to 210 inches. Gasoline-powered forklift trucks may be equipped with solid rubber or semisolid tires for use in warehouses or pneumatic tires for use in outdoor storage areas; electric-powered forklift trucks are equipped with solid rubber or semisolid tires for indoor operation only. Forklift trucks are not designed to be used as two vehicles and should not be used for that purpose.

1098D Date of last revision: Jun 84

Electric-powered models are more suitable than gas-powered ones for poorly ventilated areas and (when properly shielded) for handling flammable items and explosives. The National Fire Safety Standard for Powered Industrial Trucks lists 13 different types of forklifts. Several of these are described below:

- (a) Type D units are diesel powered units having minimal acceptable safeguards against inherent fire hazards.
- (b) Type DS units are diesel powered units that, in addition to all the requirements for the type D units, have additional safeguards to the exhaust, fuel, and electrical systems.
- (c) Type DY units are diesel powered units that have all the safeguards of the type DS units and, in addition, do not have any electrical equipment, including ignition. They are equipped with temperature limitation features.
- (d) Type LPS units are liquified petroleum gas powered units that are provided with safeguards against inherent fire hazards as well as having additional safeguards to the exhaust, fuel, and electrical systems.
- (e) Type E units are electrically powered units having minimum acceptable safeguards against inherent fire and electrical shock hazards.
- (f) Type ES units are electrically powered units that, in addition to all of the requirements for the type E units, are provided with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperature.
- (g) Type EE units are electrically powered units that have, in addition to all of the requirements for E and ES units, the electric motors and all other electrical equipment completely enclosed.
- (h) Type EX units are electrically powered units that differ from the E, ES, and EE units in that the electrical fittings and equipment are so designed, constructed, and assembled that the units may be used in atmospheres containing specifically named flammable vapors and dusts.
- Type G units are gasoline-powered units having minimum acceptable safeguards against inherent fire hazards.
- (j) Type GS units are gasoline-powered units that, in addition to all the requirements for tye type G units, are provided with additional safeguards to the exhaust, fuel, and electrical systems.

The fact that different types of forklifts exist is important because different situations require the use of specific types of forklifts to handle materials safely.

- 2. Safety precautions. The following safety rules are applicable to forklift truck operations.
 - (a) Forklift truck operators will slow down at all cross aisles and other passageways; when entering or leaving warehouses, the operator will come to a complete stop at the entrance, sound the horn, and proceed only when the way is clear.
 - (b) Under all travel conditions, the truck shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
 - (c) Forklift trucks will not travel with the forks elevated more than 4 inches above the floor or ground and when parked, the forks will be lowered and rest on the ground.
 - (d) Stacks will not be bumped or pushed with the forklift trucks to straighten or move the stack.
 - (e) The load capacity plus the gross weight of each truck will be placed on the machine at a place that is visible at all times. The capacity will not be exceeded and counter-weighting of the trucks to increase lifiting capacity is prohibited.
 - (f) People will not stand under the loads being hoisted or lowered.
 - (g) Forklift trucks will be driven forward when transporting cargo up ramps or other grades and will be driven in reverse on downgrades.
 - (h) People will not be allowed to ride forks, machine, or load when the forklift truck is moving.
 - (i) Forklift trucks will be driven slowly over railroad or rough surfaces.
 - (j) Overhead doorways and crossbeams will be cleared by the forklift truck.
 - (k) When the operator parks a forklift truck, he must check the brake to be sure the truck will not move.
 - Operators of forklift trucks must not cut corners. This
 practice may result in upset loads, damaged goods, and
 serious injury.
 - (m) Operators will not jam on the brakes or stop suddenly.
 - (n) Operators must know where the override (panic) controls are located on electric forklifts and how to use them in an emergency. Incidents have occurred where the controller contact points have stuck shut or welded shut, preventing normal control of the forklift. Emergency controls must be checked each time the forklift is operated to make sure they work.

3. Fire hazards. A large number of fires involving forklifts are caused by equipment failure due to a lack of maintenance. Requiring special attention is the detection of faulty fuel connections on gasoline forklifts and the removal of accumulations of grease and dirt on all types of equipment. The number of fires involving battery-powered trucks is comparatively small; however, electrical short circuits, hot resistors, arcing or fused contacts, and exploding batteries have caused fires in some forklifts. Any vehicle that emits hazardous sparks or flames from the exhaust system should be removed from service immediately. When dealing with hazardous wastes, not only can the forklift start on fire but the flammable cargo may also ignite or explode.

B. Handtrucks.

- 1. General. Handtrucks are useful in all types of storage operations, particularly where mechanical equipment cannot be employed because of space limitations. They are often more economical to use for the movement of a single item than a piece of mechanical equipment. The four-wheel handtruck may be used to advantage in carrying light loads or for any operation involving short hauls with frequent stops. Because they can be more easily controlled, handtrucks are often the safest way to move small quantities of hazardous waste.
- 2. Safety precaustions. The following safety rules are applicable to handtruck operations.
 - (a) The two-wheeled handtruck should not be used to transport units of material heavy enough to cause undue strain on workers.
 - (b) Barrel-type handtrucks should be provided to move drums, large kegs, or other cylindirical units to prevent rolling or slipping of the material causing possible damage to material or injury to workers.
 - (c) Handtrucks with spark proof wheels or rims will be used in areas or rooms where wastes of highly flammable or explosive nature are stored or handled.

C. Pallets.

1. General. A pallet is a low portable platform constructed of wood, metal, or fiberboard, built to specified dimensions, on which supplies are loaded, transported, or stored in units. Flat pallets are either single faced or double faced. Single-faced pallets have one platform with stringers underneath on which the weight of the load rests. Double-faced pallets have two platforms, separated by stringers. Pallets may allow two-way or four-way entry. The two-way entry pallet is so constructed that the forks of a forklift truck may be inserted from either the front or rear of the pallet. The four-way pallet is built so that forks may be inserted from any side. Pallets permit

transporting, storing, or issuing quantities of waste with a minimum of manual handling. The efficiency of operations is greatly increased since the pallet system of storage provides for the transportation of packaged items in unit loads and increases the volume and tonnage of wastes which may be handled per manhour.

- 2. Problems. While the use of pallets is widespread and very necessary from a material handling perspective, there are potential problems that can cause spills of hazardous waste if a worker is not careful. The following questions should be considered when working with pallets.
 - (a) Is the pallet you're using of sound construction? Spills can be caused if you've loaded hazardous waste on pallets that are falling apart.
 - (b) Does the load fit the pallet? Often material is loaded so that it hangs over the edge of the pallet. A forklift truck or adjacent stack of material will often damage the container in such a case leading to a leak or spill of hazardous waste.
 - (c) Is the unit loaded evenly? Hazardous waste unevenly stacked will fall causing all sorts of problems.

IV. MHE SELECTION FACTORS.

The potential savings in terms of time, funds, and personnel resulting from the selection of the right type of MHE for an operation cannot be overemphasized. When handling hazardous wastes, this selection can be especially significant. When selecting equipment, the size, shape, weight, and container strength of the commodities to be handled should be considered. Some examples of the application of MHE are as follows:

- A. Palletized supplies are handled best by forklift trucks.
- B. Small, uniform sized commodities or containers are readily adaptable to palletization and handling as a unit by forklift trucks.
- C. Containers such as large bales, crates, or boxes may be efficiently handled and stacked by forklift truck with the use of short dunnage or special fork attachments.
- D. Large items packed in boxes or crates, with cleats or runners nailed to the underside of the container are generally adaptable to handling by forklift trucks.
- E. For small items to be moved over a short distance, or for handling items in confined areas, the handtruck may be most useful.

V. WASTE HANDLING PRINCIPLES.

Whether or not an item is hazardous, certain general principles exist that should be recognized when a Navy facility is establishing procedures to handle waste. By developing an understanding of these principles, a worker will be able to recognize if the procedures being used are the best ones possible under the circumstances. Generally:

- The least handling is the best handling. The greatest economy in moving materials is secured by not handling the material at all. This is usually impossible but an attempt must be made to keep handling to a minimum. Since there is always a danger of a spill when moving hazardous wastes, the less they are moved, the less chance of a major incident. If hazardous wastes are properly identified and classified, they can be properly placed initially, thus reducing the need for further movement. Also, to avoid unnecessary handling, a single individual should be designated as the point of contact for handling and storage questions pertaining to hazardous wastes. This individual would be familiar with hazardous waste safety, storage, and handling considerations and could insure items were properly placed initially and handling requirements minimized. Another way handling can be minimized is to modify traditional storage and handling procedures. The feasibility of modifying procedures would depend on local facilities and operational procedures.
- B. Standardization of methods and equipment benefits the waste handling activity. Costs of operation can be reduced because maintenance and repair, storage, and handling procedures can be simplified. As standardized procedures are repeated, individuals become familiar with the special handling required for different types of hazardous wastes and are, thus, more likely to use correct procedures.
- C. Materials handling equipment should be selected for a multiple number of applications. Equipment should be purchased with the understanding that flexibility is a key note. Specialized equipment should be kept to a minimum. Normally, initial cost, cost of operation, and maintenance costs are greater for special equipment than for standard equipment. If equipment is used properly, most hazardous wastes can be handled safely using standard equipment.
- D. The number of items to be moved determines the method of handling.
 Regardless of the size, shape, or hazardous characteristic, the first
 question to be answered before selecting the type of MHE to be used
 is "how many have to be moved?"
- E. Advanced planning on waste handling methods and equipment should be carried on at the same time as other planning activities. This is particularly true with hazardous wastes since it is much easier to prevent an incident than to respond to one.
- F. Equipment capacities should never be exceeded. Overloading causes excessive wear of equipment and creates additional accident potential.
- G. The physical state of materials is a factor in determining MHE requirements. The three physical states of material—solid, liquid, or gas—determine the method of packing. Gases are contained in cylinders; liquids such as acids are contained in carboys; and solids such as sheet and bar stock metals may require wood skids. This type of packaging, in turn, influences selection of materials handling equipment.
- H. Short, irregular moves lend themselves to manual materials handling. Some materials handling operations do not occur with any degree of repetitiveness. The use of equipment may be much more costly than

manpower. When moves are short, irregular and the load capacity of the men is not exceeded, it may be more economical to use manpower. Although this principle is generally applicable, when handling hazardous wastes, the facility must consider the cost of individual protective clothing and equipment as well as personal safety.

I. Wherever practicable, materials should be moved in the horizontal plane or with the aid of gravity. When people have to reach either up or down during loading and unloading, excessive effort is used. Changes in the workplace layout could reduce this extra effort and the inherent safety problems associated with lifting things up and down. An example of such a problem is accidently knocking a small bottle of hazardous waste off a shelf while trying to reach another item.

VI. WASTE HANDLING SAFETY PRECAUTIONS.

There are a number of safety precautions that should be followed when handling any material. Given the special characteristics of hazardous wastes, it makes good sense to be especially sure you take these precautions when working with these wastes. When considering the following safety rules, think of how they might prevent spills or personal injuries.

- A. Protective clothing and accessories including gloves, face shields, goggles, and safety shoes will be worn when required.
- B. Material will be examined for leaks, container damage, corrosion, weakened places, or other factors which may cause injury to workers. Defects should be corrected before proceeding.
- C. All stacked items will be arranged in an orderly manner for convenient and safe handling.
- D. Defective or broken strapping on packages will be removed, repaired, or replaced.
- E. Containers will not be thrown from elevated places to the floor or ground. Use suitable lowering equipment.
- F. Wheelbarrows, handtrucks, and other similar devices will not be overloaded. These devices will be pushed, not pulled, except when going up inclines.
- G. Ropes used for carrying or towing which have defects will be replaced.
- H. Appropriate tools will be used for each job. For example, nail pullers will be used for opening boxes, strap or wire cutters for cutting metal strapping or wire, and hammers for driving nails. Safety handtools are constructed of wood or other nonsparking or spark resistant materials (such as bronze, lead, and beryllium alloys) which, under normal conditions of use, will not produce sparks. Properly maintained, nonferrous handtools will be used for work in locations which contain hazardous concentrations of flammable dusts, gases, or vapors. Handtools used in the vicinity of hazardous wastes must be handled carefully and kept clean.

- Hand-operated trucks, dollies, and similar equipment will not be parked in traffic lanes or roadways.
- J. Cylindrical objects will be blocked to prevent rolling.
- K. When working at high elevations, a lifeline and safety belt will be worn if other safeguards are impractical.
- L. Carboy tilters will be used for safe removal of dangerous liquids, such as acids from carboys.
- M. Special bung fittings and automatic faucets will be used on drums for dispensing and storing of dangerous liquids.
- N. When transferring flammable liquids from one container to another, make sure that the container is grounded and that a connector exists between the two containers.

VII. HAZARDOUS WASTE HANDLING CONSIDERATIONS.

So far, we have talked about the various types of MHE available to you. general principles for using MHE, and safety precautions to take when handling hazardous waste. It is useful to review some of the reasons why extra attention should be paid to handling hazardous wastes. Essentially we are trying to prevent accidents, spills that damage the environment, and damage to the waste being moved (either directly or indirectly). It is important to remember that damaging the pallet or outer container will often result in spills or accidents at a later time. That is why it is necessary to avoid such things as damaging a pallet or container by hitting it with a forklift. When handling a hazardous waste, it is useful to recall why the waste is hazardous. It may be sensitive to an increase in temperature; it may be sensitive to vibration; it might react adversely to water; or it might be under pressure. If you fail to consider these factors when handling hazardous waste, you can expect trouble, either immediately or later on. There are a number of questions you can ask yourself that can help you handle such waste safely. These include:

- A. Am I handling hazardous waste in accordance with local operating procedure?
- B. Have I avoided handling incompatible wastes at the same time?
- C. Am I using the right piece of MHE to move this item?
- D. Am I operating MHE safely?
- E. Am I using adequate personal protective equipment?
- F. Am I avoiding damaging the outer container?
- G. Am I using proper procedures to handle hazardous waste?
- H. Do I report/clean up spills when they occur?
- I. Do I know how to identify an item as hazardous prior to moving it?

- J. Do I understand "what can go wrong" when handling hazardous waste?
- K. Do I know how to find out if special handling is required for certain waste?

Being able to answer all of the questions above may not guarantee that accidents and spills will be a thing of the past, but the chances that you will not be responsible for such a problem are increased. Of course, in order to make sure you are not a victim of your friends' ignorance, it is necessary that everyone working at your facility be able to answer these questions and act accordingly.

VIII. SOURCES OF INFORMATION.

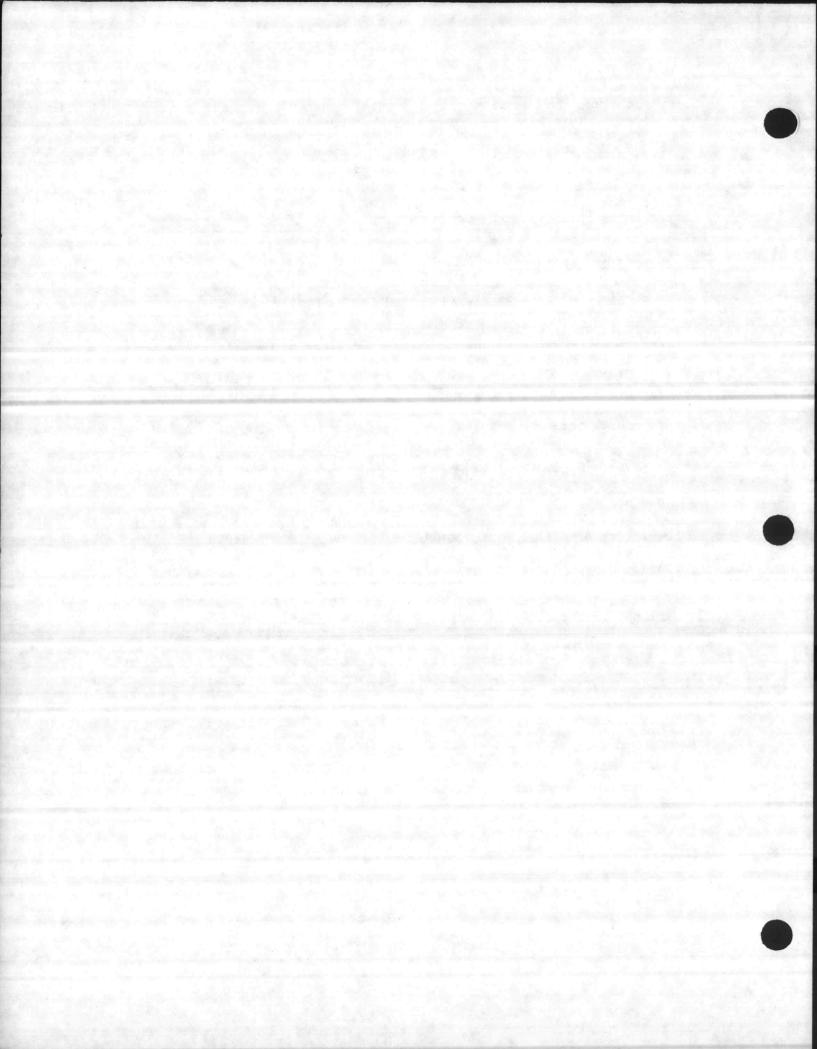
Sources of information provide guidance on handling hazardous materials. One of the best sources is the Department of Defense's "Storage and Materials Handling" (DOD 4145.19-R-1). The table on pages 5-61 to 5-87 gives specific storage and handling guidelines as well as associated hazards for many materials.

Another source of information is the Hazardous Materials Information System (HMIS). This is a microfiche system which lists special handling procedures for each chemical.

Material Safety Data Sheets (MSDS) which accompany any shipment of hazardous material are another important source of handling information.

IX. SUMMARY.

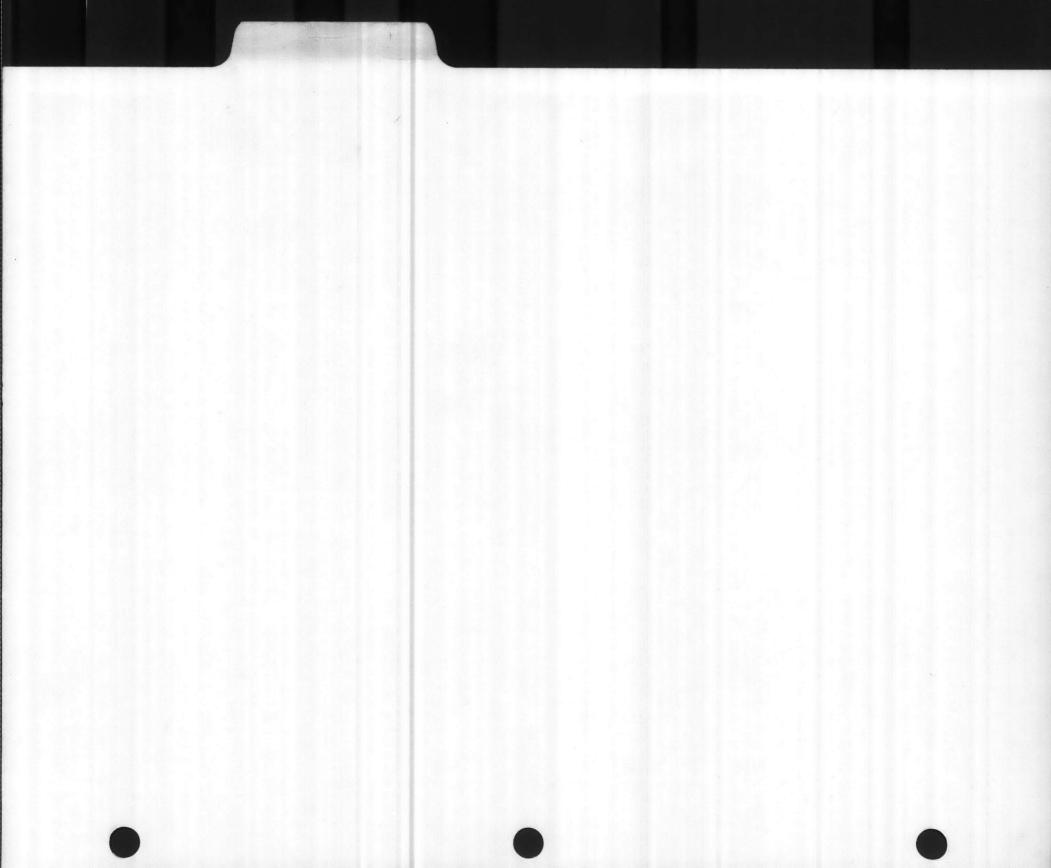
During this unit of instruction, we have covered the use of materials handling equipment; the typical types of MHE available; why proper handling procedures are necessary; and common problems encountered when handling hazardous waste. Proper waste handling procedures can prevent injuries to workers, spills which damage the environment, and damage to valuable material which costs the taxpayer money.



TAB PLACEMENT HERE

DE	SCRIPTION:
	HW STORAGE
X	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



HAZARDOUS WASTE COMPATIBILITY CHART EPA-600/2-80-076 April 1980 A METHOD FOR DETERMINING THE COMPATIBILITY REACTIVITY GROUP NAME NO. OF HAZARDOUS WASTES Acids, Mineral, Non-oxidizing Munic :a Environmental Laboratory Office o Research and Development U. S. En Instantal Protection Agency Cincinnati, 16:0 45268 2 CAUTIONII Acids, Mineral, Oxidizing Into Chart is intended as an inercation of some of the hazards that can be expected on missing chemical wasters. Second of the different citivations of the Inhanelman of compounds that may be excludified, it is not postupite to make any chart definitive and all the thatwell it cannot be extended in a make any chart definitive and all the thatwell it cannot be extended in the state of the compounds of the compou 0 H 3 Acide, Organic Alcohole and Glycole Aldehydes . Amides Ammes, Aliphatic and Aromatic Reactivity Consequences a | a | H | a Azo Compounds, Diazo Compounds and Hydrazines Heat generation H . Carbamates F 10 Innocuous and non-liammable Caustics G Toxic gas generation 11 GT Cyanides 12 GF Flammable gas generation Dithiocarbamates Explosion E Esters Violent polymerization P 14 Ethers Solubilization of toxic substances 8 01 OT 07 15 Fluoridas, Inorganic May be hazardous but unknown U Hydrocarbons, Aromatic 17 Example: 17 Halogenated Organics Heat generation, fire, and toxic FGT 18 Isocyanates gas generation 19 Ketones 20 Mercaptane and Other Organic Sulfides Metals, Alkali and Alkaline Earth, Elemental 21 Metals, Other Elemental & Alloys as Powders, Vapors, or Sponges 22 Metals, Other Elemental & Alloys as Sheets, Rods, Drops, etc. 23 Metals and Metal Compounds, Toxic 24 26 Mitrides 26 Mitriles, 27 G.F 27 Nitro Compounds, Organic Hydrocarbons, Allphatic, Unsaturated 29 Hydrocarbons, Aliphatic, Saturated G.F 30 Peroxides and Hydroperoxides, Organic 31 Phenois and Cresols Organophosphates, Phosphothicates, Phosphodithicates 32 33 Sulfides, Inorganic H . U 34 Epoxides Combustible and Flammable Materials, Miscellaneous 102 Explosives Polymerizable Compounds Oxidizing Agents, Strong Reducing Agents, Strong Water and Mixtures Containing Water EXTREMELY REACTIVE 107 DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL - EXTREMELY REACTIVES Water Reactive Substances 10 11 12 13 14 15 18 17 18 19 20 21 22 23 24 25 26 27 23 29 30 31 32 33 34 10 10 2 10 3 10 4 10 5 10 6 107 1 2

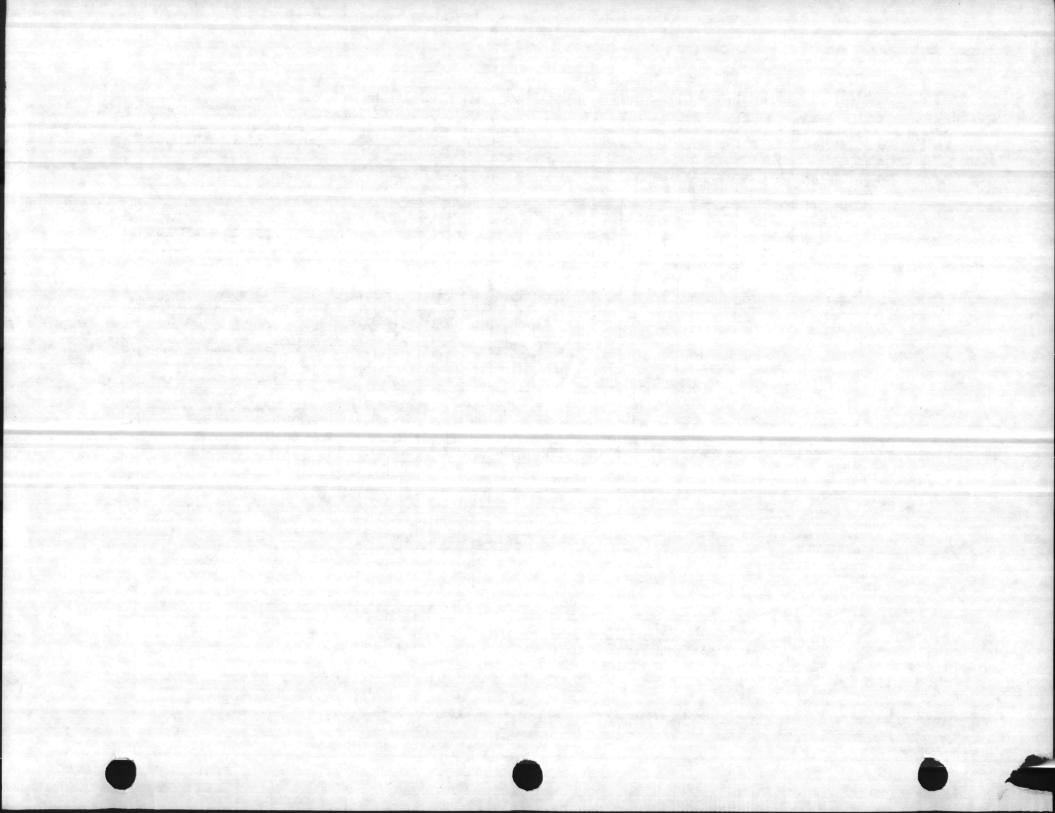


Table 5-5. Hazardous Materials Storage and Handling Criteria

		Hazard	Identity			-		Тур	e of Store	ge Facilit	ies	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	Stor- age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whae	Fire Extin- guisher Type	Class Liquid
Acetaldehyde	2.	4	2	0	Store in end of building to aid fire	A	4' aisle space	х				2a-3	IA
Acetic Acid	2	2	1	0	fighting. Separate from chromic acid, nitric acid and sodium peroxide.	В	Minimum of 4' aisle space		x			1-2a-3	11
Acetic Acid Anhydride (See Acetic Anhydride). Acetic Acid (Glacial) (See Acetic Acid).													
Acetic Anhydride	2	2	2	E	Protect against physical damage.	A	4' aisle space	Х				2a-3	II
Acetone	1	3	l o	0		A			1				- 9 - 7
Acetone Cyanohydrin	4	1	2	o	Protect against physical damage.	A	4' aisle space from class I flammables.	X				2a-3	111
Acetonitrile	2	3	1	0	Protect against physical damage.	A	4' aisle space	X				2a-3	IB
Acetyl Chloride	3	3	2	Н	Protect against physical damage.	A	None	X				22-3	IB
Acetyl Oxide (See Acetic Anhydride)													
ACETYL PEROXIDE	1	2	4	D	Special storage and handling.	E	4' aisle space						11
(25%) Acetylene		4	3	0	Separate from oxygen and other flammable gases. Store upright.	C	Solid wall compartment or separate building.			х		1–3	IA
Acetylene (in Acetone)	1	4	2	0	The state of the s	1 .	N.	x				2-3	IB
Acetylene Dichloride	2	3	2	0	Protect against physical damage.	A	None					.	
Acetylene Tetrabromide	3	0	1	0	Protect against physical damage.	D	3' aisle space					1	ID
Acrolein	3	3	2	0	Store in end of building to aid fire fighting.	A	4' aisle space					1-22-3	IB
Acrolein Dimer	. 1	2	1	0	Store in end of building to aid fire	A	4' aisle space from class II flammable.	X				. 3-4	11

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hazard	Identity			Stor-		Ту	pe of Stor	age Facili	ties	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whse	Fire Extin- guisher Type	Class Liquid
Acrylic Acid	3	2	2	0	Protect against physical damage.	В	4' aisle space		Х			3	II
(See Acrolein) Acrylenitrile	4	3	2	0	Store in end of building to aid fire fighting.	A	4' aisle space from class II flammables.	х				3-4	IB
Aerosols (Paint)	See la	bel			Store in end of building.	D	3' aisle space				x	2,3,4	
Alcohol (Denatura	-	4	0	0	Store in end of building to aid fire	A	4' aisle space	х				8-4	IB
Aldehyde (See Acetaldeham) Allyl Alcohol See Organic Common Materials. Allyl Aldehyde (See Aerolein) Allyl Chlorocarbonne (See Allyl	3	3	1	0	fighting. Store in end of building.	A	4' aisle space from class II flammables.	x				8-4	IB
Chloroformate)	3	3	1	С	Store in end of	A	4' aisle space from	x				3-4	IC
Allylamine	3	3	1	0	building. Store in end of building.	A	class II flammables. 4' aisle space from class II flammables.	x				3-4	IB
Alum (See Aluminum Potassium Sulphate) Aluminum (Dust or Powder).	0	1	1	E	Separate from combustible items.	D	3' aisle space				x	5	
luminum Acetate	1	0	0	0	No special handling	D	None		A 180		x	1.0	
luminum Ammonium Sulphate.	1	0	0	0	No special handling		None				X	1–3 1–3	
luminum Chloride	3	0	2	E	No special handling	D	None				x	1-3	
luminum Potassium Sulphate.	1	0	0	0	No special handling	D	None				x	1-3	
luminum Sulphate	1	0	0	0	No special handling	D	None	100			x	1-3	

Amino Cyclohexane	4 1 2				make a state of the								
(See													
Cyclohexylamine)										200	100		in the second
minopropane				100									
(See Propylamine)		7			A CONTRACTOR OF THE PARTY OF			and the same		100	-		
minotoluene			7	Part of				1.00	5 3.3	- 500		- AL 1	
(See Toluidine)		100									49		
(Ortho, Para)		-40		_	Separate from gases	C	Separate building or			x		3	
Ammonia (Anhydrous)	3	1	0	0	such as chlorine, bromide, etc.	ŭ,	solid compartment.		The same	erwic			
Ammonium Acetate	0	0	0	0	No special handling	D	None				X	1-3	
Ammonium Bifluoride	2	0	0	ő	No special handling	D	None				X	1-3	
Ammonium Chloride	1	0	0	o	No special handling	D	None				X	1-3	
Ammonium Citrate	o	0	0	ő	No special handling	D	None				X	1-3	
Ammonium Dichromate	3	2	1	D	Separate from	D	3' aisle space				X	1-3	
Ammonium Dichromate		1	0	"	combustible items.					1.00			
Ammonium Hydroxide	2	1	1	0	Separate from combustible items.	D	3' aisle space				X	1–3	
Ammonium Nitrate	2	1	3	D	Separate from Organic	D	3' aisle space				X	1	
Ammonium Nitrate	-		"	1	materials.							A 4	
		1.34	5	0	immediately remove	. 60							
				1	and dispose of any					100			
				1	spilled nitrate.								
		1000			"Bulk quantities should	. 13							
			ring and		be stored in			100					
	100			200	accordance with TO				100				
		San .	200	1	428-1-3."	6.3			2 2				
		1		1 -		D	3' aisle space		L 100		X	1.	
Ammonium Perchlorate	2	1	4	D	Separate from combustible items.	1	o aisie space						
		1				A	4' aisle space with	x			10	3-4	IC
Amyl Acetate	1	3	0	0	Store with class I flammables.	A	class II flammables.	-					
				1			Separate from class I	x			12 11 1	1,3,4	IC
Amyl Alcohol	1	2	0	0	Store with class II	A	flammable by 4'	A .				1-,-,-	The second second
	1				flammables.	N.Ta.		1000			14		
			1		이 경험에 보면 영화 가입을		space.			100			
Amyl Hydrosulfide										2 5 3		1 1 1 1 1	
(See Amyl		0.00	1							Section 6		100	
Mercaptan)							Samuela from alass I	X			10 10	3,4,5	IB
Amyl Mercaptan	2	3	0	0	Store with class II	A	Separate from class I flammable by 4'	^				3,2,0	-
					flammables.				Colores of		ring the city		
		1		1			space.	1		May 60			
Amyl Sulfhydrate		1											
(See Amyl			1										100000000000000000000000000000000000000
Mercaptan)		1										3,4,5	IIIA
Aniline	3	2	0	0	Store with class II	A	4' aisle space	X				3,4,0	IIIA
		1	1	1	flammables.	1	en e			100000			
Anthion	1			1							The St		
(See Potassium			1 44						No.	100	1		1
Persulfate)	1	1	1	1		1		1	1	•	•		

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hazard	Identity			Stor-		Тут	e of Store	age Facili	ties	Portable	
Nous	Health	Flam- ma- bility	Reac- tivity	Spe- cific Has- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose -Whee	Fire Extin- guisher Type	Class Liquid
Anti-Freeze (75% Ethylene Glycol). Antimonie Sulfide (See Antimony Pentasulfide) Antimony Pentasulfide	3	1	1	0	None	D D	4' aisle space				x	3-4	IIIB
Antimony Red (See Antimony Pentasulfide)													
Argon Gas Aqua Fortis (See Nitric Acid)	0	0	0	0	None	С	None			Х		N/A	
Azotic Acid (See Nitric Acid) Barium Binoxide (See Barium Peroxide)													
Barium Chlorate Barium Dioxide	1	0	2	D	Separate from other items.	D	3' aisle space				х	1	
(See Barium Peroxide)						113							
Barium Nitrate	1	0	1	D	Do not store on wood pallets. Immediately remove and dispose of any spilled nitrate.	D	3' aisle space				X	1	
Barjum Peroxide	1	0	1	D	Separate from combustible organic materials. Remove	D	3' aisle space				X	Dry pow- der.	
Barium Superoxide (See Barium					spilled peroxide immediately.								
Peroxide) Bensene	-	3	0	0	Store in end of building to aid fire fighting.	A	Separate from class II flammable liquids by 4' space.	x				3,4,5	IB

Benzol (See Benzene)		1	0	0	Separate from	D	3' aisle space				x	1,3,4		
Benzoic Acid	2				oxidizing materials.									
BENZOYL PEROXIDE.	1	4	4	D	Special facility handling.	E					x	3		
Beryllium (Dust or Powder).	4	1	1	E	Separate from oxidizing materials.	D	3' aisle space							
Biethylene (See Butadiene) Bleaching Powder (See Calcium Hypochlorite) Boroethane														
(See Diborane) Bromine (Small Lots Only).		0	0	М	Separate from acids— Keep from freezing. (Freezing point is 20° F.)	В	Maintain 5' space from acids.		х			1		
Bromochloromethane	1	0	0	0	Protect from physical	D	None				X	N/A		
Bronze (Dust or Powder). Burnt Lime (See		0	1	E	damage. Protect from physical damage.	D	Keep separate from aluminum dust.			-	x	5		
Calcium Oxide). Butadiene Gas	2	4	2	0	Do not store with oxygen cylinders.	c	Separate building or solid compartment.	÷		x		3-4		
Butanal (See Butyraldehyde). Butane Lighter Fuel (2 3-oz containers). Butanoic Acid (See Butyric Acid).	1	4	0	0	Store in end of building.	A	3' aisle space from class II flammables.	х		<u> </u>		8-4		
Butanol (See Butyl Alcohol). Butyl Alcohol	1	3	0	0	Store with class II flammables.	A	Separate from class I flammable liquid by 4' aisle space.	x				3	IC	
Butyl Acetate	1	3	0	0	Store in end of	A	Separate from class II	х				3-4	IB	1
Butyl "Cellosolve"	2	2	0	0	building. Store with class II flammables.	A	4' aisle space from class I flammables.	x				3-4	IIIA	
Butyl Ether (See Dibutyl Ether). BETYL	1	4	4	D	Special storage and handling.	E	4' aisle space		6-2			1,3,4	II	
HYDROPEROXIDE. BUTYL PERACETATE.	2	3	4	D	Special storage and handling.	E								

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hazard	Identity			Stor-		Тур	e of Stor	age Facilit	ties	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bidg	Gen Pur- pose Whae	Fire Extin- guisher Type	Class Liquid
BUTYL PERBENZOATE.	1	3	4	D	Special storage and handling.	E							
BUTYL PEROXYPIVALATE	2	3	4	D	Special storage and handling.	E						3,4	
Butyraldehyde (Normal and Iso).	2	3	1	0	Store in end of building.	A	4' aisle space	х				3,4 Foam	IB
Butyrie Acid	2	2	0	0	Store in end of building.	В	4' aisle space		X			3,4	IIIA
Butyric Aldehyde (See Butyraldehyde).						- Karal							
Cadmium Oxide	3	0	0	0	No special treatment .	D	None				X	1-3	
CALCIUM	1	4	2	E	Special storage and handling.	E						5	
Calcium Carbide	1	4	2	E	Store in unsprinklered, non-combustible shed for storage over 10 drums.	DE	End of warehouse with 3' space from other materials.						
Calcium Cyanide	4	0	0	0	No special treatment .	D	Separate from oxidizing materials.				X	3	
Calcium Hydroxide (Slacked Lime).	1	0	0	0	No special treatment .	D	None				X	1-3	
Calcium Hypochlorite (Bleaching Powder).	2	4	2	E	Protect against physical damage. Keep dry, store in unsprinklered space.	D	Separate from combustible materials by 3' aisles.						
Calcium Oxide (Quick Lime).	1	0	1	0	Store in dry place	D	None				x	1-3	
Calcium Sulfate	1	0	0	0	No special treatment	D	None				x	1-4	
Calibrating Fluid (F.P. 100° F.).	See la	bel		0	Store with class II flammables.	A	Separate from class I by 4' aisle.	х				8-4	11
Calyx (See Calcium Oxide) Carbamic Nitrile (See Cyanamide)									214 1 1 4				
Carbolic Acid (See Phenol)													
Carbon Dioxide (Gas)	1	0	0	0	Extinguishing agent	C	None			x		N/A	
Carbon Dioxide (Solid)	1	0	0	0	No special treatment .	D	None				X	N/A	II

Carbon Disulfide	2	3	1-	0	Stored in end of building to aid fire	A	Separate from class II flammables by 4' aisle space.	x	 		3-4	II
Carbon Removing	See	label .	1	0	fighting. No special handling	D	None		 	X	3-4	
Compound. Carbon Tetrachloride		1 0	1.0	0	Protect from physical	A	None		 	X	N/A	de
		1	1		damage. Store with class II	A	Separate from class I	x .	 		3/4	
Caustic Potash (See Potassium Hydroxide). Caustic Soda (See	See			0	flammables.		flammables.					
Sodium Hydroxide). Celluloid (See Cellulose Nitrate).												
Cellulose Acetate (Dopes)	2	2	3	0	Protect against excess of heat or light.	A	Separate from class I flammables by 3' aisle space.	Х	 		1	
Cellulose Nitrate (Dopes)	2	3	3	0	Store in end of building to aid fire fighting.	A	Separate from class II flammables by 3' aisle space.	X			1,3	
Cement, Rubber	See	label		. 0	Store in end of building to aid in fire fighting.	A	3' aisle space from class II flammables.		 	х	3-4	
Charcoal	0	2	0	0	Store away from oxidizing materials (subject to spontaneous heating).					x		
Charcoal (Activated)	0	2	0	0	Store away from oxidizing materials (subject to spontaneous heating).	D	3' aisle space			^		
Chloride of Lime (See Calcium Hypochlorate). Chlorinated Lime (See Calcium Hypochlorate).									x			
Chlorine	. 3	1	0 1	D	Keep in separate building or separated from acetylene, ammonia hydrogen gases.	С	Solid wall compartments or separate building.		^			
Chlorobenzene (See Monochlorobenzene). Chlorobenzole (See Monochlorobenzene).		ŀ										

15 September 1979

DOD 4145.19-R-1

15 September 1979

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hazard	Identity			Stor-		Тур	e of Stor	ige Facili	ties	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whse	Fire Extin- guisher Type	Class Liquid
Chloroethane (See Ethyl Chloride). Chloroethene (See Vinyl Chloroethylene (See Vinyl Chloride). Chloroform	e de la companya de l	0	0 2	O N	No special treatment _ Drums must be stored with plugs up. Drums must be vented once a week.	D B	None				x	N/A N/A	
Chromic Acid (See													
Chromium Trioxide). Chromic Anhydride (See Chromium					Constitution of the constitution								
Trioxide).	100,000	7.0										100	
Chromium Trioxide	1	0	1	D	Do not store on wood floors or pallets.	В	3' aisle space		X			1	
Cinnamene (See Styrene). Cleaning Compound	San la	hal			Separate from class I	A	4' aisle space from	x			240	5	шв
Solvent (F.P.	See 18	Dei			flammables.	A	class I flammables.	^				•	шь
Cleaner and lubricant (See Methyl Chloroform).													
Cobaltus Nitrate	1	0	1	D	Do not store on wood floors or pallets.	D	Separate from combustible materials by 3' aisle space.				х	1	
Collodion (See Cellulose Nitrate).							news and the same of the same						
Copper Carbonate	1	0	0	0	No special handling	D.	None				X	3	
Copper Sulfide Copper Sulphate.	1	0	0	E	No special handling	D	None				X	1-3	
Copper Nitrate	1	0	1	D	Do not store on wood floors or pallets.	D	Separate from combustible materials by 3' aisle space.				Х	1	

Corrosion Preventive	See lai	bel		0	No special handling	A/D	4' aisle space	x			x	3-4	IIIB	5
(F.P. 350° F.).	G 1-1	1			No special handling	D	None				X	3-4		8
Corrosion Remover	See la	2	0	C	No special handling	A	May be stored with	X				3-4,5	II	2
Cresol, Ortho					No special names		class II flammables.							i i
Meta	3	1	0	C										September 1979
Cresylic Alcohol (See Cresol).								an in				3,4,5	IIA	3
CUMENE HYDRO- PEROXIDE.	1	2.	4	D	Special facility require- ment. Non-combusti- ble, detached, ventilated, unheated building. Water del- uge system required for large quantity storage.	Е	Do not store with other material.					0,4,0		
Cupric Carbonate (See	1	100					A STATE OF THE STATE OF							
Copper Carbonate).			1	1		-				100	· x	1-3		
Cupric Fluoroborate Cupric Nitrate (See Copper Nitrate).	1	0	0	0	No special handling	D	None				^	-		
Cupric Sulphate.			1	1				100			x	1-3	IIIB	
Cyanamide	4	1	3	0	No special handling	D	4' aisle space			X	^	li l		
Cyanogen (Gas)			2	E	Do not store with oxy- gen cylinders.	C	Separate building or solid wall compart- ment.							
Cyclohexane	1	3	0	0	A. S.							1 10		1
Cyclohexanone		2	1.0	0							100		IC	
Cyclohexylamine		8	0	0	No special handling	· A	May be stored with class II flammables.	X				1, 2a, 8,	ic	
Deak (See Diethyl Alu- minum Chloride).											x	3-4		
Decaborane	- 8	2	1	0	Separate from oxidiz- ing agents.	D	3' aisle space				^	-		
Decaboron Tetradeca-							Annual Control of the		Page 1				1000	
hydride (See Decabor ane).												3-4		
Decontaminating Agent	See 1	abel _		. 0			None				X	3-4		-
Deodorants (Dichloro- benzene Ingredients).	2	2	0	0	The second secon	Timer.	9.0	40.00			-	3-4		DOD
Deoxidant					No special handling	. D					1 2	8-4		4
Desiceants (Activated)		1			No special handling	_ D				1 1 1 1 1 1	1	3-4		1
Developer Inspection	See 1	abel _			Store with class II	A		X				- 3-4	The second	ं ज
Penetrants (Fluores- cent and Non-Flu- orescent).					flammables.		flammables by 3' aisle space.							4145.19-B-
Discetyl Peroxide (See Acetyl Peroxide).		1		1						1	1	1		1.5

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hound	Identity		The state of the s	Stor-		Tyr	pe of Ster	age Facili	ities	Portable	
Non	Health	Plan- inity	Reartivity	Spe- cific Han- ard	Storage and Handling	age Comp Group	Separation Requirement	Planna Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whee	Pire Extin- guinher Type	Chao Liquid
Diamine (See Hydra- zine).										Danie .			
Diborane (Gas)	3	4	3	E	Separate from oxygen cylinders. (Gas will ignite spontaneously on contact with air.).	С	Separate building or solid compartment.			х		3-4	IA
Diboron Hexahydrido (See Diborane).					on contact year air.).					Deliver and			
Dibutyl Ether	2	3	0.	0	Store in end of build- ing to aid fire fight- ing.	A	4' space from class II flammable liquids.	х				3,4,5	IC
Dibutylperoxide (Ter- tiary).	2	3	4	D	Store in end of build- ing to aid fire fight- ing.	A	4' space from class II flammable liquids.	х				3,4,5	IB
Dichlorobenzane (Ortho)	2	2	0	0	Store with class II flammables.	A	4' aisle space from class I.	x				1,3,4,5	IIIA
Dichlorobutane	2	2	0	0	May be stored with class II flammable liquids.	A	Separate from class I flammables, 4' aisle space.	х				3,4,5	11
Dichlorodifuoromethane (Freon—12 Gas).	1	0	0	0	No special handling	C	Inert gas—may be stored with any		-	x		1	
Dichloro Ethane (See Ethylene Dichloride). Dichlorothylene (See Vinylidene Chloride).							other type gas.						
Diethyl Aluminum Chloride.	3	3	3	E	Protect containers against shock and damage.	A	May be stored with class II flammables.	x				3-4	
Diethylamine Diethylene Dioxide (See Dioxane).	2	3	0	0								2a,3,4	
Diethylene Ether (See Diaxane).													
Diethyl Ether (See Ether).													
Diethyl Oxide (See Ether).													

15 September 19

Diethylenetriamine	8	1	0	0	Protect against physical damage.	A	May be stored with class II flammables.	X	 		2a-8-4	IIIB
Diethylene Glycol (F.P. 275° F.).		2	0	0	No special handling if in general purpose warehouse.	A,D	4' aisle space if stored in flammable building.	x	 	x	8-4	IIIB
Diethyl zinc	-	3	8	E.	Protect against physical damage.	A	3' aisle space	x	 		8-4	
Diisopropylamine	8	3	0	0	Protect against physical damage.	A	4' aisle space	X	 		2a-3-4	IB
DIISOPROPYL PEROXYDICAR- BONATE.	-	4	4	D	Special handling and facility. Max. 58° F.	E						
Dimethylamine (See Methyl Amines). Dimethyl Benzene (See Xylene).	3		0	0								
Dimethylene Oxide (See Ethylene Oxide).	2.64											S 445.8
Dimethyl Sulfide	4	4	0	0	Store in end of building to aid fire fighting.	A	Separate from class I flammables by 3' siele space.	х	 		8-4	
DINITROBENZENE	8	1	4	0	Special handling and facility.	E	4' aiale space		 	•	1,8,4	IIIB
(ORTHO). DINITROTOLUENE.	8	1	3	0	Special treatment and facility. Explosive hazard when involved in fire.	E			 		1,8,4	
Dioxane Para	2	8	0	0	Store in end of building to aid in fire fighting.	A	Separate from clase II flammables by 4' aisle space.	x	 	-	8-4	1B
Diphacinpariffin (See Rodenticide). Dopes (See Cellulose Nitrates and Cellulose Acetates).												
Drying Agent (Aerosol)	0	1	0	0	No special treatment .	D	None		 	X	8-4	
Dust Mop Treatment Compound.	See la	bel			No special treatment	D	None		 	x	8-4	
Dye Solutions (1 Qt. Bottles).	See la	ibel			Store in end of building to aid in fire fighting.	A	Separate from class II flammables by 3' aisle space.	X	 		8-4	
Dye, Xylene. Azo, Xylene.	0	8	0	0	Store in end of building to aid in fire fighting.	A	Separate from class II flammables by 3' aisle space.	X	 		. 8-4	4.48
Enamels (See Organic Costing Materials).								-				IA
Ether (Ethyl-Diethyl)	2	4	1	0	Store in end of building to aid in fire fighting.	A	Separate from class II flammables by 4' aisle space.	X	,		- 8-4	IA

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

10000000000000000000000000000000000000		Hazard !	Identity			Stor-		Typ	e of Store	ge Facilit	ies	Portable	
Noun	Health	Flam- ma- bility	Reactivity	Spe- cific Has- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whee	Fire Extin- guisher Type	Class
Etherin (See Ethylene). Ethyl Acetate	1	3	8	0	Store with class I flammables.	A	Separate from class II flammables by 4' aisle space.	x	-			8-4	IB
Ethylacetic Acid (See Butyric Acid).				let garde									IB
Ethyl Acrylate	2	8	2	0	Store with class I flammables.	A	Separate from class II flammables by 4' aisle space.	Х				2,8,4	IB
Ethyl Alcohel	-	4	0	0	Store with class I flammables.	A	Separate from class II flammables by 4' aisle space.	x				1-8-4	IB
Ethylamine Ethyl Bensene	3 2	3	0	0	Store with class I flammables.	A	Separate from class II flammables by 4' aisle space.	x		-		8-4	IB
Ethyl Benzol (See Ethyl Benzene). Ethyl Chloride	2		0	0	Store with class I	A	Separate from class II	x				8-4	IA
					flammables.		flammables by 4' aisle space.						
Ethyl Nitrate (Nitrie Ether). Ethyl Ether (See	2	3	1	0					1				
Ether). Ethyl Nitrite (Nitrous Ether).	2	4		0	Store with class I flammables at end of building.	A	4' aisle space from class II.	х				2,8,4	lA
Ethyl Oxide (See Ether).						C	Separate building or			x	x	3-4	
Ethylene Aldehyde (See Acrolein).		1	2	0	Separate from oxygen, chlorine gases.		solid compartment.						
Ethylene Chloride (See Ethylene Dichloride). Ethylene Dichloride	. 2	3	0	0	Store with class I flammables.	A	Separate from class II flammables.	x			-	3-4	18
Ethylene Glycol Monobutyl (See "Butyl Cellosolve").													

15 September 19

Ethylene Oxide (Gas)	2	1	3	0	Store in separate shed or in gas building separate from	c	Solid compartment away from oxygen.			x		3-4	
		- ja 19	orthon to	an again to gift	oxygen.								
Feric Chloride	2	0	0	Н	No special handling	D					X	1-4-5	
Ferric Nitrate	0	1	0	D	No special handling	D					X	1-4	
Ferrous Sulphate		0	0	0	No special handling	D					X	1-4	
Fluorine	4	0	3	J	Separate storage or separate from oxygen.	С	Separate building or solid compartment.			X		Water spray	
Formaldehyde Solution	2	2	0	0	Separate from combustible and oxidizing materials.								
Gas	2	4	0	0		D	4' aisle space				X	3-4	IIIA
Formalin (See Formaldehyde).		8			4.0				x			1–3	IIIA
Formic Acid	8	2	0	С	Separate from other acids.	В	4' aisle space	15.	^			Signer)	4.02
Formic Aldehyde (See Formaldehyde). Freon (See Dichloro- difluromethane).													
Glycerol (See Glycerin).								4			-		IIIB
Glycerin	_	1	0	0	No special treatment .	D	4' aisle space				X	1-8	шв
Greases		1	0	0	No special treatment .	D	None				X	1-3-4	
Gum Preventive (Gasoline). Guncotton (See Cellulose).	-	3	0	0	Store in end of building.	A	3' aisle from class II flammables.	х				3-4	
Helium	0	0	0	0	Inert gas	C	None			X		N/A	
Helium and Methane	0	li	0	0	No special handling	C	None			X		N/A	
Helium and Nitrogen	0	10	0	0	Noncombustible gas	C	None			X		N/A	
Herbicides	See l	ahel			No special treatment	D	None				X	1-3	
Hexametaphosphate Hexamethylene (See Cyclohexane).	0	0	0	0	No special treatment	D	None				х	1-3-4	
Hexone (See Methyl Isobutyl Ketone).						_	None				x	1-3-4	
Hydraulic Fluid	See I				No special handling	D	Separate from class II	X				1-3-4	II
Hydrazine (Anhydrous)	3	8	2	C	Store in end of building to aid in fire fighting.	A	flammables by 4' aisle space.						
Hydrochloric Acid	. 3	0	0	C	Protect against physical damage.	В	3' aisle space		х			. 1-3-4	
Hydrocyanic Acid (See Hydrogen Cyanide).			17.00			West of		Sol.		1	1		

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

Table Palaceter		Hazard	Identity			Stor-		Тур	e of Stor	age Facili	ties	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Has- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whae	Fire Extin- guisher Type	Class Liquid
Hydrofluoric Acid	4.9	0	0	C	Protect against physical damage.	В	3' aisle space		X			1	
Hydrogen (Gas)	0	4	0	0	Storage in separate building or gas storage shed.	С	Solid partition from oxygen cylinders.			X		3-4	
Hydrogen Chloride (See Hydrochloric Acid).					The Longitude Co.								
Hydrogen Cyanide	4	4	2	0	Store in end of building to aid fire fighting.	A	4' aisle space from class II flammables.	х				3-4	IA
Hydrogen Dioxide (See Hydrogen Peroxide). Hydrogen Fluoride (See Hydrofluoric Acid).													
Hydrogen Peroxide	2	0	1	M	Do not store on wood pallets or dunnage.	В	10' space from other acids.		x			1	
over 52% Hydrogen Sulfate (See Sulphuric Acid).	2	0	3	M	panets of dumage.		SAME.						
Hydrogen Sulfide	3	4	2	0	Separate building or in compressed gas shed, separate from oxygen.	С	Solid partition from oxygen cylinders.			x		1-2-4 Spray	
Hydroxybenzene (See Phenol).													
Hydroxylamine	1	3	3	0	Separate from class I flammables.	A	4' aisle from class I flammables.	х				8	IIIB
Inhibitors (See Trisodium Phosphate).	0	2	0	0	No special handling	D	None				X	1–3	
Insecticide (Chlordane)	3	2	0	0	No special handling	D	None				x	1-3	
nsecticide (DDT)	3	0	0	0	No special handling	D	None				X	1-3	
nsecticide (DDT- Aerosol).	3	1	1	0	No special handling	D	None				X	1–3	
nsecticide (Diazinon)	3	0	0	0	No special handling	D.	None				X	1-3	
nsecticide (Dialdrin)	3	0	0	0	No special handling	D	None				X	1-3	
nsecticide (Lindane)	3	0	0	0	No special handling	D	None				X	1-3	
Insecticide (Malathion)	2	0	0	0	No special handling	D	None				X	1-3	
Insecticide (Pyrethrin)	2	1	0	0	No special handling	D	None				X	1-3	

Insect Repellent		200	0 1		No special handling	D	None	x			•	2.4	
Inspection Penetrant Emulsifiers &	See lal	bel			Store with class II flammables.	A	3' aisle space from class I flammables.	^		er in h	-		
Removers.	See lal	hal			Store in end of	A	Separate from class II	x				3-4	IC
Insulating Varnish	See III	JC1			building to aid in fire fighting.		flammables by 4' aisle space.						
Isopropyl Formate	2	3	0	0	Store in end of building to aid in fire fighting.	A	3' aisle space from class II flammables.	х				34	
(See Isopropyl Formate).							a		x			14	
Iodic Acid (Crystals)	0	2	1	D	Separate from other acids.	В	3' aisle space				x	1,2,4	
ledine	2	0	0	D	No special handling	D	None			-			
Issamyi Acetate (See Amyl Acetate).							4' aisle space from	x	1.4			24	IC
Isobutyl Methyl Ketone	2	3	2	0	Store in end of building.	A	class II flammables.	35				3-4	IB
Isopropyl Alcohol	1	3	0	0	Store in end of building.	A	4' aisle space from class II flammables.	X					
Keresene (130° F.P.)	0	2	0	0	Store with class II	A	4' aisle space from class I flammables.	X				3-4	11
Lacquers	See la	bel			Store in end of	A	Separate from class II	x				3-4	IC
					building.		flammables.		1		x	134	
Lanthanum Nitrate	0	0	3	D	No special handling	DE	3. wisie shace						
LAUROYL PEROXIDE.	-	2	3	D	Special facility required for quantity storage.	E							
Lead Nitrate	-	1	2	0	Store in end of building.	D	Separate from class II flammables.				x	1-3-4	
Lead Sulfocyanate	1	1	1	0	Separate from other items.	D	3' aisle space				x	1	
Lead Thiocyanate (See Lead Sulfocyanate). Lime (Unalaked) (See Calcium Oxide).													
LITHIUM	1	1	2	E	Special handling and storage required.	E				-			
Lithium Ahmainum Hydride.	3	1	2	E	No special handling	D				-	x	5	
LITHIUM HYDRIDE	1	A	2	E	Special handling and facility required.	E			-		-	- 6	
Lye (See Potassium Hydraxide).					STATE OF THE PARTY	-						5 Tale	
MAGNESIUM	-	1	2	E	Special handling and storage.	E		-	-				10
(Including Allays).	_	1	0	0	No special handling	D					X I	1134	L

Table 5-5. Hazardous Materials Storage and Handling Criteria

		Hazard	Identity			Stor-		Тур	e of Stora	ge Facilit	ies	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Hardling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whae	Fire Extin- guisher Type	Class Liquid
Magnesium Nitrate	1	0	1	D	Protect from physical damage.	D	Separate from combustible items by 3' aisle space.				х	8-4	
Magnesium Perchlorate	1	0	1	D	Protect from physical damage.	D	Separate from combustible items by 3' aisle space.	ADD ALLES			X	3-4	
Maleic Anhydride (Crystals).	3	1	1	E	Store with class II flammables.	A	3' aisle space					3-4	
Mandelic Acid (Crystals).	1	0	0	0	No special handling	D	None				X	1-3-4	
Mannitol (Crystals)	1	1	0	0	Protect from physical damage.	D	Separate from combustible items by 3' aisle space.				X	8-4	
Mercury	3	0	0	0	No special handling	D					X	3-4	
Mesityl Oxide		3	0	0	Store in end of building to aid in fire fighting.	A	Separate from class II flammables by 4' aisle.		Х			3-4	IC
Methacrylic Acid Methanel (See Formaldehyde). Methanol (See Methyl Alcobol).	3	2	2	0	Protect against physical damage.	В	3' aisle space		X			3-4	IIIA
Methane Gas	1	4	0	0	Separate from oxygen cylinders.	C	Solid compartment or separate building.			X		4	
Methyl Acrylate	2	4	2	0	Store in end of building.	A	Separate from class II flammables by 4' aisle.	х				8	IB
Methyl Alcohol	-	3	0	0	Store in end of building.	A	Separate from class II flammables by 4' aisle.	х				3-4	IB
Methylamines (Mono, di).	3	4	0	0	Store in end of building.	A	Separate from class II flammables by 4' aisle.	х				3-4	IA
(Tri). Methyl Benzene (See Toluene).	2	4	"	0									
Methyl Bromide Mathyl Chloride Chloromethane.	8	0	2 0	0	Non Flammable Gas	C	None Separate from Oxygen			X		N/A Stop- flow of gas.	

Methylene Chloride	2	0 1	0 1	0	Non Flammable Gas	C	None		 X		N/A	
Methyl Chloroform Methyl Cyanide (See	2	0	0	0	No special handling	D	None		 200 P - 1	X	84	
Acetonitrile). Methyl Ethyl Ether	2		-	0	Store in end of building to aid in fire fighting.	A	Separate from class II flammables by 4'	х	 		84	IA
Methyl Ethyl Ketone	2	8	0	0	Store in end of building.	A	Separate from class II flammables by 4' aisle space.	х	 		8-4	IB
METHYL ETHYL KETONE PEROXIDE.	2	2	4	D	Special handling and storage.	E						
Methyl Formate	2	4	-	0	Store in end of building to aid fire fighting.	A	Separate from class II flammables by 4' aisle space.	x	 		8-4	IA
Methyl Isobutyl Ketone	2	3	-	0	Store in end of building to aid fire fighting.	A	Separate from class II flammables by 4' aisle space.	X	 		3-4	IC
Methyl Methacrylate	2	3	2	0	Store in end of building to aid fire firefighting.	A	Separate from class II flammables by 4' aisle space.	х			8-4	IB
Methyl Phenol (See Cresol).												
Methylene Oxide (See Formaldehyde).	E.,											
Mineral Spirits (See Naphtha Aromatic).	1200	1994	1								0.00	
Molybdenum Disulfide (See Molybdenum Sulfide).												
Molybdenum Sulfide	1	0	0	0	No special handling	D	None		 	X	84	IC
Monochlorobenzene (Chlorobenzene).	2	3	-	0	Store in end of building to aid fire fighting.	A	Separate from class II flammables by 4' aisles.	X	 	, i		10
Monochlorodifluoro- methane.	2	0	0	0	Separate from oxygen cylinders.	C	Separate building or solid compartment.		 X			
Monoethanolamine (Ethanolamine).	2	1	0	0	Store in end of building to aid fire fighting.	A	Separate from class II flammables by 4' aisle.	х	 		8-4	IIIB
Muriatic Acid (See Hydrochloric Acid).					2.0	LLSE.						
Naphtha	See 1	abel		0	Store in end of building to aid fire fighting.	A	Separate from class II flammables.	х	 		8-4	
Naphtha Aliphatic	2	3	0	0	Store in end of building to aid in fire fighting.	A	Separate from class II flammables.	x	 		. 8-4	

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

			Hazard	Identity			0		Тур	e of Store	ge Facilit	ies	Portable	
	Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	Stor- age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bidg	Comp Gas Stge Bldg	Gen- Pur- pose Whee	Fire Extin- guisher Type	Class
	Naphtha Aromatic	2	3	0	0	Separate from class II flammables.	A	3' aisle space	Х				2-4	
	Naphthalene	2	2	-	0	Separate from class I flammables.	A	4' aisle space	х				8-4	IIIA
	Nestsfoot Oil	0	1	0	0	No special handling	D	4' aisle space				X	8-4	IIIB
	Nickle Acetate	1	0	0	0	No special handling	D	None				X	8-4	
	Nickel Chloride	i	0	0	0	No special handling	D	None				X	3-4	
	Nickel Nitrate	1	0	1	D	Separate from other items.	D	8' aisle space				X	3-4	
	Nickel Sulfate	1	0	0	K	No special handling	D	None				X	8-4	
		2	0	2	K	Store with bungs up.	B	3' aisle space		X			1	
	Nitric Acid	-				Do not store on wood pallets or dunnage.		•						
	Nitric Ether (See Ethyl						7	Extra de la companya del companya de la companya del companya de la companya de l						
	Nitrate).		1		1 _		. D	4' aisle space		1		x	1-3	IIIB
	Nitroaniline	3	1	1	0	Separate from other items.	. в	4 asse space				"		-
	Nitrobarite (See Barium Nitrate).													
	Nitric Oxide (See Nitrogen Tetroxide). Nitrous Ether (See Ethyl Nitrite). Nitrobenzene	3	2	-	0	Store with class II	A	4' aisle space from class I flammables.	x			20	1-3-4	1111
9	Nitrobenzol (See Nitrobenzone).	BLS.				and an array of								
	Nitrocellulose (See				N SSERVED				1	120	1	1		
	Cellulose Nitrate).		1				Land Inter		-					and the same of th
	Nitrochlorobenzene	3	1	1	0	Store with class II flammables.	A	4' aisle space from class I flammables.	x				. 1-3-4	IIII
	Nitreethane	1	3	3	0	Store with class I flammables.	A	4' aisle space from class II and other class I flammables.	X				- 8-4	IC
	Nitrogen (Gas) Nitrogen Peroxide (Gas) (See Nitrogen	0	0	0	0	Nonflammable gas	С	None			х		. N/A	

Nitrogen Tetroxide	3	10	1 1	D	Store away from	C	Separate shed or solid		1	X I		18-4	1 1
					oxygen cylinders.		compartment.				AL MESS		and the second
Nitromethane		3	4	0	Store in end of building	A	4' aisle from class II flammables.	X				8-4	IC
Nitropropanes	-	2	3	0	Store in end of building	A	4' aisle from class II	X				8-4	п
Nitrous Ether (See Ethyl Nitrite).	2	4	4	0									
Nitrous Oxide	2	0	1	0	Do not store with flammable gases.	C	Separate building or solid compartment.			X		N/A	
Nitric Ether (See Ethyl Nitrate).	7-						1						
Organic Coating Materials (Oil Base Paints, Enamels & Aerosols).	See la	abel			Store in ends of bays or in areas offering quick access to fire department hose streams.	D	3' aisle space				х	2,8,4	
Oil of Vitriol (See Sulphuric Acid).					Sci Canas.	28							
Oila (Lubricating)	0	1	0	0	Store away from other items.	D	3' aisle space				x	8-4	
Oxalic Acid	-	0	0	0	No special handling	В	3' aisle space from other acids.		x			8-4	and the City
Oxygen Gas	0	0	1	0	Do not store with flammable gases.	C	Separate building or solid compartments.			x	••••	N/A	
Paints (Oil Base) (See Organic Coating Materials).													
Paints (Water Base)	See l	abel			No special handling	D	None				x	1-8-4	
Paraldehyde	2	3	1	0	Store with class I	A	Separate from class II flammables.	x					IC
Parathion	4	1	0	0	Separate from other items.	В	3' aisle space		x			1	
Penetrating Fluid (See Inspection Penetrant).													
Peracetic Acid	3	2	4	0	Separate from other items.	В	4' aisle space	2000	X			1	п
Perchloric Acid	3	0	3	K	Separate from other items. Protect against freezing— 4° F. Do not store on wood pallets.	В	3' aisle space		X			3-4	
Petroleum Ether (See Ether, also Benzine).			-	0	on wood panets.	100	o bears						
Phenol (Carbolic Acid) .	-	2	0	C	Separate from other items.	В	4' aisle space	Charles &				3-4	AIII
Phanolphthalein	1	0	0	i	No special handling	D	None				X	3-4	
Phospherus (Red)		1	1	U	Separate from other items.	D	3' aisle space				x	1	

15 September

Table 5-5. Hazardous Materials Storage and Handling Criteria—Continued

		Hazard	Identity		The same of the same of the same of	Stor-		Тур	e of Store	ge Facilit	ies	Portable	
Noun	Health	Flam- ma- bility	Reac- tivity	Spe- cific Haz- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whae	Fire Extin- guisher Type	Class Liquid
Phosphorus (White- Yellow).	3	3	1	0	Separate from other items.	A	3' aisle space	х				1	
Phosphorus Penta- Sulfide.	3	1	2	E	Separate from other items.	D	3' aisle space				X	3 Dry.	
Phosphorus Seequisulfide.	2	1	1	0	Separate from class I	A	3' aisle space	x			****	T	
PHOSPHORUS TRICHLORIDE.	3	0	2	Н	Special facility	E							
PICRIC ACID	2	4	4	D	Special facility	E	4' aisle space						IIIB
Pine Oil	ī	2	0	0	Store with class II flammables.	Ā	4' space from class I	X				8-4	IIIA
POTASSIUM	3	1	2	E	Special facility and handling.	E							
Potassium Bifluoride	1	0	0	0	No special handling	D	None				x	3-4	
otassium Bromate	1	0	0	D	No special handling	D	None				x	3-4	
otassium Carbonate	1	0	0	0	No special handling	D	None				X	8-4	
Potassium Chlorate		0	2	D	Separate from other items.	D	3' aisle space				X	ī	
Potassium Chromate	1	0	0	D	No special handling	D	None				x	8-4	
Potassium Cyanide		0	0	0	Separate from other items.	8	3' aisle space				x	3	
Potassium Dichromate	2	0	0	D	Separate from other items.	D	3' aisle space				x	8-4	
Potassium Fluoride	1	0	0	0	No special handling	D	None				x	84	
otassium Hydroxide	3	0	i	B	Separate from other	D	3' aisle space			•••••	X	1	
(Lye).	i	0	0		items.								
Otassium Nitrate		-	2	0	No special handling	D	None				X	8-4	
		0		D	Separate from other items.	D	3' aisle space				X	,	
Potassium Perchlorate	1	0	2	D	Separate from other items.	D	3' aisle space				X	8-4	
otassium Permanganate	0	0	1	D	Separate from other items.	D	3' aisle space				X	8-4	
otassium Peroxide	3	0	2	D	Separate from other items.	D	3' aisle space				X	4	
Potessium Persulfate	1	0	1	D	Separate from other items.	D	3' aisle space				x	1	
Potassium Sodium Tartarate.	1	0	0	0	No special handling	D	None				x	8-4	

Potassium Sulfide	2	1	0	0	Separate from other	D	3' aisle space				X	1	
Propionaldehyde (Propanal).	2	4	1	0	Store in end of building.	A	4' aisle space from group II flammables.	x				8-4	IB
Propionic Acid	. 2	2	0	0	Separate from class I flammables.	A	4' aisle space from class I flammables.	X				1-8-4	11
Propane Gas	1	4	0	0	Stored separated from oxygen.	С	Separate building or solid compartment.			х		3-4	
Propane Torch Fuel (14 oz. containers) (See Soldering Torch Kit).												700	
Prophlamine	8	8	0	0	Store in end of building.	A	3' aisle space from class II flammables.	X				8-4	
Propyl Nitrate	2	3	3	0	Store in end of building.	A	4' aisle space	X				3-4	IB
Propylene (Gas)	1	4	1	0	Separate from oxygen cylinders.	С	Separate building or solid compartment.			x		3-4	
Prophlene Oxide	2	4	2	0	Store in end of building.	A	4' aisle space	x				3-4	IA
Pyridine	2	8	0	0	Store in end of building.	A	4' aisle space	x				8-4	IB
Pyrogallol	1	0	0	0	No special handling	D	None				x	3-4	
Pyroxylin (See Cellulose Nitrate).		-	1 1								-		
Que Bracho Quick Lime (See Calcium Oxide).	0	1	0	0	No special handling	D	None				х	1-3-4	
Quick Silver (See Mercury).						- 6							
Rodenticide (Diphacinparaffin).	See b	abel		0	No special handling	D	None				X	1-8	
Saltpeter (See Potassium or Sodium	See la	abel		0	No special handling	D	None				x	8-4	
Nitrate). Shellac (Liquid)	0	14	0	0		A	None			-	x	2,3,4	The second second
Silicone Compound		abel			No special handling	D	None				X	8-4	1000
Silver Cyanide	1	10	1 0	0	No special handling	D	None				X	3-4	6.00
Silver Nitrate	1	0	1	D	Separate from other items.	D	3' aisle space				X	3-4	
Skin Protective Compound.	0	0	0	0	No special handling	D	None				X	3-4	
SODIUM	3	1	2	E	Special handling and facility.	E							
Soldering Torch Kit	1	4	1	0	Store in end of	A	Separate from class II	x				3-4	1000
(Portable Propane					building to assist in	113	flammables by 3'		et year			The state of	-81
Torch, 14-oz. fuel cylinders).					fire fighting.		aisle space.						
Sodium Acetate	0	0	0	0	No special handling	D	None				X	3-4	

		Hazard	Identity			Stor-		Ty	e of Sterr	ge Facili	ties	Purtable	
Neum	Health	Plam- ma- bility	Reactivity	Spe- cific Haz- ard	Storage and Handling	age Comp Group	Separation Requirement	Flamm Stge Bldg	Acid Stge Bldg	Comp Gan Stage Bldg	Gen Pur- pose Whoe	Pire Extin- guisher Type	Class Liquid
Sodium Bicarbonate	0	0	0	0	None	D	None			7	X	N/A	alt alt
Sodium Bisulfate	3	0	0	E	None	D	None				X	3-4	
Sodium Borate		0	0	0	None	D	None				X	3-4	
Sodium Bromide	1	0	1	E	No special handling	D	None				X	1-3-4	44. 4
odium Carbonate		0	0	0	None	D	None				X	3-4	
lodium Chlorate	-	0	2	D	Separate from other items.	D	3' aisle space				X	1	
lodium Chloride	-	1	2	D	Separate from other items.	D	3' aisle space				X	1	
lodium Cyanide	3	0	0	E	Separate from other items.	S	3' aisle space				X	1	
Sodium Hydrosulfite	3	1	2	E	Separate from other items.	D	3' aisle space				X	1-3-4	
odium Hydroxide (Lye).	3	0	1	В	Separate from other items.	D	3' aisle space				X	1	
odium Hyperchlorite	2	1	0	D	Separate from other items.	D	3' aisle space				X	1-3-4	
odium Hypophosphite	2	2	0	0	Separate from other items.	D	3' aisle space				X	1-3-4	
lodium Nitrate		0	2	D	Separate from other items.	D	3' aisle space				X	1	
Sodium Perchlorate	2	0	2	D	Separate from other items.	D	3' aisle space			9 700	X	1	
Sodium Peroxide	3	0	2	J	Separate from other items.	D	3' aisle space				X	1-4	
Bodium Phosphate	2	0	0	0	No special handling	D	None				X	1-3-4	A CO
ODIUM POTASSIUM ALLOYS.	3	3	2	E	Special facility and handling.	E							
odium Silicate	_	0	0	0	No special handling	D	None				X	N/A	
odium Sulfide		1	-	0	Separate from other items.	D	3' aisle space				X	1	No.
dium Sulphate	0	0	0	0	No special handling	D	None				X	3-4	
adium Sulphite		0	1	Н	No special handling	D	None				X	3-4	
tarter Fluid		4	1	0	Store in end of building.	A	3' aisle space from class II flammables.	X				1-3-4	
Stocklard Solvent (Dry Cleaning).	2	3	0	0	Store with class II flammables.	A	4' space from class l flammables.	х				3-4	11
Strontium Nitrate	1	0	1	D	Do not store on wood pallets.	D	3' aisle space				X	1-3-4	

15 September 1979

DOD 4145.19-

OL Marido I	. 1	0 1	1 1	D	Do not store on wood	D	3' aisle space				X	14	
Strontium Peroxide	•		. 1		pallets.		At all the second Assess	x	-			84	IC
Styrene (monomer)	2	8	2	Ó	Store in end of building.	A	4' aisle space from class II flammables.	^					
Sulfuric Ether (See Ether).					and the second				- 54		x		
Solphur	2	1	0	0	Separate from other	D	3' aisle space				^		
Sulphur Dioxide	8	0	0	0	No combustible gas	C	Store with oxygen cylinders.			X		N/A	
Sulphuric Acid	8	0	1	K	Separate from other	В	3' aisle space		x			4	
	E-1.			0	No special handling	D	None			X		8-4	
Tale	See la			_	Separate from other	B	3' sisle space		X			8-4	
Tannie Acid	0	1	0	0	items.								
Tar Camphor (See						To all				1.0			100
Naphthalene).					G. 10 Jun 11	A	3' aisle space from	X				1-3-4	
Tetraethyl Lead (TEL	8	2	8	0	Store with class II	•	class I flammables.						
Compound).	1 580			3.4	flammables.		3' aisle space	x				1-8-4	
Tetraethyl Lead (TML	8	8	3	0	Store in end of	A	2. state shace	_ ^				1.00	
Compound).					building.	100		x				20-2-4	IB
Tetra Hydrofuran	2	8	1	0	Store in end of building.	A	4' aisle space from class II flammables.	•			••••		
Tartaric Acid		11	0	0			병에 열맞는 그는 사고 있는 경기를 하				x	1	45
*Thorium Nitrate		0	-	D	Separate from other items.	D	3' aisle space			*****	4-2-3		IB
Toksene	2	4	0	0	Store in end of building.	A	4'aisle space	X				2,8,4	
Toluene-Disocyanate	2	1	2	E	Separate from class I	A	4' aisle space	x					IIIB
Toluene Methyl	2	8	0	0	Store in end of building.	A	3' aisle space	X				8-4	
Isobutyl Ketone. Toluidines (Ortho, Para)	8	2	-	0	Separate from class I flammables.	A	4' aisle space	X		3		3-4	IIIA
Totuol (See Toluene).	1	1	1	1		1 20		0.4000		7	0.000		I IIIA
Triamylamine	- 2	1	0	0	Separate from class I	A	4' aisle space	X				8-4	and the second
Tributylamine	. 2	2	0	0	Separate from class I	A	4' aisle space	X					IIIA
Trichlorosthane	2	0	0	10		D	None				X	8-4	
Trichloroethylene	1 -	li	10	10	No special handling	_	None				X	8-4	
Trichlorofiuoromethane		1 0	0	0	No special handling	D	None				X	8-4	
Trichlorotrifluoroethane	_	0	0	10	No special handling		None			Later Company of the Control of the	X	8-4	
Triethanolamine		1 1	1 1	0	No special handling		None				X	8-4	1
Trechanojamine	- 1		1 .	-	No special handling	-	4' aisle space				X	8-4	IB
Triethylamine Triethelborane (See	2	8	0	0	No special nanutaly	1	a anse space						
Diborane). Tricresyl Phosphate	2	1	0	0	No special handling	D	None	.		l	x	1,8,4	

Hazardous Materials Storage and Handling Criteria—Continued

Noun	100	Hazard I	identity		Storage and Handling	Stor- age Comp Group	Тур	e of Store	Portable				
	Health	Flam: ma- bility	Reac- tivity	Spe- cific Has- ard			Separation Requirement	Plamm Stge Bldg	Acid Stge Bldg	Comp Gas Stge Bldg	Gen Pur- pose Whee	Fire Extin- guisher Type	Class Liquid
TRINITROBENZENE	2	4	4	0	Special facility and handling	E							
TRINITROTOLUENE	2	4	4	0	Special facility and handling.	E							
Trisodium Phosphate	2	0	0	0	No special handling	D	None				X	3-4	5.422
Turpentine	1	3	0	0	Separate from class I flammables.	A	4' aisle space	X				3-4	IC
Unelaked Lime (See Calcium Oxide).					Administration of the second							i de	
Unsymmetrical Dimethylhydrazine.	8	4	1	0	Store in end of building.	A	4' aisle space from class II flammables.	X				8-4	IB
*Uranium Nitrate	-	0	1	D	Separate from other items.	D	3' aisle space				X	1	
Uranyl Acetate	1	0	1	0	No special handling	D	None				X	8-4	
Vurnish	See Is	bel		0	No special handling	D	None				X	18-4	
Vinegar Acid (See Acetic Acid).													
Viayi Acetate	2	4	2	0	Store in end of building.	A	4' aisle space from class II flammables.	X	****			8-4	IB
Vinyl Benzene (See Styrene).													
Vinyl Chloride (Gas)			1	0	Separate from oxygen cylinders.	C	Separate building or solid compartment.			x		8-4	
Viayl Ether (Divinyl Ether) (Dichloethylene)	2	3	2	0	Store in end of building.	A	Separate from class II flammables by 4' aisle space.	x				8-4	IB
Vinylidena Chloride	2	4	2	0	Store in end of	A	4' aisle space	x				8-4	IA
				-	building.		and the second second second second	-	Name of Street				distribution
Kylenes (Ortho, Para	2	3	0	0	Store in end of	A	4' aisle space from	X				2-3-4	IC
Meta).	2	4	0	0	building.		class II flammables.				100	Companies	
Kylol (See Xylone). Water Glass (See													
Sodium Silicate).				100					The second		10000	C. Carrier	
Zinc (Powder)		1	1	0	Separate from other items.	D	3' aisle space		1.0		X	5	
Zinc Chlorate	2	0	2	D	Do not store on wood pallets.	D	3' aisle space				X	1-5	
Zine Oxida	1	0	0	0	No special handling	D	None				X	8-4	
Chae Sulfide		0	0	0	No special handling	D	None	1				3-4	

Zirconium (Powder)	1	4	1	0	Separate from other items.	D	3' aisle space	 	 X	5	
Zinc Diethyl (See Diethylsinc). Zinc Ethylde (See Diethylsinc). Zinc Ethyl (See Diethylsinc).											

1. The following codes describe the health hazards. (A dash (-) means identity to be developed)

- Code A few whiffs of the vapor could cause death, or the vapor or liquid could be fatal on penetrating the fire fighter's normal full protective clothing which is designed for resistance to heat. The normal full protective clothing available to the average fire department will not provide adequate protection against skin contact with these materials.
- Materials extremely hazardous to health, but areas may be entered with extreme care. Full protective clothing, including selfcontained breathing apparatus, rubber gloves, boots and bands around legs, arms and waist should be provided. No skin surface should be exposed.
- Materials hazardous to health, but areas may be entered freely with selfcontained breathing apparatus.
- Materials only slightly hazardous to health. It may be desirable to wear selfcontained breathing apparatus.
- Materials which on exposure under fire conditions would offer no health hazard beyond that of ordinary combustible material.
- 2. The following codes describe the flammability hazards.

Code

Explanation

- Very flammable gases, very volatile flammable liquids, and materials that in the form of dusts or mists readily form explosive mixtures when dispersed in air. Shut off flow of gas or liquid and keep cooling water streams on exposed tanks or containers. Use water spray carefully in the vicinity of dusts so as not to create dust clouds.
- Liquids which can be ignited under almost all normal temperature conditions. Water may be effective on these liquids because of their low flash points. Solids which form coarse dusts, solids in shredded or fibrous form that create flash fires, solids that burn rapidly, usually because they contain their own oxygen, and any material that ignites spontaneously at normal temperatures in air.
- Liquids which must be moderately heated before ignition will occur and solids that readily give off flammable vapors. Water spray may 2 be used to extinguish the fire because the material can be cooled to below its flash point.
- Materials that must be preheated before ignition can occur. Water may cause frothing of liquids with this flammability rating number if it gets below the surface of the liquid and turns to steam. However, water spray gently applied to the surface will cause a frothing which will extinguish the fire. Most combustible solids have a flammability rating of 1.
- Materials that will not burn.
- 3. The following codes describe the reactivity hazards. (A dash (-) means identity to be developed) Explanation
 - Code Materials which are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures. Includes materials which are sensitive to mechanical or localized thermal shock. If a chemical with this hazard rating is in an advanced or massive fire, the area should be evacuated.

15	
September	
1979	

gr.	Code	Explanation
%	3	Materials which are capable of detonation or of explosive decomposition or of explosive reaction, but which require a strong initiating source or which must be heated under confinement before initiation. This includes materials which are sensitive to thermal or mechanical
		shock at elevated temperatures and pressures or which react explosively with water without requiring heat or confinement. Fire fighting should be done from a protected location.
	2	Materials which are normally unstable and readily undergo violent chemical change but do not detonate. This includes materials which can undergo violent chemical change at elevated temperatures and pressures, and materials which may react violently with water or which may form potentially explosive mixtures with water. In advanced or massive fires, fire fighting should be done from a protected location.
	1	Materials which are normally stable but which may become unstable at elevated temperatures and pressure or which may react with water with some release of energy, but not violently. Caution must be used in approaching the fire and applying water.
	0	Materials which are normally stable even under fire exposure conditions and which are not reactive with water. Normal fire fighting procedures may be used.
4. TI	he following code	s describe the specific hazards.
	Code	Explanation

В	Corrosive Alkali (ALK)
C	Corrosive material other than acid and alkali (COR)
D	Oxidizing Material (OXY)
E	Use No Water in Fire Fighting (W*)
F	Corrosive Acid; Use No Water in Fire Fighting (ACID W*)
G	Corrosive Alkali; use no water in fire fighting (ALK W*)
H	Corrosive material other than acid and alkali; use no water in fire fighting (COR W*)
J	Oxidizing material other than acid and alkali; use no water in fire fighting (OXY W*)
K	Oxidizing Acid (ACID OXY)
L	Oxidizing Alkali (ALK OXY)
M	Corrosive Oxidizing Material (COR OXY)
N	Corrosive Oxidizing Material; Use no water in fire fighting (COR OXY W*)
0	No specific hazard.

*This symbol will include a dash on the identification label.

Corrosive Acid (ACID)

5. The following codes describe the storage compatibility group.

Explanation

Items in this group will be stored in the flammable storage building with separation as indicated in the Table of Hazardous Materials. Code

Items in this group will be stored in acid storage building, with separation as indicated in the Table of Hazardous Materials.

Items in this group will be stored in the compressed gas cylinder storage facility, with separation as indicated in the Table of Hazardous Materials.

	D	Items in this group may be stored in general purpose warehouse, with separation as indicated in the Table of Hazardous Materials.
	E	Items in this group require special facilities and handling. Consult the installation Fire and Safety Officers and other appropriate personnel of the respective service for specific storage and fire protection requirements.
	S	Items in this group shall be kept in a locked storage space accessible to authorized personnel only.
	w	Items in this group shall be stored in a non-sprinkler protected space.
6. Th	e following code Code	s describe the most suitable extinguishing agents in the form of portable extinguishers. Extinguishing Agent Water
	2	Foam
	22	Alcohol Foam
	8	Carbon Dioxide
	4	Dry Chemical
	5	Dry Chemical for Metal Fires
7. TA	e following code Code IA	Explanation Liquids having flashpoints below 73° F (22.8° C) and having a boiling point below 100° F (87.8° C).
	IB	Liquids having flashpoints below 78° F (22.8° C) and having a boiling point at or above 100° F (37.8° C).
	IC	Liquids having flashpoints at or above 73° F. (22.8° C) and below 100° F (37.8° C).
	п	Liquids with flashpoints at or above 100° F (37.8° C) and below 140° F (60 C) except any mixture having components with flashpoints of 200° F (98.3° C) or higher, the volume of which make up 99 percent or more of the mixture.
	ш	Liquids with flashpoints at or above 140° F (60° C).
	IIIA	Liquids with flashpoints at or above 140° F (60° C) and below 200° F (98.3° C) except any mixture having components with flashpoints of 200° F (98.3° C) or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.
	IIIB	Liquids with flashpoints at or above 200° F (93.3° C).

Section 5. SUBSISTENCE

5-501. Perishable Subsistence, Chill and Frozen Storage

a. Prevention of deterioration.

(1) General. All chilled and frozen subsistence is highly perishable and subject to rapid deterioration when improperly stored. Storage at temperatures which are too high or too low, under unfavorable conditions of humidity, and in the absence of proper air circulation in unsanitary storerooms will result in rapid spoilage and eventual loss of the product. Most spoilage of chilled and frozen subsistence is caused by micro-organisms, particularly certain species of bacteria and fungi; the contamination spreads rapidly from the decayed items to the surrounding sound subsistence. Therefore, frequent inspection while in storage, followed by sorting and removal of the decayed items or portions thereof, is of basic importance in maintaining the products in top condition and in keeping losses and surveys to a minimum. All shipments should be segregated and marked in such a manner as will assure that the oldest lots are issued first, except when it may become necessary to issue a lot quickly to avoid loss by spoilage or when another lot of the same commodity is in a better condition for continued storage. Old lots of chilled or frozen subsistence should not be allowed to accumulate in storage rooms but should be issued promptly or surveyed if unfit for use. Frozen products will not be accepted in a partially thawed condition, nor will such products be refrozen after having been defrosted.

(2) Air circulation.

(a) General. Along with proper temperature and humidity, air circulation in a storage room is an important factor in the proper storage of chilled and frozen stored subsistence. This is facilitated by stacking the products on pallets in such a manner, that will provide a 4-inch wall clearance, 2-foot ceiling clearance and sufficient working aisleway.

(b) Fruits and vegetables. Containers should be raised off the floor by the use of pallets and individual lots should be stacked so as to permit free circulation of air. The use of a fan or duct system may be desirable in some cases to maintain proper circulation in all parts of the room. The introduction of outside air into cold storage rooms

housing fruits and vegetables is not necessary. However, when fresh fruits and vegetables are stored in tight compartment at temperatures of 40° F or higher, the concentration of carbon dioxide produced by respiration may reach such a danger point that a match or candle will be extinguished. While this condition is not considered harmful to most products, personnel should not work in such rooms until a supply of fresh air has been introduced.

(c) Quick-frozen fruits and vegetables. Quickfrozen fruits and vegetables are highly perishable unless properly stored. Correct handling and proper storage of such foods are imperative in utilizing frozen foods to the best advantage. Upon delivery, quick-frozen fruits and vegetables should be transferred promptly to a low temperature storage space. Temperature of the load should be checked upon arrival by taking temperature readings of cartons selected from top layers inside of shipping cases. If the temperature of the product is higher than freezer room temperature, shipping cases should be scattered loosely about the room on handtrucks or upon pallets on the floor with adequate space between individual cases to permit rapid lowering of the product temperature to freezer room temperature. The use of a portable fan to create an air current over the products will hasten temperature equalization. When the temperature of the product has been lowered sufficiently, cases should be stacked compactly. If the product temperature upon delivery is the same as or below temperature of freezer room, the cases should be stacked compactly immediately.

(d) Meat, meat products and poultry. A prime factor in keeping the temperature in all parts of meat storage spaces at the recommended levels is proper circulation of the refrigerated air. Meat items will not be stored on the bare floor; pallets should be placed on the floor to allow free circulation of air under all items stored in the space. Generally, when the recommended temperature in all parts of the refrigerated space is uniform and is maintained within the stacks in the freezer space, the circulation of air may be considered to be adequate.

(e) Dairy products and eggs. To keep the air

EXERCISE: MODULE IX - HAZARDOUS WASTE STORAGE

STORAGE COMPATIBILITY EXERCISE

OBJECTIVE: Develop a compatible storage plan for a facility by using the EPA storage compatibility method.

SITUATION: You have just reported to work at the hazardous waste storage facility at your activity. This facility consists of 6 separate storage areas. Your first assignment is to make sure that all of the stored chemicals are compatible.

To assist you in this assignment, you have been given the following:

- The current facility storage plan
- EPA Storage Compatibility Chart (see module IX, page IX-B-1)
- List of Reactivity Group Numbers (RGN) (see module IX, page IX-A-1)

REQUIRED TASK:

- 1. Determine what hazardous situations exist with the current storage plan.
- Develop a compatible storage plan for the chemicals you currently have in storage.

PROCEDURE:

- 1. Determine the Reactivity Group Numbers for each chemical using the RGN list.
- 2. Use the Storage Compatibility Chart to determine the hazards present in each of the 6 storage areas.
- 3. Using the Storage Compatibility Chart, rearrange the storage areas until no incompatible chemicals are stored together. This will be the new storage plan.

CURRENT STORAGE PLAN (Identify hazard for each storage bay)

ACID WASTES

Benzene Phosphorus Dichloride /07

Boric Acid

Formic Acid 3

HAZARD: Extrevely receive

CAUSTIC WASTES

Ammonium Hydroxide /O

Sodium Hydroxide /O

Trichloroethene /7

HAZARD:

ORGANIC WASTES

Calcium Nitrate 104

Methanol 4

Toluene /6

HAZARD: Heat & Fire

OXIDIZER WASTES

Calcium Hypochlorite 104

Methyl Ethyl Ketone / 9

Sodium Nitrate 104

HAZARD: Heart of Fire

REACTIVE WASTES

Aluminum Bromide /07

Aluminum Chloride 107

Hydrochloric Acid

HAZARD: Extremely reache

GENERAL WASTES

Ammonium Nitrate 107

Gasoline /0/

HAZARD:

MODULE IX

HAZARDOUS WASTE STORAGE

I. LEARNING OUTCOMES DESIRE.

At the completion of this unit of instruction, you should be able to:

- A. Understand "conforming" storage and "compatible" storage.
- B. Store hazardous wastes safely and in accordance with local procedures.
- C. Use storage aids available at your facility to effectively and efficiently store hazardous waste.
- D. Correctly determine the storage compatibility of specific hazardous wastes at your facility.

II. INTRODUCTION

This subject of hazardous waste storage is complex and yet very important. Naval activities must be highly concerned that substances are stored properly. Waste in storage can cause injuries, spills, and damage to property even if they were originally packaged and handled properly. In this section, we will cover some of the concepts that are applicable to the safe storage of hazardous waste. We will discuss the importance of compatible storage and describes storage aids available to assist you in doing your job.

III. COMPATIBLE STORAGE AND CONFORMING STORAGE.

These concepts are important to understand because they relate directly to whether or not you are storing hazardous wastes in a safe manner.

Conforming Storage. According to the Department of Defense (DOD)

Consolidated Hazardous Material/Hazardous Waste Disposal Guidance,
conforming storage is, a "facility or location which conforms to
regulations of the Environmental Protection Agency (EPA) and other
regulatory authorities governing the storage of hazardous materials".

What makes some buildings better than other? Common sense can illustrate several of the criteria to be used in determining which of several buildings has the most conforming storage. For example, which building has the best nonleaking roof? Which building has the most solid, level floor which will prevent spills from escaping into the environment? Which building has a berm around the storage area to contain the entire amount of spilled waste? Which building has the best nonleaking walls to protect stored waste from the elements? Which building has the best ventilation system to prevent hazardous waste fumes from accumulating? Which building has fire protection equipment, emergency eyewashes/showers, and explosion-proof electrical systems?

Satellite Accumulation Areas. Hazardous wastes can be accumulated in suitable, DOT-approved containers in areas without compliance with the 90-day accumulation time limit if the total volume of accumulated waste does not exceed 55-gallons (or 1 quart of acutely hazardous wastes, "P" wastes). Once the volume limit is exceeded, those containers must be moved to a conforming storage or accumulation area within 3 days. The 90-day time clock begins running once the volume limit is exceeded.

1103D Date of last revision: Jun 84

While many hazardous wastes are not covered by specific regulations on how they must be stored, the regulations for polychlorinated biphenyls (PCB) highlight several points to be evaluated in determining the best storage site for a specific hazardous waste. The PCB storage regulations issued by the EPA require, for example:

- Adequate roof and walls to prevent water from reaching the stored items.
- 2. A floor which has a minimum curb of 6 inches. The floor and curb must be able to contain two times the volume of the largest item or 25 percent of the volume of all the items and containers stored.
- Floor and curbing constructed of continuously smooth and impervious materials such as Portland cement, concrete, or steel, to prevent or minimize penetration of PCBs.
- 4. No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area.
- 5. A site that is above the 100-year floodwater elevation.
- B. Compatible Storage. Some wastes will react with each other to produce fires, explosions, toxic vapors, or corrosion. In planning to store hazardous wastes, this fact must be recognized. A major problem is that to be reasonably safe, a number of separate areas must be maintained. You should separate incompatible hazardous wastes as much as possible. A method for determining compatibility is explained in section VI of this chapter.

IV. STORAGE AIDS.

Special devices, accesssories, and attachments have been designed to handle wastes in situations where conventional materials handling equipment is not adequate.

- A. Box Pallet. The box pallet is used for storage of odd-sized items or weak containers which will not support a superimposed load. These pallets also prevent fragile items from falling during movement.
- B. Pallet Support Set. The pallet support set can be used to form a box pallet (by assembly onto flat wood pallets) to allow for stacking of pallets containing irregularly shaped commodities, or items that are susceptible to crushing.
- C. Pallet Rack. The pallet rack provides a support for pallets and is independent of lower loads. It is used where the pallets to be stored are not strong enough to support a superimposed load, are irregular in shape, are too small for bulk storage or too large for bin storage, or where it is desirable to remove pallets from a lower tier without disturbing upper tiers. Racks are valuable when trying to segregate small quantities of hazardous wastes. By using racks, the activity can have many separate pallets with different types of chemicals on them without taking up a lot of floor space. Care should be taken, however, to ensure that incompatible wastes are not stored near one another.

- D. Safety Pallet. The safety pallet is used both for maintenance work and for moving wastes in to or out of storage. The safety pallet is handled the same as an ordinary pallet except it is secured to a forklift truck. Primarily, the safety pallet is used to elevate personnel and tools and to permit warehouse people to safely store waste in high racks where items cannot be stored directly by a forklift truck.
- E. Dunnage. Dunnage is used to permit mechanical handling and to protect wastes containers from possible damage from waterflows or dampness from the floor or ground area. In either covered or open storage, wastes should be stored on pallets or dunnage. Skids on boxes or crates should be considered as attached dunnage for storage purposes. Usually, dunnage consumes less storage than a pallet. Dunnage may be cut from salvaged lumber at little cost. It should be used at floor or ground level and between units in the stack when one dimension of a stable container exceeds the width of a forklift truck. A supply of dunnage, cut into appropriate lengths, should be available in all storage areas.
- F. Collars and Notched Spaces.
 - 1. Carboy Collars. To stack glass carboys of acids and similarly packaged items, the weight of the upper pallets must be supported by the protective crating around the carboy. This can be done by use of the wood collar. By using this collar, carboys can be stacked to permit maximum use of storage space. Care should be taken to ensure that the outer edges of the collar rest directly above the sides of the carboy crate. The center member of the collar should be midway between the carboys and securely fastened because this member supports the center stringer of the upper pallet.
 - 2. Collars for Compressed Gas Cylinders. The valves on acetylene and similar cylinders must be protected from the superimposed weight of the upper pallets; this is done by the use of wooden collars. However, since this collar rests upon the cylinder, the neck of which has a slight slope, it is necessary that this unit be reinforced for support. All cylinders palletized in an upright position must be bound with steel strapping to stabilize the load and to prevent accidental tipping of a cylinder during transporting or stacking operations.
 - Notched Spacers. Notched spacers are used for the horizontal palletizing of compressed gas cylinders. Also, these spacers may be used to palletize short sectons of a large diameter pipe or similar items. When cylindrical items are palletized horizontally and must be transported long distances or over rough terrain, such units should be bound to the pallet with wire or steel strapping.
- G. Plastic Tubs. Plastic tubs and small plastic bins come in a variety of sizes and shapes and are often used to store small items. They can also be useful in storing hazardous wastes. If the facility has small hazardous packages which are damaged, fragile, or otherwise

sensitive to rough handling, it may be worthwile to store and transport these items in plastic tubs. In this way, the item receives some protection, and spills will be contained within the tub.

H. Drip Pans. Drip pans are shallow containers designed to contain leaks. These are often used to catch drips from vehicles or engines but can also be placed under leaking containers or containers that are like to leak in the future. In this way, any hazardous waste is contained. Care must be taken, however, to ensure that the leaking waste will not react adversely with the material of which the pan is made.

V. STORAGE SAFETY CONSIDERATIONS.

There are a number of important things to be aware of when storing hazardous wastes. Below are a few of the general safety precautions you should practice in housekeeping, general storage and hazardous waste storage.

- A. Good housekeeping practices are essential to safety as well as to efficient storage operations. Many potential accidents and fires are prevented when inside and outside storage areas are maintained in a clean and orderly condition.
 - 1. Provide adequate lighting so that workers can easily read labels and clearly see what they are doing.
 - 2. Keep machines, equipment, and working surfaces clean and orderly.
 - Provide adequate storage for tools and safety equipment and maintain it in neat order.
 - 4. Provide enough approved waste containers.
 - 5. Systematically remove and dispose of scrap and waste.
 - 6. Clean up work areas as soon as work is completed. Remove hazardous objects from the floor or ground areas during work. Clean up chemical residues and spilled wastes immediately so that they are not spread around the facility.
 - Remove broken straps, exposed nails, and wires from containers or unit loads to avoid personnel injury and to prevent containers from being punctured.
 - Allow eating only in authorized places. This is especially important when workers and food may be contaminated by dangerous chemicals.
 - 9. Keep offices and restrooms in orderly condition.
 - 10. Clean up immediately any spilled flammable liquids, greases, or other dangerous substances from working floors or panel areas.
 - 11. Use containers, pallets, and units of sound construction.

- 12. Maintain proper and safe storage of hazardous packing materials such as excelsior, sawdust, wood cellulose, preservative liquids, and chemicals.
- 13. Eliminate tripping hazards.
- 14. Place flammable waste (such as oily rags, steel wool, and sweeping of excelsior) in special covered metal containers and dispose of regularly.
- 15. Store dunnage material in an orderly manner.
- 16. For inside storage areas:
 - (a) Maintain proper clearances at fire doors, and near overhead sprinklers and bulkheads.
 - (b) Keep floors dry.
 - (c) Prohibit smoking near entrances to prevent discarded cigarettes from being blown in.
 - (d) Do not block established fire doors. Do not block access to fire extinguishers, alarms, eyewashes, or shower facilities.
- B. General Rules for Safe Storage. There are a number of general rules you should follow for any material; when the material is a hazardous waste, these rules become even more significant.
 - All waste containers should be placed and secured in a safe manner.
 - All pallet loads should be squared to achieve a four-point level top. Superimposed loads should be placed squarely and firmly to prevent rocking or tipping.
 - 3. Partially loaded pallets should be stored in pallet racks or at the top of stacks. A full load should not be superimposed on a partial load and a large load should not be superimposed on a small load. Heavy loads shuld not be stored on top of a light load or on material which could be broken or damaged.
 - 4. Nonsecured top loads of tall cylindrical units stacked on end, or any type of unit which has a tendency to lean or settle outwards, should be tied with cord or tape. When stacked vertically, loads with cylinders of compressed gas should be strapped and collared.
 - Broken or damaged pallets should be replaced with pallets in safe condition.
 - 6. Where it is necessary to stack heavy waste containers in open storage on muddy or soft ground or on asphalt-type paved surfaces that soften in hot weather, sufficient base dunnage of broad dimensions should be provided to prevent tipping or settling of the container.

- 7. For regions where strong winds occur, noncapped or nonstrapped stacks of lumber or empty drums in open storage should be tied to prevent top units from being blown off.
- Pallet loads should be stacked with 2 inches of clearance on all sides to prevent dislocation of adjacent units.
- 9. Crushable containers should have vertical supports placed in such a manner that the weight of material stored above will not be supported entirely by the containers.
- 10. Cylindrical units stored in horizontal position should be blocked, nested, or separated by notched horizontal spacers.
- 11. In bulk storage, corner markers at main and cross-aisle intersections should be used to prevent damage to containers.
- 12. All loose straps or wire from loads in storage should be removed to prevent injury to worker. All nails sticking out from dunnage should be pounded level or removed.
- 13. Floor load limits should be observed whether a facility is single or multistory.
- C. Safe Storage of Flammable Wastes. Follow safety rules when storing this type of waste.
 - 1. When storing flammable wastes:
 - (a) Use end bays when possible.
 - (b) Handle containers carefully to avoid breakage.
 - (c) Maintain accessibility to the stack interior for firefighting purposes.
 - (d) Ensure that proper ventilation is maintained for wastes which give off flammable vapors.
 - (e) Avoid storing in any location where spilled liquids may come in contact with sparks or flames.
 - (f) Use only electric materials handling equipment that is spark-enclosed.
 - (g) Post "NO SMOKING" signs and enforce them.
 - In addition to the above rules, if you are storing waste in a standard flammable storage building:
 - (a) Keep all doors and windows open. This will help ventilation during work operations.
 - (b) Keep unauthorized people out of the bulding.
 - (c) Investigate any unusual odor at once.

- (d) Use a combustible gas indicator when spills, leaks, or vapors occur to determine if the area is safe.
- (e) Keep firefighting equipment available and in operating order.
- (f) Remove and repair leaky containers.
- (g) Store gas cylinders (such as acetylene, chlorine, and sulfur dioxide) upright to prevent damage to valves.
- (h) Keep valves on all cylinders containing compressed gases tightly closed.

D. Safe Acid Storage.

- 1. Isolation. All acids should be stored inside. Acids may be stored outside, but must be protected from the direct rays of the sun in covered sheds or under tarps. Acids should be protected against freezing, whether inside or out, to prevent breakage of containers. Drums should be stored with bungs up. Isolation of acids from other materials (such as paper, excelsior, sawdust, wood scrap, cellulose, cloth, textiles, or flammable liquids) should be maintained to prevent fire. Acid drums should be isolated from other chemicals (such as hydrogen sulfide, turpentine, carbides, metallic powers, and combustible materials).
- Ventilation. All inside areas should be well ventilated. Good ventilation should be maintained constantly while people are working in acid storage areas. If leaks and spills of acids occur, the area should be well flushed with large quantities of water. If water is not immediately available, use clean dry sand or gravel to cover the spill. Smoking should not be allowed in or near acid storage areas. Acids should be stored away from metal material, because of the corrosive action of acid vapors.
- 3. Venting of Drums. Drums of acid in storage should be vented weekly or more often in hot weather to release the pressures that may have built up. Extreme caution should be used when plugs in drums are being loosened; a long-handled pipe or plug wrench should be used. Workers should face away from the plug and turn the plug only one turn until the pressure has equalized. Drums should be handled carefully, especially in warm weather, to prevent bumping sharply against each other. Tools must not be permitted to strike the drums or plugs sharply which may cause sparking. Open flames must not be permitted to contact drums or tanks. This is because hydrogen, a highly flammable gas, is often given off by acids as they sit in drums. Sulfuric acid must be especially well ventilated to prevent vapor accumulations.
- 4. Inspection of Containers. All carboys and drums of acid should be carefully inspected for possible leaks. Set aside leaking or damaged containers for special handling. Do not walk a carboy on the edges of its box; use trailers or specially designed handtrucks. Do not handle carboys by the neck. Never attempt to remove carboy stopper wire by twisting or prying; use a

wirecutter. Be sure closures on filled or empty carboys are fastened securely before moving. Unwashed empty carboys must be handled as carefully as filled containers. If acid containers are stored together or on top of one another, special care must be taken to clean up any leaks so that leaking acid does not corrode metal caps. of nearby containers.

E. Storage of Empty Drums.

1. Definitions.

- (a) Container. Any portable device in which a material is stored, transported, disposed, or otherwise handled.
- (b) Hazardous Previous Contents Containers. Containers that have previously contained materials that are hazardous by any Federal (DOT/EPA/Occupational Safety and Health Act (OSHA)) or state definition.
- (c) Acutely Hazardous Previous Contents. Containers that have previously contained any material listed in the Resource Conservation and Recovery Act (RCRA) regulations as acutely hazardous (40 CFR 261-33(e)). This list covers those hazardous wastes that are very toxic. There are 122 such wastes on that list.

2. Empty Containers.

- (a) A container is considered empty if all wastes have been removed, and no more than one inch of residue remains on the bottom of the container or inner liner.
- (b) A container is also considered empty if no more than three percent by weight of its total capacity remains in the container (for containers less than or equal to 110 gallons in size) or 0.3 percent for larger containers.
- (c) A container that previously held an acutely hazardous material is considered "empty" only if it has been triple rinsed with an appropriate solvent, cleaned by an equivalent removal method approved by the EPA, or has had the liner removed.
- (d) Empty compressed gas containers are ones which have been opened to atmospheric pressure.

Storage.

Containers must be stored according to the category of previous contents (nonhazardous, hazardous,, or acutely hazardous). In all cases, storage compatibility must be observed.

F. Indoor and Outdoor Storage.

Ideally, hazardous wastes will be stored indoors to provide adequate protection to the container and to minimize the potential for environmental damage. However, under certain circumstances it may be

necessary to store hazardous waste outside. If this happens at your facility, there are several things that should be done to minimize the likelihood of accidents, spills, and damage to the waste container.

First, select an outdoor storage area with enough room available for the waste. Congestion at storage sites is a leading factor in the development and spread of fire. Make sure that the land is level and stable. Sloping land or swampy ground creates problems with stored waste stability and poses a serious hazard to firefighters. Make sure that grass, brush, and debris do not create a fire hazard. Make sure that an outdoor hazardous waste storage area is roped off and identified with appropriate warning signs. Make an earth berm around the storage site to contain any hazardous waste that might spill. Inspect the outdoor storage area frequently to detect any problems that might develop. Use tarps to protect stacks of hazardous waste from the elements. If at all possible, do not store fiberboard or other packages susceptible to water damage outside.

All of these practices can help to reduce the chances that you will have an accident or spill with hazardous waste stored outdoors. Remember though, that the best outdoor storage technique for hazardous waste is usually not store it outside at all!

VI. STORAGE COMPATIBILITY.

Because many hazardous wastes will react with other wastes producing fires, explosions, and toxic fumes, it is necessary to develop and follow a plan to prevent these wastes from coming in contact with each other. Given the limited resources available at most activities, and the wide variety of wastes that are handled, the implementation of a compatible storage plan is not easy. Where you store various categories of hazardous waste at your activity depends upon your local operating procedures and on storage compatibility. During this secton of instruction, we will talk about general storage compatibility rules and how to determine if certain wastes require special storage consideration.

A. General Storage Compatibility Rules.

1. Flammable and Combustible Liquids. In storing flammable and combustible liquids you must consider stacking heights and distances between stacks. Different classes of liquids (based on flashpoints) have different restrictons. Flammable liquids should be classified according to flashpoint. If not immediately available on the container, this information can be obtained from the various references at your activity. The classification of flammable and combustible liquids is described below.

DOT Classification	Flash Point	Boiling Point
Flammable Liquid	Less than 100° F	
Class IA	Less than 73° F	Less than 100° F
Class IB	Less than 73° F	100° or above
Class IC	Less than 100° F; at or above 73° F	

DOT Classification	Flash Point	Boiling Point
Combustible Liquid	100° F or above	
Class II	100° F to less than 140° F	
Class IIIA	140° F to less than 200° F	
Class IIIB	200° F or above	

By classifying a liquid acording to flashpoint, it is possible for workers to reduce the chance of accidents and fires when dealing with flammable and combustible liquids.

Page IX-6 lists the safe storage rules for flammable wastes. There are several additional considerations when storing flammable liquids. Stacked containers should be separated by pallets or dunnage when necessary to provide stability and to prevent excessive stress on container walls. The outdoor storage area should be graded in a manner so that spills will be diverted from buildings or they should be surrounded by a curb at least 6 inches high.

Compressed Gases. Such gases must be handled with extreme care-particularly flammable and explosive gases. Compressed gas cylinders must never come in contact with fire, sparks, or electrical circuits. Also, injury or death can be caused by breathing some of these gases.

(a) General Precautions.

- For storage and handling purposes, all cylinders should be considered full and corresponding care exercised.
- Empty cylinders should not be stored with full cylinders.
- Cylinders should not be used for rollers, supports, or for any purpose other than containing compressed gas.
- Compressed gas should not be used to dust off clothing.
- Suitable material handling equipment should be used for lifting and moving cylinders.
- "NO SMOKING" signs should be posted and enforced around compressed gas storage sheds.

(b) Storage Criteria for Gas Cylinders.

- Roofed, open-sided shed storage on a concrete slab, above grade, is the preferred type of storage facility if climatic conditions permit.
- All storage facilities for compressed gases should be separated from other buildings by a least 50 feet.

- Sheds should be constructed of light, noncombustible materials.
- If one or more sides are installed, provisions must be made to ensure a complete change of air at least six times each hour.
- If an enclosed storage facility is used, separate storage rooms must be constructed for flammable gases.
- (c) Protective Equipment. Where irritant gases (such as ammonia and sulfur dioxide) are present in light concentrations, gastight goggles and respiratory protective devices, or full face mask respiratory protective devices should be worn. When entering areas known to be highly contaminated, workers should be properly equipped with self-contained breathing apparatus or other appropriate respiratory equipment. Mechanical filter respirators offer no protection against high gas concentrations and should not be used. Workers should be trained in the use and care of respiratory protective equipment and in inspection for operational capability.
- (d) Although compressed gas cylinders may be listed as "empty", they should be handled and stored as "full" cylinders. Valve protection caps, where cylinders are designed to accept caps, must always be in place unless the cylinders have been devalved or have holes drilled in them. Oxygen cylinders in storage must be separated from fuel gas cylinders by a minimum of 20 feet or by a noncombustible barrier at least 5 feet high having a fire resistance rating of a least one-half hour. Compressed gas cylinders, condemned or not, should not be devalved, torch cut, mutilated, or crushed. Residual amounts of gas always remain in these cylinders.
- 3. Acids. Acids are dangerous to workers because of their corrosive qualities. Page IX-7 lists the safe storage rules for acid storage. In addition, care must be taken to prevent any spill or container breakage which could permit contact to skin or eyes, or inhalation into lungs. Buildings used for bulk storage of acid should be one story in height, of fire-resistant construction, and equipped with automatic sprinkler protection. They should be heated to prevent freezing of certain acids. Protective clothing, eye wash, deluge-shower, and self-contained breathing apparatus should be readily available. Different acids should be stored separately in designated areas.
- B. EPA Hazardous Wastes Compatibility Chart. The purpose of this compatibility chart is to show chemical combinations that can be dangerously reactive. The EPA chart can be used to help develop a compatible storage plan. In order to use the chart:
 - 1. Using Appendix A, the list of Reactivity Group Numbers (RGN), identify RGNs for all Hazardous Wastes to be stored.
 - Find the RGN of the first group on the first column of the chart (Appendix B).

- 3. Find the RGN of the second group from the bottom squares of RGNs.
- 4. Find the intersecting reaction square for the two RGNs.
- 5. Note the Reaction Code(s) (RC) in the square.
- 6. Refer to the legend on the chart for the explanation of the RC.
- Continue comparing one-by-one until all combinations have been considered.

If there is a negative reaction possible, segregate the two wastes from each other.

VII. SUMMARY

During this unit, we have covered the safe storing of hazardous wastes; reviewed procedures you should be using to store hazardous waste safely; discussed why your activity should have and follow a plan for compatible storage; and gone over the use of storage aids. You should practice using the different aids for determining storage compatibilities, and check to see if these aids are available at your activity. Proper storage techniques go along with proper identification, labeling, handling, and packaging procedures in reducing accidents and environmental damage.

VIII. REFERENCES

NFPA 30; "Flammable and Combustible Liquids Code, 1984" can be obtained from:

National Fire Protection Association Batterymarch Park Quincy, MA 02269

APPENDIX IX-A

LIST OF REACTIVITY GROUP NUMBERS (RGNs) FOR CHEMICAL SUBSTANCES

Names	Synonyms	RGN
Abate*		32
Acenaphthene		16
Acetamide		6
A cetal dehyde		5
Acetic acid		. 3
Acetic anhydride		107
Acetone	Dimethyl ketone	19
Acetone cyanohydrin	Hydroxyisobutyronitrile	4, 26
Acetonitrile	Methyl cyanide	26
Acetophenone		19
Acetoxybutane	Butyl acetate	13
Acetoxypentane	Amyl acetate	13
Acetyl acetone		19
Acetyl azide		102
Acetyl benzoyl peroxide		30
Acetyl bromide		17, 107
Acetyl chloride		17, 107
Acetylene		28
Acetyl nitrate		27, 102
Acetyl peroxide		30
Acrolein	Aqualin	5, 103
Acrylic acid		3, 103
Acrylonitrile		26, 103
Adipic acid		3
Adiponitrile		26
Agailol	Methoxyethylmercuric	
이 글을 잃었다면 있는데 그 얼마나 되는 것으로	chloride	24
Agaloaretan	Methoxymethylmercuric	
	chloride	24
Aldicarb	Temik*	9, 20
Aldrin		17
Alkyl aluminum chloride		107
Alkyl resins		101
Allene		28
Allyi alcohol	2-Propen-1-o1	4
Allyl bromide	Bromopropene	17
Allyl chloride	Chloropropene	17
Allyl chlorocarbonate	Allyl chloroformate	13, 17
Allyl chloroformate	Allyl chlorocarbonate	13, 17
Allyl trichlorosilane		107
Aluminum		22, 23
Aluminum aminoborohydride		107
Aluminum borohydride		105, 107

Names	Synonyms	RGN
Aluminum bromide		
Aluminum carbide		107
Aluminum chloride		105
Aluminum diethyl monochloride	Diethylaluminum chloride	105, 107
Aluminum fluoride		15, 107
Aluminum hydride		105
Aluminum hypophosphide		107
Aluminum phosphide Aluminum tetraazidoborate		107
Aminobenzene	Aniline	8
Aminobutane	Butylamine	7
Aminochlorotoluene	Chlorotoluidine	7, 17
Aminodiphenyl		7
Aminoethane	Ethylamine	7
Aminoethanoi		4, 7
Aminoethanolamine		7
Aminonexane Aminomethane	Hexylamine.	7
Aminopentane	Methylamine Amylamine	7 7
Aminophenol	Amytamine	7, 31
Aminopropane	Isopropyl amine	7
Amino propionitrile		7, 26
Aminothiazole		7, 8
Aminotoluene Ammonia	Toluidine	7
Ammonium arsenate		10
Ammonium azide		24 102
Ammonium bifluoride		15
Ammonium chlorate		102, 104
Ammonium dichromate		24, 102
Ammonium fluoride Ammonium hexanitrocobaltate		15
Ammonium hydroxide		24, 102
Ammonium hypophosphide		105
Ammonium molybdate		24
Ammonium nitrate Ammonium nitridoosmate		102
Ammonium nitrite		24, 104
Ammonium perchiorate		102 104
Ammonium periodate		102, 104
Ammonium permanganate		24, 102, 104
Ammonium persulfate Ammonium picrate		104
Ammonium sulfide		33, 105
Ammonium tetrachromate		24, 104
Ammonium tetraperoxychromate		24, 102, 104
Ammonium trichromate Amyl acetate	A cotour postone	24, 104
Amyl alcohol	Acetoxy pentane	13
Amyl chloride	Chloropentane	17
Amyl cyanide		26
Amylamine Amylene	Aminopentane Pentene	7
Amyl mercaptan	Pentanethiol	28 20
Aniline		7
Animert* V-101	Tetrasul	20
Anisole Anisole chloride		14
Anthracene		107
Antimony		23, 24
Antimony chloride	Antimony trichloride	24, 107
Antimony fluoride	Antimony trifluoride	24, 107
Antimony nitride Antimony oxychloride		24, 25
Antimony oxide	Antimony trioxide	24 24
Antimony pentachloride		24
Antimony pentafluoride		24
Antimony pentasulfide		24, 33, 105
Antimony perchlorate Antimony potassium tartrate		24, 104
Antimony sulfate	Antimony trisulfate	24
Antimony suifide	Antimony trisulfide	24, 33, 105
Antimony tribromide		24, 107
Antimony trichloride	Antimony chloride	24, 107
Antimony trifluoride	Antimony fluoride	24, 107
Antimony triiodide Antimony trioxide	Antimony oxide	24, 107
Antimony trisulfate	Antimony sulfate	24
Antimony trisulfide	Antimony sulfide	24, 33
Antimony trivinyl	A late	24, 107
Aqualin Aqueous solutions & mixtures	Acrolein	5, 103 106
Aretan*	Methoxyethylmercuric	100
	chloride	24
Aroclor*	Polychlorinated biphenyl	17
Arsenic Gromide	Arsenic tribromide	24, 107
Arsenic chloride	Arsenic trichloride	24, 107

등이에게 하면서 하고 있는데 사람이 없는데 하다 없었다.		
Names	Synonyms	RGN
Arrania distufida	Associa sulfida	24 22 104
Arsenic dislufide Arsenic iodide	Arsenic sulfide	24, 33, 105
Arsenic locide Arsenic oxide	Arsenic triiodide	24, 107
Arsenic battle Arsenic pentaselenide	Arsenic pentoxide	24
Arsenic pentasulfide		24, 33
Arsenic pentoxide	Arsenic oxide	24, 33
Arsenic sulfide	Arsenic disulfide	24, 33, 105
Arsenic tribromide	Arsenic bromide	24, 107
Arsenic trichloride	Arsenic chloride	24, 107
Arsenic trifluoride	Aliseide Cidolide	24, 107
Arsenic triiodide	Arsenic iodide	24, 107
Arsenic trisulfide		24, 33, 105
Arsine		24, 105
Askarel	Polychlorinated biphenyl	17
Aschalt		101
Azigocarbonyl guanidine		8, 102
Azido-s-triazole		3
Azinphos ethyi		32
Aziridine	Ethyleneimine	7, 103
a,a-Azodiisobutyronitrile		3, 26
Azogrin*	Monocrotophos	32
Caxente*		101
Bano!	Carbanolate	9
Barrum		21, 24, 107
Barium azide		24, 102
Barium bromate		24, 104
Barium carbide .		24, 105, 107
Barium chlorate		24, 104
Barium chloride Barium chromate		24
Barium fluoride		24, 104
Barium fluosilicate		15, 24
Barium hydride Barium hydroxide		24, 105
Barium hypophosphide		10, 24
Barium iodate		24, 105 24, 104
Barium iodide		24, 104
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 25141	Fensulfothion	32
Baygon*		9
Benzadox	Topcide*	6
Benzal bromide		17
Benzal chloride		17
Benzaldehyde		5
Benz-a-pyrene		16
Benzene diazonium chloride		16
Benzene diazonium chloride Benzene phosphorus dichloride		8, 102 107
Benzidine		7
Benzoic acid		
Benzonitrile		26
Benzophenone		19
Benzoquinone	Quinone	19
Benzotriazole		8, 102
Benzotribromide		17
Benzotrichloride		17
Benzotrifluoride	Trifluoromethylbenzene	17
Benzoyl chloride	그 걸다면 하는 것이 없는 것이다.	107
Benzoyl peroxide	Dibenzoyl peroxide	30, 102
Benzyl alcohol		4
Benzylamine		7
Benzyl benzene	Diphenylmethane	16
Benzyl bromide	Bromotoluene	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, 107

Names	Synonyms	RGN
Beryllium hydroxide		10, 24
Beryllium oxide		24
Beryllium sulfide		33, 105
Beryllium tetrahydroborate Bidrin*		24, 105, 107
Bismuth		22, 23, 24
Bismuth chromate		24
Bismuthic acid Bismuth nitride		24, 25, 102
Bismuth pentafluoride		24, 107
Bismuth pentaoxide		24
Bismuth sulfide		24, 33, 105
Bismuth tribromide Bismuth trichloride		24 24
Bismuth triiodide		24
Bismuth trioxide		24
Bismuth trisulfide	Sulfatoon	24, 33, 105
Blada-fum* Blue vitriol	Sulfotepp Copper sulfate	32 24
Bomyl	Copper Called	32
Borane		24, 107
Bordeaux arsenites Boric acid		24
Boron arsenotribromide		24, 105
Soron bromodiiodide		24, 107
Boron dibromoiodide		24, 107
Boron nitride Boron phosphide		24, 25 24, 107
Boron triazide		24, 102
Boron tribromide		24, 107
Boron trichloride Boron trifluoride		24, 107
Boron triiodide		24, 107 24, 107
Boron trisulfide		24, 33, 105
BPMC	Bassa*	9
Brass Bromic acid		23
Bromine		104
Bromine azide		102
Bromine cyanide	Cyanogen bromide	104, 107
Bromine monofluoride Bromine pentafluoride		104, 107
Bromine trifluorice		104, 107
Bromoacetylene		17
Bromobenzoyl acetanilide Bromobenzyl trifluoride		6, 19
Bromodiborane		105
3romodiethylaluminum		107
Sromodimethoxyaniline	Tribromomethane	14
Sromoform Bromomethane	Methyl bromide	17
Bromophenol		17, 31
Bromopropene	Allyl bromide	17
Bromopropyne Bromosilane		17
Bromotoluene	Benzyl bromide	17
Bromotrichloromethane		17
Bromotrifluomethane	3.5-Dibromo-4-hydroxy	17
Bromoxynil	benzonitrile	17, 26, 31
Bronze		23
Buna-N*		101
Bunker fuel oil Butacarb		101
Butadiene		28, 103
Butadiyne	Diacetylene	28
Butanal Butane	Butyraldehyde	5 29
Butanediol		4
Butanethiol	Butyl mercaptan	20
Butanetriol trinitrate	David allerted	102
Butanol Butanone	Butyl alcohol Methyl ethyl ketone	19
Butenai	Crotonaldehyde	5
Butene	Machael Manual Lancas	28
Butene-2-one Butyl acetate	Methyl vinyl ketone Acetoxybutane	19
n-Butyl acrylate	, icetox, battale	13, 103
Butylamine	Aminobutane	7
Butyl alcohol	Butanol	8
t-Butyl azidoformate Butyl benzene	Phenyibutane	16
Butyl benzyl phthalate		13
Butyl diplombers		105
Butyl dichloroborane Butyl ether	Dibutyl ether	105

	Cunnyume	BCN
Names	Synonyms	RGN
Butly formate		13
Butyl fluoride		17
Butyl glycidyl ether		34
Butyl hydroperoxide		30
t-Butyl hypochlorite		102, 104 105, 107
n-Butyl lithium	Butanethiol	20
Butyl mercaptan	Butanetruot	30
Butyl peroxide Butyl peroxyacetate	t-Butyl perbenzoate	30
Butyl peroxybenzoate		30
Butyl peroxypivalate		30
t-Butyl perbenzoate	Butyl peroxyacetate	30
t-Butyl-3-phenyl oxazirane		34
Butyl trichlorosilane		107
Butyramide		6
Butyraldehyde	Butanol	5
Butyric acid		3 26
Butyronitrile		9
Bux*	Dimethylarsenic acid	24
Cacodylic acid Cadmium	Dimetriylar seric acid	23, 24
Cadmium acetylide		24, 105, 107
Cadmium arnide		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 Cadmium hexamine perchlorate		24, 102 24, 102
Cadmium iodide		24
Cadmium nitrate		24, 102, 104
Cadmium nitride	레이블리 12 개월 13일 12일 12일 12일 12일	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
Calcium arsenite Calcium bromate		104
Calcium carbide		105, 107
Calcium chlorate		104
Calcium chlorite		104
Calcium fluoride		15
Calcium hexammoniate		105
Calcium hydride	18 P. District 18 Phys. 5 Lea 1980	105, 107
Calcium hydroxide	Hydrated lime	10
Calcium nypochlorite	Calcium oxychloride	104
Calcium hypophosphide		105
Calcium locate Calcium-manganese-silicon alloy		23
Calcium nitrate	Lime nitrate, nitrocalcite	104
Calcium oxide	Slaked lime	10, 107
Calcium exychloride	Calcium hypochlorite	104
Calcium perchromate		104
Calcium permanganate		104
Calcium peroxide		104
Calcium phosphide		107
Calcium sulfide		33, 105
Camphor oil		101
Caproic acid Caproic acid	Hexanoic acid	
Caprylic acid	HEXABOIC ACID	3
Caprylyl peroxide	Octyl peroxide	30
Carbacrol		31
Carbaryl		9
Carbetamide		6
Carbanolate	Banol	9
Carbofuran	Furadan*	9
Carbolic acid Carbolic oil	Phenol	31
Carbon, activated, spent		31
Carbon bisulfide	Carbon disulfide	101
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

Names	Synonyms	RGN
CDEC		
CDEC		12
Cellulose	Allera II. I	101
Cellulose nitrate Cerium	Nitro cellulose	27, 102
Cerium hydride		22
Cerium trisulfide		105
Cerous phosphide		33, 105 105
Cesium		21
Cesium amide		107
Cesium azide		102
Cesium carbide		105
Cesium fluoride		15
Cesium hexahydroaluminate		105
Cesium hydride		105, 107
Cesium phosphide		107
Cesium sulfide		33, 105
Chloral hydrate	Trichloroacetaldehyde	. 5
Chlordane		17
Chlorestol	Polychlorinated biphenyl	17
Chlorie acid		32
Chloric acid Chlorine		2, 104
Chlorine azide		104
Chlorine dioxide		102
Chlorine fluoroxide		102, 104, 107
Chlorine monofluoride		102, 104
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
Chloroazodin		3, 17
Chlorobenzene Chlorobenzotriazole		17
Chlorobenzoyl peroxide		8, 17
Chlorobenzylidene malononitrile		17, 30
Chlorobutyronitrile		17, 26
Chloro chromic anhydride	Chromyl chloride	17, 26 24, 104, 107
Chlorocreosol	Chaomyr Chaoride	17, 31
Chlorodiborane		105
Chlorodiisobutyl aluminum		105, 107
Chlorodimethylamine diborane		105
Chlorodinitrobenzene	Dinitrochlorobenzene	17, 27
Chloro dinitrotoluene		17, 27
Chlorodipropyl borane		105
Chloroethane	Ethyl chloride	17
Chloroethanol		4, 7
Chloroethylenimine Chloroform	Talablassanash	17
Chlorohydrin	Trichloromethane	17
Chloromethane	Methyl chloride	17
Chloromethyl methyl ether	mentyr circuite	17
Chloromethyl phenoxyacetic acid		3, 17
Chloronitroaniline		17, 27
Chloronitrobenzene	Nitrochlorobenzene	17, 27
Chloropentane	Amyl chloride	17, 27
Chicrophenol		31
Chlorophenyl isocyanate		17, 13, 107
Chloropicrin	Chlorpicrin,	
Chlorossos	Trichloronitromethane	17, 27, 102
Chloropropane	Isopropyl chloride	17
Chloropropene Chloropropylene oxide	Allyl chloride	. 17
Chlorosilane	Epichlorohydrin	17, 34
Chlorosuifonic acid		105
Chlorothion*		12 12
Chlorotoiuene	Benzyl chloride	17, 32
Chlorotoluidine		7, 17
Chlorotrinitrobenzene	Picryl chloride	
Chlorotrinitrobenzene 3-Chlorov:nyldichloroarsine	Picryl chloride Lewisite	17, 27, 102
3-Chlorov:nyldichloroarsine Chloroccrin	Lewisite	17, 27, 102
3-Chlorov:nyldichloroarsine		17, 27, 102
3-Chlorov:nyldichloroarsine Chloroccrin	Lewisite Trichloronitromethane	17, 27, 102

Names	Synonyms	RGN
Chromic anyhdride	Chromium trioxide,	
Character ablants	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, 33, 103
Chromium trifluoride	Chromic fluoride	15, 24
Chromium trioxide	Chromic acid,	13, 24
Chaomidir aroxide		
Chromyl chloride	Chromic anhydride	2, 24, 104
Chromyl chloride	Chloro chromic anhydride	24, 104, 107
Chrysene	a [기본] (일어) - [세계는 기계에게 하기를 (기	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, 104
Cobaltous chloride	Cobalt chloride	
Cobaltous nitrate	Cobalt nitrate	24
Cobaltous resinate	Cobalt resinate	24, 104
Cobaltous sulfate		24
	Cobalt sulfate	24
Cobalt resinate	Cobaltous resinate	24
Cobalt suifate	Cobaltous sulfate	24
Collodion	Pyroxylin	27
Copper		23, 24
Copper acetoarsenite	Paris Green	24
Copper acetylide	24.	102, 105, 107
Copper arsenate	Cupric arsenate	24
Copper arsenite	Cupric arsenite	24
Copper chloride	Cupric chloride	
Copper chlorotetrazole	Cupric citoride	24
	Consider account de	24
Copper cyanide	Cupric cyanide	11, 24
Copper nitrate	Cupric nitrate	24, 104
Copper nitride	생생님 [1] 경기가 하게 하면요요요. 시설계 = :	24, 25
Copper suifate	Cupric sulfate, Blue vitriol	24
Copper sulfide		24, 33, 105
Compound 1836	Diethyl chlorvinyl phosphate	17, 32
Coroxon*		32
Coumafuryl	Fumarin	19
Coumatetralyl		19
Cresol		31
Cresol glydicyl ether		34
Cresote		
Crimidine	Castrix	31
		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 suifate	24, 104
	Copper sunate	
Cupriethylenediamine	Majoria nissila	7, 24
Cyanoacetic acid	Malonic nitrile	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
		107
Cyclonexenyl trichlorosilane		
Cyclohexyl phenol		31
Cyclohexyl trichlorosilane		107
Cyclopentane		29
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*	Fensulfothion	32

Names	Synonyms	RGN
DBCP	Dibeamaghlasansana	17
003	Dibromochloropropane Dichlorobenzene	17
000	DIC. Horobenzene	17
DONP	Diazodinitrophenol	3, 27, 102
100	Diddouinin opiiciio;	17
DDVP	Dichlorovos, Vapona*	17, 32
DE.AC	Diethylaluminum chloride	105, 107
Decaborane		107
Decahydronaphthalene	Decalin	29
Decalin	Decanydronaphthalene	29
Decane Decanor		29
Decene		23
Decyl benzene		16
Delnav*	Dioxathion	32
Demeton-s-methyl sulfoxid	Metasystox R*	32
Diacetone alcohol		4, 19
Diacetyl		19
Diacetylene Diamine	Butadiyne	28
Diaminobenzene	Hydrazine	8, 105
Diaminohexane	Phenylene diamine Hexamethylenediamine	7
Diazidoethane	riexamethylenediamine	9 102
Diazinon*		8, 102 32
Diazodinitrophenol	DDNP	27, 102
Dibenzoyl peroxide	Benzoyl peroxide	30, 102
Diborane	Diboron hexahydride	105, 107
Diboron hexahydride	Diborane	105, 107
Dibutyl ether	Butyl ether	. 14
Dibutyl phthalate 3,5-Dibromo-4-hydroxybenzonitrile	9.comovumil	13
Dibromochloropropane	Bromoxynil DBCP, Fumazone*, Nemagon*	17, 26, 31
Dibromoethane	Ethylene dibromide	17
Dichloroacetone	anytone apromise	17, 19
Dichloroamine		104
Dichlororobenzene	DCB	17
Dichlorobenzidine		7, 17
Dichlorodimethylsilane Dichloroethane	Dimethyl dichlorosilane	107
Dichloroethene	Ethylene dichloride	17
Dichloroether	Dichloroethylene Dichloroethyl ether	17
Dichloroethylarsine	Diciaoroethyr ether	14, 17 24, 107
Ethyl dichlorosilane		107
Ethyl ether	Dichloroether	14, 17
Dichloroisocyanuric acid	Dichloro-s-triazine-2,4,5-trione	104
Dichloromethane	Methylene chloride	17
Dichlorophene Dichlorophenol		17
Dichlorophenoxyacetic acid	2,4-D	17, 31
Dichloropropane	Propylene dichloride	3, 17
Dichloropropanol	Tropytone diduction	4, 17
Dichloropropene	Dichloropropylene	17
Dichloropropylene	Dichloropropene	17
Dichloro-s-triazine-2,4,5-trione	Dichloroisocyanuric acid	104
Dichlorovos	DDVP	17, 32
Dicumyl peroxide Dicyclopentadiene		30
Dieldrin		28
Diethanolamine		4, 7
Diethyl aluminum chloride	Aluminum diethylmonochloride,	4, /
	DEAL	105, 107
Diethylamine		7 -
Diethyl benzene		16
Diethyl chlorovinyl phosphate	Compound 1836	17, 32
Diethyl dichlorosilane Diethylene dioxide	Diavasa	107
Diethylene giycol dinitrate	Dioxane	27 102
Diethylene glycol monobutyi		27, 102
ether acetate		13
Diethylene triamine		7
Diethyl ether		14
Diethyl ketone		19
Diethyl zinc	7ing athul	34 105 107
Diesel oil	Zinc ethyl	24, 105, 107
Difluorophospinoric acid		101
Diglycidyl ether	Bis(2,3-epoxypropyl) ether	34
Diisobutylene		23
Diisobutyl ketone	The state of the s	19
Diisopropanolamine		4, 17
Diisopropylbenzene hydroperoxide		30
Diisopropyi beryllium		24, 104, 107
Diisopropyl ether Diisopropyl peroxydicarbonate	Isopropyl ether	14
Dimecron*	Isopropyl percarbonate Phosphamidon	30
Dimefox	Hanane*	6, 32
Dimethyl acetylene		23
		20

Names	Synonyms	RGN
Dimetnyl amine		7
Dimethylamino azobenzene	Methyl yellow	7, 8
Dimethyl arsenic acid	Cacodylic acid	24
Dimethylbenzyl hydroperoxide Dimethyl butane	Cumene hydroperoxide Neohexane	30
Dimethyl butyne	Neonexane	29 28
Dimethyl dichlorosilane	Dichlorodimethylsilane	107
Dimethyldithiophosphoric acid		32
Dimethyl ether		14
Dimethyl formal		19
Dimethyl formamide Dimethylbexane dihydroperoxide		6
Dimethyl hydrazine	UDMH	30
Dimethyl ketone	Acetone	19
Dimethyl magnesium		105, 107
Dimethylnitrobenzene	Nitroxylene	27
Dimethylnitrosoamine Dimethyl suifide	N-Nitrosodimethyl amine	7, 27
Dimeton	Methyl sulfide	20
Dinitropenzene		32 27
Dinitrochlorobenzene	Chlorodinitrobenzene	17, 27
2.4-Dinitro-6-sec-butyl phenol	Dinoseb	27, 31
Dinitrocresol	DNOC, Elgetol 30	27. 31
Dinitrophenol Dinitrophenyl hydrazine		27, 31
Dinitrotoluene		3, 27
Dinoseb	2,4-Dinitro-6-sec-butylphenol	27, 31
Dioxacarb	2,4-Billio-0-3ec-batytpileiloi	27, 31
Dioxane	Diethylene dioxide	14
Dioxathion	Delnav*	32
Dipentaerythritol hexanitrate		27, 102
Dipentene Diphenamide		28
Diphenyl	Phenylbenzene	6
Diphenyl acetylene		16
Diphenylamine		7
Diphenylamine chloroarsine	Phenarsazine chloride	7, 24
Diphenyl ethane Diphenyl ethylene	Stilbene	16
Diphenyl methane	Benzylbenzene	16
Diphenylmethane diisocyanate	Benzyroenzene	18, 107
Diphenyl oxide		14
Dipicryl amine	Hexanitrodiphenylamine	7, 27, 102
Dipropyl amine	D1	7
Disulfoton Disulfuric acid	Disyston*	32
Disulfur dinitride		25, 102
Disulfuryl chloride		107
Disyston*	Disulfoton	32
Dithane* M-45		12
Dithione* DNOC	Sulfotepp	32
Dodecene	Dinitrocresol	27, 31
Dodecyl benzene		28 16
Dodecyl trichlorosilane		107
Dowco-139*	Mexacarbate	9
Dowicide I	o-Phenyl phenol	31
Dowtherm Durene		16
Dyfonate*	Fonofos	16 32
Dynes Thinner		101
Elgetol 30	Dinitrocresol	27, 31
Endolsulfan	Thiodan*	17, 20
Endothall		3
Endothion Endrin	Exothion	32
EPN		17
Epichlorohydrin	Chloropropylene oxide	17, 34
Epoxybutane		34
Epoxybutene		34
Epoxyethane	Ethylene oxide	34, 103
Epoxyethylbenzene	Districted sets as	34
Bis(2-3-Epoxypropyl) ether Ethane	Diglycidyl ether	34 29
Ethanethiol	Ethyl mercaptan	20
Ethanol	Ethyl alcohol	4
Ethion*	Nialate	32
Ethoxyethanoi		4, 14
Ethyl acetate		13
Ethyl acetylene Ethylacrylate		28
Ethyl alcohol	Ethanol	13, 103
Ethylamine	Aminoethane	7
Ethyl penzene	Phenylethane	16
Emyi butanoate	Ethyl butyrate	13
Ethyl butyrate Ethyl chloride	Ethyl buranoate	13
Ethyl chloroformate	Chloroethane	13. 17
		13. 17

Names	Synonyms	RGN
Ethyl dichloroarsine	Dichlorcethylarsine	24, 107
Ethyi dichlorosilane		107
Ethylene	Diethyl ether	14
Ethylene incomic oxide		23 24, 104
Ethylene chloronydrin		4, 17
Ethylene dyanohydrin Ethylene diamine	Hydroxypropionitrile	4, 26
Emylene dibromide	Dibromoethane	7
Ethylene dichloride	Dichloroethane	17
Ethylene glycol Ethylene glycol dinitrate	Glycol dinitrate	37 102
Ethylene glycoi monomethyl ether	diyeor dilittate	27, 102 4, 14, 17
Ethyleneimine	Aziridine	7, 103
Ethylene oxide Ethyl formate	Epoxyethane	34, 103
2-Ethylhexyl acrylate		13, 103
Ethyl mercaptan	Ethanethiol	20
Ethyl nitrate Ethyl nitrite		27, 102
Ethyl propionate		27, 102
Ethyl trichlorosilane		107
Exothion Eugenol	Endothion	32
Fensulfothion	Bayer 25141, Dasanit*	31
Ferbam		12
Ferric arsenate Ferric sulfide		24
Ferrous Arsenate	Iron arsenate	33 24
Ferrous sulfide		33, 105
Fluoranthrene Fluorene		16
Flucime		104, 107
Fluorine acros		102
Fluoreacetamilide	Oxygen difluoride	104, 107
Finnacine and		6. 17
Filosoperic acid		1, 15
Fluorosulfonic acid	Fluosulfonic acid	1, 107
Fluosulfonic acid Fluosilicic acid	Fluorosulfonic acid	1, 107 1, 15
Fonofos*	Dyfonate*	32
Formaldehyde	Methanal	5
Formamide Formetanate hydrochloride		6
Formic acid	Methanoic acid	3
Freon*	Prothoate	32
Fumaric acid		17
Fumarin	Coumafuryl	19
Furadan*	Dibromochloropropane Carbofuran	17
Furan	Furfuran	9
Furfural		5
Furfuran Gas oil, cracked		14
Gasoline		101
Germanium sulfide		33, 105
Glutaraldehyde Glycerin		5 4
Glycidol		34
Glycol diacetate	THE RESIDENCE OF STREET	13
Glycol dinitrate Glycol ether	Ethylene glycol dinitrate	27, 102 14
Glycolic acid		3
Glycol monolactate trinitrate		27, 102
Glycolonitrile Gold acetylide		26 105, 107
Gold cyanate	Gold fulminate	102, 107
Gold fulminate	Gold cyanate	102
Gold sulfide Grease		33, 105 101
Guaiacol		31
Guanyl nitrosaminoguanylidene hydrazi	ne	8, 102
Guanidine nitrate Gun cotton	Nitrocellulose	27, 104 27, 102
Guthion*		32
Hafnium	Dimefeu	22
Hanane* Hemimellitene	Dimefox	6, 32 16
Heptachlor		17
Heptane		29
Heptanal Heptanol		5 4
Heptanone		19
Heptene		28
Hexaborane Hexachlorobenzene		105
		1/

Names		
Names	Synonyms	RGN
Hexadecyl trichorosilane		107
Hexaethyl tetraphosphate		32
Hexafluorophosphoric acid Hexahydride diborane	Diborane	1, 15
Hexamethyl benzene	Dibotale	105, 107
Hexamethylenediamine	Diaminohexane	7
Hexamethylenetetraamine		7
Hexanitrodiphenylamine	Dipicrylamine	7 27 102
Hexanol	Dipici ylanine	7, 27, 102
Hexanoic acid	Caproic acid	3
Hexene Hexylamine		23
Hexyl trichlorosilane	Aminohexane	107
Hexyne		28
HMX		102
Hopcide* Hydrated lime	Calgium budgevide	9
Hydrazine	Calcium hydroxide Diamine	3, 105
Hydrazine azide		8, 102
Hydrazoic acid	Hydrogen azide	102
Hydriodic acid Hydrobromic acid	Hydrogen iodide	1
Hydrochloric acid	Hydrogen bromide Muriatic acid	1, 107
Hydrocyanic acid	Hydrogen cyanide	1, 11
Hydrofluoric acid	Hydrogen fluoride	1, 15
Hydrogen azide Hydrogen bromide	Hydrazoic acid Hydrobromic acid	102
Hydrogen cyanide	Hydrocyanic acid	1, 11
Hydrogen fluoride	Hydrofluoric acid	1, 15
Hydrogen iodide	Hydroiodic acid	1
Hydrogen peroxide Hydrogen phosphide	Phosphine	104
Hydrogen seienide	Phosphine	105 24, 105
Hydrogen sulfide		33, 105
Hydroguinone		31
Hydroxyacetophenone Hydroxydibromobenzoic acid		19, 31
Hydroxydiphenol		3, 17
Hydroxyhydroquinone		31
Hydroxyacetophenone Hydroxyisobutyronitrile	Name and the state of the state	19, 31
Hydroxyl amine	Acetone cyanohydrin	4, 26 105
Hydroxypropionitrile	Ethylene cyanohydrin	4, 26
Hypochlorous acid		2
Indene Indium		16
Inerteen	Polychlorinated biphenyl	22, 23, 24
lodine monochloride	a.p.i.e.i,	107
lodine pentoxide		104
Iron arsenate	Ferrous arsenate	23
Isobutane	rerrous arsenate	24 29
Isobutanol		4
Isobutyl acetate		13
Isobutyl acrylate Isobutylene		13, 103
Isodecyl acrylate		28 13
Isodurene		16
Isoeugenol Isohexane		31
Isooctane	Trimethylpentane	29 29
Isooctene		28
Isopentane	Methylbutane	29
Isophorone Isoprene	Methyl butadiene	28, 103
Isopropanol	methyl batacrene	28, 103
Isopropyl acetate		13
Isopropylamine	Aminonnon	28
Isopropyl benzene	Aminopropane Cumene	7 16
Isopropyl chloride	Chloropropane	17
Isopropyl ether	Diisopropyl ether	14
Isopropyl mercaptan N-Isopropylmethylcarbamate		20
a-Isopropyl methylphosphoryl fluoride		17, 32
Isopropyl percarbonate	Diisopropyl peroxydicarbonate	30
Isotactic propylene		101
J-100 Jet oil		101
Kerosene		101
Lacquer thinner		101
Landrin*	Methomyl	9
Lannate* Lauroyl peroxide		9, 20
	Methonyi	
Lead Lead acetate	Methony	30 23, 24

Names	Synonyms	RGN
Lead arsenate	Lead orthoarsenate	24
Lead arsenite		24
Lead azide		24, 102
Lead carbonate Lead chlorite		24 104
Lead cyanide		24, 104 11, 24
Lead dinitroresorcinate		24, 27, 102
Lead mononitroresorcinate		24, 27, 102
Lead nitrate Lead orthoarsenate	Lead arsenate	24, 104
Lead oxide	Lead arsenate	24 24
Lead styphnate	Lead trinitroresorcinate	24, 27, 102
Lead sulfide		24, 33, 104
Lead trinitroresorcinate	Lead styphnate	24, 27, 102
Lewisite Lime nitrate	B-ChlorovinyIdichloroarsine Calcium nitrate	24 104
Lindane		17
Lithium		21, 107
Lithium aluminum hydride		105, 107
Lithium amide Lithium ferrosilicon		10, 107
Lithium hydride		105, 107
Lithium hydroxide		10
Lithium hypochlorite		104
Lithium nitride Lithium peroxide		104, 107
Lithium silicon		107
Lithium suifide		33, 105
London purple	Sodium hydroxide	24
Lye Magnesium	Journal Hydroxide	21, 22
Magnesium arsenate		24
Magnesium arsenite		24
Magnesium chlorate		104
Magnesium fluoride Magnesium nitrate		15
Magnesium perchlorate		104
Magnesium peroxide		104
Magnesium sulfide		33, 105
Malathion Maleic acid		32
Malonic nitrile	Cyanoacetic acid	3, 26
Maneb		12
Manganese		22, 23, 24
Manganese acetate Manganese arsenate	Manganous arsenate	24 24
Manganese bromide	Manganous bromide	24
Manganese chloride	Manganous chloride	24
Manganese methylcyclopentadienyl-		24
Manganese nitrate	Manganous nitrate	24, 104
Manganese sulfide		24, 33, 105
Manganous arsenate	Manganese arsenate	24
Manganous bromide	Manganese bromide	24
Manganous chloride Manganous nitrate	Manganese chloride Manganese nitrate	24 104
Mannitol hexanitrate	Nitromannite	27, 102
Matacil*		9
Mayer's reagent	Mercuric potassium iodide	13 27
Medinotero acetate Meobal		13, 27
Mercaptopenzothiazole		3. 20
Mercatoethanoi		4, 20
Mercarbam		32
Mercuric acetate Mercuric ammonium chloride	Mercury ammonium chloride	24 24
Mercuric benzoate	Mercury benzoate	24
Mercuric bromide		24
Mercuric chloride	Mercury chloride	24
Mercuric cyanide Mercuric dioxysulfate	Mercury cyanide Mercuric subsulfate	11, 24
Mercuric iodide	Mercury iodide	24
Mercuric nitrate	Mercury nitrate	24, 104
Mercuric oleate	Mercury oleate	24
Mercuric oxide Mercuric oxycyanide		11, 24, 102
Mercuric potassium iodide	Mayer's reagent	11, 24, 102
Mercuric salicylate	Salicylated mercury	24
Mercuric subsulfate	Mercuric dioxysulfate	24
Mercuric sulfate Mercuric sulfide	Mercury sulfate	24 33 105
Mercuric thiocyanate	Mercury thiocyanide	24, 33, 105
Mercuric thiocyanide	Mercury thiocyanate	24
Mercurol	Mercury nucleate	24
Mercurous bromide Mercurous gluconate		24 24
Mercurous iodide		24

Names	Synonyms	RG
Mercurous nitrate		24, 10
Mercurous oxide		
Mercurous sulfate	Mercury bisulfate	
Mercury Mercury (vapor)		22,
Mercury acetate	Mercuric acetate	Acres - Decree
Mercury ammonium chloride	Mercuric ammonium chloride	
Mercury benzoate	Mercuric benzoate	
Mercury bisulfate	Mercurous sulfate Mercuric chloride	
Mercury chloride Mercury cyanide	Mercuric cyanide	11,
Mercury fulminate	mer corre cyanice	24, 10
Mercury iodide	Mercuric iodide	
Mercury nitrate	Mercuric nitrate	24, 10
Mercury nucleate	Mercurol	August Sale
Mercury oleate	Mercuric oleate Mercuric sulfate	
Mercury sulfate Mesitylene	1,3,5-trimethylbenzene	
Mesityl oxide	1,5,5 trimethy isolitation	and the same of
Mesurol*		
Metasystox-R	Demeton-S-methyl sulfoxid	and the land
Metham	Formald to de	10000
Methanal	Formaldehyde	
Methane Methanethiol	Methyl mercaptan	2
Methanoic acid	Formic acid	a trade of
Methanol	Methyl alcohol	
Methomyl	Lannate*	9, 2
Methoxyethylmercuric chloride	Agallolaretan*	, 2
Methyl acetate		1
Methyl acetone	Marked by some	10
Methyl acetylene	Methyl butyne	13 10
Methyl acrylate Methyl alcohol	Methanol	13, 10
Methyl aluminum sesquibromide		105, 10
Methyl aluminum sesquichloride		105, 10
lethylamine	Aminomethane	
lethyl amyl acetate		
N-Methyl aniline	Propulancimina	
Methyl aziridine Methyl benzene	Propyleneimine Toluene	1
Methyl bromide	Bromomethane	i
Methyl butadiene	Isoprene	28, 10
Methyl butane	Isopentane	2
Methyl butene		2
Methyl butyl ether		I
Methyl t-butyl ketone Methyl butyne	Isopropyi acetylene	1 2
Methyl butyrate	isopropy: acceptance	ī
Methyl chloride	Chloromethane	i
Methyl chlorocarbonate	Methyl chloroformate	13, 1
Methyl chloroform		1
Methyl chloroformate	Methyl chlorocarbonate CMME	13, 1
Methyl chloromethyl ether Methyl cyanide	Acetonitrile	14, 1
Methyl cyclohexane	Accionitine	2
Methyl dichloroarsine		2
lethyl dichlorosilane	[15] [16] [16] [16] [16] [16] [16] [16] [16	10
lethylene chloride	Dichloromethane	1
Methylene diisocyanate		13, 10
4,4-Methylene bis(2-chloroaniline)		7, 1
Methyl ethyl chloride Methyl ethyl ether		1
lethyl ethyl ketone	Butanone	i
fethyl ethyl ketone peroxide		3
lethyl ethyl pyridine		
lethyl formate	Maran asked by desired	- 1
lethyl iodice	Monomethyl hydrazine	
Methyl isobutyl ketone		
fethyl isocyanate		13, 10
lethyl isopropenyl ketone		1
lethyi magnesium bromide		105. 10
lethyl magnesium chloride		105, 10
lethyl magnesium iodide	Methanethiol	195. 19
Methyl mercaptan Methyl methacrylate	Hetrianemior	12 10
Methyl magnithalene		13, 10
Methyl parathion		3
Methyl pentanoate	Methyl valerate	1
Methyl propionate		i
Methyl n-propyl ketone		1
Methyl styrene	District will be	28, 10
Methyl sulfide	Dimethyl sulfide	2
Methyl trichlorosilane Methyl valerate	Methyl pentanoate	10
lethyl vinyl ketone	Butene-2-one	i
Methyl yellow	Dimethylamino azobenzene	7,
		3

Names	Synonyms	RGN
Mexacarbate Mineral spirits	Dowco-139*	9
Mintacol*	Paraoxon	101
Mipcin*	T di donoii	32 9
Mobam* Mocap*		9
Molybdenum		32
Molybdenum anhydride	Molybdenum trioxide	22, 23, 24
Molybdenum sulfide Molybdenum trioxide		24, 33, 105
Molybdic acid	Molybdenum anhydride	24 24
Monochloroacetone	Chloroacetone	17, 19
Monochloroacetic acid Monocrotophos	Chloroacetic acid Azodrin*	3, 17
Monoethanol amine	Azodi III-	32 4, 7
Monofluorophosphoric acid		1
Monoisopropanolamine Monomethyl hydrazine	Methyl hydrazine	4, 7
Morpholine	menty nyarazare	8 7
Municipal solid waste Muriatic acid	Refuse	101
Nabam	Hydrochloric acid	12
Nack	Sodium-potassium alloy	21, 107
Nak Naptha	Sodium-potassium alloy	21, 107
Naphthalene		101
Naphthol		31
Naphthylamine Naphthyl mercaptan		7
Naphtite	Trinitronaphthalene	27, 102
Nemagon* Neohexane	Dibromochloropropane	17
4-NBP	Dimethyl butane Nitrobiphenyl	29 27
Niacide*		12
Nialate Nickel	Ethion	32
Nickel acetate		22, 24
Nickel antimonide		24, 107
Nickel arsenate Nickel arsenite	Nickelous arsenate	24
Nickel carbonyl	Nickelous arsenite Nickel tetracarbonyl	24 24
Nickel chloride	Nickelous chloride	24
Nickel cyanide Nickel nitrate	Nickelous sisses	11, 24
Nickelous arsenate	Nickelous nitrate Nickel arsenate	24, 104
Nickelous arsenite	Nickel arsenite	24
Nickelous chloride Nickelous nitrate	Nickel chloride Nickel nitrate	24
Nickel selenide	West intate	24, 104
Nickel subsulfide Nickel sulfate		24, 33, 105
Nickel tetracarbonyl	Nickel carbonyl	24 24
Nitraniline	Nitroaniline	7, 27
Nitric acid Nitroaniline	Nitraniline	2
Nitrobenzene	Nitrobenzol	7, 27 27
Nitrobenzol Nitrobiphenyl	Nitrobenzene	27
Nitrocalcity	4-NBP Calcium nitrate	27
Nitrocellulose	Cellulose nitrate, gun cotton	104 27, 102
Nitrochlorobenzene Nitrogen dioxide	Chloronitrobenzene	17, 27
Nitromannite	Mannitol hexanitrate	27, 102
Nitrogen mustard		7, 17
Nitrogen tetroxide Nitroglycerin	Trinitroglycerin	104
Nitronydrochloric acid	raminogrycer in	27, 102
Nitrophenol Nitropropane		27, 31
Nitrosodimethylamine	Dimethylnitrosiamine	7 27
Nitrosoguanidine		7, 27 27, 102
Nitrostarch Nitroxylene	Starch nitrate	27, 102
Nitroxylos	Nitroxylol, Dimethylnitrobenzene Nitroxylene, Dimethylnitrobenzene	27
N-Nitrosodimethylamine	Dimethylnitrosoamine	7, 27
Nonyl phenol Nonyl trichlorosilane		31
Nonane		107
Nonene		28
Nonanone Nonanal		19
Nonanoi		5
Octadecyl trichlorosilane Octadecyne		107
Citadecyne Citamethylpyrophosphoramide	Schradan	28
Octanal	and the second s	6. 32
3 stane		29

Names	Synonyms	RGN
Octanone		15
Octanol		
Octene Octyl peroxide	Caprylyl peroxide	25
Octyl trichlorosilane	Cap. y. y. peroxade	107
Oil of bergamot		101
Oil of vitriol Oleum	Sulfuric acid	
Orris root	Sulfuric acid	2, 24
Orthozenol	o-Phenyl phenol	31
Osmium		23, 24
Osmium amine nitrate		24, 104
Osmium amine perchlorate Oxamyl		24, 104
Oxalic acid		
Oxygen difluoride		104, 107
PCB	Polychlorinated biphenyl	17
Paper Paraoxon	Mintacol*	101
Parathion	Mintacor-	32
Paris green	Copper acetoarsenite	24
PETD	Polyram combi*	12
PETN	Pentaerythrityl tetranitrate,	
Pentaborane	Pentaerythritol tetranitrate	27, 102
Pentachlorophenol		17, 31
Pentaerythritol tetranitrate	Pentaerythrityl tetranitrate, PETN	27, 102
Pentamethyl benzene		16
Pentane Pentanethiol	Amyl mercaptan	29
Pentanal	Valeraldehyde	20
Pentanone		19
Pentene	Amylene	28
Pentylamine		7
Pentyne Peracetic acid	Peroxyacetic acid	28
Perbromic acid	reloxyacetic acid	3, 30
Perchloric acid		2
Perchloroethylene	Tetrachloroethylene	17
Perchloromethyl mercaptan Perchlorous acid	Trichloromethylsulfenylchloride	17, 20
Perchloryl fluoride		104
Periodic acid		2
Permonosulfuric acid		1
Peroxyacetic acid	Peracetic acid	3, 30
Petroleum naptha	Polyram combi*	12
Petroleum oil		101
Phenanthrene	A CONTRACT OF THE PROPERTY OF	16
Phenarsazine chloride	Diphenylamine chloroarsine	7, 24
Phenol Phenyl acetic acid	Carbolic acid	31
Phenyl acetonitrile		3 26
Phenyl acetylene		16
Phenylaniline	Diphenylamine	7
Phenyibenzene	Diphenyl	16
Phenylbutane Phenylchloromethyl ketone	Butylbenzene Chloroacetophenone	17, 19
Phenyl dichloroarsine	o de la constantione	24
Phenylene diamine	Diaminobenzene	7
Phenylethane	Ethylbenzene	16
Phenyl hydrazine hydrochloride	Orthogonal Dowigide I	8
o-Phenyl phenol Phenyl trichlorosilane	Orthozenol, Dowicide I	31 107
Phenyl valerylnitrile		26
Phenylpropane	Propyibenzene	16
Phloroglucinol		31
Phorate Phosdrin*	Thimet* Mevinphos	32 32
Phosphamidon	Dimecron*	32
Phosphine	Hydrogen phosphide	105
Phospholan	Cyolan*	20, 32
Phosphoric acid		105, 107
Phosphoric acid Phosphoric anhydride	Phosphorus pentoxide	107
Phosphoric sulfide		105, 107
Phosphorus (Amorphous red)		105, 107
Phosphorus (White-Yellow)		105
Phosphorus heptasulfide	Phosphoryl bromide	33, 105
Phosphorus oxybromide Phosphorus oxychloride	Phosphoryl bromide Phosphoryl chloride	104, 107
Phosphorus pentachloride	Phosphoric chloride	104, 107
Phosphorus pentasulfide	Phosphoric sulfide 33,	105, 107
Phosphorus pentoxide	Phosphoric anhydride	107
Phosphorus sesquisulfide	Tetraphosphorus trisulfide 33,	105, 107
Phosphorus tribromide Phosphorus trichloride		107
		10/

Names	Synonyms	PCN
Phosonoryl bromide	The least the second second second	RGN
Phosphoryl chloride	Phosphorus oxybromide Phosphorus oxychloride	104, 107 104, 107
Phtnalic acid Picramide	Trinitroaniline	3
Picric acid	Trinitrophenol	7, 27, 102 27, 31, 102
Picricine Picry: chloride	Chlorossinissahanaa	7
Piperidine	Chlorotrinitrobenzene	17, 27, 102
Pirimicarb Polyglycol ether		9
Polyamide resin		14
Polyprominated biphenyl Polybutene		17
Polychlorinated biphenyls	PCB, Askarel, Arochlor*,	28
	Chlorextol, Inerteen	17
Polychlorinated triphenyls Polethylene		17
Polyester resin		101
Polymeric oil Polyphenyl polymethylisocyanate		101 18, 107
Polypropylene		28, 101
Polyram combi* Polysulfide polymer	PETD	20, 101
Polystyrene Polyurethane		101
Polyvinyl acetate		101
Polyvinyl chloride Polyvinyl nitrate		101
Potasan		27, 102
Potassium Potassium acid fluoride		21, 107
Potassium aluminate	Potassium fluoride	15
Potassium arsenate Potassium arsenite		24
Potassium bifluoride	Potassium fluoride	24 15
Potassium bichromate Potassium bromate	Potassium dichromate	24, 104
Potassium butoxide		104
Potassium cyanide Potassium dichloroisocyanurate		. 11
Potassium dichromate .	Potassium bichromate	104 24, 104
Potassium dinitrobenzfuroxan Potassium fluoride	Potassium acid fluoride	27, 102
Potassium hydride		105, 107
Potassium hydroxide Potassium nitrate	Caustic potash Saltpeter	10
Potassium nitride	Sattpeter	102, 104
Potassium nitrite Potassium oxide		104
Potassium perchlorate		107 104
Potassium permanganate Potassium peroxide		24, 104
Potassium sulfide		104, 107 33, 105
Promecarb Propanal	Propionaldehyde	9
Propane		29
Propanethiol Propanoic acid	Propyl mercaptan Propionic acid	20
Propanol Propanol	Propyl alcohol	4
Propargyl bromide Propargyl chloride		- 17
2-Propen-1-ol	Allyl alcohol	4
Propiolactone Propional dehyde	Propanal	13
Propionamide		6
Propionic acid Propionitrile	Propanoic acid	3 26
Propyl acetate Propyl alcohol	Personal	13
Propylamine	Propanol	7
Propyl benzene Propylene dichloride	Phenyl propane Dichloropropane	16
Propylene glycol	Dicitoroproparie	17
Propylene giycol monomethyl ether Propylene oxide		4, 14 34, 103
Propyleneimine	Methyl aziridine	7
Propyl ether Propyl formate		14
Propyl mercaptan	Propanethiol	13
Propyl Trichlorosilane Prothoate	Fostion*	107
Pseudocumene	1,2,4 trimethylbenzene	16
Pyridine Pyrogallol		7 31
Pyrosulfuryl chloride	Disulfuryl chloride	107
Pyroxylin Quinone	Collodion Benzoquinone	27 19
Raney nickel		22

Names	Synonyms	RGN
RDX	Cyclotrimethylene trinitramine	27 102
Refuse	Municipal solid waste	27, 102 101
Resins		101
Resorcinol		31
Rubidium	Marania adiadaa	21
Salicylated mercury Saligenin	Mercuric salicylate	24
Saltpeter	Potassium nitrate	102, 104
Schradan	Octamethyl pyrophosphoramide,	
경기 그렇게 하시네 말이 되는 것이 없다.	OMPA	6, 32
Selenious acid Selenium	Selenous acid	1, 24
Selenium diethyldithiocarbamate		22, 23, 24 12, 24
Selenium fluorice		15, 24
Seienous acid	Selenious acid	1, 24
Silicochioroform	Trichlorosilane	107
Silicon tetrachoride Silicon tetrafluoride		107
Silver acetylide	24	15, 107
Silver azice	-71	24, 102
Silver cyanide		11, 24
Silver nitrate Silver nitride		24, 104
Silver stypnnate	Silver trinitroresorcinate	24, 25, 102
Silver sulfide	Jares Million Cool Childre	
Silver tetrazene		24, 33, 105 24, 102
Silver trinitroresorcinate	Silver styphnate	24, 27, 102
Slaked lime	Calcium oxide	10, 107
Smokeless powder Sodamide	Cadium amida	102
Soda niter	Sodium amide Sodium nitrate	10, 107
Sodium	Journal Intrace	21, 105, 107
Sodium acid fluoride	Sodium fluoride	15
Sodium aluminate		10, 105
Sodium aluminum hydride Sodium amide	Sodamide	105, 107
Sodium arsenate		10, 107
Sodium arsenite		24
Sodium azide Sodium bichromate	Cadina distance	102
Sodium bifluoride	Sodium dichromate Sodium fluoride	24, 104
Sodium bromate	Journal Hourice	104
Sodium cacodylate	Sodium dimethylarsenate	24
Sodium carbonate		10
Sodium carbonate peroxide Sodium chlorate		104
Sodium chlorite		104 104
Sodium chromate		24
Sodium cyanide		11
Sodium dichloroisocyanurate Sodium dichromate	Sodium bichromate	104
Sodium dimethylarsenate	Sodium cacodylate	24, 104
Sodium fluoride	Sodium acid fluoride	15
Sodium hydride		105, 107
Sodium hydroxide Sodium hypochlorite	Caustic soda, Lye	10
Sodium hyposulfite	Sodium thiosulfate	10, 104
Sodium methylate	Sodium methoxide	10, 107
Sodium methoxide	Sodium methylate	10, 107
Sodium molybdate Sodium monoxide	Sodium oxide	24
Sodium nitrate	Soda niter	10, 107
Sodium nitride		25
Sodium nitrite	Cadlum manual da	104
Sodium oxide Sodium pentachlorophenate	Sodium monoxide	10, 107
Sodium perchlorate		31 104
Sodium permanganate		24, 104
Sodium peroxide		104, 107
Sodium phenoisulfonate Sodium picramate		27, 102
Sodium polysulfide		101
Sodium potassium alloy	Nak, Nack	21, 107
Sodium selenate		24
Sodium sulfide Sodium thiosulfate		24, 33, 105
Stannic chloride	Tin tetrachloride	105 24, 107
Stannic sulfide		33, 105
Starch nitrate	Nitrostarch	27, 102
Stilbene Stoddard solvent	Diphenyl ethylene	16
Strontium		101
Strontium arsenate		24
Strontium dioxide	Strontium peroxide	24, 104
Strontium monosulfide		24, 33, 105
Strontium nitrate Strontium peroxide	Strontium dioxide	24, 104
Strontium tetrasulfide		24, 33, 105

Names	Synonyms	RGN
Styphnic acid	Trinitroresorcinol	27, 31, 102
Styrene	Vinylbenzene	16, 23, 103
Succinic acid Succinic acid peroxide		3
Sulfonyl chloride	Sulfuryl chloride	30 107
Sulfonyl flouride		107
Sulfotepp	Dithione*, Blada-Fum*	32
Sulfur chloride Sulfur (elemental)	Sulfur monochloride	107
Sulfuric acid	Oil of Vitriol, Oleum	2, 107
Sulfuric anhydride	Sulfur trioxide	104, 107
Sulfur monochloride	Sulfur chloride	107
Sulfur mustard Sulfur oxychloride	Thiopyd chloride	20
Sulfur pentafluoride	Thionyl chloride	15, 107
Sulfur trioxide	Sulfuric anhydride	104, 107
Sulfuryl chloride	Sulfonyl chloride	107
Sulfuryl fluoride Supracide*	Sulfonyl fluoride Ultracide*	107
Surecide*	Cyanophenphos	32 32
Synthetic rubber		- 101
TCDD TEDP	Tetrachlorodibenzo-p-dioxin	14, 17
TEL	Tetrethyl dithionopyrophosphate Tetraethyl lead	32
TEPA	Tris-(1-aziridinyl) phosphine oxide	6, 32
TEPP	Tetraethyl pyrophosphate	32
THE	Tetrahydrofuran	14
TML	Trimethylamine Tetramethyl lead	7 24
TNB	Trinitrobenzene	27. 102
TNT	Trinitrotoluene	27. 102
Tail oil Tailow		101
Tar		101
Tellurium hexafluoride		15. 24
Temik+	Aldicarb	9, 20
Tetraborane Tetrachlorodibenzo-p-dioxin	TCDD	105
Tetrachloroethane	TCDD	14, 17
Tetrachloroethylene	Perchioroethylene	17
Tetrachloromethane	Carbon tetrachloride	17
Tetrachlorophenol Tetrachloropropyl ether		17, 31
Tetradecene		14, 17
Tetraethyl dithionopyrophosphate	TEDP	32
Tetraethyl pyrophesphate	TEL TEPP	24
Tetraethyl pyrophosphate Tetrahydrofuran	THE	32 14
Tetramethylenediamine		7
Tetramethyl lead	TML	24
Tetramethyl succinonitrile Tetranitromethane		26
Tetraphenyl ethylene		27, 102
Tetraphosphorus trisulfide	Phosphorus sesquisulfide	33, 105, 107
Tetraselenium tetranitride Tetrasul	A-i	24, 25, 102
Tetrasulfur tetranitride	Animert* V-101	25, 102
Tetrazene		8, 102
Thallium		24
Thallium nitride Thallium sulfide		24, 25, 102
Thallous suifate		24, 33, 105
Thimet*	Phorate	32
Thionyl chloride	Sulfur oxychloride	107
Thiocarbonyl chloride Thiodan*	Thiophosgene Endosulfan	107
Thionazin	Zinophos*	17, 20
Thionyl chloride	Sulfur oxychloride	107
Thiophosphoryl chloride	Thiocarbonyl chloride	107
Thiram		107
Thorium		22, 23, 24
Tin tetrachloride	Stannic chloride	24, 107
Titanic chloride Titanium	Titanium tetrachloride	24, 107
Titanium sesquisulfide		22, 23, 24 24, 33, 105
Titanium sulfate		24
Titanium sulfide		24, 33, 105
Titanium tetrachloride TMA	Titanic chloride Trimethylamine	24, 107
TNB	Trinitrobenzene	27, 102
TNT	Trinitrotoluene	27, 102
Tolualdehyde	Talval Maskull	5
Toluene diisocyanate	Toluol, Methylbenzené	18, 107
Toluic acid		3

Names	Synonyms	RGN
Toluidine	Aminotoluene	7 16
Toluci	Toluene, Methylbenzene	6
Topcide*	Benzadox	9, 26
Tranid* Triamphos	Wepsyn* 155	6, 32
Tribromomernane	Bromoform	17
Tri-n-butylajuminum		107
Tricadmium dinitride		24, 25
Tricalcium dinitride		25
Tricesium nitride		24, 25
Trichloroacetaldehyde	Chloral hydrate	5, 17
Trichloroborane		107
Trichloroethane	Trichloroethylene	17
Trichloroethene Trichloroisocyanuric acid	Triciaoroethyrene	104
Trichloromethane	Chloroform	17
Trichloromethyl sulfenyl chloride	Perchloromethyl mercaptan	17, 20
Trichlorenitromethane	Chloropicrin	17, 27, 102
Trichlorophenoxyacetic acid		3, 17
Trichloropropane		17
Trichlorosilane	Silicochloroform	107
Tridecene		28
Triethanolamine		4, 7
Triethyl antimony	Triethylstibine	105, 107 24, 105, 107
Triethyl antimony Triethyl arsine	1115th/15thDille	24, 107
Triethyl bismuthine		24
Triethylamine		7
Triethylene phosphoramide	Tris(1-aziridiny1)	
	phosphine oxide	6, 32
Triethylene tetraamine		7
Triethyl scibing	Triethyl antimony	24, 105, 107
Trifluoroathane	O samesificacido	17
Trifluoromethylbenizene	Benzotrifluoride	105, 107
Triisobutyi aluminum Trilead dinitride		24, 25, 102
Trimercury dinitride		24, 25, 102
Trimethyl aluminum		105, 107
Trimethylamine	TMA	7
Trimetnyl antimony	Trimethylstibine	24, 105
Trimethyi arsine		24, 107
1.2,4-Trimethylbonzene	Pseudocumene	16
1.3,5-Trimethylbenzene	Mesitylene	16 24
Trimethyl bismutrine	Isooctane	29
Trimethyl pentane Trimethylstibine	Trimethyl antimony	24, 105, 107
Tri-n-butyiborane	Transcript distances	105, 107
Trinitroaniline	Picramide	7, 27, 102
Trinitroanisole	Trinitrophenylmethyl ether	14, 27
Trinitrocenzene	711B	27, 102
Trinitrobenzoic acid		3, 27, 102
Trinitroglycerin	Nitroglycerin	27, 102
Trinitronaphthalene	Naphtite	27, 102
Trinitrophenol	Picric acid	27, 31, 102
Trinitrophenyl methyl ether	Trinitroanisole	14, 27 27, 31, 102
Trinitroresorcinol Trinitrotoluene	Styphnic acid 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) phosphine oxide	TEPA, Triethylene	/ 12
T-labla-	phosphoramide	6, 32
Trithion Trithorium tetranitride		24, 25
Trivinyl stibine		24, 107
Tsumacide*		9
Tungstic acid		24
Turpentine		101
UDMH	Dimethyl hydrazine	8
Ultracide*	Supracide*	32
Undecene		28 101
Unisolve	Uranyl nitrate	24, 104
Uranium nitrate Uranium sulfide	Oranyi mirate	24, 33, 105
Uranyl nitrate	Uranium nitrate	24, 104
Urea formaldehyde	G.G.G.	5
Urea nitrate		27, 102, 104
VC VC	Vinylidene chloride	17, 103
Valeraldehyde	Pentanal	5
Valeramide		6
Valeric acid	War diameter and the second	3
Vanadic acid anhydride	Vanadium pentoxide	24 24
Vanadium oxytrichloride	Vanadic acid anhydride	24
Vanadium pentoxide Vanadium sulfate	Vanadyl sulfate	24
randulum sunate	. unusy. valuate	

Names	Synonyms	RGN
Vanadium tetroxide	AND THE RESERVE	
Vanadium trichloride		24
Vanadium trioxide		24, 107
Vanadyl sulfate	Vanadium sulfate	24
Vapona*	DDVP	24
Vinyl acetate	DOVE	32
Vinyl azide		13, 103
Vinyibenzene	Styrene	16, 28, 103
Vinyl chloride	3.7.6.10	
Vinyl cyanide		17, 103 26, 103 -
Vinyl ethyl ether		20, 103
Vinyl isopropyl ether		17
Vinylidene chloride	VC	17, 103
Vinyl toluene		28, 103
Vinyl trichlorosilane		107
VX		20, 32
Water		106
Waxes		101
Wepsyn* 155	Triamiphos	6. 32
Wood		101
Zectran*	Dowco 139*	9
Zinc		22, 23, 24
Zinc acetylide		24, 105, 107
Zinc ammonium nitrate		24, 104
Zinc arsenate		24
Zinc arsenite		24
Zinc chloride		24
Zinc dioxide	Zinc peroxide	24, 102, 104, 107
Zinc ethyl	Diethyl zinc	24, 105, 107
Zinc cyanide Zinc fluoborate		11, 24
		24, 15
Zinc nitrate		24, 104
Zinc permanganate Zinc peroxide	Zinc dioxide	24, 104
Zinc phosphide	Zinc dioxide	24, 102, 104, 107
Zinc salts of dimethyl		24, 107
dithiocarbamic acid		12, 24
Zinc sulfate		24
Zinc sulfide		24, 33, 105
Zineb*		12, 24
Zinophos*	Thioazin	20
Ziram*		12. 24
Zirconium		22. 23. 24
Zirconium chloride	Zirconium tetrachloride	24
Zirconium picramate		24, 104
Zirconium tetrachloride	Zirconium chloride	24

NEW STORAGE PLAN (Rearrange wastes into safe storage areas)

ACID WASTES

CAUSTIC WASTES

ORGANIC WASTES

OXIDIZER WASTES

REACTIVE WASTES

GENERAL WASTES

QUIZ: MODULE IX - HAZARDOUS WASTE STORAGE

1.	Define CONFORMINNG STORAGE -
2.	Define COMPATIBLE STORAGE -
TRUI	E or FALSE:
3.	A container that previously held acutely hazardous waste is empty if it contains less than 1 inch of residue.
4.	Floor drains that drain into sewer lines should not exist within storage areas.
5.	Door and windows should be left open in flammable waste storage areas.
6.	A conforming storage area must be above the 100-year flood elevation, and have a floor curb that will contain the volume of all the containers being stored.

7. Determine the compatiblity hazards that exist in each of the areas in the following storage plan:

ACID WASTES

CAUSTIC WASTES

Carbolic Acid Perchloric Acid Sodium Carbonate Trichloroethene

HAZARD:

HAZARD:

ORGANIC WASTES

GENERAL WASTES

Methyl Ethyl Ketone

Mineral Spirits

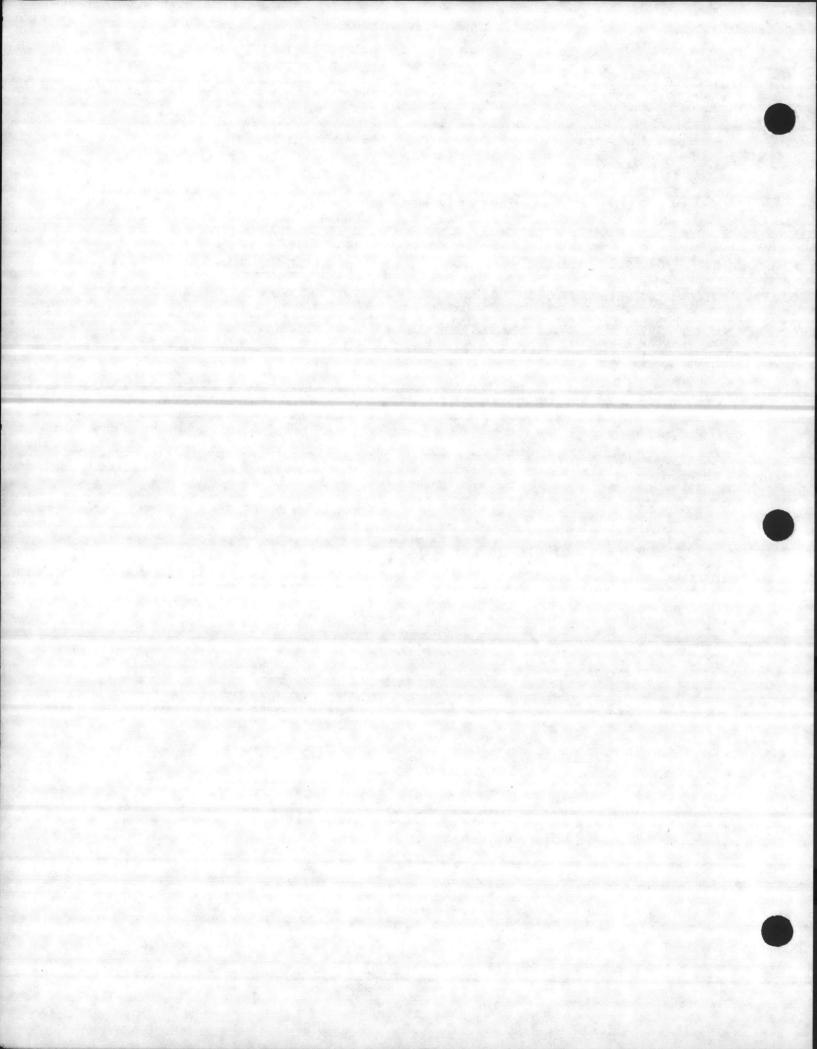
Dimethyl Hydrazine

Calcium Hypochlorite

HAZARD:

HAZARD:

8. Develop a compatible storage plan for the chemicals listed above.



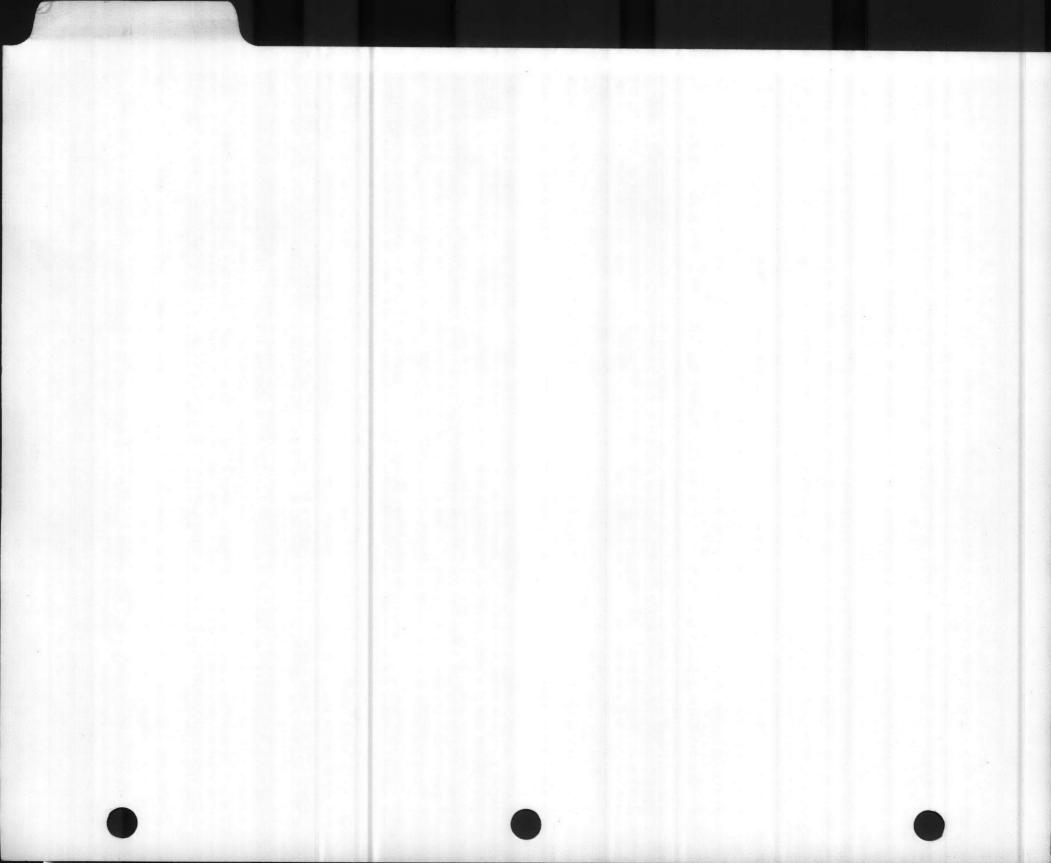
TAB PLACEMENT HERE

DESCRIPTION:

HW TRANSPORTATION

- ☐ Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



HAZARDOUS MATERIALS PLACARDING CHART



EXPLOSIVE A

Placard any quantity of Explosives A or combination of Explosives A and B.



EXPLOSIVE B



BLASTING AGENTS

Placard 1,000 lbs. or more gross weight of Plasting Agents. See DANGEROUS



FLAMMABLE GAS Placard 1,000 lbs. See DANGEROUS ore of flammable gas



NON-FLAMMABLE GAS
Placard 1,000 lbs. or more aggregate groweight of non-flammable gas. See DAN-GEROUS



RADIOACTIVE

RADIOACTIVE
Placard any quantity of packages bearing the
RADIOACTIVE YELLOW III label. Certain
low specific activity radioactive materials in
"exclusive use" will not bear the label, but
RADIOACTIVE placard is required.



OXIDIZER

Placard 1,000 lbs. or more gross weight of oxidizing material. See DANGEROUS



OXYGEN
Placard 1,000 lbs. or more aggregate gross weight of liquified pressurized oxygen con-tained in a manner as not meeting definition in Sec. 173.300. See DANGEOUS



ORGANIC PEROXIDE

Placard 1,000 lbs. or more gross weight of organic peroxide. See DANGEROUS



CORROSIVE

CORROSIVE
Placard 1,000 lbs. or more gross weight of corrosive material. Placard not required for a material that is corrosive only to steel when transported in a portable tank, cargo tank, or tank car by rail or highway. See DANGEROUS



COMBUSTIBLE

Placard a combustible liquid when transporte Placard a combustible liquid when transported in a spackaging exceeding 110 gallon rated capacity, in a cargo tank or a tank car. A FLAMMABLE placard may be substituted for the COMBUSTIBLE placard on a cargo tank and portable tank in highway transportation. See DANGEROUS



FLAMMARI F

more flammable liquid Placard 1,000 lbs. or See DANGEROUS



FLAMMABLE SOLID
Placard 1,000 lbs. or more gross weight of flammable solid. A FLAMMABLE placard may be substituted for a FLAMMABLE SOLID placard, except when a DANGEROUS WHEN WET label is specified (See Flammable Solid W) See DANGEROUS



FLAMMABLE SOLID W Placard any quantity of Flammable Solid or when DANGEROUS WHEN WET label is re-quired (See Table of Hazardous Materials) hie Solid only



DANGEROUS

A freight container, motor vehicle, or rail car containing two or more of the materials listed below may be placarded DANGEROUS instead of separate placarding for each material in omore than 5,000 lbs. aggregate gross weight of one class of material is loaded at one loading facility (not applicable to portable tanks, cargo tanks, or tank cars).

cargo tanks, or tank
Class C Explosives
Blasting Agents
Nonflammable Gas
Chlorine
Pressurized Liquid
Oxygen
Flammable Gas
Combustible Liquid

Flammable Liquid Flammable Solid Oxidizer Organic Peroxide Poison B Corrosive Material Irritating Material



POISON GAS

y quantity of Poison A.



POISON



CHLORINE

Placard 1,000 lbs. or more aggregate gross weight of chlorine. See DANGEROUS



FUNIGATED

PUMIGATED
Placard motor vehicle, freight container rail car fumigated with poisonous liquid, solid or gas when transported by rail.

DISPLAY OF IDENTIFICATION NUMBER WHEN TRANSPORTING HAZARDOUS MATERIALS IN PORTABLE TANKS, CARGO TANKS AND TANK CARS.



Placard empty tank cars for material last contained.

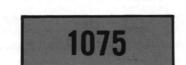
AVOID ACCIDENTS

DO NOT REMOVE THIS DOME COVER WHILE GAS PRESSURE EXISTS IN TANK KEEP LIGHTED LANTERNS AWAY



BACKGROUND

acard for rail cars only; for EXPLOSIVE POISON GAS and POISON GAS-EMPTY



ORANGE PANEL

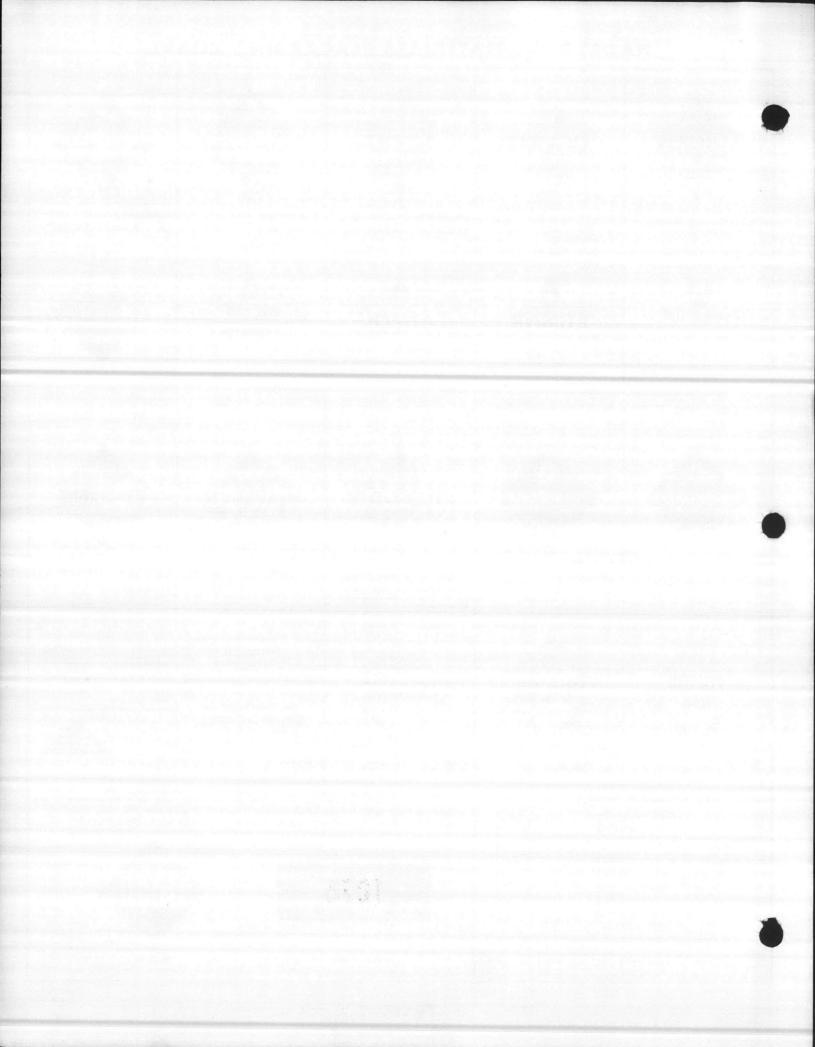


PLACARD

Must display U.N. hazard class num-ber approximately 1¾" in height.

med tank cars containing certain liquids (See 173.119(h)).





CHAPTER X

HAZARDOUS WASTE TRANSPORTATION

LEARNING OUTCOMES DESIRE.

At the completion of this unit of instruction, you should be able to:

- A. Follow proper procedures when loading or unloading hazardous wastes.
- B. Identify the type of hazardous waste entering or leaving your facility by reading the warning placard on the vehicle.
- C. Use the appropriate DOT tables to determine which specific placard is required on a load of hazardous wastes leaving the activity.
- D. Use the DOT "Hazardous Material Emergency Response Guidebook" to identify identification numbers, potential hazards and emergency action for a given hazardous waste.

II. INTRODUCTION.

- A. One of the most important aspects of hazardous waste handling is transportation. How a waste is transported can determine if an accident or spill will occur. How it is identified will determine what accident/spill response is appropriate. We will cover some of the general rules regulating loading procedures, discuss the importance of load compatibility, and review placarding requirements. While we are discussing the topic of hazardous waste transportation, try to think about the modes of transportation used to move hazardous waste to and from your facility. Also consider how hazardous waste is moved around your facility. What types of vehicles are used? Are they loaded properly? Is hazardous waste leaving the facility properly placarded? When you see a placard on a truck, do you understand what it means?
- B. The Department of Transportation (DOT) regulates the transportation of hazardous materials. The RCRA regulations, which apply to hazardous wastes, require compliance with certain DOT regulations. Therefore, the DOT regulations, placarding requirements and emergency response procedures we discuss will apply to hazardous wastes as well as hazardous materials. The transporting of hazardous waste is managed through a manifest system. This system allows "cradle to grave" control in accordance with RCRA requirements. A manifest must accompany all hazardous waste from when it is produced to when it is disposed.

III. GENERAL LOADING PRINCIPLES.

There are a number of considerations that should be kept in mind when loading any waste. These factors will vary somewhat in application depending upon the type of vehicle being loaded (railcar, truck, trailer, etc.). We will focus on truck loading.

1111D Date of last revision: Jun 84

A. Importance of proper loading.

The delivery of truck shipments in good condition depends to a large extent on the manner in which the vehicle was loaded. The most important factor in preventing damage in truck loading is tight loading. Rarely does the material to be shipped fit a closed truck without side slack or end slack. In most instances, slack may be taken up with bulkheads or dunnage. Physical dimensions, capacities, weight limitations, and load distributions of trucks vary greatly. Therefore, it is impossible to specify exactly how trucks should be loaded. You have to be able to apply a general understanding of load movements, types of load, and load balance to your specific situation. The construction of closed trucks does not facilitate tight loading, blocking, or bracing. The safe bracing of high center of gravity items in closed trucks requires good judgment, ingenuity, and sound workmanship if items are to arrive safely at their destination.

B. Load movements.

1. Causes of load movements. The forward movement of loads, if not braced properly, will be caused by sudden stops and the braking of vehicles on steep descents. Rearward movements of loads will be caused by sudden increases in speed, load rebounds after the sudden application of brakes, and going up steep hills. Lateral movement of loads will be caused by rounding corners or sharp curves, swerving to avoid accidents, and traveling on highcrowned or banked roads.

2. Prevention of load movements.

- (a) General. The movement of loads is even more likely to occur when vehicles are traveling on rough or unpaved roads or when traveling over snow or ice. However, almost all load movement can be prevented by proper blocking and bracing. All loads should be balanced in the vehicle lengthwise and crosswise before the vehicle leaves the facility. If the load is not tight or is out of alignment, unbalanced loading will cause unequal pressures. The use of bulkheads, separation gates, dividers (lengthwise and crosswise), layer separators, runners, blocks, cleats, and strapping can eliminate or prevent all load movement.
- (b) Forward movement. Forward movement can be prevented by the use of a front bulkhead. The front bulkhead serves to square the load and to distribute load pressures over the frontal area of the vehicle rather than just at points of contact. A typical front bulkhead is pictured on page 10.
- (c) Rearward movements. Rearward movement can be prevented by use of a rear bulkhead or gate. The rear bulkhead or gate must be braced (either with diagonal supports back to the doorposts of the vehicle or by secured risers against the doorposts and the bulkhead or gate). Backup blocks must be driven into place and nailed to the risers and gate to eliminate slack.

- (d) Lateral movement. Lateral movement can be eliminated by the use of space fillers, longitudinal separators, steel strapping, and rigid blocking and bracing devices.
- C. Summary. Although you may not have direct control of how hazardous wastes are loaded prior to arriving at your facility, you can let the generator know if there are any problems. Violating general principles can have adverse consequences for a great number of people when hazardous waste is involved. For more examples of "what and what not to do" in loading vehicles, see Appendix A.

IV. HAZARDOUS MATERIAL LOADING AND UNLOADING RULES.

There are a number of DOT regulations applicable to the loading and unloading of hazardous materials. These are also applicable to hazardous waste. These rules should be followed to reduce the chances of accidents/spills resulting from unsafe transportation procedures. While you may not be directly responsible for the loading and unloading of hazardous waste, you should know what things are regulated so that you can identify unsafe practicies. If you are aware of dangerous practices, you can then take action to try to solve the problem.

A. General requirements.

- Any tank, barrel, drum, cylinder, or other packaging which contains hazardous material must be secured against movement within the vehicle on which it is being transported.
- Smoking on or near any motor vehicle while loading or unloading any explosive, flammable liquid, flammable solid, oxidizing material, or flammable compressed gas is forbidden.
- 3. Extreme care must be taken in the loading and unloading of any explosive, flammable liquid, flammable solid, oxidizing material, or flammable compressed gas to prevent people in the vicinity from smoking, lighting matches, or carrying any flame, lighted cigar, pipe, or cigarette, and to keep fire away from the vehicle.
- 4. No hazardous material shall be loaded or unloaded from any motor vehicle unless the handbrake is securely set and all other reasonable precautions taken to prevent motion during the loading/unloading process.
- No tools which are likely to damage a container of hazardous material shall be used during the loading/unloading process. Non-sparking tools should be used for flammable or explosive materials.
- 6. Containers of hazardous material must be braced to prevent relative motion between different containers; containers having valves or other fittings must be loaded so that there will be minimum likelihood of damage to these fittings during transportation.

- 7. Reasonable care should be taken during the transit of hazardous material to prevent undue rise in temperature of containers and their contents.
- 8. A cargo tank must be attended by a qualified person at all times when it is being loaded or unloaded.
- 9. When flammable solids, oxidizing materials, or corrosive liquids are transported on a motor vehicle, they will be loaded in such a manner that ready access is available for shifting or removal of containers.

B. Flammable liquids.

- Unless the engine of the motor vehicle is to be used for the operation of a pump, no flammable liquid shall be loaded or unloaded from any motor vehicle while the engine is running.
- Cylinders containing pyrophoric liquids must be secured so that no shifting occurs in transit.
- No person shall drive a tank motor vehicle unless all manhole closures on the cargo tank are closed and secured and all valves are closed and free of leaks.
- 4. Matches must not be loaded next to a package bearing a flammable liquid label.

C. Flammable solids and oxidizing materials.

- Special care must be taken in the loading of any motor vehicle
 --with flammable solids or oxidizing materials which are likely
 to be hazardous when wet--to keep them from being wetted during
 the loading process and to keep them dry during transit.
- 2. If an item being transported is susceptible to spontaneous combustion, the material will be loaded in such a manner that sufficient ventilation is provided to prevent this occurrence.

D. Corrosive liquids.

- 1. No carboy (or any other container) of nitric acid shall be loaded above any container of another material. The loading of carboys of nitric acid shall be limited to two tiers high.
- All reasonable precautions must be taken to prevent the dropping of carboys and fragile containers containing corrosive liquids.
 No such container may be loaded into a motor vehicle containing an uneven floor surface.

E. Compressed gases.

 Cylinders containing compressed gases shall not be loaded onto any part of the floor of a motor vehicle which is not essentially flat.

- 2. To prevent their overturning, cylinders containing compressed gases must be securely lashed in an upright position, loaded into racks securely attached to the motor vehicle, packed in boxes or crates of such dimensions as to prevent their overturning, or loaded in a horizontal position.
- 3. No flammable compressed gas shall be loaded or unloaded from any tank motor vehicle with the engine running unless the engine is used for the operation of the transfer pump of the vehicle.

V. PLACARDS.

- A. DOT regulations require hazardous material being transported to be placarded. Hazardous material placards look very much like hazardous material warning labels in terms of shape, color, and design. Refer to the Blue DOT Chart 7 which list DOT Hazardous Materials Warning Placards. Placards are used to let people know about the potential dangers associated with the type of hazardous material contained in a motor vehicle, railcar, freight container, cargo tank, and portable tank. They also guide emergency personnel in their response to spills or accidents involving this hazardous material.
- B. DOT Placarding Requirements.
 - A person who offers hazardous material to a motor carrier for transportation must supply the carrier with the appropriate placards.
 - 2. No motor carrier may transport a hazardous material unless the appropriate placard is affixed to the vehicle.
 - 3. Placarding exceptions:
 - (a) In an emergency situation, if:
 - the vehicle is escorted by a State of local government representative,
 - The DOT has given permission to the carrier to move the vehicle,
 - or the movement of the vehicle is necessary to protect life and property.
 - 4. Hazardous material placards when attached to a motor vehicle or railcar must be displayed on each end and on each side and be readily visible from the direction it faces.
 - 5. The requirements under the DOT hazardous material regulations for the types of placards which must be affixed vary according to the type of vehicle or container.
- C. Two tables outlining placarding requirements are included in DOT regulations for railcars and motor vehicles (see appendix B).

- Table I lists those materials which, when shipped by railcar or motor vehicle, must be placarded as noted, regardless of the quantity shipped.
- Table II requires placarding with exceptions based on the quantity shipped and provisions for substituting placards.

Take some time to review these tables and practice determining what placards are required for specific items. The placards on trucks transporting hazardous materials allow better response if an accident occurs. This assumes that material has been properly placarded in the first place.

VII. DOT HAZARDOUS MATERIALS EMERGENCY RESPONSE GUIDEBOOK.

- A. The DOT <u>Hazardous Materials Emergency Response Guidebook</u> is divided into three major sections as follows:
 - An index, in numerical order, of hazardous material identification numbers (yellow pages);
 - An index, in alphabetical order, of hazardous material names (white pages);
 - A set of guides listing potential hazards and emergency action for an applicable hazardous material. (White pages with an orange banner.)
- B. Procedure for using this guidebook.
 - 1. Identify the naterial:
 - (a) by the black 4-digit identification (ID) number on the placard; or
 - (b) by the 4-digit number on the shipping paper or package; or
 - (c) by the name on the shipping paper or package.

NOTE: ONLY if no ID number or name can be found, match the placard on the vehicle with the placard in the back of the guidebook and turn to the guide page given.

- 2. Locate the guide number;
 - (a) in the numerical index; or
 - (b) in the alphabetical index; and
 - (c) double check the guide number.

NOTE: -- Only for explosives, use the table on the first page of the guidebook.

- -- If an ID number or name is not listed in this guidebook call CHEMTREC (800) 424-9300 (toll-free). For non-emergencies, call CHEMTREC Operations at (202) 483-6126.
- 3. Turn to the numbered guide page. Read the guide carefully before taking action.

NOTE: ONLY if you cannot identify the material by ID number, name or placard, use Guide 11.

4. As soon as you have assessed the situation and started response action, call CHEMTREC if assistance is needed.

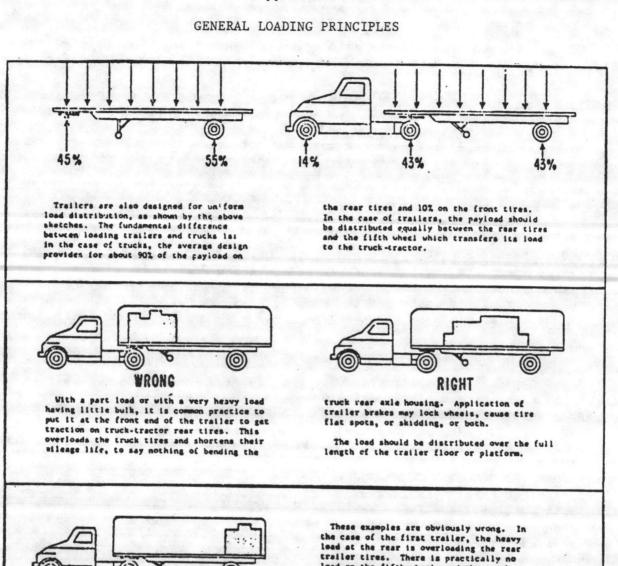
VIII. CHEMTREC.

CHEMTREC - The Chemical Transportation Emergency Center is a public service provided by the Chemical Manufacturers Association and is headquartered in Washington, D.C.. The purpose of CHEMTREC is to provide immediate advice for those at the scene of a transportation emergency and then to contact the shipper of chemicals for more assistance. It is important to remember that CHEMTREC will only help in the case of transportation emergencies

IX. SUMMARY.

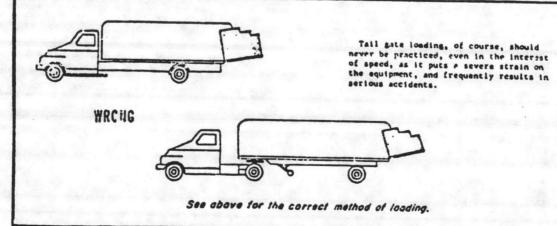
During this unit of instruction, we have covered some of the general procedures governing the loading/unloading of wastes as well as specific DOT regulations. We have discussed the importance of load compatibility. We have reviewed the use of placards and pointed out the importance of insuring that loads are placarded properly. We have discussed the proper use of the DOT Hazardous Materials Emergency Response Guidebook. It should be obvious to you by now that the safe transportation of hazardous waste is directly connected to the proper identification, labeling, packaging, handling, and marking of such waste. Proper attention paid to all of these subjects by everyone at your facility can reduce the number of accidents, environmental damage, and human injury, not to mention lawsuits and penalties. Hazardous wastes improperly dealt with can affect many people outside the boundaries of your facility.

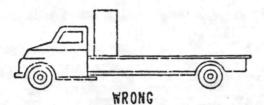
Appendix A



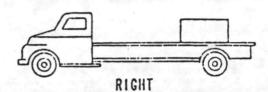


trailer tires. There is practically no load on the fifth wheel, and the truck-tractor rear tires would certainly slip and wear away rubber. Braking distribution would also be very uneven.

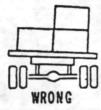




I heavy load, like a tig piece of machinery or a safe, should not be loaded against the ceb. This loading will tend the frame, perhaps permanently. It will also overload the frant tires, say erun cause a blowout on a rorm tire. Eard attering will also result, and the load may be top-heavy.



A heavy concentrated load should to placed near the rear and on its long side if at all possible. Most of the load should be over the rear axle to get proper tire loading and eliminate bending of the frame.

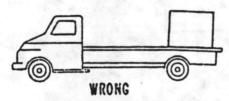


A very heavy load should not be loaded at one side. This overloads one spring and the tires at that side. This loading could be bad smough to allow the brakes to lock on the wheels at the light side and cause flat spote on the tires, or a skid on a wet surface.

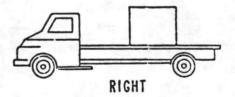


This loading has equal loads on rear tires and eliminates twisting of the frame, which might loosen rivets of cross members or frame brackets. Uniform loading crosswise prevents axle housing and whoel bearing overloading, too.

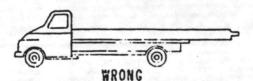
This above exemple applies to trucks and trailers alike.



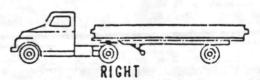
This loading should never be permitted. The frame beids, the rear tires are very much everloaded, and snough weight is taken from the front tires to make steering almost impossible.



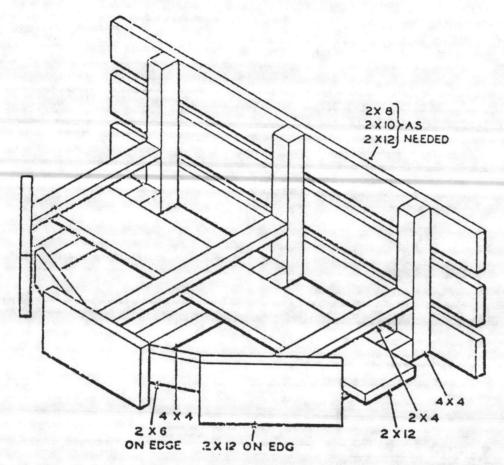
Again, the proper place for a concentrated load like this is just ahead of the rear axle, with the longest side on the floor,



This type of loading woulds from the use of the wrong vohicle for the job. Such loading can result, on rough roads, in an actual pivoting of the truck on its reer wheel, and taking the fixet wheels entirely off the road.



A tractor-trailer combination is the proper vehicle for use in service like this. By using the proper vehicle, damage to the truck and tires, and even serious accidents, may be avoided.



Front bulkhead.

Appendix B

DOT PLACARDING TABLES

The requirements in the hazardous materials regulations for the type of placard which must be affixed vary according to placards for a motor vehicle or rail car, placards for freight containers, and placards for cargo tanks and portable tanks.

Two tables outlining placarding requirements are included in the regulations for rail cars and motor vehicles. Essentially, Table I lists those materials, which when shipped by rail car or motor vehicle, regardless of the quantity shipped, must be placarded as noted. Table II requires placarding with exceptions based on the quantity, and provisions for substituting placards.

If the motor vehicle, railcar, or freight container contains a material classed (described) as-

The motor vehicle, rail car, or freight container must be placarded on each side and each end-

only).
adioactive material RADIOACTIVE,**

adioactive material:

Uranium hexafluoride, fissile (containing more than RADIOACTIVE AND CORROSIVE. O.7 pet UES).

Uranium hexafluoride, low specific activity (containing 0.7 pet or less UES).

¹See sec. 172.510(a).

¹See sec. 172.510(a).
¹EXPLOSIVES B placard not required if the freight container, motor vehicle, or rail car contains class A explosives and is placarded EXPLOSIVES A as required.
³FLAMMABLE SOLID "W" placard is required only when the DANGEROUS WHEN WET label is specified in § 172.101 for a material classed as a Flammable solid.
*Applies only to any quantity of packages bearing the RADIOACTIVE YELLOW III label. (See § 172.403.)
¹See secs. 173.389(c) and 173.389(o), for full-load shipments of radioactive materials meeting the definition of low specific activity when transported pursuant to sec. 173.392(b).
*CORROSIVE placard not required for shipments of less than 1000 pounds gross weight.

TABLE 2				
If the motor vehicle, rail car, or freight container contains a material classed (described) as—	The motor vehicle, rail car, or freight container must be placarded on each side and each end—			
Class C explosives Blasting agents Nonflammable gas Nonflammable gas (Chlorine) Nonflammable gas (Fluorine) Nonflammable gas (Gas) Nonflammable gas (Oxygen, pressurized liquid). Flammable gas Combustible liquid Flammable liquid Flammable solid Oxidizer Organic peroxide Poison B Corrosive material	BLASTING AGENTS. 9, 10 NONFLAMMABLE GAS. 8 CHLORINE. 7 POISON. OXYGEN. 2 FLAMMABLE GAS. 8 COMBUSTIBLE LIQUID. 3, 4 FLAMMABLE. FLAMMABLE. FLAMMABLE. OXIDIZER. 9, 10 ORGANIC PERIOXIDE.			

[45 FR 34560, May 22, 1980, effective November 20, 1980; 45 FR 46419, July 10, 1980, effective immediately]

Applies only to a class C explosive required to be labeled with an EXPLOSIVE C label.

²OXYGEN placards may be used to identify liquefied pressurized oxygen contained in a manner so it does not meet the definition in sec. 173.300 of this subchapter.

³COMBUSTIBLE placard required only when a material classed as a combustible liquid is transported in a packaging having a rated capacity of more than 110 gallons, a cargo tank, or a tank car.

⁴A FLAMMABLE placard may be used on a cargo tank and a portable tank during transportation by highway and water.

⁵Except when offered for transportation by water, a FLAMMABLE placard may be displayed in place of a FLAMMABLE SOLID placard except when a DANGEROUS WHEN WET label is specified for the material in sec. 172.101. (See table 1. this section.)

6See §173.245(b) of this subchapter for authorized exemptions.

⁷CHLORINE placard required only for a packaging having a rated capacity of more than 110 gallons; the NON-FLAMMABLE GAS placard for packaging having a rated capacity of 110 gallons or less.

⁸A NON-FLAMMABLE GAS placard is not required on a motor vehicle displaying a FLAMMABLE GAS placard. [Effective November 20, 1980]

⁹BLASTING AGENTS, OXIDIZER and DANGEROUS placards need not be displayed if a freight container, motor vehicle, or rail car also contains Class A or B explosives and is placarded EXPLOSIVES A or EXPLOSIVES B as required. [Effective November 20, 1980]

10Except for shipments by water, OXIDIZER placards need not be displayed if a freight container, motor vehicle or rail car also contains blasting agents and is placarded BLASTING AGENT as required. [Effective July 10, 1980]

The provisions for Table 1 dictate that placards as prescribed are always used for the materials noted. Table 2 allows for substitution of the Dangerous Placard in certain instances and also does not always require the use of placards.

A freight container, rail car or motor vehicle containing two or more materials listed in Table 2 may be placarded DANGEROUS instead of placarding for each material is loaded at one loading facility, the placard specified for that class of material, e.g. OXIDIZER, must be affixed to the container or transport vehicle. These provisions do not apply to a portable tank, cargo tank or tank car.

EXERCISE: MODULE X - HAZARDOUS WASTE TRANSPORTATION

PLACARDING EXERCISE

OBJECTIVE: Successfully placard a number of trucks containing hazardous waste for shipment.

SITUATION: You have been placed in charge of making sure that trucks leaving your facility carrying hazardous waste are placarded properly. To assist you in this task, you have been given a placarding chart and a DOT Table (49 CFR 172.101).

REQUIRED TASK: Determine the correct placards to be attached to trucks containing hazardous waste.

PROCEDURE:

- 1. Use the DOT Table to determine the hazard class (column 3) for the waste.
- 2. Use the placard chart to determine the correct placard (if any) to be placed on all four sides of the truck. Note carefully the instructions under each placard.
- 3. Use the DOT Table to determine the correct DOT Identification Number (column 3A) to be displayed on the placard.

TRUCK 1	: lank lruck
1,00	00 gallons (10,000 pounds) - Dimethyl Sulfide
I	Hazard Class:
I	Placard:
I	OOT ID Number:
TRUCK 2	: Flat Bed Truck Carrying Drums
50 6	drums (500 pounds each) - Isopropyl Percarbonate
I	Hazard Class:
I	Placard:
I	OOT ID Number:

TRUCK 3: Tank Truck	
90 gallons (900 pounds) - Xylene	
Hazard Class:	
Placard:	
DOT ID Number:	
TRUCK 4: Flat Bed Truck Carrying Drums	
3 drums (1,500 pounds) - Triethylamine 3 drums (1,400 pounds) - Fuel Oil No. 6	
3 drums (1,200 pounds) - Charcoal, Activated	
Hazard Class: Triethylamine	
Fuel Oil	
Charcoal	
Placard:	
DOT ID Number:	
TRUCK 5: Tank Truck	
8,000 pounds - Liquified Petroleum Gas	
Hazard Class:	
Placard:	
DOT ID Number:	

TAB PLACEMENT HERE

DESCRIPTION: CONTINGENCY PLANNING Tab page did not contain hand written information Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08

SECURIORISM. ######### #Rittlessings 物物的酶 . :01-03/20wgs SEMPAR OF STATES

CHAPTER XI

CONTINGENCY PLANNING

I. LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Use the Activity Spill Contingency Plan (ASCP) and any local spill response plans, to accomplish any task within these plans for which you are responsible.
- B. Use an understanding of the ASCP, the capabilities of the activity spill response team, the physical properties of various hazardous wastes, and the dangers associated with a spill to determine the need for involving the response team in spill response and cleanup.
- C. Ensure that your individual response to a spill or other release is safe, efficient, and effective.
- D. Report spills to proper authorities to reduce safety, health, and environmental hazards and avoid creating legal problems for the local facility.

II. INTRODUCTION.

A primary goal of any organization that handles or stores hazardous wastes should be to operate in such a way that those wastes do not become a danger to workers, the public, or the environment. A secondary goal should be to respond to mishaps, if and when they happen, so as to reduce safety, health, and environmental risks. Adequate individual response to a mishap involving hazardous wastes requires both information and some way to apply that information. The same is true of organizations. One way organizations can apply knowledge is to have suitable equipment, materials, and procedures available before the problem arises. Another is by arranging response training for employees. An organization requires a Contingency Plan to make sure the right equipment is purchased and properly located and maintained, to determine who should be trained and how much, to summarize and organize that organization's knowledge, and to provide standard operating procedures (SOP).

Local facility planning requirements. Organizations that handle or store oil or hazardous materials/wastes which could be released into the environment are required by Federal water pollution control laws to have two plans. One is a Spill Prevention, Control, and Countermeasures (SPCC) Plan. This plan discusses spill prevention and the readiness of response materials, equipment, procedures, and alarms. It is a plan to prevent spills. The other plan, the one most people are referring to if they just use the phrase, "our contingency plan," is called the Spill Contingency Plan (SCP). This plan discusses response procedures and equipment and contains a step-by-step sequence for reacting to a spill.

1164D--Date of last revision: Aug 84

III. FEDERAL REQUIREMENTS.

- A. The National Oil and Hazardous Substances Contingency Plan. This document was developed in response to the requirements of the Federal Water Pollution Control Act (Clean Water Act). It is the basis for overall Federal action to minimize pollution damage nationally from major discharges of oil or hazardous substances. The plan, and regional and local extensions of it, creates an organizational structure through which national contingency planning and spill response are to be accomplished. This structure will be explained later in the section on spill contingency plans.
- B. Required revisions of SCPs and SPCC Plans. As a result of the passage of the "Superfund" bill (the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)), EPA was given the responsibility for revising the National Contingency Plan. The revisions may potentially modify the required contents of local plans, and definitely will include response to hazardous substance (but not oil) spills on land. Until the revised national plan is final, the law itself provides authority for modifying SCPs to cover releases on land as well as in water. CERCLA also incorporates the hazardous materials of other laws besides the Clean Water Act into its definition of hazardous substances, so the chemicals covered by local SPCC Plans and SCPs may have to be expanded as well.

IV. DEPARTMENT OF DEFENSE CONTINGENCY PLANNING.

- A. Defense Department. In accordance with the National Contingency Plan and other Federal regulations, DOD adopted requirements for individual military facilities in DOD Directive 5030.41, Implementation of the National Oil and Hazardous Substances Pollution Contingency Plan. The directive requires each installation or activity with oil or hazardous materials that could be spilled to have both a SPCC Plan and a SCP.
- B. Navy plans. OPNAVINST 5090.1 of 26 May 1983 set up the "Navy Hazardous Materials Environmental Management Program." This program includes the requirements for spill prevention and contingency plans. NAVENENVSA is in the process of developing guidance for these plans.

V. CONTINGENCY PLANS.

- A. Spill Contingency Plans.
 - 1. National Contingency Plan (NCP).
 - (a) NCP Organization. The NCP (40 CFR 300) establishes national, regional and local federal organizations and plans for response to oil discharges and HS releases in the United States, and its contiguous zone. The plans assign responsibilities to "participating" federal agencies and outline state and local governmental as well as non-governmental cooperation in response actions.
 - (1) National Response Team (NRT). Consists of representatives of the fourteen (including DOD) participating federal agencies. The Chairman is designated as the EPA representative; the U.S. Coast Guard (USCG) representative

is vice chairman. The NRT serves as a standing committee to evaluate methods of responding to discharges or releases, recommends revisions to response organizations and the NCP, maintains readiness for response to nationally significant discharges and releases and monitors regional response team actions. The Department of Defense (and the Navy as a component of DOD) is designated as one of fourteen federal agencies that may be called upon during the planning or implementation of response actions.

- (2) National Response Center (NRC). Duty office to receive reports of oil discharges and HS releases required by federal law. The NRC is manned by the Department of Transportation (USCG) and operates as the focal point in the chain of rapid notification of government authorities to insure quick response when a pollution incident occurs. The NRC may be reached by a toll free telephone line (800-424-8802).
- (3) Regional Response Teams (RRTs). An RRT is established for each standard federal region and consists of representatives from regional, state and local governments, and the participating federal agencies, as appropriate. The Chairman is the representative of EPA or the USCG. The RRT predesignates Federal OSCs for all areas within the region, develops regional response plans and provides coordination and advice during plan implementation.

Figure XI-1 illustrates the relationship between the various components of the National Contingency Plan organization.

- 2. Activity Contingency Plan. SCPs contain preparedness information, including amounts and locations of response equipment and materials, but are primarily oriented toward specifying procedures to be followed in the event of a spill or release of oil or a hazardous chemical. More specifically, SCPs must contain:
 - (a) Names, addresses, and phone numbers of the NOSC, NOSCDR and Activity OSOT.
 - (b) A description of personnel actions and responsibilities required in response to fires, explosions, or any unplanned release of oil, hazardous materials, or hazardous waste to air, soil, or surface water at the facility.
 - An example of typical personnel responsibilities is provided as Appendix A. Figure XI-2 is a flow diagram showing the actions and interactions of the activity OSOT.
 - (c) Emergency equipment and response materials--location and capabilities.

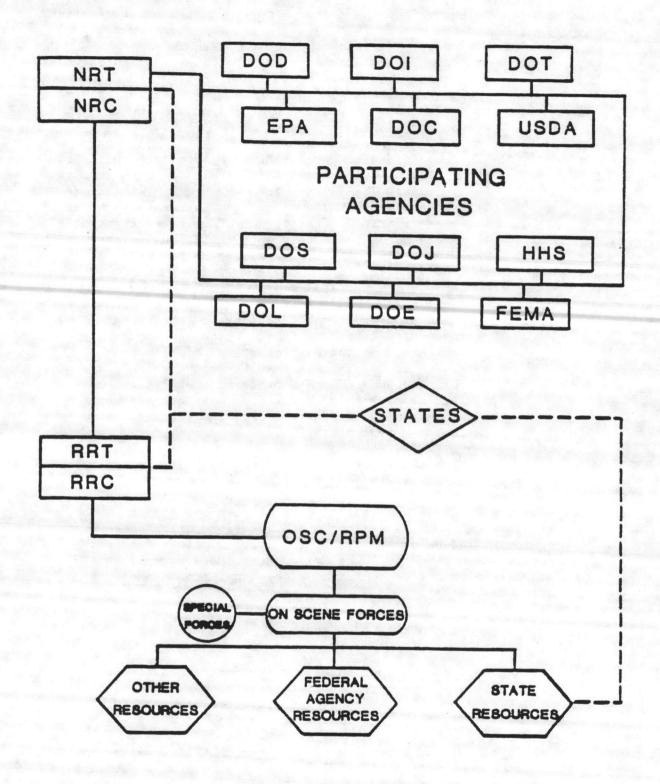
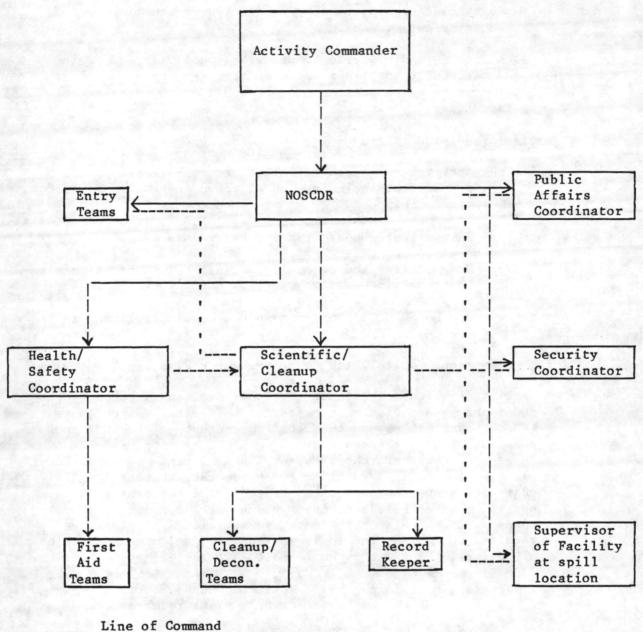


Figure XI-1. National Contingency Plan Organizational Chart.



Line of Coordination

Figure XI-2. Model OSOT Structure.

- (d) An evacuation plan, including signals, evacuation routes, and alternate routes.
- (e) A description of arrangements with local fire and police departments, hospitals, contractors, and state and local emergency response teams for response or coordination of services.
- (f) In addition, a good SCP should also contain:
 - Activity response team alert and mobilization procedures, including use of communications systems for timely response.
 - Surveillance procedures for early detection.
 - Key activity and community organizations and officials to be notified in the event of a release.

Additional guidance on SCPs can be found in the documents listed in Appendix B.

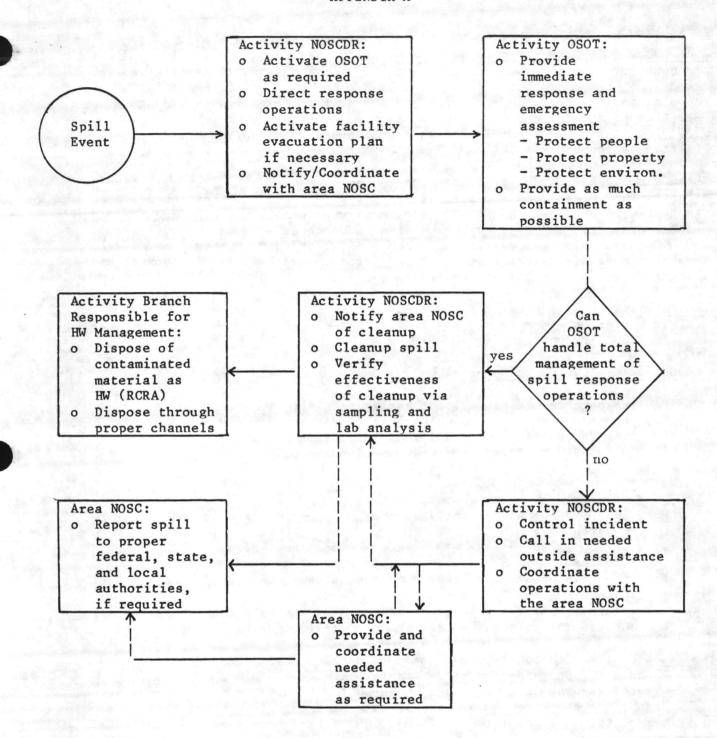
- B. Spill Prevention, Control, and Countermeasures Plans.
 - 1. Facilities which may discharge oil or hazardous substances in reportable quantities must prepare a SPCC Plan. Since there is some overlap between the required contents of the SCP and the SPCC Plan, the two are often combined as one document. In general, however, the SPCC portion is oriented toward proper planning for spill prevention and readiness, whereas the SCP addresses proper actions to be taken in the event of actual spills or other releases. SPCC plans must be updated every three years. Whatever the details, activity SPCC Plans are required to contain the following topics, including discussion of how well the facility conforms to EPA guidelines.
 - (a) Listing of spills over the past 12 months, corrective actions taken, and plans for preventing recurrence.
 - (b) Predictions of spill directions, rate, and maximum quantity in the event of equipment failure for each storage or handling site.
 - (c) Containment provisions and diversionary structures or equipment which will prevent the discharge from reaching surface waters or other sensitive resources. Preventive systems may include such features as dikes, berms, curbing, gutters or other drainage systems, booms, diversion or retention ponds, or use of sorbent materials.
 - (d) Facility conformance to EPA guidelines on facility drainage, bulk storage tanks, transfer operations, pumping, in-plant processes, and tank car or truck loading and unloading.

- (e) Required inspections and records. Signed inspection records must be retained as part of the plan for 3 years.
- (f) Security precautions and procedures.
- (g) Required personnel training and spill prevention procedure briefings.
- (h) Other information which can be included separately or incorporated into the above list:
 - Identification of populations at risk.
 - Identification of environmentally sensitive areas, probable need for waterfowl conservation efforts, and presence of endangered species or other protected resources.
 - Considerations of local geography, hydrology, and climate.
 - Most probable locations for pollution incidents.

VI. PERSONAL PLANNING.

- A. Each of you needs to develop your own personal plan of action for how you would react in an emergency. Some of the more important factors in personal planning are discussed below.
- B. The first step in your own planning is to find out where hazardous wastes are stored and how they are labeled or otherwise identified within your organization. If you are involved in the receiving process, you will already be reviewing a lot of information about materials and helping decide where they should go. If you are not involved with the receipt process, the people on the receiving line are the first ones you could ask about what kinds of materials are coming in. Of course, your supervisor remains a key point of contact for this as well as all other matters.
- C. The second step is to make sure you know who the OSC is, and the telephone number(s) to call in case of a spill. The same goes for any reporting to your supervisor, particularly for after-hours situations.
- D. In addition, you need to know what kind of response materials and safety equipment are available, and where; plus who is responsible for using them in exactly what situations. If you are one of those with assigned responsibilities, you definitely need to make sure you are trained in how to use that equipment. All personnel should know the location and proper use of fire extinguishers and alarms as well as eyewashes and showers.

- E. Know your specific responsibilities, in sequence, under the SCP. Also, if you do work around hazardous wastes, try to mentally sort out the few simple steps for reacting to spills or releases of the types of wastes stored in one particular area as opposed to another. The designated hazardous wastes expert, your supervisor, or the safety officer can give you guidance on this. Eventually the basic steps to follow in, let us say, an acid spill or a flammable liquids spill in warehouse B, should be second nature to you. A big advantage of learning as much as you can is that you can recognize problems that should be corrected before there is a problem.
- F. Finally, make a commitment to yourself to stick to the safety rules developed for you, such as not smoking around flammables, wearing protective clothing when working around hazardous wastes, and using proper handling procedures. These rules are inconvenient sometimes, but they are definitely the easiest way to give yourself the benefit of the planning already done by your organization.



Functional Operations Diagram for Area NOSC, NOSCDR, and OSOT during HS Emergency Responses.

Appendix A

The NOSC is the Navy official designated by the Navy as the overall coordinator and director of all responses to oil and HS releases from Navy activities in his area of responsibility. The area NOSC is responsible for providing and coordinating any assistance required by the activities for responding to major HS releases, and for coordinating the Navy's participation in the NCP. The area NOSC is also responsible for the development of a contingency plan for his area of responsibility.

The NOSCDR is the Navy official designated by each Navy shore activity to direct actual operations for the initial response, control, containment, and cleanup of HS spills. The NOSCDR is primarily responsible for protecting people, property, and the environment from adverse effects caused by a spill. The NOSCDR is also responsible for organizing, coordinating, training, and directing an activity response team, and for coordinating the development and implementation of an activity contingency plan.

The Activity OSOT is a team of individuals predesignated by each Navy shore activity to execute operations for the initial response, control, containment, and cleanup of HS spills.

Scientific/Cleanup Coordinator:

Public Works should normally be assigned this function.

Environmental coordinator (or technically-oriented individual preferably with background in chemistry or toxicology) should be designated as Scientific/Cleanup Coordinator.

Duties:

Notifies OSOT members of spill according to established procedures or as required by the NOSCDR.

Directs and coordinates field monitoring and sampling activities at the site for preliminary assessment.

Interprets information collected to assess the level of risk and determine appropriate spill/hazard control procedures.

Provides necessary manpower, equipment, and materials required for spill containment/control as determined by preliminary assessment.

Coordintes with Safety Coordinator to develop the cleanup strategy.

Assists NOSCDR in determining need for outside cleanup contractor.

Directs cleanup activities and/or support contractor cleanup activities.

Determines the adequacy of the ultimate cleanup effort, advises NOSCDR of the need for further cleanup, and defines the scope of additional cleanup.

Insures proper disposal of all HW resulting from spill.

Health/Safety Coordinator:

Medical clinic and Safety should be assigned this function.

Activities that have an Industrial Hygiene Division should also assign such office to assist in this function.

Duties:

Provides advise to NOSCDR and cleanup coordinator on all matters related to the health and safety of everyone involved in operations at spill site (i.e., standard safety practices).

Provides first aid and medical support throughout incident control and cleanup operations.

Provides advise to NOSCDR and cleanup coordinator on the types of protective equipment needed.

Coordinates activities with Scientific Coordinator.

Security Coordinator:

Security should be assigned this function.

Duties:

Performs necessary evacuation of spill area.

Secures affected area and limits access of unauthorized persons throughout duration of incident.

Advices NOSCDR in those matters.

Public Affairs Coordinator:

Public Affairs Office should be assigned this function.

Duties:

Serves as on-base and off-base communication link throughout duration of incident.

Maintains all contact with press and public.

Facility Supervisors:

Duties:

Notify NOSCDR immediately of spill at their facility.

Evacuate facility personnel to safe area.

Advise NOSCDR and Cleanup Coordinator regarding facilities information throughout emergency.

-- Field Operations Personnel:

Initial Entry Teams (Fire Division Crew or Disaster Control Team)

Perform site monitoring and sampling operations to determine safety zones.

Perform rescue functions.

Perform spill/hazard control operations.

First Aid Team (Medical/Safety)

Provides on-scene first aid to injured personnel.

Cleanup and Decontamination Team (Public Works Crew or Disaster Control Team)

Performs cleanup operations and/or supports contractor cleanup operations.

Performs sampling required for defining the cleanup area and for verifying the effectiveness of the cleanup.

Performs decontamination of the spill site.

Performs decontamination of all personnel and equipment involved in spill site operations.

Recordkeeper (Public Works)

Maintains official records of site activities throughout duration of incident.

--Navy shore activities should establish a spill response management program to support the OSOTs in their mission. Such program should consist of the following major elements:

Spill Contingency Plan
Spill Response Equipment Inventory/Maintenance Program
Spill Response Training Program
Health and Safety Program

- --Standard Operating Safety Procedures for Spill Response
- -- Medical Surveillance Program
- -- Education and Training in Safety Practices

Spill Prevention Plan Recordkeeping and Reporting System

The organizational structure of these team members is shown on figure 4-2.

Appendix B

NAVY GUIDANCE ON HAZARDOUS MATERIALS MANAGEMENT AND CONTINGENCY PLANS

Guidance on the content of SCPs and on hazardous materials management within the Navy is in the following documents.

- A. OPNAVINST 5090.1 of 26 May 1983, Environmental Protection and Natural Resources Manual Chapter 13.
- B. NESO 20.2-024B, Navy Hazardous Materials Management Guide.
- C. NESO 20.2-028A, PCB Compliance, Assessment, and Spill Control Guide.
 - D. NESO 20.2-019B, NEPSS Guidelines for Pesticide Spill Prevention and Cleanup.
 - E. NESO 8-027A, Hazardous Waste Management Regulations.
 - F. NESO 20.2-011, Hazardous Waste Disposal Guide.

EXERCISE: MODULE XI - CONTINGENCY PLANNING

PERSONAL CONTINGENCY PLAN EXERCISE

OBJECTIVE: Develop a personal contingency plan that will help you deal with emergency situations at your facility.

REQUIRED TASK: In order to help you to respond to emergency situations at your workplace, complete the personal contingency plan worksheets attached to this exercise using the available references. Develop your own personal contingency plan.

PROCEDURE:

- 1. Make a list of hazardous substances that you handle regularly while performing your job.
- Using Material Safety Data Sheets (MSDSs), the DOT Table (49 CFR 172.101), and other references provided to you by your supervisor, complete Table XI-1 (except for the column labeled "ACTION").
- 3. Under the column labeled "ACTION", indicate whether to leave the area (and call for help) or to take response action (containment, cleanup) in the event of a spill. In order to make this decision, use the contents of the other columns as well as MSDSs, other references, and discuss with emergency response team. You should leave the area if a spill could present an immediate danger to your health, or if you don't have the correct safety equipment on (or immediately available).

 Remember that this action is a general guideline and any actual spill is going to require a judgmental decision on your part.
- 4. On Table XI-2, draw a floor plan of your facility, and mark the locations of emergency exits, eyewash stations, emergency showers, fire extinguishers and fire alarms.
- 5. Complete Table XI-3 using the following possible sources of information:
 - Talk with your supervisor and coworkers.
 - Walk through your facility.
 - Read your local contingency plan.
 - Talk to local emergency team representatives.

Table XI-1

HAZARDOUS SUBSTANCES

NAME	HAZARD	SPECIAL HAZARDS	RESPIRATORY PROTECTION	GLOVES/ CLOTHING	ACTION

Table XI-2

FLOOR PLAN

Table XI-3

SPILL INFORMATION

 Points of contact to notify in the event of a hazardous waste (HW) emergency:

SITUATION	PERSON OR DEPARTMENT	PHONE NUMBER
Minor HW Spill (Non-emergency)		
Major HW Spill (Emergency)		
Fire Emergency		

2. Other points of contact.

- Emergency Response Department

Phone Number

- Fire Department
- Ambulance
- Police
- Supervisor

SPILL INFORMATION

3.	Location	of	Material	Safety	Data	Sheets:	

4. Available spill response equipment:

Type Location . Use For

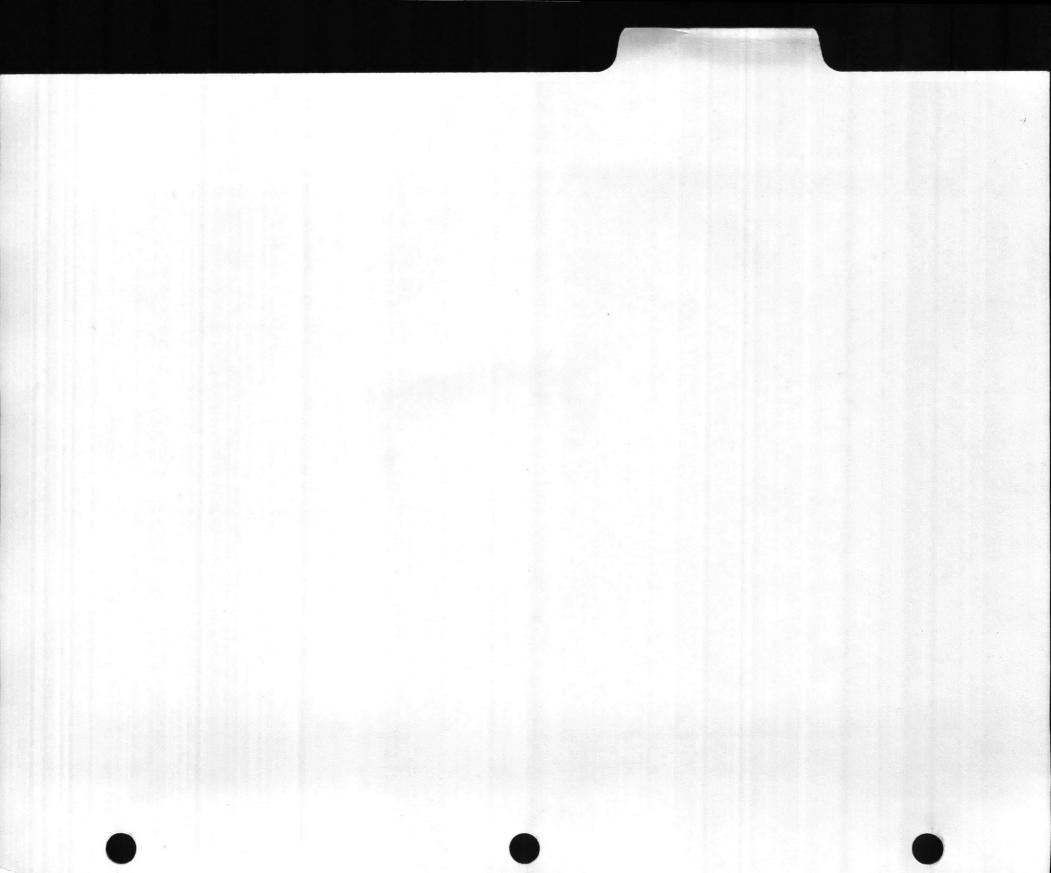
5. Fire Extinguishers:

Type Location Use For

TAB PLACEMENT HERE

DE	SCRIPTION:
	SPILL RESPONSE, CLEANUP
	AND DECONTAMINATION
X	Tab page did not contain hand written information
	Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08



CHAPTER XII

SPILL RESPONSE, CLEANUP, AND DECONTAMINATION

LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Make immediate and effective response to spills, releases, or leaks of hazardous wastes in which no fire or explosion is involved.
- B. Use appropriate containment techniques and materials to prevent the spread of spilled wastes.
- C. Evaluate spills and take appropriate steps toward evacuation when containment and control are hazardous to the safety or health of immediate bystanders or facility personnel.
- D. Clean up minor spills or leaks of hazardous wastes and decontaminate the spill area when safe and appropriate, in accordance with the local Activity Spill Control Plan (ASCP) and facility Standard Operating Procedures (SOP).
- E. Use appropriate protective clothing during spill response and cleanup.
- F. Use emergency shower and eyewash when skin or clothing is splashed or contaminated with hazardous wastes.

II. INTRODUCTION.

- A. When a hazardous waste is released from its container, how do you tell whether you have an immediate problem? What do you do to clean up the released waste? Should you leave the area and let the activity spill response team (RT) and the on-scene coordinator (OSC) clean it up?
- B. To answer these questions, you need to consider the waste spilled; the size and speed with which it is being released; the surface on which it is spilled; what other wastes are stored nearby; whether there is any fire or explosion hazard; how much training you have had; whether you are alone; what materials and equipment you have to respond with; and Navy policies. This unit of instruction is designed to give you a start at answering these questions.

III. HAZARDOUS WASTE ACCIDENTS.

A. The trigger. What are some of the things we should automatically start considering once an accident occurs? Let's assume that the trigger is damaged to a container, and that at least at the outset no fire is involved.

1125D Date of last revision: Jun 84

1. What is it?

- (a) Does the container type tell anything about the contents (for example a gas cylinder)?
- (b) What other means of identification are available on the container (name, stock number, hazard label)?
- (c) Does the storage location tell anything about the type of waste, or are area identifiers or labels available which cover the particular stack?
- (d) What do physical state (solid, liquid, gas), appearance, and odor tell about the waste's identity?

2. Is it hazardous?

- (a) Do you know what it is by name yet? Or if not, are there other indicators (hazard label, location, it's bubbling, someone has been splashed and he's yelling).
- (b) What type of hazard (for example, poison, flammable, oxidizer, shock-sensitive)?
- 3. How hazardous is it (immediate explosion predicted; corrodes/dissolves wooden pallets; chronic exposure cancer hazard with no immediate danger)? Is it hazardous in itself, or due to proximity to other wastes? What is the rate, quantity, and direction of release?
- 4. To whom or what is it hazardous? Any immediate injury? Is it moving into soil, outside air, draining into surface waters, draining into sewer system?
- 5. What other factors add to the danger (for example sparks, cigarettes, no nearby showers or protective clothing)?
- B. General emergency response sequence. In the ideal situation, you would discover the answers to all the above questions in only a few seconds, and then be prepared with precisely the correct response. However, usually you have to begin responding before all the questions are answered. We will therefore discuss a general response sequence for emergencies. Our general emergency response sequence uses the acronym R-A-C-E, which reminds us to hurry and stands for Rescue, Alert, Contain, Evacuate.
 - Rescue. If anyone is injured, including yourself, rescue should be the first objective. If you are rescuing a victim, you don't want to become one yourself. Precisely what actions are taken will depend on the person's condition. Someone in your facility should have had both general first aid training and training in cardiopulmonary resuscitation (CPR), and their aid should be enlisted as soon as possible. Here are some additional steps to follow.

- (a) Remove the victim from the spill area as soon as possible, after properly preparing yourself (i.e. protective clothing, respirator, etc.).
- (b) If the person has spilled chemicals on their skin or clothing, get them to an emergency shower as soon as possible and drench for 15 minutes unless you know it is not necessary. Get the clothes off while you are at it (Do not let the person put them back on later.). (NOTE: Some of the emergency response guides make a distinction between washing "promptly" and washing "immediately." This distinction is based on the speed with which the contaminating wastes can damage the skin and their general level of toxicity if absorbed into the body. "Immediately" means "right now; run to the wash facility," but "promptly" may allow you time to quickly strip your clothing first.)
- (c) Have a blanket, sheet, or coat available to prevent body heat loss after using shower; in fact a good supply cabinet should have some sort of temporary garment (drawstring pants and loose top, slippers) that a person could wear home if not otherwise injured.
- (d) If the person is having difficulty breathing, administer pressurized air or oxygen if you have it. (Make sure the Activity Response Team has some.)
- (e) For those of you dealing with unconscious persons:
 - Don't try to give liquids, even antidotes.
 - Use something which allows you to give artificial resuscitation without transferring corrosives or contaminants from the victim's facial skin to your mouth.
 - Make sure you know how to give artificial resuscitation other than mouth-to-mouth. If the victim has inhaled a poisonous gas, mouth-to-mouth will poison you as well.
- (f) In general, put on protective clothing before attempting rescue. Use the best you have. Some protective gloves, for example, are not the best for regular use with certain chemicals but will suffice to protect you during a rescue situation. Unless you know the specific chemical and have a canister respirator for it, choose a respirator with self contained air supply. Note that lack of an odor is not sufficient to indicate safety.
- (g) Put on protective equipment for the remainder of the response sequence as well.
- 2. Alert. Notify your supervisor, who will then follow the instant notification procedure defined in your host activity's spill contingency plan. If your supervisor is not handy and it is really an emergency, make the call yourself. Request an ambulance if necessary; make that call yourself if you can.

Give the RT point of contact some information about the spilled waste--identification, rate, quantity, direction of movement, injuries, potential hazard as you see it. The activity on-scene coordinator will notify and involve other organizations as necessary. (A further word: major spills and other emergencies bring out public officials, reports, and other bystanders. Be sure you are familiar with required communication channels as specified in the contingency plan. Loose talk might cause unnecessary panic or otherwise interfere with orderly public relations.)

- 3. Contain. Just what you do in an emergency to contain a spill or release will depend on the extent of the emergency. General containment procedures are covered later, but here are some specific points.
 - (a) Wastes of great toxicity or other inherent hazard should be contained if at all possible to prevent them from entering surface waters or flowing onto soils from which they eventually could leach into ground waters. Try to set up some type of absorbent or containment system immediately, even for small spills.
 - (b) Where larger volumes are involved, the best defense is having some sort of diversion and containment system already available. In their absence or for "medium-sized" spills, large quantities of sorbents will be necessary. Pillows and boom-type containers used in spills on water can also be used on land as temporary berms for larger spills.
 - (c) Throw up temporary earth, straw, or clay berms to prevent drainage off site.
 - (d) Turn off valves supplying gases; turn on valves opening special drainage systems. Cover all other drains (sewage and storm systems).
 - (e) Control of vapors already released usually means do not contain them. They are generally much more hazardous in enclosed areas. Other than shutting off the supply, the best thing to do may be to ventilate buildings and evacuate if necessary.
 - (f) With particulate solids or flammable liquids, control sources of spark or static.
 - (g) Containment always includes preventing reaction with incompatible wastes, including metal or wood pallets.
- 4. Evacuate. Includes evacuation of the affected areas, adjacent lands, and off-installation areas as necessary. The RT will usually make the decision for any evacuation beyond the activity itself. Someone within the activity should be assigned to evacuate important records if there is any chance of fire or explosion or toxic gases preventing access to them when needed.

4. This includes records which identify and locate hazardous property, and spill response guides. All persons not designated to perform specific tasks in an evacuation should immediately and calmly leave the premises by designated routes and assemble in specific areas outside so they can be checked off as "accounted for."

IV. CONTAINMENT AND CLEANUP.

These two step cannot be considered separately because some materials used to "contain" are subsequently picked up and removed in "cleanup." In the following discussion "contain" means prevent from spreading further.

- A. Stop Discharge. The first step is to stop adding to the release. This may consist of:
 - 1. Turning off pumps or closing valves.
 - 2. Returning containers to upright position.
 - 3. Patching holes.
 - 4. Transferring wastes to other containers.
 - 5. Moving containers to a less dangerous location.
- B. Contain. The expansion of an existing spill can be prevented or slowed:
 - On water (if the waste floats), by use of floating barriers (booms), porous absorbent materials, or by "herding" using propellers, water hose streams or chemicals that change the surface tension of the spilled waste.
 - On land, by porous or absorbent barriers in consolidated or particulate form. See table 1 for examples of the materials which may be used.
 - 3. The containment of gases or vapors can be very difficult. In many cases it is preferable to disperse a gas/vapor cloud by using fans or blowers. Vapor emissions from flammable or toxic liquids may be controlled by covering the area with high expansion foam or by using knock-down misting where the mist absorbs the vapor (this method can be used for gases as well). In the case of large clouds or highly toxic materials, evacuation may be the only answer.
- C. Collect and Recover. Liquid or solid spilled waste is gathered together so it can be separated and recontainerized in contaminated or filtered form.
 - On water, floating wastes are skimmed off with their absorbents, run through separators and stored. The absorbent may often be reused. Materials which dissolve cannot typically be recovered; materials which sink may be pumped or dredged from the bottom, then separated and stored.

Table 1. Examples of Absorbent Materials

Mineral Products	Vegetable Products	Synthetic Products
Perlite	Straw	Polyurethane
Talc	Нау	Polystyrene
Vermiculite	Sawdust	Polyester Plastic Shavings
Clays	Bark	Urea Formaldehyde
Volcanic Ash	Peat	Resin Type Foams
Chalk	Kelp	
Fly Ash	Corncob Grindings	
Carbon Powder	Modified Wood Fiber	

Activated Carbon

- 2. On land, spilled waste may be diked, by absorbents or other material, or pumped or drained to a diked (and possibly lined) temporary storage area; or the absorbents may be used to soak up the entire spill. Recovery is by pumping to storage or by separation from the absorbents used. Contaminated soil may need to be removed and replaced in some cases.
- D. Treat. A spill, or nonrecoverable portions of it, may be treated to render it nonhazardous.
 - Burning. Ignition of the spill itself is a dangerous business.
 It could be useful to remove floating flammable liquids to stop downwind travel of flammable gases.

2. Neutralize.

- (a) Acids and alkalis can be neutralized--returned to a neutral pH. (This usually does not affect any toxic characteristics of the material.) In either case, a pH meter, pH paper, or litmus paper is needed, along with a noncorrodible stirrer (glass, ceramic, or teflon rods, or noncorrodible floor-type squeegee) and enough neutralizer to equal two to three times the volume or weight of the spilled chemical (use the larger amount). After sufficient mixing the resulting pH should be between 6 and 8. (Concentrated acids have a pH below 3; alkalis are usually above 12.) The neutralizer must be weak or adverse reactions may result. Table 2 lists potential neutralizers.
- (b) Strong oxidizers and reducing agents may also be "neutralized" but this is an entirely different process and must be specific to the particular chemical, so it should only be done under the supervision of a chemist.
- 3. Absorb. Absorption as a treatment method is really a combination of containment, collection, and either recovery or disposal.
 - (a) The sorbent is distributed using mops, "pillows," sheets, or booms, or as loose chips, particles, beads, or fibers (scattered by hand or by blower).
 - (b) The sorbent with its absorbed spill material is collected by skimming, direct pickup, filtering, or settling. This can be a cumbersome and hazardous process.
 - (c) If desired, the hazardous waste can be squeezed, wrung, or centrifuged out of some types of sorbents so that the sorbent can continue to be used for treating the spill. The chemicals so removed must be stored appropriately prior to reuse and disposal.
 - (d) Sorbents not to be reused immediately must be disposed of.
 Unless they change the chemical composition of, or otherwise
 react with, a spilled hazardous waste, they are now
 hazardous waste with associated disposal requirements.

Table 2. Potential Neutralizers

Neutralizers for acids	Neutralizers for bases (alkalis)
Limestone (CaCO ₃)	dilute acetic acid (vinegar)
dolomite (MgCO3-CaCO3)	citric acid (granular, anhydrous or monohydrate)
soda ash (Na ₂ CO ₃)	dry ice (plus waterforms weak carbonic acid
slaked lime	

(e) Preferred sorbents are inert nonreactive clay minerals (neutralizing agents may be added), activated carbon (for control of flammable vapors), or specific formulations which provide automatic neutralizatio or vapor control. "Imbiber beads" (DOW chemical) are excellent for PCBs and other hazardous wastes because they hold the absorbed chemical in an essentially nonleachable form.

Certain chemicals require special absorbents. For example, elemental mercury liquid, which gives off toxic vapors, requires special materials to attract the very small droplets of the metal likely to remain undetected on floors. Hydrofluoric acid is extremely poisonous in addition to being a strong acid, and so requires more than a simple neutralizer.

V. DECONTAMINATION.

Decontamination removes the last traces of hazardous waste from the areas where it spilled, from cleanup materials, and from protective equipment and clothing. Decontamination procedures for commonly used chemicals should be part of the SCP or facility spill plan. Many chemical and safety equipment firms have kits available for decontamination of protective equipment. Some chemicals you may work with (where you would have the protective equipment on all day) require cleaning your equipment at the end of every work shift. Generally:

- A. Outdoor surfaces may require final cleaning via steam and hot water, abrasive blast cleaning (dry or wet), high pressure water, or surface sorption. Consult EPA since the waste stream may be hazardous.
- B. Indoor surfaces may be cleaned by modified versions of the above methods. Some materials are not very soluble in water and some other solvent would be preferable.
- C. The Laboratory Waste Disposal Manual of the Chemical Manufacturers' Association (under their former name, the Manufacturing Chemists' Association) provides guidance on decontamination of small quantities of spills which may be appropriate for removal of final traces of spilled material. If a person with some background in chemistry can be assigned to maintain stocks of decontamination materials and perform such services, it may be practical to have decontamination performed in-house. Otherwise, the OSC should contract for this service.
- D. Contaminated response equipment and clothing should be rinsed or wiped with some solvent of the spilled waste (which does not react with the equipment) after each incident. Equipment should also be checked for cracking and wearing every one to three months.
- E. Clothing which must be laundered should be washed separately. It is generally best to run an empty tub full of water between launderings. Do not wash with children's clothes. Discard badly contaminated clothes.

- F. Exposed skin should be washed thoroughly with soapy water after exposure and after spill response is completed. This applies even if no contamination was noticed.
- G. Avoid touching the face or eyes during spill response without thoroughly washing hands first. Do not eat without a complete change of clothes; do not use lunch areas while wearing contaminated clothing. Do not smoke during spill cleanup.
- H. Do not forget that your shoes, watchband, cap, and eyeglasses are part of your clothing and must be decontaminated. To avoid contaminating personal garments, use overboots and goggles during cleanup operations.
- I. Do not wear contact lenses at any time around hazardous chemicals, especially when a spill has occurred. If you must wear contact lenses, use special sealed goggles or a full face maks.

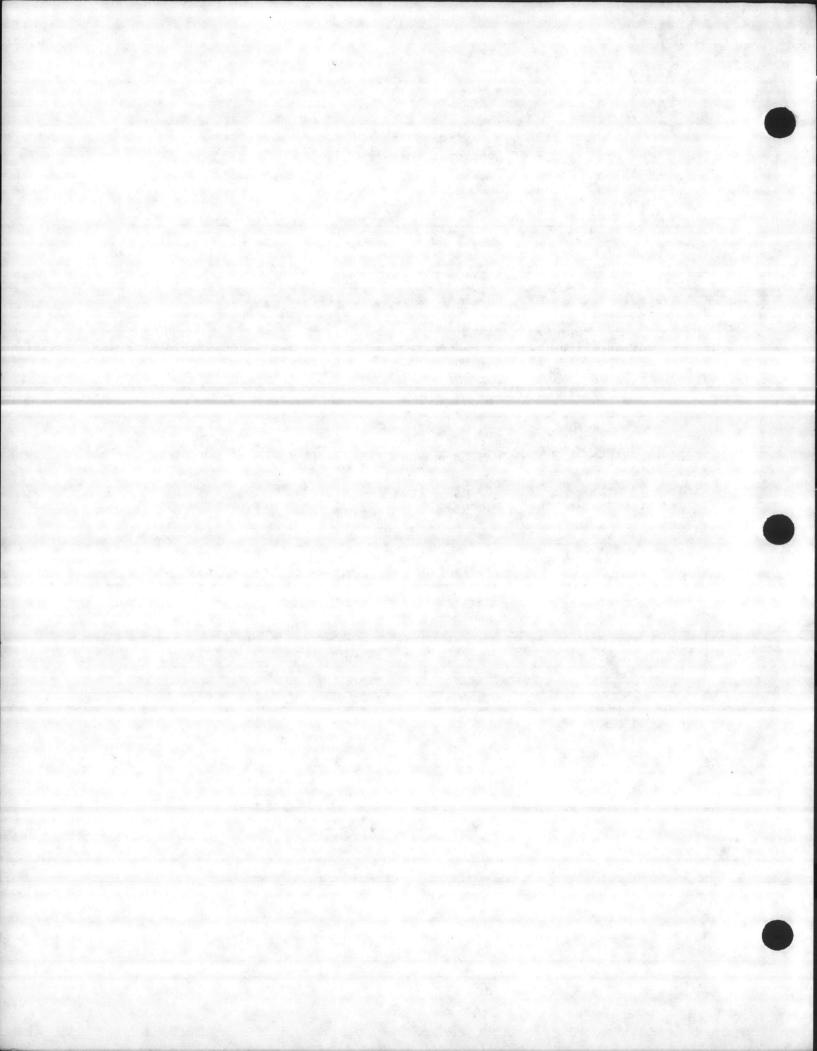
VI. EMERGENCY GUIDES.

You will have an opportunity to use some of these later in a practical exercise. Table 3 lists the major advantages and disadvantages of several of these response guides.

- A. US Coast Guard Chemical Hazard Response Information System (CHRIS) Condensed Guide to Chemical Hazards.
- B. CHRIS Response Guides.
- C. National Fire Protection Association 49, Hazardous Chemical Data.
- D. NIOSH/OSHA Pocket Guide to Chemical Hazards.
- E. 1984 Department of Transportation <u>Hazardous Materials--Emergency</u> Response Guidebook.
- F. Department of Defense "Hazardous Materials Information System (HMIS)".
- G. Chemical Manufacturers' Association "Materials Safety Data Sheets" and "Chemcards.'

Table 3. Advantages and Disadvantages of Emergency Response Guides

Major Advantages	Major Disadvantages
 portable 	small print; not all CHRIS
thorough response descriptions	not portable; much internal cross-referencing
fire department will have copy; portable	primarily describes hazards and response for fires
thorough; portable	many abbreviations
quick response; has UN numbers	cross referencing required
has National Stock Numbers	microfiche; missing information
thorough response description prepared by chemical manufacturer	not always complete not available at all Naval facilities
	portable thorough response descriptions fire department will have copy; portable thorough; portable quick response; has UN numbers has National Stock Numbers thorough response description prepared by chemical



TAB PLACEMENT HERE

DESCRIPTION: FIRE /EXPLOSION RESPONSE ☐ Tab page did not contain hand written information ☐ Tab page contained hand written information *Scanned as next image

Confidential Records Management, Inc. New Bern, NC 1-888-622-4425 9/08

nerversende : 980000000 disease contin adding Grand

CHAPTER XIII

FIRE/EXPLOSION RESPONSE

LEARNING OUTCOMES DESIRED.

At the completion of this unit of instruction, you should be able to:

- A. Recognize potential fire hazards.
- B. Effectively use the proper type of fire extinguisher when fighting a fire.
- C. Take appropriate action to protect personnel and equipment in response to a fire or explosion emergency.

II. INTRODUCTION.

Fires and explosions cause millions of dollars of damage each year and are something every individual should be concerned about. Special care must be taken, however, when dealing with hazardous wastes, since the very nature of some of these wastes make them very reactive and highly ignitable. Some give off toxic fumes when burned, increasing considerably the hazards and difficulties in dealing with these types of fires. Prevention is the key in this area, but if a fire does break out, response must be quick and efficient.

III. FIRE HAZARDS.

When dealing with hazardous wastes, there are a variety of potential fire hazards to consider:

- A. Direct fire/explosion hazards. Some chemicals are fire hazards in themselves--flammable liquids and solids, flammable liquids or gases under pressure, explosives, and certain other chemicals. These substances should be handled with care at all times. They are dangerous because:
 - They may have a low auto-ignition point (catch fire at a relatively low temperature).
 - They may be relatively volatile, rapidly producing vapors that are flammable, or they may be flammable and contained under pressure, presenting an explosion hazard.
 - 3. The waste itself may react with air, liberating heat. Sometimes the reaction is violent.
 - Some wastes are spontaneously combustible under certain conditions.
 - 5. Shock-sensitive wastes can be easily detonated even though not officially classed as explosives. "Nitro" compounds are a typical example.

1126D Date of last revision: Jun 84

- B. Indirect or delayed fire/explosion hazards. Some chemicals, although not flammable by themselves, are fire hazards when combined with other materials.
 - 1. Strong oxidizers react with combustibles, releasing heat which can ignite the remainder of the combustible material. These oxidizers supply oxygen, thus making it difficult to extinguish such fires.
 - 2. Some chemicals react rapidly with each other to produce explosive products, and thus create a dangerous explosion hazard in a spill situation. Other chemicals react with air or moisture or decompose into products which are explosive or shock-sensitive. Still others may be explosive in dry form, and are therefore dangerous only after their solvent evaporates. This is why some of the wastes you may be handling are not stored together and why you should be especially careful when handling incompatible hazardous wastes.
- C. Indirect health hazards. Besides the obvious hazards associated with fires and explosions, certain substances are dangerous in a fire because they give off poisonous fumes or gases when heated. Thus, you must be concerned with fires involving any hazardous waste, even if it is not listed as flammable.
- D. Extinguishing agent hazards. Another type of hazard in fires is related to the type of fire extinguishing agent which may be used.
 - 1. Some chemicals react violently with water. The reaction products may be hydrogen or hydrocarbons (which may be flammable or explosive), oxygen, steam, or acid fumes (see Table 1). Thus, the use of water on such fires is highly dangerous.
 - Carbon dioxide extinguishing systems may generate sparks that can ignite flammable vapors. CO₂ is also an asphyxiant and, as such, a health hazard in large quantities or confined spaces.
 - 3. Foam extinguishing agents can conduct electricity and should not be used in electrical fires.

IV. FIRE DETECTION SYSTEMS AND DEVICES.

These are generally of three types. Heat detectors measure either the actual temperature, or the rate of temperature increase. Smoke detectors measure the production of visible smoke before there are significant temperature changes. Flame detectors measure the production of radiant energy. Because the first two types depend on the combustion products being retained in an enclosed area where a marked change can be detected, they are of little use in covered sheds or open storage. Even in enclosed warehouses, they have limited value unless a very extensive system is provided or the devices are placed relatively close to known fire hazards. In relatively small enclosed spaces or in warehouses without high ceilings and with fire partitions kept closed for most of the day, they may have some value. These detection systems may be of more value as evacuation warnings in office areas and escape routes.

Table 1. Water-Reactive Materials

A. MATERIALS WHICH LIBERATE HYDROGEN

Calcium Li Solid Moderate Lithium Li Solid Moderate Sodium Na Solid Vigorous, may explode Potassium K Solid Usually explodes Calcium hydride CaH2 Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH CENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Phosphorus pentachloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentachloride Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Titanium tetrachloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid					
Lithium Li Solid Moderate Sodium Na Solid Vigorous, may explode Potassium K Solid Usually explodes Calcium hydride CaH2 Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuric acid Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Material	Formula	State A	ction	
Lithium Li Solid Moderate Sodium Na Solid Vigorous, may explode Potassium K Solid Usually explodes Calcium hydride CaH2 Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H6)2Cl Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Calcium	Ca	Solid M	oderate	
Potassium K Solid Usually explodes Calcium hydride LiH Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Lithium		Solid M	oderate	
Potassium K Solid Usually explodes Calcium hydride CaH2 Solid Moderate to vigorous Lithium hydride LiH Solid Moderate to vigorous Moderate to vigorous Solid Moderate to vigorous Moderate to vigorous Moderate to vigorous Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. Moderate to vigorous, acetylene formed which may detonate if confine Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Phosphorus pentachloride Solid Sulphuric acid Liquid Phosphorus pentoxide Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Sodium	Na	Solid V	igorous, n	may explode
Calcium hydride LiH Solid Moderate to vigorous Moderate to vigorous Solid Moderate to vigorous B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Sulphuryl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Potassium	K			
B. MATERIALS WHICH LIBERATE HYDROCARBON Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Titanium chloride Liquid Titanium tetrachloride Liquid Titanium tetrachloride Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Calcium hydride	CaH ₂			
Aluminium tri-ethyl Al(C2H5)3 Liquid Vigorous, ethane formed Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. mono chloride CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentoxide Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Calcium oxide—quicklime Solid Activated silica Solid Activated solica Solid Activated molecular sieves Solid	Lithium hydride	LiH	Solid M	oderate to	vigorous
Aluminium di-ethyl - Al(C2H4)2Cl Liquid generally explodes. mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Phosphorus pentachloride Solid Sulphuric acid Liquid Phosphorus pentoxide Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	B. MATERIALS WHICH LI	BERATE HYDROCAR	BON		
mono chloride Calcium carbide CaC2 Solid Moderate to vigorous, acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated molecular sieves Solid	Aluminium tri-ethyl	A1(C ₂ H ₅) ₃	Liquid V	igorous,	ethane formed
acetylene formed which may detonate if confine C. MATERIALS WHICH LIBERATE OXYGEN Flourine F ₃ Gas Violent, ozone and acid fumes formed. Sodium peroxide Na ₂ O ₂ Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Aluminium di-ethyl mono chloride	- $A1(C_2H_4)_2C1$	Liquid g	enerally e	explodes.
Flourine F3 Gas Violent, ozone and acid fumes formed. Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Aluminium chloride Solid Phosphorus pentachloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated solica sieves Solid	Calcium carbide	CaC ₂	a	cetylene	formed which
Sodium peroxide Na2O2 Solid Moderate on heating. D. MATERIALS WHICH GENERATE STEAM AND ACID FUMES Acetyl chloride Liquid Silicon tetrachloride Aluminium chloride Solid Sulphuric acid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Flourine	F ₃			
Acetyl chloride Liquid Silicon tetrachloride Liquid Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Sodium peroxide	Na ₂ O ₂			
Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	D. MATERIALS WHICH GE	ENERATE STEAM AN	D ACID FUMES		
Aluminium chloride Solid Sulphuric acid Liquid Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	Acetyl chloride	Liquid	Silicon tetrachlo	ride	Liquid
Phosphorus pentachloride Solid Sulphuryl chloride Liquid Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid					
Phosphorus pentoxide Solid Thionyl chloride Liquid Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxide—quicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid	[19] [19] [19] [19] [19] [19] [19] [19]			e	
Phosphorus trichloride Liquid Titanium tetrachloride Liquid E. MATERIALS WHICH GENERATE STEAM ONLY Calcium oxidequicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid			4명 사용하다 경영구들을 가장하다면 전 경험이 되었다고 하는데 모든데 모든데 되었다.		
Calcium oxidequicklime Solid Activated silica Solid Activated alumina Solid Activated molecular sieves Solid				oride	
Activated alumina Solid Activated molecular sieves Solid	E. MATERIALS WHICH GE	ENERATE STEAM ON	LY		
Activated alumina Solid Activated molecular sieves Solid	Calcium oxidequickl	ime Solid	Activated silica		Solid
				ar sieves	
	Sodium hydroxide	Solid			Solid

V. TYPES OF FIRES.

Four classes of fires are generally recognized in the Unites States: A, B, C, and D.

- A. Type A fires involve combustible materials, such as wood and paper, that leave an ember or ash.
- B. Type B fires involve <u>flammable liquids</u> such as gasoline, oil, or solvents.
- C. Type C fires involve energized electrical equipment (the power is turned on).
- D. Type D fires involve metal equipment, solid elemental metals, or finely divided metal powders, such as magnesium or aluminum.

VI. FIRE EXTINGUISHING AGENTS.

- A. Water. Water extinguishes combustible material fires by cooling.
 - 1. Sprinkler systems. No water-reactive chemicals should be stored in buildings with operable water sprinkler systems. Most of these systems are also of little use in flammables storage. Water systems may be fed by gravity tanks external to the normal water supply, in which case the stored volume is a limiting factor in firefighting ability. The pipes are either wet (water is maintained in the distribution system) or dry (the pipes are empty until the system is activated). Dry pipe systems have the advantage that they do not require heating in cold weather; on the other hand, they take longer to supply the water to the area with the fire.
 - Water spray systems. These systems use high pressure and very finely meshed nozzle heads to produce a fog which can stop or prevent ignition of flammable liquids and liquified gases by preventing oxygen from reaching the area of ignition.
- B. Foam. Foams are typically used for class B (flammable liquid) fires as smothering agents. Like water, foam is electrically conductive and thus should not be used on type C fires. Foam systems may use air or carbon dioxide, may or may not include water, and include a foaming agent to produce the froth. Like water systems, foam may be applied through fixed pipes.
- Carbon dioxide. CO₂ and other inert gases smother fires in enclosed areas by replacing the oxygen-containing air. The gas is stored under pressure (usually in cyclinders) and supplied via piping. Used for class B and/or C (electrical) fires, this type of system can be a hazard to employees and firefighters because of its asphyxiating action.
- D. Dry chemical. These systems use free-flowing powders which can extinguish fires chemically, coupled to a pressurized inert gas propellant and a piping and outlet system. The chemicals are

neither toxic nor electrical conductors, and they can be used on both B and C type fires. Principal ingredients include: sodium or potassium bicarbonates, which liberate carbon dioxide when heated and also help neutralize acids; finely powdered metal salts which absorb radiant heat; and a chemical which maintains the free-flowing character of the powder.

VII. PORTABLE FIRE EXTINOUISHERS.

A. Types.

- 1. Water. Water extinquishers are for use only on Class A (combustibles) fires. Water cannot cool the flammable vapors sufficiently in class B fires, and it may spread flammable liquids further. Also, as a conducting material, it is dangerous to use in class C (electrical) fires.
- 2. Foam. Foam extinguishers are for use only to smother class B (flammable liquid) fires. Foam is not a sufficient cooler for class A fires and may not adequately blanket the entire ignitible surface of the combustible material. As a conducting agent, foam is also not suitable for electrical fires.
- 3. Carbon dioxide. Carbon dioxide extinguishers can be used for either electrical (class C) or flammable liquid fires (class B). However, additional actions may be required. As with all electrical fires, the power source should be turned off to eliminate further danger. (In fact, turning off the power immediately changes the fire class, since electrical energy is no longer supplied.) With flammable liquids, the heat generated in the fire remains and produces more vapors, which can reignite after the carbon dioxide has dissipated. Thus, care should be taken even after the fire is out.
- 4. Dry chemicals. The agents in dry chemical extinguishers stop the chemical reactions within the flame. Dry chemical extinguishers are ordinarily labeled and used either for class B and class C fires, or for classes A, B, and C.

 Special dry powder extinguishers may be obtained which can be used on class D (metals) fires.
- B. <u>Use</u>. It is important that you remember the following about how to use portable fire extinguishers.
 - Do not wait until vou have a fire before learning how to use the portable extinguishers available to you; it will probably be too late by then.
 - 2. The distance covered by the extinguisher discharge determines how close to the fire you must be to use it effectively. In most cases, this means you must be reasonably close to the fire. If you cannot get within effective range because of the heat and smoke, it will probably be more efficient to call the fire department than to try to put the fire out with an extinguisher.

- 3. You must also be aware of how long the extinguisher will continue to discharge. It would be more efficient to call in an alarm than to try to use an extinguisher much too small for the size of fire you already have.
- 4. In general, for all extinguishers, aim at the base of the fire. Starting at the front (the side the flames are moving or leaning away from), sweep the extinguisher stream or plume back and forth. The force of the extinguisher stream can spread the fuel. Do not aim under the base, but right at the surface between the fuel and the flame.

C. Inspection and maintenance.

- Make sure all fire extinguishers are completely recharged immediately after use, even if they were not completely discharged. The activity fire department can do this.
- 2. Portable fire extinguishers should be inspected monthly, or at more frequent intervals. The overall condition of the extinguisher should be checked (dents, broken nozzle, bent parts) as well as the seal. If the extinguisher has a recharge indicator, that should also be checked. If an extinguisher feels very light, that too is an indication that it may need recharging. Tags or host activity records must show extinguisher maintenance or recharge data, and the initials or signature of the person who performs this service (OSHA Standards, section 1910.157). The host or servicing fire department should be contacted to ensure that the above is accomplished, and that the proper number and type of fire extinguishers are provided.

VII. FIRE/EXPLOSION RESPONSE.

As with spills or releases of nonflammables, the general response pattern to follow in fire/explosion emergencies uses the letters R-A-C-E, standing for Rescue, Alert, Contain, Evacuate. Naturally the more persons that are prepared and participate, the more quickly the sequence can be implemented (and the more specialized each person's job will be).

A. Rescue.

- If someone is involved in a spill of flammables or other reactives where fire or explosion is likely but has not happened yet, the first thing is to remove him to a safe area. If possible, wash the material from his body and clothing in an emergency shower.
- 2. If people have been burned, stunned, or injured by a fire or explosion or overcome by smoke or fumes, and you will not put yourself in danger by approaching, remove them from the immediate area. Put out the flames by wrapping them in fire blankets or coats, rolling them back and forth on the ground, using a fire extinguisher, or putting them under an emergency shower. Someone with first aid training should be called on to supply artificial

resusciutation if the person is having difficulty breathing or is not breathing. While waiting for the ambulance, have the person lie quietly on as clean a surface as possible; cover with a light sheet, coat, or blanket.

- 3. Rescuing yourself may require that you know your exit route by memory, and that includes by feel alone. If dense smoke blocks your vision, remember to stay near the floor since the hot smoke will rise.
- B. Alert. Pull the fire alarm and call the fire department as soon as possible after discovering a fire. Call the hospital and ambulance if appropriate. Notify your supervisor. He may request the On-Scene Coordinator (OSC) if a hazardous substance is involved (including fires in which the hazardous waste may burn with no immediate release). Emergency numbers should be posted on or by all telephones. If you know what hazardous waste is involved, identify it at each call. If not, pass on any information which may help identify the waste.
- Contain. Whether containment is really the third action you take may depend entirely on the circumstances. It will depend on a number of factors including the type and size of the fire and the type of fire extinguisher available to you. In some cases, such as small fires, it may be better to contain the fire even before sounding an alarm. In other situations, it may be impossible to contain the fire at all. Containment may involve any or all of the following, not necessarily in this order.
 - 1. Use portable extinguishers if appropriate.
 - Shut off sources of electricity or electrical spark, if shutting them off won't in itself cause a spark. This might include merely pulling the plug or shutting off power at the circuit box.
 - 3. Cover drains into sanitary or storm sewers. Don't allow flammables or their vapors to enter.
 - 4. Shut off valves supplying flammables.
 - 5. Put out cigareets.
 - 6. Use sorbents for small spills. Preferably use sorbents which trap flammable vapors as well as liquids. (Do not use sawdust to absorb spills of oxidizers as the sawdust itself may ignite.) Control vapors by other means in large-area spills, or use vapor-trapping sorbents which can be sprinkled or sprayed on the surface.
- D. Evacuate. Next, evacuate the premises of all nonessential personnel. All persons not predesignated to perform specific tasks in an evacuation should immediately and calmly leave the premises by designated evacuation routes, and assemble in specific areas outside so they can be checked as having left the evacuated area.

IX. FIRE PREVENTION GUIDANCE AND INFORMATION.

- A. Specific local guidance can be obtained from local acitivity fire and safety Standard Operating Procedures. All personnel should be familiar with applicable portions of these documents.
- 10
- B. Information on activity firefighting capabilities can be obtained from the activity fire marshall. The fire marshall can also provide hands-on training for personnel in the use of fire extinguishers.
- C. NFPA 30, "Flammable and Combustible Liquids Code, 1984" provides guidance on maximum quantities, required aisle space/separation distances and firefighting/sprinkler design for the storage of a variety of flammable and/or combustible liquids.



EXERCISE: MODULE XIII - FIRE/EXPLOSION RESPONSE

FIRE EXTINGUISHER EXERCISE

- OBJECTIVE: Develop a better understanding of the specific applications of the different types of fire extinguishers.
- SITUATION: Yor facility is equipped with a number of different types of fire extinguishers. It also has the potential of having many different types of fires. It is your job to match the fire extinguishers to the types of fires.
- REQUIRED TASK: Using information given in Module XIII, develop a chart of fire classes versus extinguishing agents.
- PROCEDURE: Using Table XIII-1, list the fire extinguishing agent(s) that will be effective in extinguishing types of fires listed.

Table XIII-1

FIRE	FIRE TYPES	EXTINGUISHING AGENT(S)
A	Combustibles	
	Examples: Wood	
	Bags	
	Paper	
		A COLUMN TO THE RESERVE OF THE SECOND
В	Flammable Liquids	
	Examples: Paint Th	inner
	Gasoline	
	MEK	
С	Electrical	
	(Energized electre equipment)	ical
D	Metals	
	Examples: Sodium Magnesium	m I
		[마다] 그리고 그리고 있는 그리고 있는데 그리고 있는