HAZARDOUS WASTE SITE
INVESTIGATION TRAINING

Washington, D.C.,
May 28-30, 1981

This manual has been prepared by the FIT National Project Management Office, Ecology and Environment, Inc., Arlington, Va., under EPA Contract No. 68-01-6056. (Reference TDD: HQ-8008-04)

AGENDA

DAY 1

A

Name (optional) ______________________________

Affiliation ______________________________

Key
5 - Outstanding
4 - Very Good
3 - Adequate
2 - Poor
1 - Inadequate

EVALUATION FORM

HAZARDOUS WASTE SITE
INVESTIGATION TRAINING

LECTURE	CONTENT	PRESENTATION	COMMENTS
Orientation	1 2 3 4 5	1 2 3 4 5	
Approach to Field Investigations	1 2 3 4 5	1 2 3 4 5	
Hazardous Wastes	1 2 3 4 5	1 2 3 4 5	
Toxicology	1 2 3 4 5	1 2 3 4 5	
Personnel Protection	1 2 3 4 5	1 2 3 4 5	
Ambient Air Characterization	1 2 3 4 5	1 2 3 4 5	
Site Safety Plan Development	1 2 3 4 5	1 2 3 4 5	
Site Safety Considerations and Personnel Decontamination Station Operation Procedures	1 2 3 4 5	1 2 3 4 5	
Emergency Preparedness	1 2 3 4 5	1 2 3 4 5	
Orientation to Respiratory Protection Equipment	1 2 3 4 5	1 2 3 4 5	
Explanation of Parts of the SCBA and Demonstration of Equipment Use	1 2 3 4 5	1 2 3 4 5	

LECTURE	CONTENT	PRESENTATION	COMMENTS
Checkout Procedures for SCBA and Demonstration of Donning	1 2 3 4 5	1 2 3 4 5	
Equipment Exercise: Wearing SCBA	1 2 3 4 5	1 2 3 4 5	
Orientation to Field Exercise	1 2 3 4 5	1 2 3 4 5	
Field Exercise - Overall	1 2 3 4 5	1 2 3 4 5	
Station #1: Location and Setup of Command Post; Dress Out; Evacuation	1 2 3 4 5	1 2 3 4 5	
Station #2: Equipment Operations	1 2 3 4 5	1 2 3 4 5	
Station #3: Downrange Considerations	1 2 3 4 5	1 2 3 4 5	
Station # 4: Personnel Decontamination Procedures	1 2 3 4 5	1 2 3 4 5	
Station #5: Health & Safety Rights and Responsibilities	1 2 3 4 5	1 2 3 4 5	
Station #6: Air-Purifying Respirators; Fit Testing	1 2 3 4 5	1 2 3 4 5	
Overall Course	1 2 3 4 5	1 2 3 4 5	

GENERAL REMARKS

1. Did this training course meet your needs? Please give reasons for your answer.

2. What, if anything, should be added to the course?

3. What, if anything, should be deleted from the course?

4. Please comment about the length of the course. Right amount of time? Too long? Too short?

5. Did you find the course manual adequate? Any recommendations for additions or deletions? Format changes?

6. Please add any other comments that you wish to make. (Use other side)

COURSE ORIENTATION

1. INTRODUCTIONS

2. COURSE GUIDE

Contents. The Course Guide is intended to provide a summary of the course. The guide contains an outline of the various presentations, copies of handouts, and biographical sketches of speakers.

3. COURSE MECHANICS

A. Style of Presentation. The course will be a combination of classroom lectures, and hands-on exercises. Students will be given the opportunity to practice what is taught during he lectures.

B. Breaks. Breaks are scheduled for both morning and afternoon. Because the agenda is very tight, please try to be punctual at break time.

C. Lunch.

D. Field Exercises. Sessions on Tuesday and Thursday will require some running around with SCBA's and protective clothing. All participants should wear old casual clothes and shoes.

E. Course Evaluation Form. It is important that we get feedback on the course and recommendations on additions, deletions, changes in emphasis, etc. This information will be helpful for structuring the course in other Regions.

4. COURSE OBJECTIVES

A. Primary Objective. To prepare participants to undertake waste site investigations in a safe and resource-efficient manner.

B. Objectives Statement

C. "One Approach" Concept

5. COURSE AGENDA

Review highlights of the five days.

6. NATURE AND SCOPE OF THE PROBLEM

A. Background. Uncontrolled hazardous waste disposal sites have been a problem for many years. However, the problem became a major public concern and political issue in 1977/1978 with the discovery of Love Canal. Since that time, uncontrolled hazardous waste disposal sites have been discovered in almost every state of the country. Several studies have been conducted in an attempt to determine the scope of the problem:

1) A study conducted by Fred C. Hart Associates for EPA estimated that 30,000 to 50,000 sites may exist around the country and that 2000 of them may pose serious health hazards.

2) A study conducted by the Office of Solid Waste in 1977 estimated that 90% of the potentially hazardous wastes generated in this country are disposed in an environmentally inadequate manner. The report also assesses damages caused by the disposal practices. See Tables 1 and 2.

Table 1

DISPOSAL PRACTICES FOR POTENTIALLY HAZARDOUS WASTES GENERATED IN THE U.S.*

Disposal Practice	Quantity of Hazardous Wastes Disposed (metric tons) Dry Weight	Wet Weight	% of the Hazardous Wastes Disposed (Wet Weight)
Environmentally Inadequate			
Unlined surface impoundments	5,183,658	13,922,454	48.3
Land disposal (dumps, non-secure landfills, land storage)	3,251,785	8,743,257	30.3
Uncontrolled incineration	1,037,907	2,794,667	9.7
Deep well injection	182,427	481,787	1.7
Landspreading	32,193	86,433	.3
Use on roads	10,187	10,187	.1
Sewered	300	450	.1
Environmentally Adequate			
Controlled Incineration	600,936	1,613,416	5.6
Secure Landfills	246,813	662,653	2.3
Recovery	182,427	489,787	1.7
Lined surface impoundments	1,003	4,152	.1
Waste water treatment	1,356	1,432	.1
Autoclaving	8	325	.1
SUBTOTALS			
Environmentally Inadequate	9,698,457	26,039,235	90.4
Environmentally Adequate	1,032,543	2,771,765	9.6
TOTALS	10,731,000	28,811,000	100

*Annually during the period 1973-1975

FROM: The National Potential For Damage From Improper Waste Disposal (EPA-OSW, 1977)

Table 2

MECHANISMS INVOLVED IN INCIDENTS OF DAMAGE BY DISPOSAL METHOD[a]/

Disposal Method	Surface Impoundments	Landfills, Dumps	Other Land Disposal b/	Storage of Wastes	Smeltings, Slag, Mine Tailings
Number of Cases	89	99	203	15	15
Damage Mechanism (number of cases)					
Groundwater (259)	57	64	117	10	11
Surface Water (170)	42	49	71	-	8
Air (17)	3	5	9	-	-
Fires, Explosions (14)	-	11	3	-	-
Direct Contact Poisoning (52)	1	6	40	5	-
Wells Affected[c]/ (140)	32	28	74	4	2

a) The tabulation refers to 421 cases studied thus far. The numbers in the matrix add up to more than 421, because several damage incidents involved more than one damage mechanism.
b) Haphazard disposal on vacant properties, on farmland, spray irrigation, etc.
c) Not included as a damage mechanism.

Note: The data presented in this table have been derived solely from case studies associated with land disposal of industrial wastes.

FROM: The National Potential for Damage from Improper Waste Disposal (EPA-OSW, 1977)

3) A study conducted by the Environment, Energy and Natural Resources Subcommittee, US House of Representatives in 1980 provides the following information on groundwater utilization:

- 30 trillion gallons of groundwater withdrawn yearly.
- Use of groundwater growing at 25% each decade.
- Groundwater provides 41% of all water used for irrigation.
- Groundwater is used by 95% of all rural Americans.
- Reports now indicate well closures due to contamination in 25 states.

B. Typical Sites. The following are typical of sites currently being investigated around the country:

1) Verona, Missouri - Denny Farm Site 1

a) The Denny Farm is a 160-acre site in rural Verona, Missouri

b) A chemical facility was operational in Verona from the 1960's through 1971. From 1969-1971 the facility was used to manufacture hexachlorophene. This generated several process waste streams with dioxin contamination.

c) In 1979, Region VII received an anonymous complaint about waste disposal on the Denny Farm.

d) Investigation revealed the following:

- Between 30 and 150 drums of waste were disposed in to a 10 foot by 70 foot trench in June 1971.
- The drums were dumped from the back of a truck and were left as they fell.
- The drums were covered with from one to three feet of soil.
- Samples were taken from the trench and found to contain between 65 and 100 mg/kg (ppm) of 2, 3, 7, 8 tetrachlorodibenzo-p-dioxin.

- Geological and geophysical studies demonstrated that the area was in a classical karst topography characterized by sinkholes, linear and right-angle valley formation, pinnacle weathering, disappearing streams, springs and caves.

e) These characteristics were considered to be a serious threat to the health and welfare of area residents.

2) <u>Riverside, California - Stringfellow Site</u>

a) Stringfellow was operated as a Class 1 disposal site from 1954 to 1972.

b) The 14-acre site is located in Pyrite Canyon, a box canyon in the Jarupa Mountains. The canyon is part of the natural watershed of the Santa Ana River.

c) The site received an estimated 32 million gallons of hazardous liquid wastes including spent acids (sulfuric and chromic acids), organics (pesticides and solvents) and heavy metals.

d) The wastes were contained in four primary ponds and 12 smaller containments with a combined capacity of 20 million gallons.

e) The site was abandoned in 1974.

f) During dry weather the site poses no serious threat. However, during heavy rains the ponds overflow their banks.

- 1969 - unmonitored overflow

- 1978 - 800,000 gallons bypassed to prevent a collapse of the entire system

- 1979 & 1980 - only intensive removal operations prevented a discharge

g) Discharges from the site could enter the Santa Ana River, which is used for irrigation and public recreation.

3) Seymour, Indiana - Seymour Recycling

a) Indiana's version of Chemical Control

b) Approximately 60,000 drums and more than 80 bulk tanks containing hazardous wastes are at the site. Possibility of buried wastes must be confirmed.

c) The bulk tanks have been shown to contain combinations of toluene, xylene, phenol and cresol.

d) Studies indicate that a plume of petroleum-related aromatic hydrocarbons extends from the site and is discharging into surface waters at Heddy Run, a tributary of the White River.

e) The site is located in primarily an agricultural area with corn fields adjacent on three sides. A small industrial park is nearby and a water well is within 3,000 feet. Seymour is approximately four miles away.

f) Primary threat from the site include:

- Explosion
- Fire
- Groundwater contamination
- Surface water contamination
- Irritating odors and fumes

4) Mantua Township, N.J. - LiPari Landfill

a) The LiPari Landfill is on a 45-acre site which started as a sand and gravel business.

b) The site began receiving solid and liquid wastes in 1958. The site was operated as a sand and gravel yard and a landfill until 1971.

c) The site is surrounded primarily by private property. An apple and peach orchard is adjacent and a—housing development was built nearby. Chestnut Branch flows adjacent to the site and subsequently flows into Alcyon Lake. A public park has been built around the lake.

d) The volume of wastes disposed at the site is unknown but is estimated at 12,000 cubic yards of solid wastes and 2.9 million gallons of liquid wastes. Liquid wastes were generally disposed uncontained.

e) Waste products include cleaning solvents, paint thinners, dirty waste solvents, and phenol or amines wastes.

f) The primary problem at LiPari is leachate being discharged from the site into the groundwater and subsequently into Chestnut Branch. Contamination has also been detected in Alcyon Lake.

5) We can see from these examples that each site presents a set of unique problems based on the following parameters.

a) Waste Characteristics

b) Disposal Scheme

c) On-Site Conditions

d) Geology/Hydrology

e) Meteorological Conditions

f) Pathways of Contamination

g) Proximity of Receptors

Each of these elements must be evaluated to determine the relative level of risk (or severity of problem) posed by the site.

C. Current Situation. In summary, the current situation can be characterized as follows:

1) The Problem - Hazardous waste disposal is a pervasive, complex, and serious problem warranting the prompt attention of all levels of government.

2) The Victims - The victims are scared, and they perceive that government is often unresponsive. The victim's grievances remain unresolved.

3) The Solutions - The solutions are expensive, and we have little practical experience to assess their effectiveness. Many of the projects undertaken to date have been designed on the basis of cost and have generally been rated as unsuccessful. We have a lot to learn.

4) Your Role - We are in the early stages of development of this program, and with the passage of Superfund, EPA will be expected to assume the lead for solving this problem. The success or failure of the program hinges on how well you do your jobs.

7. EPA SITES MANAGEMENT STRATEGY

A. Program Characteristics

1) Very Large Problem

2) Multidisciplinary Approach

3) Enforcement Element

4) Limited Resources

5) Political and Media Pressures

6) Elements of Risk in Conducting Work

7) Mistakes Could Result in Serious Consequences

B. EPA Response

1) Highest priority

2) Goals. Various stated goals include early detection of public health problems, minimizing environmental impact, and minimizing costs to society.

3) Organization

   - Enforcement Task Force
   - Oil & Special Materials Control Division
   - Office of Hazardous Emergency Response

4) Management Plan (Figure 1)

5) Scope of Activities. The scope and complexity of activities and the required resources illustrate the need for a standard approach. (Figure 2)

6) Applicability to State Activities. States need to develop approaches for data management, setting priorities, worker health and safety, and other elements of the Federal program.

SITE RESPONSE MANAGEMENT PLAN

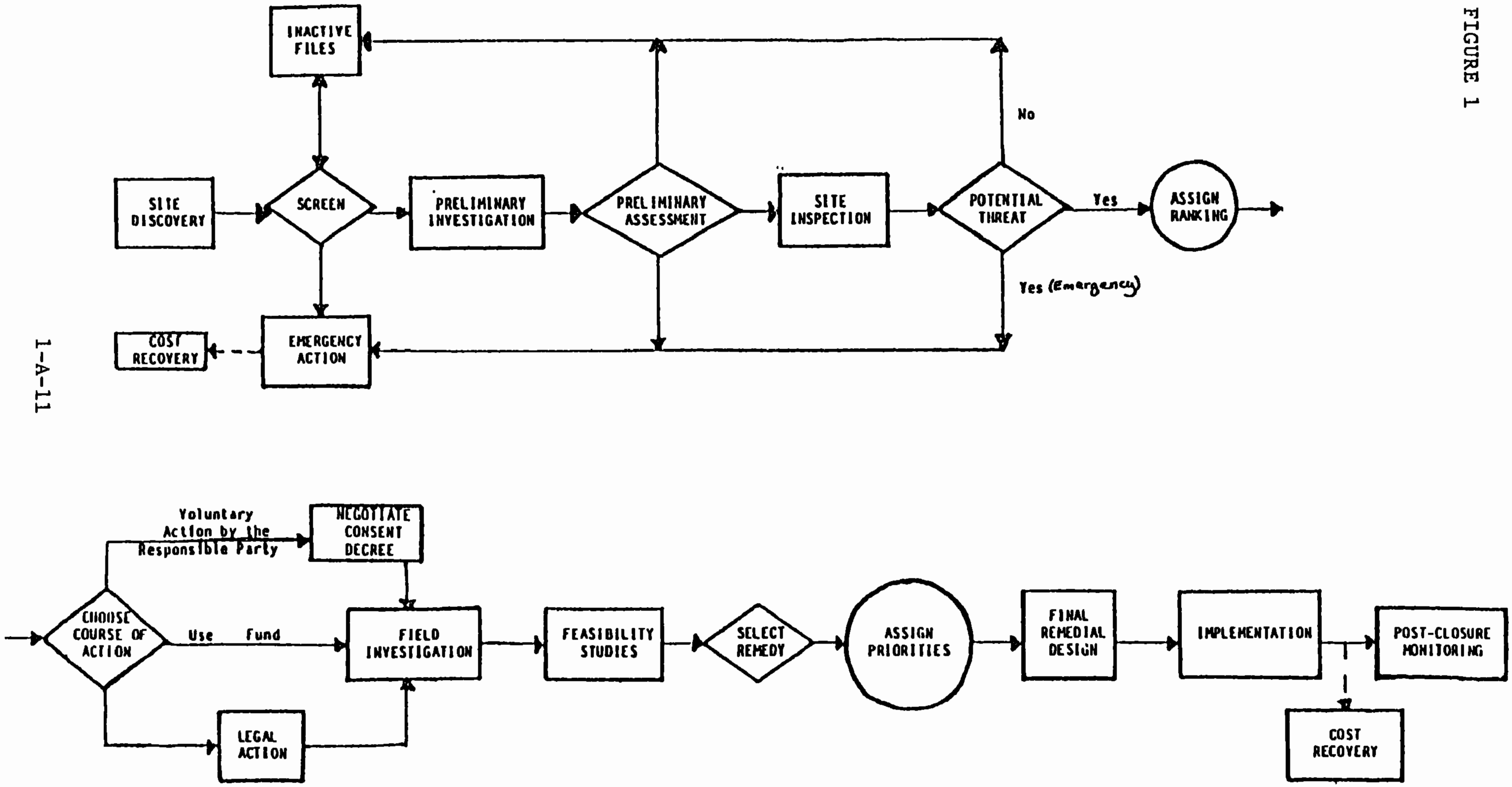


FIGURE 1

OCT 28 1980

dvn.

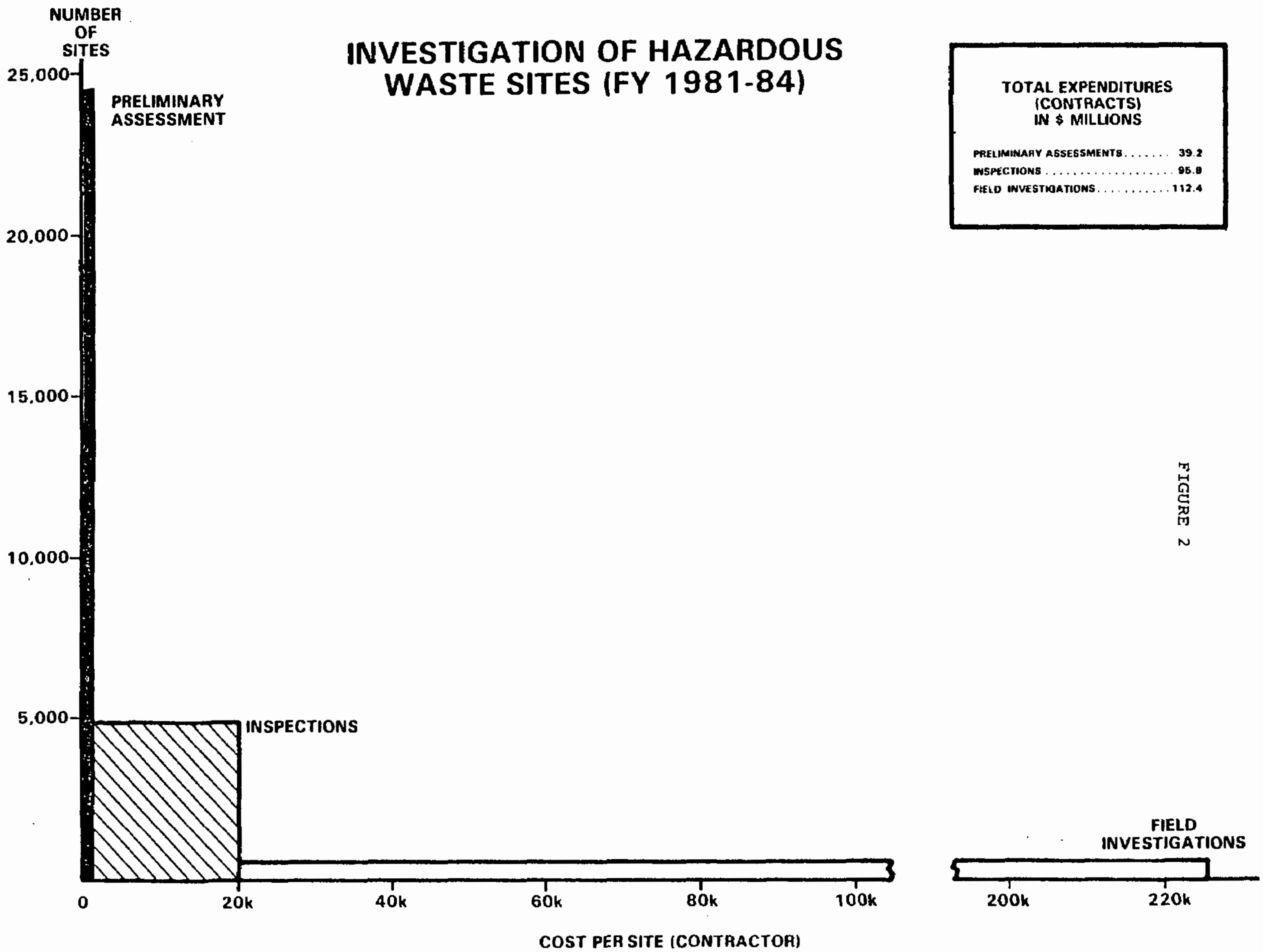

INVESTIGATION OF HAZARDOUS WASTE SITES (FY 1981-84)
NUMBER OF SITES
25,000
20,000
15,000
10,000
5,000
PRELIMINARY ASSESSMENT
INSPECTIONS
FIELD INVESTIGATIONS
0
20k
40k
60k
80k
100k
200k
220k
COST PER SITE (CONTRACTOR)
TOTAL EXPENDITURES (CONTRACTS) IN $ MILLIONS
PRELIMINARY ASSESSMENTS 39.2
INSPECTIONS 95.8
FIELD INVESTIGATIONS 112.4

FIGURE 2

7) Training. This course is intended to assist the Regions in managing this program by providing instruction in the following areas:

a) Systematic approach to investigating sites, including setting priorities

b) Appreciation for the hazards involved

c) Strict adherence to safety policies and procedures

d) Good understanding of the capabilities and limitations of field investigation techniques and procedures

8. SITE PLANNING AND SETTING PRIORITIES

A. Introduction

1) Objectives. In stating objectives, identify emergencies, screen out sites with a low probability of causing problems, sort the remaining sites according to seriousness, and provide support for follow-up activities.

2) Scope. When do you stop?

B. Example (Note that the following is not a comprehensive list.)

1) Citizens' Letters

2) Newspaper Clippings

3) State Regulatory Agency

4) EPA Files

5) Aerial Photography

6) Scientific Studies

C. Evaluating the Information (Specific example continued.)

1) Air Pollution

2) Surface Waters

3) Groundwater (Compare air photos with topo map.)

4) Human Exposure

D. Conclusions

9. PLANNING FOR INSPECTIONS (Specific example continued.)

A. Purpose and Objectives. The reasons for conducting the inspection should be clearly stated, e.g., "Test domestic water supplies; visually confirm spills and leaking containers; obtain environmental samples to discover composition of wastes." Inspections vs. Field Investigations.

B. Sketch Map. A map should be provided that shows command post area, site boundaries, landmarks, surface features, buildings, sample points, etc.

C. Background. A summary should be prepared that gives information concerning possible hazards to inspectors and the public, and a history of site operation.

D. Work Plan. The Work Plan lists major tasks to be accomplished.

E. Safety Plan. The Site Safety Plan must address the following:

1) Protective Equipment

2) Emergency Facilities

3) Monitoring Equipment

4) Contingency Plans

F. Team Assignments. The number of personnel required is a function of the mix of expertise required to do the job, safety and decontamination requirements, and communication needs.

G. Logistics Planning. Determining the necessary logistical plans includes:

1) Travel and Accommodations

2) Equipment (in addition to safety equipment)

3) Sample Handling

4) Shipment

H. Legal Entry Requirements. This may include obtaining any necessary warrants.

10. DATA MANAGEMENT

A. Purpose. For any site management system, it is necessary to have a data management system for: information storage (to maintain continuity), enforcement purposes, program management, and regulations.

B. Forms

1) Identification and Preliminary Assessment

2) Inspection

3) Log

4) Tentative Disposition

11. SETTING PRIORITIES

A. Rationale. The setting of priorities is critical in order to deal effectively with the workload and political pressures.

B. Existing Guidance

C. Specific Example

LIN HUVEN
1446 KANSAS
SAN FRANCISCO CA 94107

EPA

western union Mailgram

1-001062S235 08/22/80 ICS IPMBNGZ CSP WSHC
4158243528 MGM TDBN SAN FRANCISCO CA 225 08-22 0312A EST

PRESIDENT JIMMY CARTER
WHITE HOUSE
WASHINGTON DC 20500

MR. PRESIDENT:

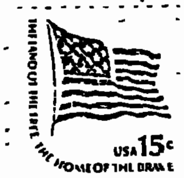
SEEING "THE KILLING GROUND" TONIGHT PROMPTED ME TO DEAL WITH AN ISSUE THAT IS IN MY MIND AND HEART ON A DAILY BASIS. BEING THE PRESIDENT OF A CONTAMINATED NATION OF SICK PEOPLE AND ANIMALS WILL NOT BE A PRESTIGIOUS POSITION EVEN WITH THE BENNIES THE CHEMICAL, OIL, AND POWER COMPANIES SAY THEY OFFER US. WITH THE HUGE PROFITS THESE COMPANIES ARE MAKING WE SHOULD ALL BE ABLE TO EXPECT THEM TO TAKE FINANCIAL RESPONSIBILITY ON PRIOR ERRORS, FUTURE WASTES AND THEIR MORAL OBLIGATIONS TO THOSE WHOSE LIVES THEY HAVE MADE A LIVING HELL AND THOSE STILL TO SUFFER. THIS SHOULD BE A TOP PRIORITY AS EVERY MINUTE THE SITUATION GROWS CLOSER TO BEING IRREVERSIBLE IN ANYONES LIFETIME. WE COULD BE DESTROYED BY OUR OWN WASTE INSTEAD OF A NUCLEAR BOMB. WHEN CITIZENS SUCH AS MYSELF ARE RESPONSIBLE TO OUR COMMUNITIES LAWS AND LARGE COMPANIES ARE NOT; WE WONDER IF WE AREN'T BEING DUPED INTO SUBMISSION BY OUR CONSCIENCE WHILE WE ARE RAPED BY THOSE WITHOUT CONSCIENCES. WHAT IS MY GOVERNMENT ACTUALLY DOING TO CHANGE THIS DEPLORABLE SITUATION? HOW QUICKLY WOULD MY GOVERMENT WORK ON THIS IF AMY CONTRACTED CANCER AFTER DRINKING WATER IN MICHIGAN WHILE ON A FISHING VACATION?

AWAITING YOUR REPLY, AN ANXIOUS CITIZEN
MS LIN HUVEN 1446 KANSAS SAN FRANCISCO CA 94107

03:14 EST

MGMCOMP MGM

Aaron R Duckworth
P.O. Box 753
SilverSrings Fla. 32688



Carol Lawson
(Lw H562)
Office of Solid Waste
US Environmental Protection
Agency Washington D.C. 20460

Carrie,
Add.
Hi ~~D~~ Hugh Kaucth

To Whom it May consern
Theres a factor were I uset to work in Cockeysville Md. That dumps hydrolic Acid + NiTric Acid + A Cemical called Kolean They say That they have a computorized sistem wich dont let any of the cemicals in the strem that alls instilled but follow the strem for miles and you still wont find any fish from ~~that~~ Maryland Specialty wire co.

Thank you
Aaron R Duckworth

P.S. I just want someting for my ~~little~~ girl to look foward to in the future I wise sommone could do something

CHESTER L. BROOKS
1065 Tommy Street
N. Canton, Ohio
44720

Sunday Mar. 4. 1979

James F. McAvoy - Director
Ohio - EPA
Box 1049
361 E. Broad Street
Columbus Ohio, 43216

Subject: Dumps at Deerfield Ohio in Portage County

Dear Sir:

I was at the residence of Doris Carver yesterday and talked with some other people in this area.- see inclosed photo copies. I have known about this area for years and prefer to let sleeping dogs alone unless it bothers me . I am supersensative to a whole range of toxic chemicals and have been this way long before EPA was ever thought of.

The eleven acre dump shown in the picture belonging to Mr. Georgeoff I am of the opinion is but a drop in the bucket as far as toxic chemicals that are buried in the area. I have made effort to get a good arial map of the area but the Akron office that has the maps of Portage County are of little value.

Yesterday there was a fire in progress in this area but it was in the area between where a whitish substance was being dumped and where there was a derrick like they were drilling a well and whether this was on Gergeoffs property or the dump just south of it I do not know as I will not even get out of the car and walk on this contaminated area. This was approximately 4:00 P.M. and the smoke was low to the ground and going Northward toward the Skating Rink on U.S. 224 and it had a stinking chemical odor.

What has really presented a challenge to me is the, go to hell attitude of the dump operators and their , health be damed and environment be damed attitude. Its time to find if there is any teeth in the Toxic Substances Control Act. Last year your boss Gov. Rhodes claimed he was the No. 1 EPA fighter in Ohio . He also made much todo about using Ohio Coal but he has changed his position. He might change his position on this environmental fester of national proportions too.

I expect to write this up to Mr. Costle at Washington in the nere future and will send you a copy of the letter. Might mention that I was in your office during the afternoon of January 25th and talked about this situation among other things with a Mr. Johnson , I believe his name was.

Very truly yours,

Fire chief thinks dump perils Deerfield

By Richard G. Ellers
Staff writer

RAVENNA — One of Portage County's least attractive, but possibly most dangerous sites is an 11-acre dump in an old strip mine west of Deerfield Center at U.S. 224 and Ohio 225.

Summit National Liquid Services Dump, owned and operated by Dan Georgeoff of Bath, is the last stop for thousands of rusted, dented, topless 55-gallon metal barrels containing chemicals that are thought to be dangerous.

Deerfield residents and health officials have been complaining about smoke and odors from the dump since it opened in 1973 and fear the leaking chemicals may contaminate water supplies.

The township fire chief said the dump may be a ticking time bomb because barrels of highly flammable chemicals are improperly stored and a fire there would be hard to handle.

Last June, the Ohio Environmental Protection Agency ordered Georgeoff to stop burning the waste chemicals and to file plans for an orderly, safe cleanup of the property. The agency believes some of the chemicals are pesticides and pharmaceuticals.

The order provided for the orderly removal of hazardous chemicals which the agency said Georgeoff cannot burn and for which he does not have a permit to handle or store.

Georgeoff has appealed the order to the state Environmental Board of Review with a hearing set for Feb. 15.

Georgeoff has applied to the Ohio EPA for a larger incinerator to burn waste oils and solvents. Georgeoff could not be contacted and his lawyer in Akron said he would not allow him to comment while hearings are pending.

At a hearing last week in which Georgeoff was to give a deposition before the county prosecutor, Georgeoff repeatedly refused to identify any of the sources or shippers of the estimated 3½ million gallons of waste chemicals at the dump.

Asst. County Prosecutor Louis Myers then filed contempt charges Tuesday against Georgeoff for his refusals.

Records of the Ohio EPA district office in Twinsburg show that soon after he started operations in 1973, Georgeoff had been repeatedly warned about his failure to correct his operations and to clean up his dump.

Dennis Lee, an Ohio EPA engineer, said Georgeoff makes a lot of promises about cleanup, but never fulfills them.

Miles Felmly, township fire chief, said the State Fire Marshal's office has never held a hearing on a fire code violation and a cleanup order he (Felmly) issued to Georgeoff last summer.

"The fire marshal accepted Georgeoff's appeal of my order even though it was late. And except for a couple of visits by inspectors, the state hasn't done anything to move the case along," Felmly said.

"If we ever have a fire at the dump, those barrels of oils and solvents will crack in the heat and take off like rockets spewing fire all the way," he warned.

Felmly said he is annoyed by the state's failure to act on his fire code violation charge because three of the violations will make the place very dangerous to his men in the event of a fire there.

He said the access road is barely the required 12 feet wide in many places and always pocked with chuckholes, some two feet deep. The road is lined on both sides with stacks of flammable chemicals, although state code requires flammables to be stored no closer than 200 feet to a fire lane, he said.

"And there is no ground contouring so that chemical spills flow to a pool where they can be pumped out."

Doris Carver, who lives across U.S. 224 from the dump, organized and is president of the Concerned Citizens of Deerfield. She said residents met last fall when it seemed state action might not really be getting anywhere.

"We met with Mr. (Ned E.) Williams (former director of the Ohio EPA) after months of him avoiding us. And he made me mad when he kept telling me we had to forget the past and only take care of the future."

Mrs. Carver said she was annoyed and worried "when Mr. Williams told us that we cannot push Georgeoff too hard or he might throw up his hands, put his corporation in bankruptcy and abandon the mess," she said.

The group hired a Columbus lawyer specializing in environmental protection and have been accepted as a party to the board of review case.

But, Mrs. Carver said, their lawyer warned the citizens group at a meeting last week that even if they win the case before the board of review, Georgeoff's appeal might drive the fight through courts for several years.

1 4-23

Citizens skate to fund cleanup

.. 1979

DEERFIELD — The Concerned Citizens of Deerfield Committee will sponsor another "skate to clean up the dump" Sunday at the Starlight Roller Rink in Atwater.

Proceeds from the skating party will go toward the citizens' ongoing fight against the Summit Nation Liquid Services Inc. chemical waste facility at the intersection of U.S. 224 and Ohio 225 in Deerfield Twp.

Admission is $1.25 and skates may be rented for 50 cents. The rink is located at 8153 Waterloo Rd. and the party will be from 4:30 to 6:30 p.m.

There will also be a bake sale during the skating party.

Cleveland Plain Dealer April-8-1977

Michigan hits return of Ohio toxic wastes

TD 44500

AKRON (AP) — Michigan Atty. Gen. Frank Kelley said yesterday he is concerned about a plan to ship toxic wastes from a company here into Michigan.

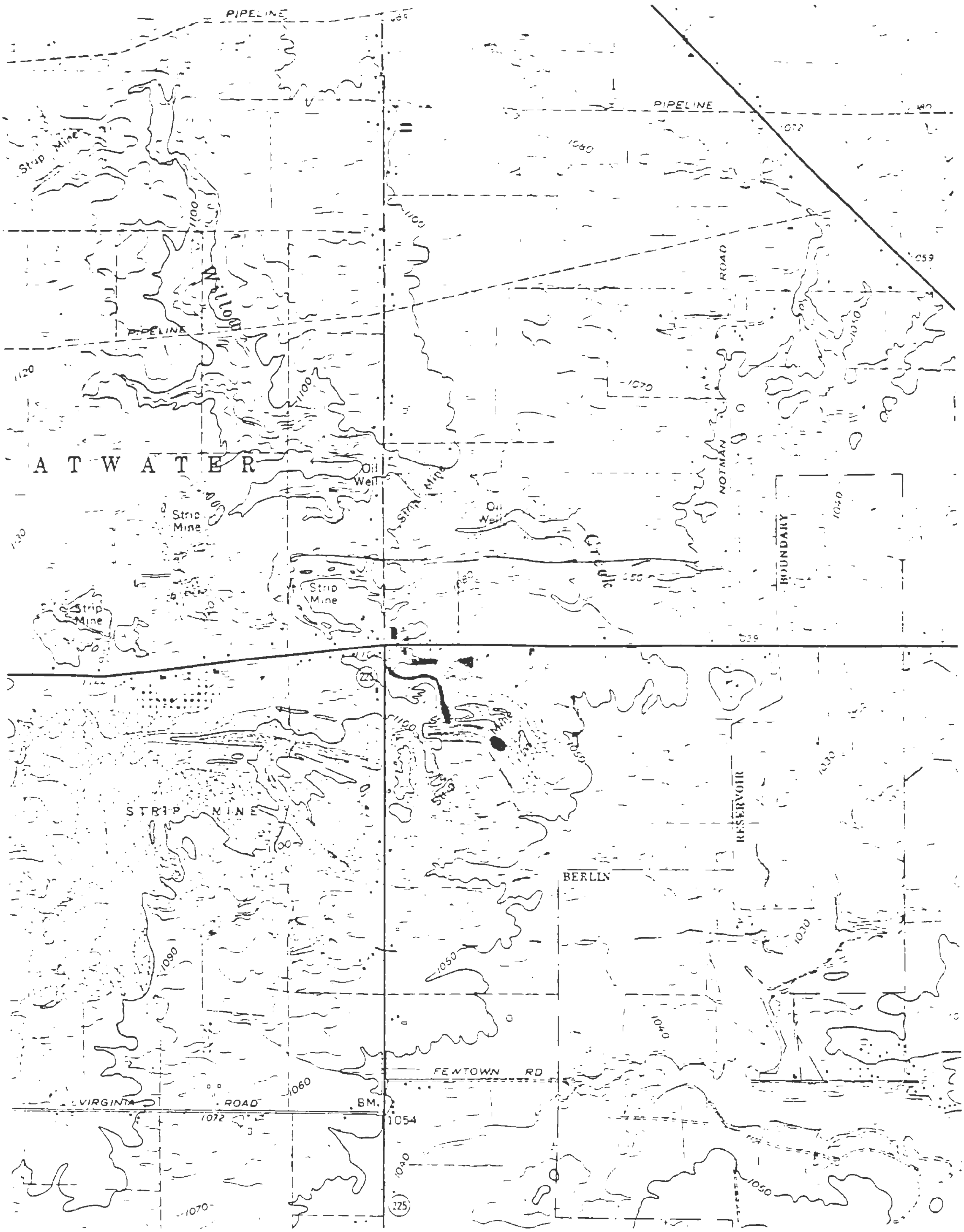
Ohio officials forced the Summit National Services Co., a commercial waste disposal operation in Deerfield Township near Akron, to close its waste incineration furnaces about a year ago. The company then began storing drums of toxic pollutants on its 11-acre lot.

The Ohio Environmental Protection Agency discovered the situation in January and began negotiating with Summit about cleaning it up. One of the proposed solutions was that the company send all of the toxic materials back to the companies that produced them.

Federal law suggests the producer of a pollutant is ultimately responsible for its disposal.

Among the materials on the Summit lot are 4,500 gallons of C56, a toxic compound of plastics and pesticides manufactured until recently by the Hooker Chemical Co., in Montague, Mich. There also are quantities of thimet and cytrolane, deadly pesticides then produced by Lakeway Chemicals Inc., of Muskegon, Mich.

When Howard Tanner, director of the Michigan Department of Natural Resources learned of the Ohio plan, he had his staff draft a letter to the Ohio EPA warning that Michigan would take legal action to block the shipments.


PIPELINE
PIPELINE
Strip Mine
1100
Willow
PIPELINE
1120
1060
1100
1070
ROAD
NOTMAN
BOUNDARY
1040
ATWATER
Oil Well
Strip Mine
Oil Well
Strip Mine
Creek
Strip Mine
Strip Mine
1030
1039
225
1100
STRIP MINE
RESERVOIR
1030
BERLIN
1090
1050
1030
1040
FENTOWN RD
VIRGINIA ROAD
1060
BM.
1054
1072
225
1050
1070

1978
BE SURE NAME, BUSINESS AND ADDRESS MATCH YOUR FILE.

ANSWERING INQUIRY

SUBSCRIBER: 061-002511R

1626100 ... 0000105

FULL REVISION

DUNS: 07-674-9373
SUMMIT NATIONAL SERVICES

BOX 1531
18 ANACONDA RD
AKRON OH 44310
TEL 216 633-0110

MAR 27 1978

LIQUID WASTE
DISPOSAL SERVICE

SIC NOS.
49 53

SUMMARY
RATING --

STARTED 1973
PAYMENTS SEE BELOW
EMPLOYS 2
HISTORY CLEAR

[redacted] OWNER

PAYMENTS (Amounts may be rounded to nearest figure in prescribed ranges)

REPORTED	PAYING RECORD	HIGH CREDIT	NOW OWES	PAST DUE	SELLING TERMS	LAST SALE WITHIN
3/78	Slow 90	250	-0-	-0-		6-12 Mos
1/78	Ppt-Slow 20	2500	-0-	-0-		6-12 Mos

ON 03/27/78 [redacted]eoff stated slowness caused by slow receivables.

FINANCE

On Mar 21 1978 Donald Georgeoff, owner, declined financial information.

HISTORY

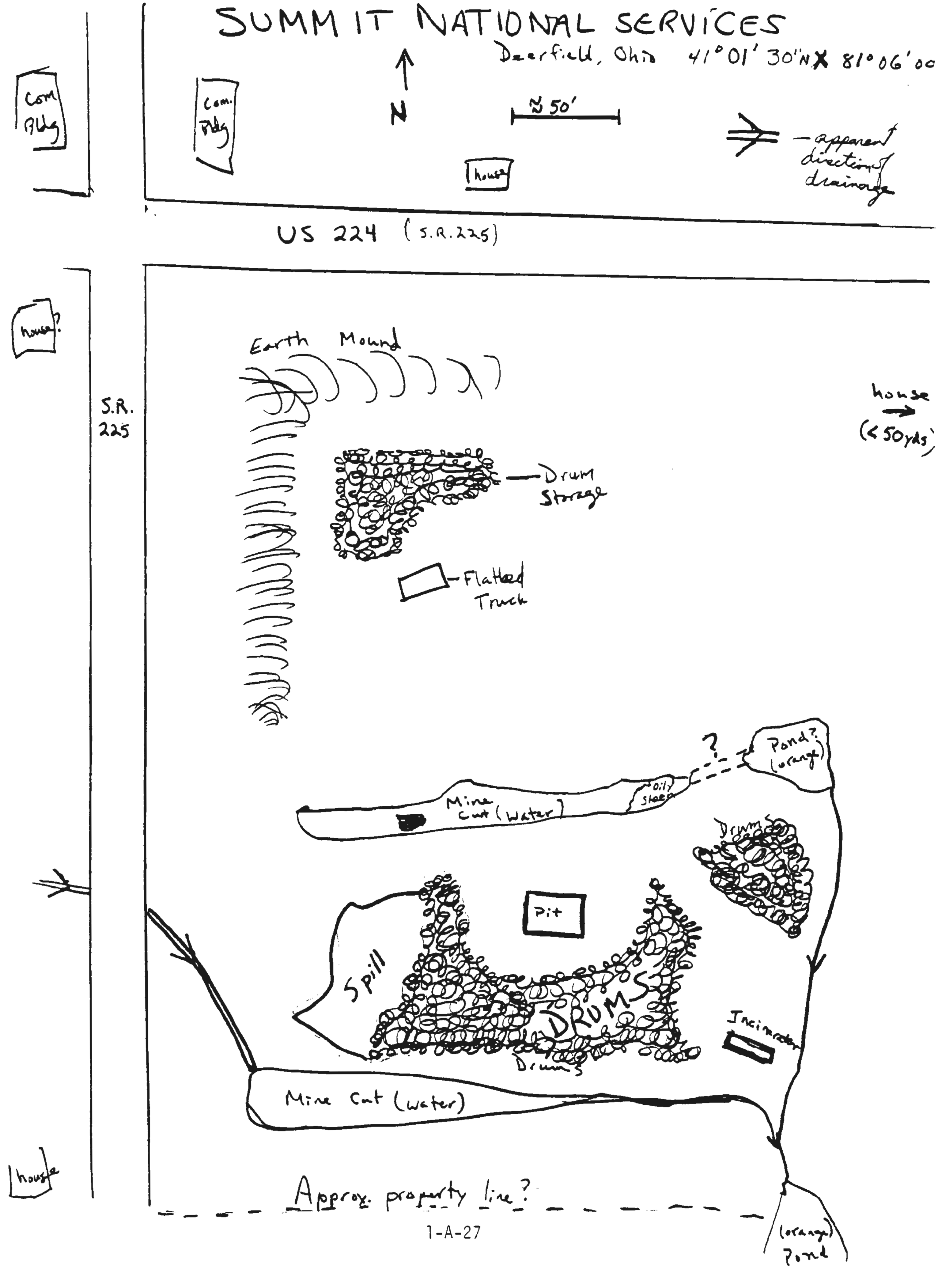
DONALD [redacted]F, OWNER

Style unregistered. Used for business purposes. Business started 1973. Initial ivestment or starting capital not learned. Georgeoff acknowledged ownership Oct 20 1976.

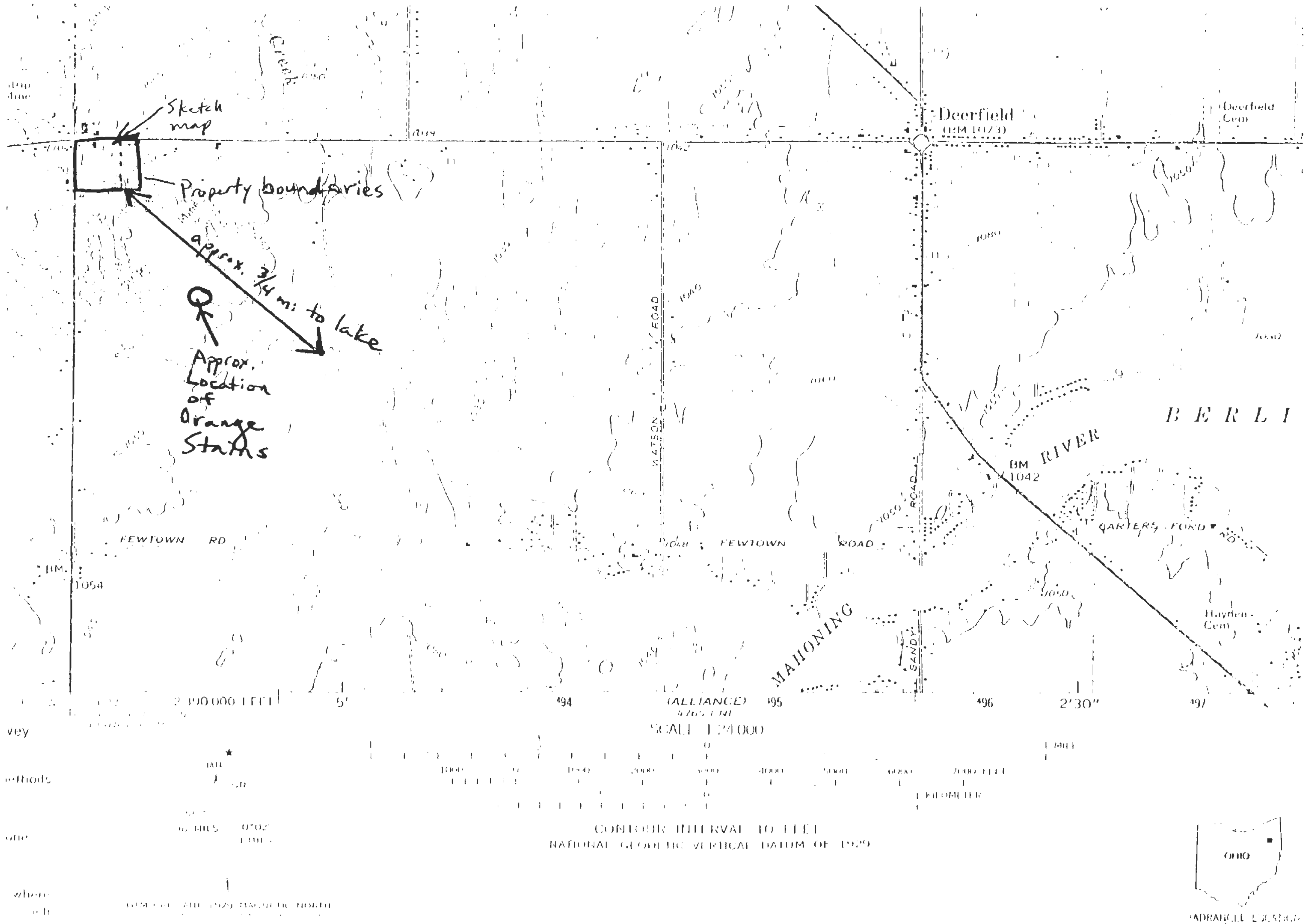
[redacted]F, born 1932, married. 1951-52 with Goodyear Tire & Rubber Company, factory worker. 1952-54 ervied in United States Army. Jun 1954 partner with Frank Zimmerman, operating service station at 1924 Bailey Road, Cuyahoga Falls Ohio. 1955 purchased partner's interest and continued individually until 1961. Mar 1961 became partner in Georgeoff's Cafe at 803 E Tallmadge Avenue, Akron Ohio, continuing until Mar 1962 when business discontinued. 1962-late 1964 self-employed in automotive repair work. 1964 formed Summit National Refuse Co, operating individually until being succeeded by ~~a corporation on Apr 20~~ 1971. The company was engaged in refuse removal service. Effective Mar 1 1972, refuse collection routes and equipment sold closed. The equipment consisted of four packer trucks and one straight truck. Tha purchase price was not disclosed, but included a cash down payment, with an additional payment to be made on Jan 1 1973. As far as can be determied, there are no outstanding loans on the equipment and the sale was profitable for Summit National Refusa Co (Inc). In 1973 this sale Summit National Services came into existance to handle that part of the businss which was not sold.

ERATION

Liquid waste disposal service 100%. Terms are net 30. Sells to industrial concerns. Territory general area.
EMPLOYEES: 2 including owner.
LOCATION: Owns 1 story brick and steel building in good condition. Located in seccndary business section on side street. Premises neat.
05-16(179 /91)0000/00 11502 2 012


SUMMIT NATIONAL SERVICES
Deerfield, Ohio 41°01' 30"N X 81°06'00
N
~50'
apparent direction of drainage
Com Bldg
Com. Bldg
house
US 224 (S.R. 225)
house?
S.R. 225
Earth Mound
house
(< 50yds)
Drum Storage
Flatbed Truck
?
Pond? (orange)
Oily Sheen
Mine Cut (water)
Drums
Pit
Spill
DRUMS
Incinerator
Drums
Mine Cut (water)
house
Approx. property line?
(orange) Pond

1-A-28


Sketch map
Property boundaries
approx. 3/4 mi to lake
Approx. Location of Orange Stains
Creek
Deerfield
(BM 1073)
Deerfield Cem
BERLI
BM 1042
RIVER
WATSON ROAD
ROAD
FEWTOWN RD
FEWTOWN ROAD
CARTERS FORD RD
MAHONING
SANDY
Hayden Cem
BM 1054
2 190 000 FEET
494
(ALLIANCE)
495
496
2'30"
497
SCALE 1:24 000
1 MILE
1000
2000
3000
4000
5000
6000
7000 FEET
KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
OHIO

EPA

POTENTIAL HAZARDOUS WASTE SITE IDENTIFICATION AND PRELIMINARY ASSESSMENT

REGION: 5

SITE NUMBER *(to be assigned by Hq)*:

NOTE: This form is completed for each potential hazardous waste site to help set priorities for site inspection. The information submitted on this form is based on available records and may be updated on subsequent forms as a result of additional inquiries and on-site inspections.

GENERAL INSTRUCTIONS: Complete Sections I and III through X as completely as possible before Section II *(Preliminary Assessment)*. File this form in the Regional Hazardous Waste Log File and submit a copy to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force *(EN-335)*; 401 M St., SW, Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME: Summit Nat'l Services

B. STREET *(or other identifier)*:

C. CITY: Deerfield

D. STATE: OH

E. ZIP CODE:

F. COUNTY NAME: Portage

G. OWNER/OPERATOR *(if known)*

1. NAME: Donald Georgeoff
2. TELEPHONE NUMBER:

H. TYPE OF OWNERSHIP

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☑ 5. PRIVATE ☐ 6. UNKNOWN

I. SITE DESCRIPTION: drum storage area bordered by shopping area, residences, trees suspected toxic substances [illegible] toward lake

J. HOW IDENTIFIED *(i.e., citizen's complaints, OSHA citations, etc.)*: Surface water discoloration

K. DATE IDENTIFIED *(mo., day, & yr.)*:

L. PRINCIPAL STATE CONTACT

1. NAME:
2. TELEPHONE NUMBER:

II. PRELIMINARY ASSESSMENT *(complete this section last)*

A. APPARENT SERIOUSNESS OF PROBLEM

☐ 1. HIGH ☐ 2. MEDIUM ☐ 3. LOW ☐ 4. NONE ☐ 5. UNKNOWN

B. RECOMMENDATION

☐ 1. NO ACTION NEEDED *(no hazard)*

☐ 2. IMMEDIATE SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR
b. WILL BE PERFORMED BY

☐ 3. SITE INSPECTION NEEDED
a. TENTATIVELY SCHEDULED FOR
b. WILL BE PERFORMED BY

☐ 4. SITE INSPECTION NEEDED *(low priority)*

C. PREPARER INFORMATION

1. NAME:
2. TELEPHONE NUMBER:
3. DATE *(mo., day, & yr.)*:

III. SITE INFORMATION

A. SITE STATUS

☐ 1. ACTIVE *(Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)*

☐ 2. INACTIVE *(Those sites which no longer receive wastes.)*

☑ 3. OTHER *(specify)*: Other
(Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)

B. IS GENERATOR ON SITE?

☑ 1. NO ☐ 2. YES *(specify generator's four-digit SIC Code)*

C. AREA OF SITE *(in acres)*: 11 acres

D. IF APPARENT SERIOUSNESS OF SITE IS HIGH, SPECIFY COORDINATES

1. LATITUDE *(deg.-min.-sec.)*: 41° 01' 30" N
2. LONGITUDE *(deg.-min.-sec.)*: 81° 06' 00"

E. ARE THERE BUILDINGS ON THE SITE?

☐ 1. NO ☑ 2. YES *(specify)*: incinerator facility

T2070-2 (10-79) Continue On Reverse

Continued From Front

IV. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

'X'	A. TRANSPORTER	'X'	B. STORER	'X'	C. TREATER	'X'	D. DISPOSER
	1. RAIL		1. PILE		1. FILTRATION		1. LANDFILL
	2. SHIP	✓	2. SURFACE IMPOUNDMENT		2. INCINERATION		2. LANDFARM
	3. BARGE	✓	3. DRUMS		3. VOLUME REDUCTION		3. OPEN DUMP
	4. TRUCK		4. TANK, ABOVE GROUND		4. RECYCLING/RECOVERY		4. SURFACE IMPOUNDMENT
	5. PIPELINE		5. TANK, BELOW GROUND		5. CHEM./PHYS. TREATMENT		5. MIDNIGHT DUMPING
	6. OTHER *(specify)*:	✓	6. OTHER *(specify)*: rectangular pit		6. BIOLOGICAL TREATMENT	✓	6. INCINERATION
					7. WASTE OIL REPROCESSING		7. UNDERGROUND INJECTION
					8. SOLVENT RECOVERY		8. OTHER *(specify)*:
					9. OTHER *(specify)*:		

E. SPECIFY DETAILS OF SITE ACTIVITIES AS NEEDED

V. WASTE RELATED INFORMATION

A. WASTE TYPE

☐ 1. UNKNOWN ☑ 2. LIQUID ☐ 3. SOLID ☐ 4. SLUDGE ☐ 5. GAS

B. WASTE CHARACTERISTICS

☐ 1. UNKNOWN ☐ 2. CORROSIVE ☑ 3. IGNITABLE ☐ 4. RADIOACTIVE ☐ 5. HIGHLY VOLATILE

☑ 6. TOXIC ☐ 7 REACTIVE ☐ 8. INERT ☑ 9. FLAMMABLE

☐ 10. OTHER *(specify)*:

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

Unknown

2. Estimate the amount *(specify unit of measure)* of waste by category; mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	AMOUNT	AMOUNT	AMOUNT 15,000 drums	AMOUNT	AMOUNT
UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE

'X'	a. SLUDGE	'X'	b. OIL	'X'	c. SOLVENTS	'X'	d. CHEMICALS	'X'	e. SOLIDS	'X'	f. OTHER
	(1) PAINT, PIGMENTS	X	(1) OILY WASTES		(1) HALOGENATED SOLVENTS		(1) ACIDS		(1) FLYASH		(1) LABORATORY PHARMACEUT.
	(2) METALS SLUDGES		(2) OTHER *(specify)*		(2) NON-HALOGNTD. SOLVENTS		(2) PICKLING LIQUORS		(2) ASBESTOS		(2) HOSPITAL
	(3) POTW				(3) OTHER *(specify)*:		(3) CAUSTICS		(3) MILLING/ MINE TAILINGS		(3) RADIOACTIVE
	(4) ALUMINUM SLUDGE						(4) PESTICIDES		(4) FERROUS SMLTG. WASTES		(4) MUNICIPAL
	(5) OTHER *(specify)*:						(5) DYES/INKS		(5) NON-FERROUS SMLTG. WASTES		(5) OTHER *(specify)*:
							(6) CYANIDE		(6) OTHER *(specify)*:		
							(7) PHENOLS				
							(8) HALOGENS				
							(9) PCB				
							(10) METALS				
							(11) OTHER *(specify)*				

 Continue On Page 3

Continued From Page 2

V. WASTE RELATED INFORMATION (continued)

3 LIST SUBSTANCES OF GREATEST CONCERN WHICH MAY BE ON THE SITE (place in descending order of hazard).

C56
thumet
cytoiane

4 ADDITIONAL COMMENTS OR NARRATIVE DESCRIPTION OF SITUATION KNOWN OR REPORTED TO EXIST AT THE SITE.

Spilled materials, [illegible]

VI. HAZARD DESCRIPTION

A. TYPE OF HAZARD	B. POTENTIAL HAZARD (mark 'X')	C. ALLEGED INCIDENT (mark 'X')	D. DATE OF INCIDENT (mo.,day,yr.)	E. REMARKS
1 NO HAZARD				
2 HUMAN HEALTH	✓			[illegible]
3 NON-WORKER INJURY/EXPOSURE	✓			No fencing
4. WORKER INJURY				
5. CONTAMINATION OF WATER SUPPLY	✓			Berlin Reservoir, wells
6. CONTAMINATION OF FOOD CHAIN				
7 CONTAMINATION OF GROUND WATER	✓			[illegible]
8 CONTAMINATION OF SURFACE WATER	✓			[illegible] oily sheen
9. DAMAGE TO FLORA/FAUNA				
10. FISH KILL				
11 CONTAMINATION OF AIR	✓			[illegible]
12. NOTICEABLE ODORS	✓			[illegible]
13 CONTAMINATION OF SOIL	✓			spills
14. PROPERTY DAMAGE				
15. FIRE OR EXPLOSION	✓			news paper [illegible]
16. SPILLS/LEAKING CONTAINERS/ RUNOFF/STANDING LIQUIDS	✓			[illegible]
17. SEWER, STORM DRAIN PROBLEMS				
18. EROSION PROBLEMS				
19. INADEQUATE SECURITY	✓			no apparent security
20 INCOMPATIBLE WASTES				
21. MIDNIGHT DUMPING				
22. OTHER (specify)				

Continued From Front

VII. PERMIT INFORMATION

A. INDICATE ALL APPLICABLE PERMITS HELD BY THE SITE.

- [ ] 1. NPDES PERMIT
- [ ] 2. SPCC PLAN
- [x] 3. STATE PERMIT *(specify)*: Ohio air permit denied
- [ ] 4 AIR PERMITS
- [ ] 5. LOCAL PERMIT
- [ ] 6. RCRA TRANSPORTER
- [ ] 7. RCRA STORER
- [ ] 8. RCRA TREATER
- [ ] 9. RCRA DISPOSER
- [ ] 10 OTHER *(specify)*:

B. IN COMPLIANCE?

- [ ] 1. YES
- [x] 2. NO
- [ ] 3. UNKNOWN

4. WITH RESPECT TO *(list regulation name & number)*:

VIII. PAST REGULATORY ACTIONS

- [x] A. NONE
- [ ] B. YES *(summarize below)*

IX. INSPECTION ACTIVITY *(past or on-going)*

- [x] A. NONE
- [ ] B. YES *(complete items 1,2,3, & 4 below)*

1. TYPE OF ACTIVITY	2 DATE OF PAST ACTION *(mo., day, & yr.)*	3 PERFORMED BY *(EPA/State)*	4 DESCRIPTION

X. REMEDIAL ACTIVITY *(past or on-going)*

- [x] A. NONE
- [ ] B. YES *(complete items 1, 2, 3, & 4 below)*

1. TYPE OF ACTIVITY	2. DATE OF PAST ACTION *(mo., day, & yr.)*	3. PERFORMED BY *(EPA/State)*	4. DESCRIPTION

NOTE: Based on the information in Sections III through X, fill out the Preliminary Assessment *(Section II)* information on the first page of this form.

RATING FORM FOR WASTE DISPOSAL SITES

...E OF SITE Summit Natl. Services ACTIVE: INACTIVE (CIRCLE ONE) ?

...CATION Deerfield, Ohio

...NER/OPERATOR Georgoff

RATING FACTOR	SOURCE AND BASIS OF INFORMATION	SITE RATING 0	1	2	3	MULTIPLIER	SITE SCORE	MAXIMUM POSSIBLE SITE SCORE
WASTE CHARACTERISTICS								
...ANTITY OF HAZARDOUS WASTES						6	—	—
TOXICITY					3	7	21	21
PERSISTENCE					3	5	15	15
RADIOACTIVITY						5	—	—
IGNITABILITY				2		3	6	[illegible]
REACTIVITY						3	—	—
CORROSIVITY						3	—	—
...NFECTIOUSNESS						3	—	—
SOLUBILITY						4	—	—
VOLATILITY						4	—	—
PHYSICAL STATE				2		4	8	[illegible]
						TOTALS		[illegible]
...DDITIONAL POINTS FOR LARGE WASTE QUANTITIES							—	24
ADDITIONAL POINTS FOR OTHER WASTE CHARACTERISTICS							15	15
RECEPTORS								
POPULATION IN 1,000 FEET				2		12	[illegible]	[illegible]
...ISTANCE TO NEAREST DRINKING-WATER WELL					3	8	[illegible]	
DISTANCE TO NEAREST OFF-SITE BUILDING					3	8	[illegible]	[illegible]
ZONING/LAND USE					3	6	18	[illegible]
ENDANGERED SPECIES OR CRITICAL HABITATS						5	—	—
						TOTALS		[illegible]
ADDITIONAL POINTS FOR OTHER RECEPTORS							30	30

P A T H W A Y S

EVIDENCE OF CONTAMINATION			1			12	12	36
DISTANCE TO NEAREST SURFACE WATER					3	8	24	24
DEPTH TO GROUNDWATER				2		7	14	21
SOIL PERMEABILITY						6	—	—
NET PRECIPITATION						6	—	—
DEPTH TO BEDROCK						4	—	—
BEDROCK PERMEABILITY						4	—	—
						TOTALS		81
ADDITIONAL POINTS FOR OTHER PATHWAYS							5	20

W A S T E   M A N A G E M E N T   P R A C T I C E S

SITE SECURITY					3	8	24	24
INCOMPATIBLE WASTES						5	—	—
RATIO OF HAZARDOUS TO NON-HAZARDOUS WASTE QUANTITIES						5	—	—
SE AND CONDITION OF CONTAINERS						4	—	—
E OF LEACHATE COLLECTION SYSTEM						4	—	—
USE OF LINERS						4	—	—
						TOTALS		24
ADDITIONAL POINTS FOR OTHER WASTE MANAGEMENT PRACTICES						20	20	20

NUMBER OF MISSING OR ASSUMED

VALUES = ________ OUT OF 29.

PERCENTAGE OF MISSING OR

ASSUMED VALUES = ________ %

TOTAL SITE SCORES 214

TOTAL ADDITIONAL POINTS 70

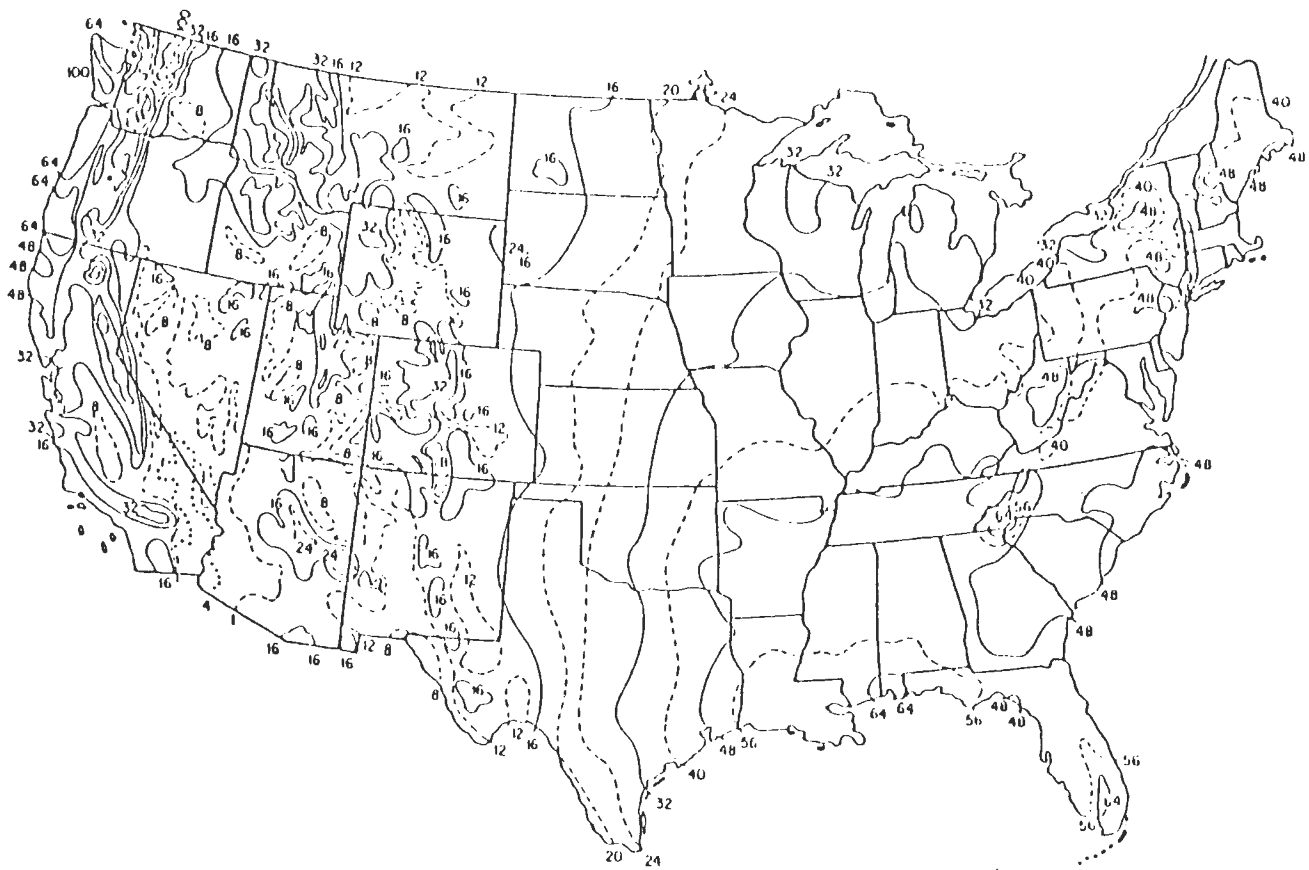
TOTAL SCORE 284
(SITE SCORES PLUS ADDITIONAL POINTS)

TOTAL MAXIMUM POSSIBLE SITE SCORE 273

NORMALIZED SCORE 104
(TOTAL SCORE DIVIDED BY MAXIMUM SCORE AND MULTIPLIED BY 100)

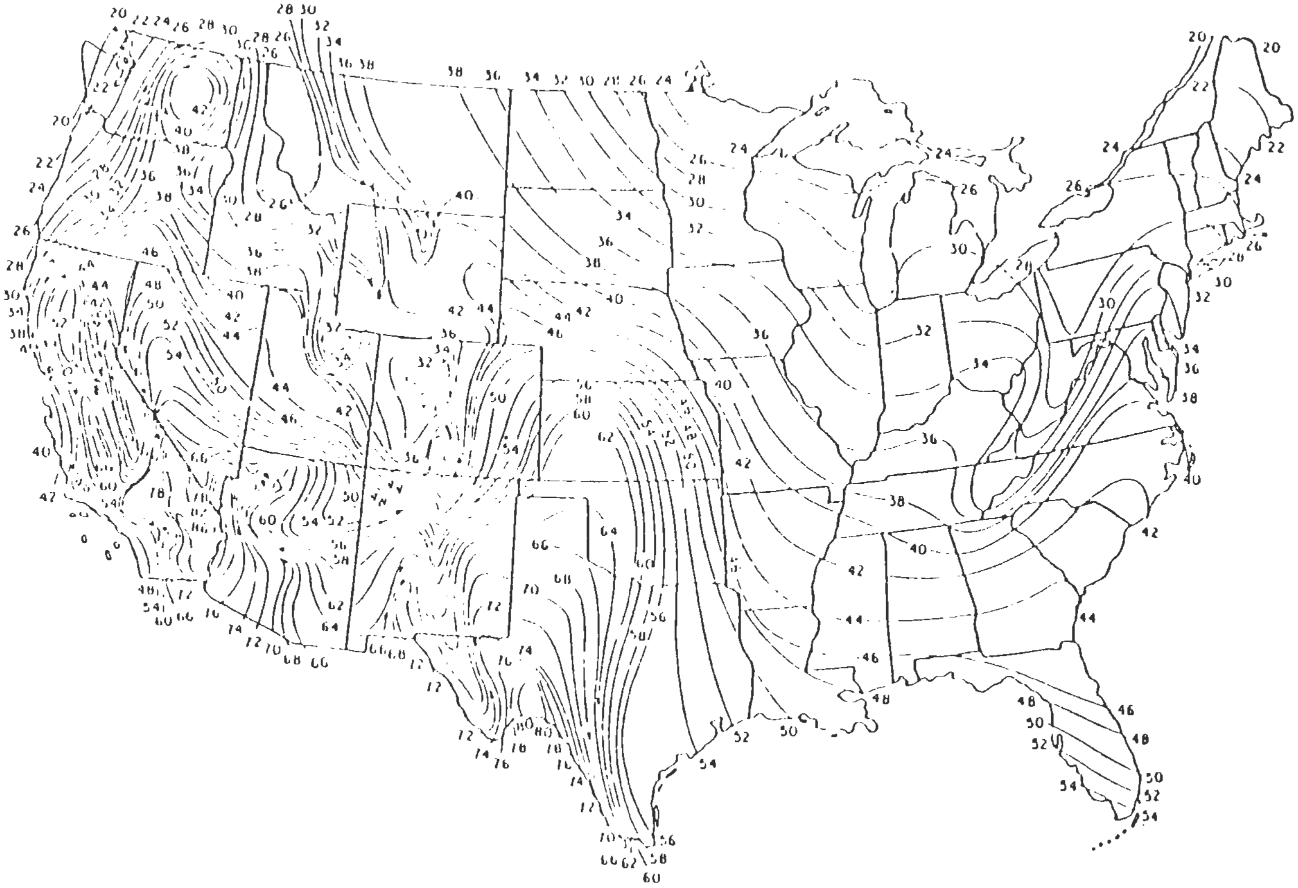
COMMENTS: ____________________

PREPARED BY: ____________________ ON ____________ 19____



Mean annual precipitation in the United States, in inches. (*U.S. Environmental Data Service.*)

Figure A-1 Maps for Evaluating Net Precipitation (Map No. 1)



Average annual evaporation (inches) from shallow lakes. (*U.S. National Weather Service.*)

Figure A-1 (Continued) Maps for Evaluating Net Precipitation (Map No. 2)

Some Properties of Textural Classes

Sand: Sand is loose and single-grained. The individual grains can readily be seen or felt. Squeezed in the hand when dry it will fall apart when the pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched.

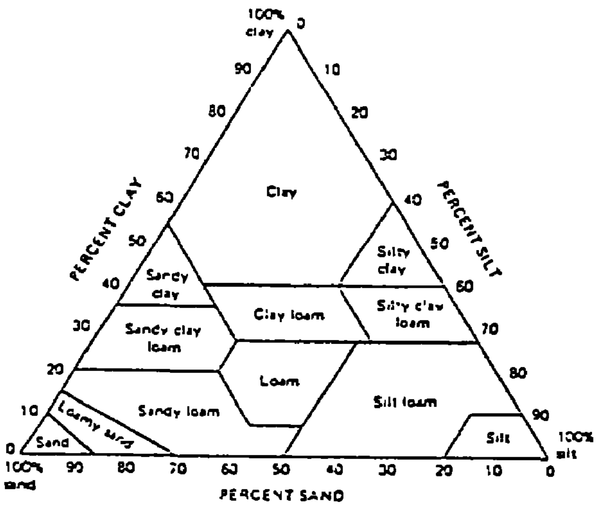
Sandy loam: A sandy loam is a soil containing much sand but which has enough silt and clay to make it somewhat coherent. The individual sand grains can readily be seen and felt. Squeezed when dry, it will form a cast which will readily fall apart, but if squeezed when moist a cast can be formed that will bear careful handling without breaking.

Silt Loam: A silt loam is a soil having a moderate amount of the fine grades of sand and only a small amount of clay, over half of the particles being of the size called 'silt'. When dry it may appear cloddy but the lumps can be readily broken, and when pulverized it feels soft and floury. When wet the soil readily runs together and puddles. Either dry or moist it will form casts that can be freely handled without breaking, but when moistened and squeezed between thumb and finger it will not 'ribbon' but will give a broken appearance.

Clay loam: A clay loam is a fine textured soil which usually breaks into clods or lumps that are hard when dry. When the moist soil is pinched between the thumb and finger it will form a thin 'ribbon' which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling. When kneaded in the hand it does not crumble readily but tends to work into a heavy compact mass.

Clay: A clay is a fine textured soil that usually forms very hard lumps or clods when dry and is quite plastic and usually sticky when wet. When the moist soil is pinched out between the thumb and fingers it will form a long, flexible 'ribbon'. Some fine clays very high in colloids are friable and lack plasticity in all conditions of moisture.

Loam: A loam is a soil having a relatively even mixture of different grades of sand and of silt and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.



Relationship between the class name of a soil and its particle size distribution. In using the diagram the points corresponding to the percentages of silt and clay present in the soil under consideration are located on the silt and clay lines, respectively. Lines are then projected inward, parallel in the first case to the clay side of the triangle and in the second case parallel to the sand side. The name of the compartment in which the two lines intersect is the class name of the soil in question.

Figure A-2 Guidance for Evaluating Soil Permeability

Table A-1 Waste Characteristics Ratings for Several Common Chemical Compounds

CHEMICAL/COMPOUND	TOXICITY	PERSISTENCY	IGNITABILITY	REACTIVITY	SOLUBILITY	VOLATILITY
ACETALDEHYDE	2	0	3	2	3	3
ACETIC ACID	2	0	2	1	3	1
ACETONE	1	0	3	0	0	3
ALDRIN	3	3	1	0	0	0
AMMONIA	3	0	1	0	1	3
ANILINE	3	1	2	0	2	1
BENZENE	2	1	3	0	1	3
CARBON TETRACHLORIDE	2	3	0	0	0	3
CHLORDANE	3	3	0	0	0	0
CHLOROBENZENE	2	2	3	0	0	1
CHLOROFORM	2	3	0	0	3	3
CRESOL-O	3	1	2	0	2	1
CRESOL-M&P	3	1	1	0	2	1
CYCLOHEXANE	1	2	3	0	0	3
DDT	3	3	0	0	0	0
DIOXIN	3	3	0	0	0	0
ENDRIN	3	3	1	0	0	0
ETHYL BENZENE	2	1	3	0	0	1
FORMALDEHYDE	2	0	2	0	2	3
FORMIC ACID	3	0	2	0	3	2
HEXACHLOROBENZENE	[illegible]	3	0	0	0	1
HYDROCHLORIC ACID	3	0	0	0	2	3
ISOPROPYL ETHER	2	1	3	1	3	3
LINDANE	2	3	1	0	0	0
METHANE	1	1	3	1	2	2
METHYL ETHYL KETONE	2	0	2	3	3	2
METHYL PARATHION	3	3	3	2	1	2
NAPHTHALENE	2	1	2	0	0	1
NITRIC ACID	2	0	0	1	0	2
PARATHION	3	3	1	0	0	0
PCB	3	3	0	0	0	0
PETROLEUM	1	1	3	0	0	1
PHENOL	3	1	2	0	2	1
SULFURIC ACID	3	0	0	2	1	0
TOLUENE	2	1	3	0	0	2
TRICHLOROETHANE	2	2	3	2	1	3
TRICHLOROBENZENE	2	3	0	1	0	1
XYLENE	2	1	3	0	0	1

Table A-2 Persistence (Biodegradability) of Some Organic Compounds*

LEVEL 3: HIGHLY PERSISTENT COMPOUNDS	
aldrin	heptachlor
benzopyrene	heptachlor epoxide
benzothiazole	1,2,3,4,5,7,7-heptachloronorbornene
benzothiophene	hexachlorobenzene
benzyl butyl phthalate	hexachloro-1, 3-butadiene
bromochlorobenzene	hexachlorocyclohexane
bromoform butanal	hexachloroethane
bromophenyl phenyl ether	methyl benzothiazole
chlordane	pentachlorobiphenyl
chlorohydroxy benzophenone	pentachlorophenol
bis-chloroisopropyl ether	1.1,3,3-tetrachloroacetone
m-chloronitrobenzene	tetrachlorobiphenyl
DDE	thiomethylbenzothiazole
DDT	trichlorobenzene
dibromobenzene	trichlorobiphenyl
dibutyl phthalate	trichlorofluoromethane
1,4-dichlorobenzene	2,4,6-trichlorophenol
dichlorodifluoroethane	triphenyl phosphate
dieldrin	bromodichloromethane
diethyl phthalate	bromoform
di(2-ethylhexyl)phthalate	carbon tetrachloride
dihexyl phthalate	chloroform
di-isobutyl phthalate	chloromochloromethane
dimethyl phthalate	dibromodichloroethane
4,6-dinitro-2-aminophenol	tetrachloroethane
dipropyl phthalate	1,1,2-trichloroethane
endrin	

*From: Abrams, E.F. et al., Identification of Organic Compounds in Effluents from Industrial Sources, EPA-560/3-75-002, April, 1975

Table A-2 Persistence (Biodegradability) of Some Organic Compounds (Continued)

LEVEL 2: PERSISTENT COMPOUNDS	
acenaphthylene	cis-2-ethyl-4-methyl-1,3-dioxolane
atrazine	trans-2-ethyl-4-methyl-1,3-dioxolane
(diethyl) atrazine	guaiacol
barbital	2-hydroxyadiponitrile
borneol	isophorone
bromobenzene	indene
camphor	isoborneol
chlorobenzene	isopropenyl-4-isopropyl benzene
1,2-bis-chloroethoxy ethane	2-methoxy biphenyl
b-chloroethyl methyl ether	methyl biphenyl
chloromethyl ether	methyl chloride
chloromethyl ethyl ether	methylindene
3-chloropyridine	methylene chloride
di-t-butyl-p-benzoquinone	nitroanisole
dichloroethyl ether	nitrobenzene
dihydrocarvone	tetrachloroethylene
dimethyl sulfoxide	1,1,2-trichloroethylene
2,6-dinitrotoluene	trimethyl-trioxo-hexahydro-triazine isomer

Table A-2 Persistence (Biodegradability) of Some Organic Compounds (Continued)

LEVEL 1: SOMEWHAT PERSISTENT COMPOUNDS	
acetylene dichloride	limonene
behenic acid, methyl ester	methyl ester of lignoceric acid
benzene	methane
benzene sulfonic acid	2-methyl-5-ethyl-pyridine
butyl benzene	methyl naphthalene
butyl bromide	methyl palmitate
e-caprolactam	methyl phenyl carbinol
carbon disulfide	methyl stearate
o-cresol	naphthalene
decane	nonane
1,2-dichloroethane	octane
1,2-dimethoxy benzene	octyl chloride
1,3-dimethyl naphthalene	pentane
1,4-dimethyl phenol	phenyl benzoate
dioctyl adipate	phthalic anhydride
n-dodecane	propylbenzene
ethyl benzene	1-terpineol
2-ethyl-n-hexane	toluene
o-ethyltoluene	vinyl benzene
isodecane	xylene
isopropyl benzene	

Table A-2 Persistence (Biodegradability) of Some Organic Compounds (Continued)

LEVEL 0: NONPERSISTENT COMPOUNDS	
acetaldehyde	methyl benzoate
acetic acid	3-methyl butanol
acetone	methyl ethyl ketone
acetophenone	2-methylpropanol
benzoic acid	octadecane
di-isobutyl carbinol	pentadecane
docosane	pentanol
eicosane	propanol
ethanol	propylamine
ethylamine	tetradecane
hexadecane	n-tridecane
methanol	n-undecane

B

HAZARDOUS WASTE

1. OBJECTIVES

A. To present federal definitions of solid wastes and hazardous wastes.

B. To develop an awareness of existing and potential hazards posed by wastes on a hazardous waste site.

2. SOLID WASTE (40 CFR 261.2)

A. The term "solid" is not to be construed as reference to a physical state. The waste may be a "solid, liquid, semi-solid, or contained gaseous material."

B. The sources of the waste may include "industrial, commercial, mining, or agricultural operations or community activities." This encompasses the industrial sector as well as the public which may utilize pesticides, insecticides, drain cleaners, solvents, etc.

C. Something must be done with this waste.

1) Discarded or abandoned waste is defined as any of the following:

a) Discharged wastes may be directed to lagoons, holding ponds, etc.

b) Deposited wastes may be placed in an orderly fashion in an assigned area.

c) Deep-well injection may be used.

d) Wastes are sometimes spilled, whether accidentally or intentionally onto the ground or into sewer lines, storm drains, catch basins, trenches, etc.

e) Storage containers, either because of lack of integrity or faulty connections, may release waste over periods of time into the air, surface water, or groundwater.

2) The waste may be burned or incinerated.

3) The waste may undergo treatment.

a. Physical. Other than burning or incineration, the waste may be encapsulated, containerized, solidified, etc.

b. Chemical. This treatment may involve reactions, u.v. photolysis, structural changes, etc.

c) Biological. Mutant organisms are currently employed either in lieu of or prior to disposal.

4) The waste may also be collected at transfer facilities where compatible wastes are accumulated in bulk storage tanks prior to treatment and/or transport.

5) The wastes may also be stored because of lack of treatment and/or disposal facilities, supplies exceeding capabilities of treatment/destruction (Chemical Control-Elizabeth, N.J.), or economics.

3. HAZARDOUS WASTE (40 CFR 261.3)

There are certain criteria that must be met for a solid waste to be classifed as a hazardous waste.

A. Solid Waste. The waste must first be classified as a solid waste (not covered by exemptions).

B. Preclassifed Wastes.

1) Specific Types/Sources

a) Inorganic pigments (chrome yellow, orange, molybdate orange, zinc yellow, iron blue) and waste waters treatment sludge present toxicological problems via leaching, fugitive emissions, etc.

b) Organic chemicals. These are products or byproducts found in still bottoms, residues, stripping processes, etc. Wastes of this nature were identified in Aurora, Mo. (dioxin-contaminated still bottoms).

c) Pesticides. These toxic compounds may contain highly toxic contaminants from their manufacture. Therefore, process wastes streams are classified. An example is the Vertac site in Arkansas.

d) Leather tanning industry. Many toxic organic (benzene, toluene) and inorganic (chrome, mercury) compounds are employed in the process.

2) Nonspecific Sources

a) Degreasing operations. The spent halogenated solvents, still bottoms from recovery, and sludges from these operations contain: methylene chloride, carbon tetrachloride, 1,1,1-trichloroethane, chlorinated fluorocarbons. These wastes are found in metal processing industries and airports. Military installations have experienced groundwater contamination problems (New Hampshire).

b) Electroplating operations. These employ degreasing solutions, acid baths (metals), caustic baths (soaps), and cyanide baths. Waste sludges may contain high levels of heavy elements such as cadmium, lead, selenium, etc. Air emissions and groundwater contamination are frequent concerns.

c) Metal heat treating process. The salt bath pot cleanings and treatment sludges may contain high concentrations of contaminants.

3. Discarded commercial chemical products, off-specification species, containers and spill residues are also considered

hazardous waste. Included in this definition are all chemical intermediates for the products as generically identified by EPA.

a) Drums or their liners may contain sufficient quantities of waste to pose a hazard to the field team--especially those containers with sharp or jagged edges which may inflict wounds and thus provide access for wastes.

b) Tank trailers, bulk storage tanks, and pond liners may be considered in this area.

4) Any solid waste generated from the treatment, storage, or disposal of hazardous wastes is considered hazardous. This may involve leachate, contaminated soil, clothing, equipment, vehicles, etc. Conceivably, field clothing may be declared hazardous waste if discarded.

a) During investigations, clothing, equipment, sample containers will have to be discarded as hazardous waste or decontaminated.

b) Decontamination solutions are then classified as hazardous waste.

5) Waste Exhibiting the Characteristics of a Hazardous Waste.

4. CHARACTERISTICS OF HAZARDOUS WASTES (40 CFR 261.2)

A. Ignitability (40 CFR 261.21)

1) Aqueous solutions containing 24% or greater alcohol by volume. Although these materials may flash without sustaining combustion, they may be the ignition sources for other wastes (e.g., alcoholic beverages and latex paints).

2) Liquids other than an aqueous solution containing less than 24% by volume and a closed cup flash point less than 140°F. These wastes would be covered by NFPA classes I and II (e.g., xylene, toluene).

3) A thermally unstable non-liquid solid which, under standard temperature and pressure, is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes.

4) Ignitable compressed gas (49 CFR 173.3). The gases may be classifed by their absolute pressures, absolute vapor pressures (for flammable liquids) and defined test methods.

5) Oxidizer (49 CFR 173.151). An oxidizer is a substance such as chlorate, permanganate, inorganic peroxide, or nitrate that yields oxygen readily to stimulate the combustion of organic matter.

B. Corrosivity (40 CFR 261.22). Two barometers have been chosen to define this characteristic: pH and corrosion rate. EPA has concluded that the great majority of wastes are presumed to be liquid or semi-liquid, and therefore there is no need to address corrosive solids. This view does not preclude the existence of these solids.

1) pH. An aqueous waste having a pH less than or equal to 2 or greater than or equal to 12.5 is considered hazardous based upon the potential for damage to human tissue, the tendancy to promote solubilization of heavy metals, and the tendancy to promote harmful reaction. These ranges indicate acids or bases.

2) Corrosion rate. Measures the capacity of a waste to corrode (steel) at given rates.

C. Reactivity (40 CFR 261.23). These wastes are extremely unstable, have a tendancy to react violently or explode, and liberate toxic fumes.

1) Reactions with water. This is not only concerned with the actual violent reaction, but the formation of potentially explosive mixtures and those products of the reaction such as toxic gases, vapors, or fumes.

a) Metal anhydrides liberate heat and hydrogen in the presence of moisture and thus the potential for fire. These conditions existed at a site in Coventry, RI where some 17 drums of sodium aluminum anhydride stored in benzene/toluene were discovered.

b) Pure metals such as sodium and potassium may react violently with water.

2) Detonation and/or explosion. This covers those wastes which will detonate or explode with or without an intiating force. Also included are: forbidden explosives (49 CFR 173.51), Class A explosives (49 CFR 173.53) or Class B explosives (49 CFR 173.88)

D) EP Toxicity. The Extraction Procedure (EP) is designed to identify wastes likely to leach hazardous concentrations of particularly toxic constituents into the groundwater under conditions of mismanagement. The scenario involved co-disposal of toxic wastes in an actively decomposing municipal landfill. Extract is analyzed for those toxic contaminants identified in the National Primary Drinking Water Standards. This test should not be construed as a direct method of measuring toxicity--such as biological testing.

c

TOXICOLOGY

1. OBJECTIVE

The objective of the toxicology lectures is to provide a basic understanding of the interactions of chemical substances with the human body and to teach the basic principles and terminology of toxicology. In addition, the objective is to relate these principles and concepts to field investigations of hazardous waste sites.

2. PRINCIPLES AND CONCEPTS OF TOXICOLOGY

A. Acute Toxicity

B. Delayed Toxicity

C. Chronic Toxicity

D. Dose-Response Realtionships

3. CHEMICAL-INDUCED DISEASES

NOTE: See Appendix A for a detailed discussion of Toxicology

A. Target Organs

B. Mechanisms

C. Carcinogenicity

D. Mutagenicity

E. Teratogenicity

4. ENTRY OF CHEMICALS INTO THE BODY

A. Absorption

B. Biotransformation

C. Excretion

5. COMPARATIVE TOXICOLOGY

6. CHEMICAL TOXINS

A. Corrosive/Caustics

B. Metals

C. Chlorinated Hydrocarbons

D. Hydrocarbons

E. Aldehydes

F. Alcohols

G. Nitrogen-Containing Compounds

H. Gases

I. Airborne Particles

7. HEALTH HAZARD ASSESSMENT

A. Toxicity Testing

B. Toxicity Data Management

C. Risk Analysis

8. HAZARDOUS SUBSTANCE CLASSIFICATION

ALL SUBSTANCES ARE POISONS; THERE IS NONE WHICH IS NOT A POISON. THE RIGHT DOSE DIFFERENTIATES A POISON AND A REMEDY.

PARACELSUS
(1493-1541)

DEFINITIONS

DOSE — THE AMOUNT ADMINISTERED
WEIGHT/UNIT BODY WEIGHT, MG/KG

RESPONSE — ANY GIVEN OBSERVATION

BIOLOGICAL VARIATION

AVERAGE RESPONSE

HYPOSENSITIVE HYPERSENSITIVE

IDIOSYNCRASY
ABNORMAL TYPE OF RESPONSE

THRESHOLD

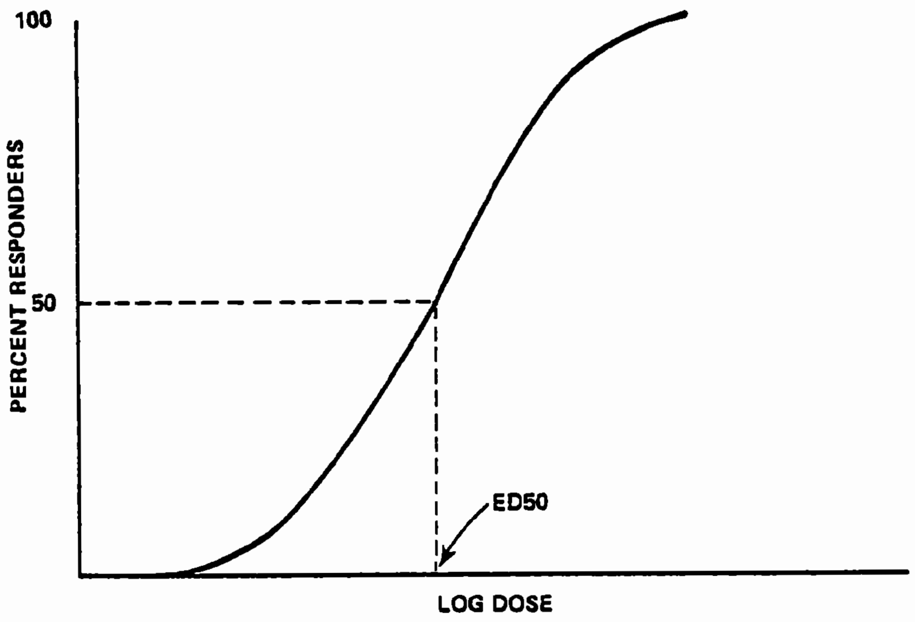
A DOSE LEVEL BELOW WHICH AN EFFECT OF A GIVEN AGENT IS NOT DETECTABLE

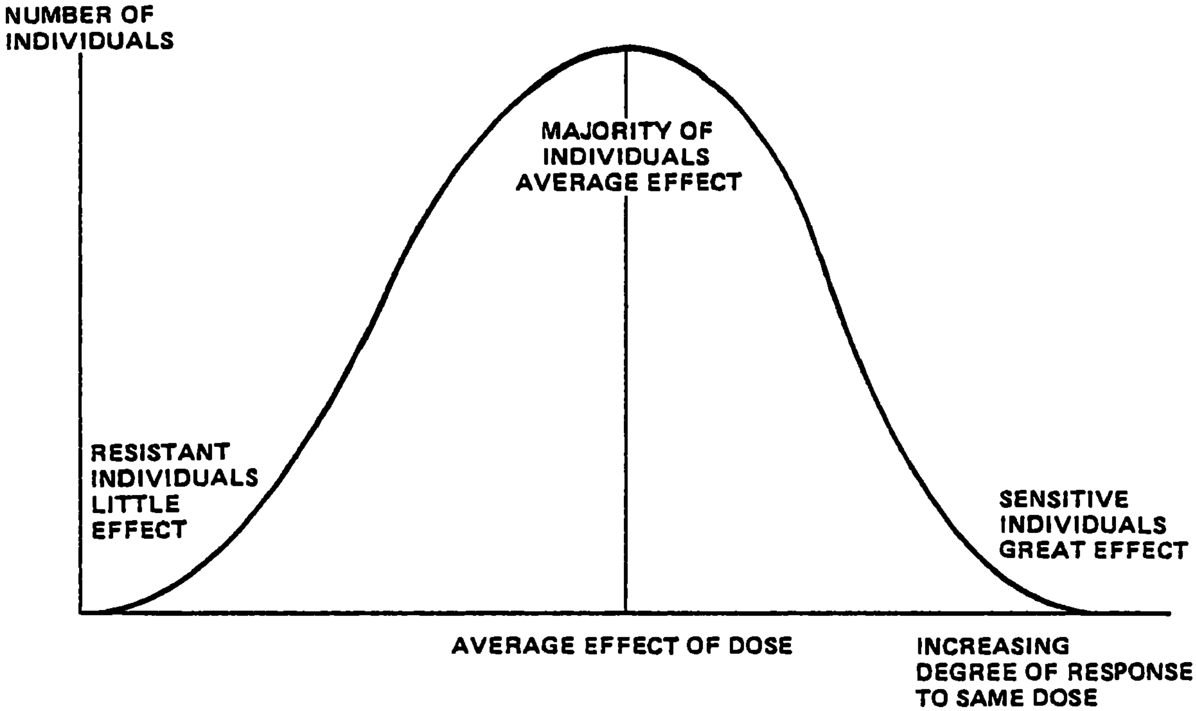
- PHYSIOLOGICAL VS TOXICOLOGICAL EFFECTS
- ONE-MOLECULE THEORY
- DEFENCE MECHANISMS

MARGIN OF SAFETY

NO-ADVERSE-EFFECT DOSE LEVEL IN ANIMALS
HUMAN EXPOSURE LEVEL

- HOW MUCH IS ADEQUATE?
  - 10, 100, 500, 1000, ETC.


100
50
PERCENT RESPONDERS
ED50
LOG DOSE


NUMBER OF
INDIVIDUALS
MAJORITY OF
INDIVIDUALS
AVERAGE EFFECT
RESISTANT
INDIVIDUALS
LITTLE
EFFECT
SENSITIVE
INDIVIDUALS
GREAT EFFECT
AVERAGE EFFECT OF DOSE
INCREASING
DEGREE OF RESPONSE
TO SAME DOSE

GENERAL RESPONSES OF BODY TISSUES TO AN INSULT

- DEGENERATION
- NECROSIS
- INFLAMMATION
- ATROPHY
- HYPOPLASIA
- HYPERTROPHY
- HYPERPLASIA
- METAPLASIA
- NEOPLASIA

CARCINOGENICITY – INDUCTION OF MALIGNANT NEOPLASMS

NEOPLASM – "NEW GROWTH" OF TISSUE

TUMOR – ANY SWELLING; NEOPLASM

BENIGN NEOPLASM – LOCALIZED, DOESN'T SPREAD

MALIGNANT NEOPLASM – EXTENDS OR SPREADS (METASTASIS)

ONCOGEN – AGENT INDUCES EITHER BENIGN OR MALIGNANT NEOPLASMS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

THE "ALARM WORDS" OF TOXICOLOGY

CARCINOGENICITY

MUTAGENICITY

TERATOGENICITY

CARCINOGENESIS (NEOPLASIA)

A CARCINOGEN IS A SUBSTANCE THAT CAUSES AN INCREASED INCIDENCE OF MALIGNANT TUMORS IN EXPERIMENTAL ANIMALS AS COMPARED WITH A CONTROL SERIES OF UNTREATED ANIMALS.

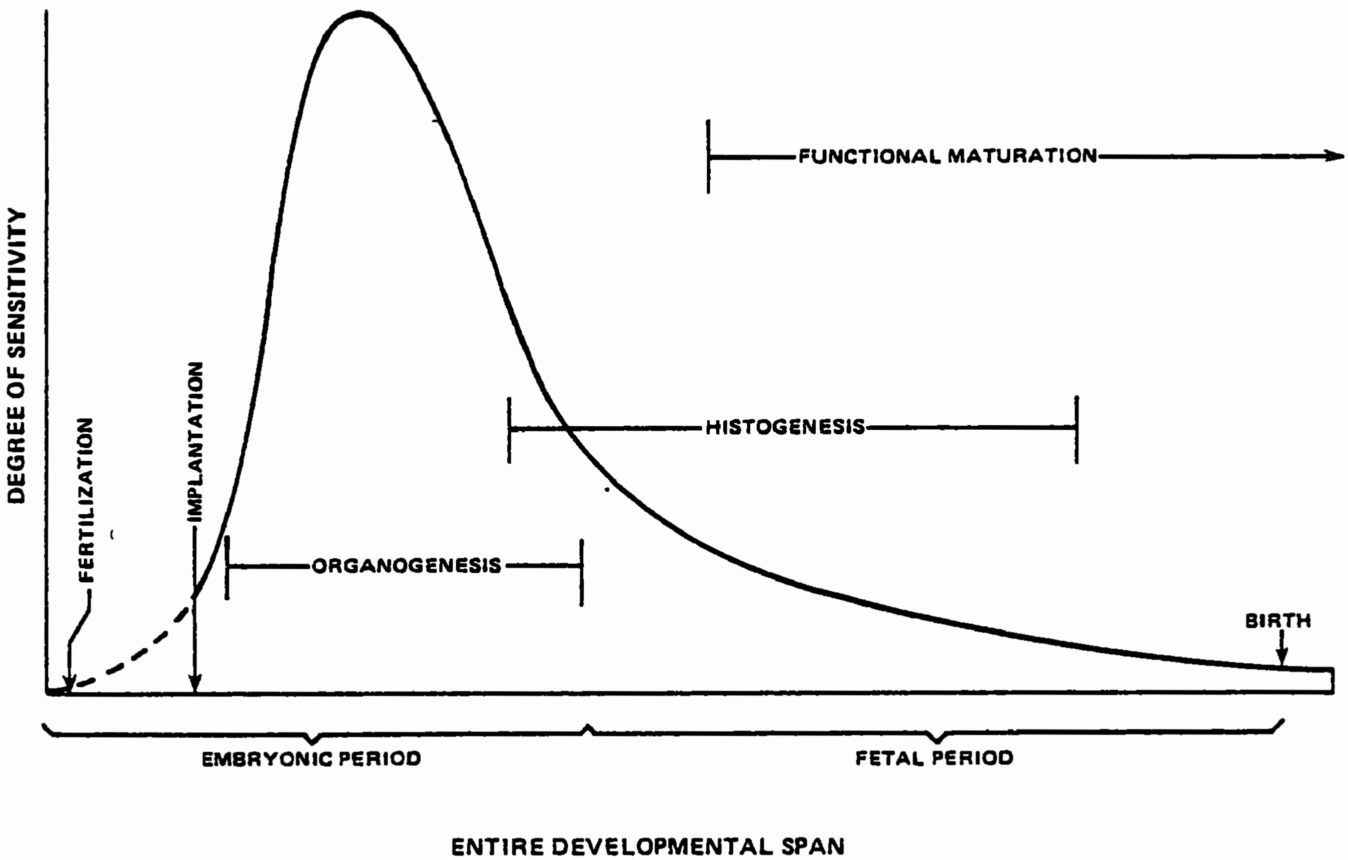
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TERATOLOGY

THE STUDY OF THE TOXIC EFFECT OF PHYSICAL, CHEMICAL, AND INFECTIOUS AGENTS ON THE DEVELOPING EMBRYO AND FETUS.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

TERATOGENIC SUSCEPTIBILITY IS GREATEST DURING EARLY ORGANOGENESIS

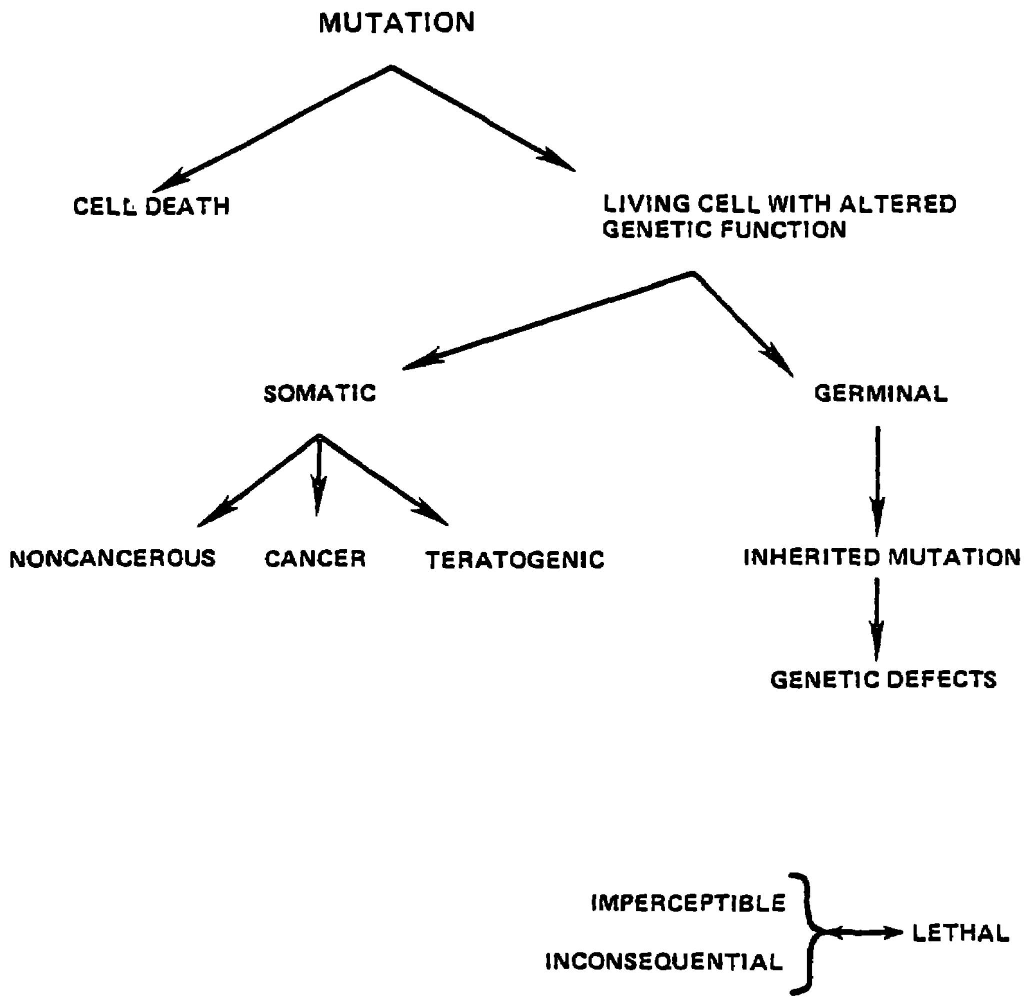


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

INTERRELATIONS BETWEEN

	TERATOGENICITY	MUTAGENICITY	CARCINOGENICITY
1. INSIDIOUS NATURE (CAUSE IS MILD RELATIVE TO THE EFFECT)	YES	YES	YES .
2. DURATION & TIME BETWEEN CAUSE & EFFECT	WEEKS	GENERATIONS	YEARS
3. IRREVERSIBLE	YES	YES	YES
4. GREATER SUSCEPTIBILITY OF IMMATURE TISSUES	YES	NO	YES/NO
5. DIFFERENCES	ALTERED DEVELOPMENT AT TISSUE/ ORGAN LEVEL	ALTERED NUCLEOTIDE SEQUENCE – MOLECULAR LEVEL; DNA	UNCONTROLLED PROLIFERATION AT CELLULAR LEVEL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY


MUTATION
CELL DEATH
LIVING CELL WITH ALTERED GENETIC FUNCTION
SOMATIC
GERMINAL
NONCANCEROUS
CANCER
TERATOGENIC
INHERITED MUTATION
GENETIC DEFECTS
IMPERCEPTIBLE
INCONSEQUENTIAL
LETHAL

ANTICIPATED EFFECTS OF MUTAGENS IN HUMANS

- INCREASED FETAL WASTAGE

  ABOUT 33% OF ALL PREGNANCIES ARE ABORTED

  ABOUT 50-75% OF THESE HAVE CHROMOSOMAL ABNORMALITIES

- MENTAL RETARDATION
- INCREASED SUSCEPTIBILITY TO DISEASE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EXTENT OF GENETIC "DISEASE" PROBLEM (U.S.)

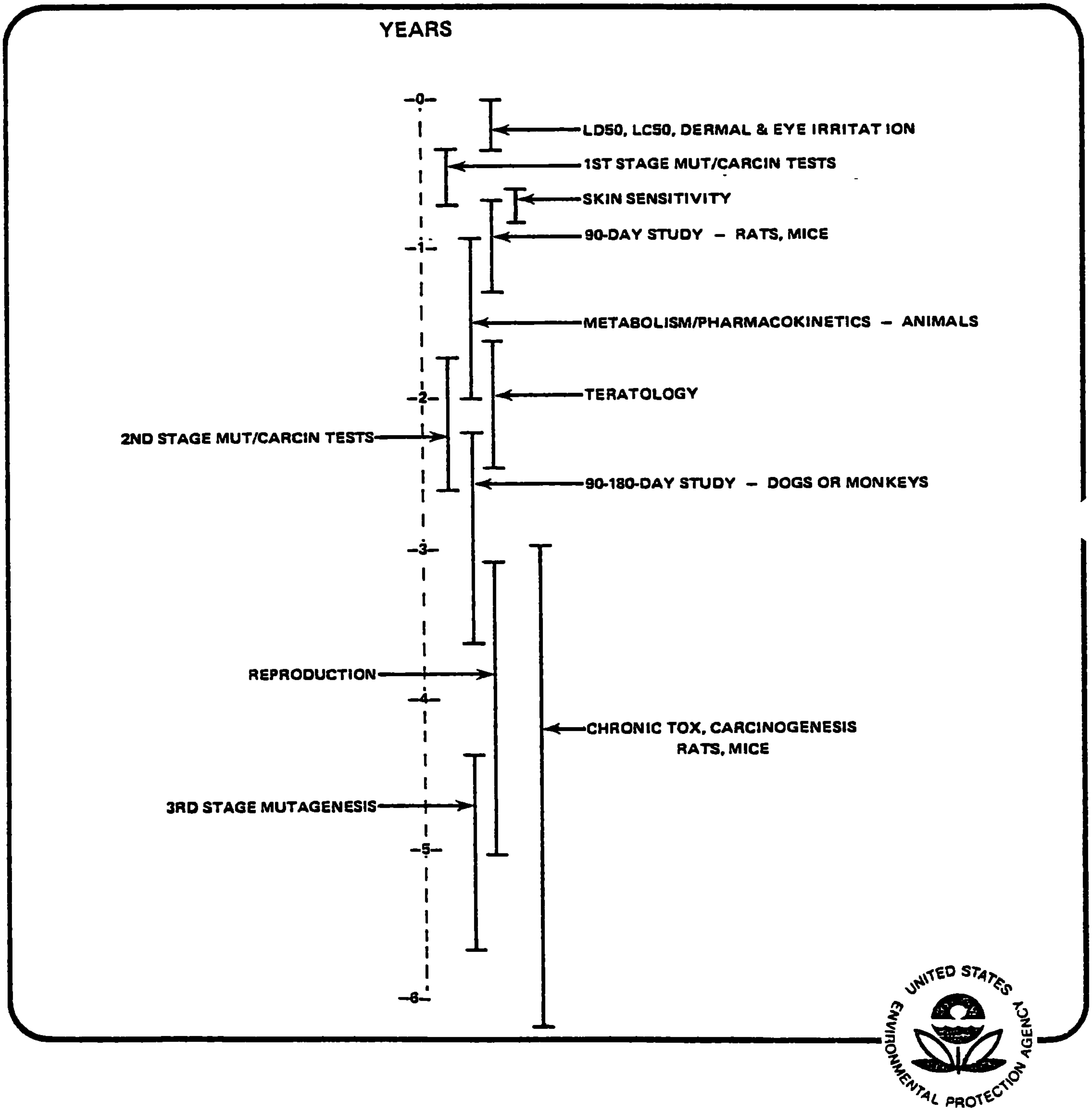
- 35-40% OF SPONTANEOUS ABORTIONS ARE CAUSED BY GROSS CHROMOSOMAL EFFECTS
- 40% OF INFANT MORTALITY RESULTS FROM GENETIC FACTORS
- GENETIC DEFECTS ARE PRESENT IN ABOUT 5% OF ALL LIVE BIRTHS
- ABOUT 80% OF MENTAL RETARDATION IS GENETIC
- ABOUT ONE-THIRD OF ADMISSIONS TO PEDIATRIC WARDS ARE FOR GENETIC REASONS
- EACH NEW BIRTH HAS A 3% RISK OF BEING GENETICALLY DEFECTIVE
- ABOUT 2000 IDENTIFIABLE GENETIC DISEASES

CHEMICALS KNOWN TO BE MUTAGENIC IN HUMANS

CHRONOLOGY OF TESTING

EARLY	ACUTE TOX – HANDLING HAZARDS
	1ST SCREEN – MUTAGEN/CARCINOGEN
	SUBCHRONIC TOX – TARGET ORGAN, TOXIC DOSE – RODENT
	BIRTH DEFECTS – TERATOLOGY
	2ND LEVEL SCREEN – MUTAGEN/CARCINOGEN
	ABSORB./DIST./METAB./EXCRETION – LAB ANIMALS (METABOLISM/PHARMACOKINETICS)
	SUBCHRONIC TOX – NON-RODENT SPECIES
	REPRODUCTION STUDY
	BEHAVIORAL TESTS
	SYNERGISM/POTENTIATION
	RESIDUE EVALUATION
	LONG-TERM STUDIES – CARCINOGENESIS – RODENTS
	DEFINITIVE TEST FOR MUTAGENESIS – RODENTS
	METABOLISM/PHARMACOKINETICS – HUMANS
LATE	EPIDEMIOLOGY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY



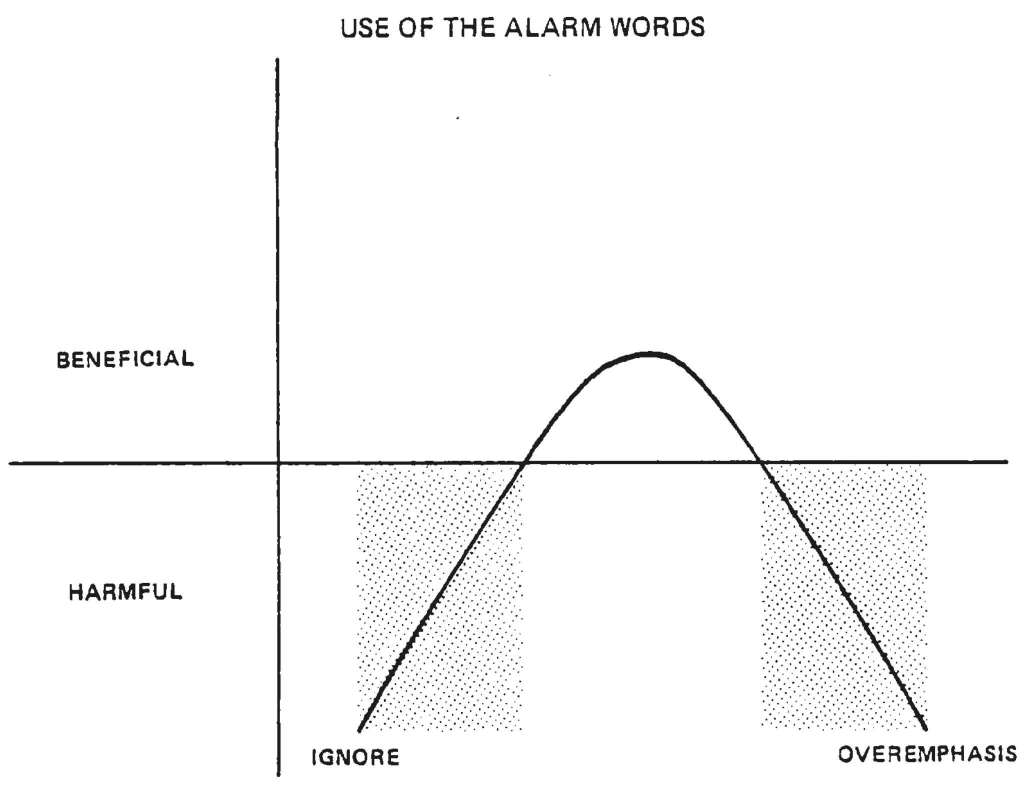
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LEVELS OF SOPHISTICATION

TOXICOLOGISTS	ANALYTICAL CHEMISTS
COUNT # DEAD	PERCENT
GROSS ORGAN CHANGES	PPM
LIGHT MICROSCOPY, BIOCHEMICAL CHANGES	PPB
	PPT
ELECTRON MICROSCOPY, MOLECULAR CHANGES	PP?

AT WHAT LEVEL IS IT NO LONGER IMPORTANT?

"NORMAL" PHYSIOLOGICAL ADAPTATION TOXICITY


USE OF THE ALARM WORDS
BENEFICIAL
HARMFUL
IGNORE
OVEREMPHASIS

D

FIELD OPERATIONS - CONSIDERATIONS/STRATEGIES

1. INTRODUCTION

A. Objective. To present an overview of the field investigation operation and to give in some detail, the procedures and equipment used by a field team.

1) Scope of Effort. To conduct investigations of abandoned and uncontrolled hazardous waste sites.

2) EPA Series 2070 Form Review*

a) 2070-8 Potential HWS Identification
Used upon notification by any means of any suspected hazardous waste site (HWS)

b) 2070-1 Potential HWS Log
Use continues throughout duration of investigation; all following forms serve to augment

c) 2070-2 Preliminary Assessment
Use to consolidate initial data, correspondence, site visits and previous sampling data.

*See page 1-D-14 for copies of EPA forms

d) <u>2070-3 Site Inspection</u>
Use tends to vary with regions; some used for any site visit, including windshield inspection. Other regions use only for actual on-site work, including sampling.

e) <u>2070-4 Tentative Disposition</u>
Used to make initial assessment of further action required, can be used to direct full field investigation

f) <u>2070-5 Final Strategy Determination</u>
Used to direct final efforts in case; can lead to enforcement action, remedial action or no further action. Closes out 2070-1.

B. <u>Phases of the Field Investigation</u>

1) <u>Identification Phase</u>
Site discovery comes from a number of sources such as, public complaints, state investigations and the EPIC. Minimal effort is currently been spent in this phase due to the backlog of existing sites.

2) <u>Preliminary Assessment Phase</u>
Includes all actions up to and including site visit. Data sources include aerial photos, historical records, conversations with other agencies at all levels, and literature search. <u>Some</u> sites may be eliminated based on this work; other sites may be declared emergencies; most sites will require a site visit.

3) <u>Inspection Phase</u>
Sometimes combined as part of preliminary assessment phase, but most often not. Can range from windshield inspection to walk through to full field investigation to environmental sampling only.

4) Full Field Investigation
Discussed separately because of risks and effort involved. Often requires sampling of hazardous waste, to include opening of closed containers.

5) Closed Out Phase
Involves final action on case. Constitutes major portion of work in some regions, especially serving as expert witness and technical support during case development plan.

2. SITE INSPECTION STRATEGY DEVELOPMENT

A. Data Collection to Assess Magnitude of Problem

1) Environmental Sampling

2) Mapping, Photography

a) EPIC

b) Enviropod

c) Soil Conservation Service

d) Handheld photos from light plane.

e) Flood Insurance Studies Photos

f) Mapping can be accomplished by sketch maps, by updating of Mylar overlay transfer of topographic maps, or by actual third-order mapping done from photos.

3) Data Assessment

Best accomplished using a small number of specialists reporting to a chief analyst. One approach to the analysis needed for complete data assessment is through the use of a modified Delphi Board. Alternatively, each specialist can be asked to review the assessments given by the other team members. The validity of the assessment is affected by the amount, type and reliability of data gathered. One prime factor to be included in data assessment is the political situation. In some cases, consideration of public opinion may lead to further investigations that may not be justified by the data.

B. Site Disposition. Data assessment is an ongoing process that results in the ultimate judgement affecting the disposition of the site. Deciding what course of action to take regarding a site is an EPA decision that involves all sections:

1) No Action

2) Enforcement Action

a) Case Development

b) Expert witness

3) Remedial Action

4) Further Investigation

3. FULL FIELD INVESTIGATION

A. Definition. The full field investigation involves a total commitment of personnel and equipment in order to adequately define the hazards associated with a site. The investigation usually involves sampling of hazardous waste, and definitely involves exposure of the team members to a hazardous environment.

B. Procedures.

1) Site Safety Plan.

2) Site Sampling Plan.

3) Site Safety Considerations and PDS Operation.

C. Methods and Equipment. The equipment used to identify the hazards associated with a site, and to protect the team members from those hazards.

TABLE 1

Government Contacts

1. EPA Regional Office

    a. Solid Waste
    b. Toxic Substances
    c. Water Supply
    d. Water Quality
    e. Air Resources
    f. Radiation
    g. Enforcement

2. Federal EPA Offices

    a. National Enforcement Investigation Center (NEIC), Denver, Colorado
    b. Environmental Monitoring System Laboratory (EMSL), Las Vegas, Nevada
    c. Environmental Photograpnic Interpretation Center (EPIC), Warrenton, Virginia

3. US Geological Survey

    a. National Cartographic Information Center, Reston, Virginia
    b. Distribution Branch, Arlington, Virginia

4. US Department of Agriculture

    a. Soil Conservation Service
    b. Agricultural Extension Service

5. US Department of Interior

    a. Bureau of Recreation
    b. Fish and Wildlife Bureau

6. State Offices

    a. Solid Wastes
    b. Water Supply
    c. Water Quality
    d. Air Resources
    e. Highway Department
    g. Enforcement

TABLE 1 (continued)

7. Local Offices

   a. Town Clerk's office
   b. Town Selectman's office
   c. Local tax or property assessment office
   d. Local zoning board
   e. Local/regional planning board
   f. Local police and fire departments

TABLE 2

Environmental Data

1. Geology

Information

a. Local bedding type
b. Thickness of strata
c. Bedding planes
d. Solution channels
e. Fracture zones
f. Depth to bedrock
g. Geologic anomolies
h. Bedrock outcrops

Source

a. US Geological Survey Maps
b. US Geological Survey reports and files
c. Soil Conservation Service
d. State Geological Survey
e. Local university geology or engineering departments
f. Local well driller logs

2. Soils and Overburden

Information

a. Soil type
b. Soil texture
c. Soil chemistry
d. Permeability
e. Depth
f. Erosion potential
g. Presence of clays

Source

a. US Geological Survey
b. Soil Conservation Service
c. Agricultural Extension Service
d. State geologic survey
e. Local university
f. Local well drillers
g. Local construction company

TABLE 2 (continued)

3. Flora and Fauna

Information

a. Species type
b. Sensitivity
c. Presence of endangered species
d. Presence of indicator species

Source

a. Department of Interior - Office of Endangered Species, Fish and Wildlife Bureau
b. State wildlife office
c. State Museum of Natural History
d. State Botanical Society
e. USDA Extension Service
f. Local wildlife and botanical groups
g. State/local field guides
h. Local university botany/zoology department

4. Climate and Air Resources

Information

a. Precipitation
b. Evaporation
c. Evapotranspiration
d. Mass-balance
e. Flooding history or potential
f. Air quality
g. Wind patterns
h. Wind velocity
i. Inversion potential
j. Air basis delineation

Source

a. National Climatic Center
b. State meteorological bureau
c. Local weather bureau
d. Local university
e. Local airports
f. Local companies/utilities
g. State Bureau of Air Resources

TABLE 2 (continued)

5. Geohydrology

Information

a. Depth of water table
b. Aquifer type
c. Characteristics of confining layers
d. Piezomettic data
e. Director of flow
f. Presence of perched aquifer
g. Interchange with surface water
h. Extent of drainage basis
i. Background groundwater quality
j. Depth of local wells
k. Pumping rates
l. Local water use

Source

a. US Geological Survey
b. State Geological Survey
c. State Water Quality Office
d. State Water Supply Office
e. Local universities
f. Local well drillers
g. Local water resource boards
h. State/local planning board

6. Surface Water

Information

a. Location of surface waters
b. Location of dry stream beds
c. Surface gradients
d. Stream flow rates
e. Surface water quality
f. Surface water uses
g. NPDES permit

Source

a. US Geological Survey
b. State Geological Survey
c. State Water Quality Office
d. State Department of Recreation
e. State Department of Fisheries
f. Local universities
g. Local water resource boards
h. State/local planning board

TABLE 2 (continued)

7. Sensitive Environments

Information

a. Floodplains
b. Wetlands
c. Sole source aquifer recharge zone
d. Karst topography
e. Fault zone
f. Potential for long-term disruption
g. Special designation

Source

a. Department of Housing and Urban Development
b. Department of Fish and Wildlife
c. US Geological Survey
d. State Geological Survey
e. State Department of Water Resources
f. Department of Recreation
g. Nature Conservancy
h. State/local planning office
i. Local university

Table 3
AERIAL PHOTOGRAPHS

Investigative Parameters	Information*		
	Safety	Logistical Support	Investigation Design
SITE DISCOVERY AND IDENTIFICATION			
Geographic Location (County Roads, Lat./Long.)		a	a
Boundaries/Property Lines			a
Area/Dimensions			a
Surrounding Land Use			a
Accessibility		a	a
Ownership/Management			c
ENVIRONMENTAL FEATURES AND CHARACTERISTICS OF THE SITE			
Type			a
Population Density/Proximity/At Risk			a
Structures			a
Utilities/Easements			
Environmentally Sensitive Areas			c
Topography		a	a
Flood Plain/Watershed Value			c
WASTE TYPES AND QUANTITIES			
Type and Quantity		a	a
Source/Origins			
Container Type and Condition			
Waste Compatibility			
Disposal Method/Organization			a
Fire/Explosion Hazard			
FIELD EVALUATION FACTORS			
Soil or Groundwater Contamination Potential			a
Surface Water Contamination Potential			a
Gradient/Erosion/Drainage Patterns			a
Ponding/Water Courses			a
Vegetation/Wildlife Stress Potential			
Evidence of Charred Areas or Source			
Existing Containment Structures			c
Evidence of Leakage or Overflow			c
Meteorology/Climate/Prevailing Winds		c	c
Air Emissions			
Odors			
On or Near Site Wells	c		c
Geologic Outcroppings/Soil Permeability			
Land Alteration/Excavation			a

Table 3 (Cont.)

Investigative Parameters	Information*		
	Safety	Logistical Support	Investigation Design
INVESTIGATIVE/REMEDIAL ACTIVITIES			
Perimeter/Exclusion Area Establishment			
Monitoring/Sampling (Air, Water, Soil)			
Procedures (Safety, Operational)			
Segregation Techniques/"Housekeeping"			
Containment/Diversion Structures			c
Traffic Control			
Site Access/Control			
Equipment (Safety, Hygiene)			
Earth-Moving Equipment			
Communications/Power Availability			
DOCUMENTATION			
Photographs	a	a	a
Violation Documentation/Record Keeping			a

* a - Apparent
c - Clue, unconfirmed or deduced presence; observations requiring further investigation

POTENTIAL HAZARDOUS WASTE SITE

INSTRUCTIONS FOR PREPARING SITE TRACKING FORMS
(EPA Form 2070-1, 2, 3, 4, 5, & 6)

The following six major forms and six supplemental forms are used for tracking potential hazardous waste sites:

FORM TITLE	REMARKS
IDENTIFICATION AND PRELIMINARY ASSESSMENT (EPA Form 2070-2)	Prepare for each known or suspected site, no matter how identified. Sources of identification include citizen's complaints, news media, state files, etc.
SITE INSPECTION REPORT (EPA FORM 2070-3)	Fill out for each site which has received a site inspection. There are five preprinted supplemental reports associated with this form: Storage (EPA Form 2070-3D) Incinerators (EPA Form 2070-3B) Landfills (EPA Form 2070-3E) Surface Impoundments (EPA Form 2070-3C) Landfarms (EPA Form 2070-3A) Supplemental information for deep well injectors, transporters, recyclers/reclaimers, chemical, physical, or biological treaters, or open dumps should also be submitted as appropriate.
TENTATIVE DISPOSITION (EPA Form 2070-4)	Fill out as soon as the results of a site inspection are available.
FINAL STRATEGY DETERMINATION (EPA Form 2070-5)	Fill out as soon as a course of action is determined as a result of the Tentative Disposition.
LOG (EPA Form 2070-1)	Update this one page summary with the key action dates developed on the above forms. This master form indicates the current status of the site at all times.
MONTHLY STATISTICAL SUMMARY FOR POTENTIAL HAZARDOUS WASTE SITES (EPA Form 2070-6)	This form covers actions through the last day of a given calendar month and is submitted to the Hazardous Waste Enforcement Task Force by the 10th day of the following month.

summary Log must be updated with each change of the other forms. At a minimum, each known or potential site must have a Preliminary Assessment form and a Log form filled out.

These forms have been designed by the Hazardous Waste Enforcement Task Force and the Oil and Special Materials Control Division with the assistance of regional and contractor personnel. They may be modified with use. The Task Force welcomes suggestions for significant improvements to the forms and the instructions for preparing the forms.

The information submitted to the Hazardous Waste Enforcement Task Force will be computerized. As soon as the information is entered into the Site Tracking System, management reports will be available to the regions and to Headquarters. These management reports include summary milestone information as well as detailed site reports.

These forms have been designed to be self-explanatory as much as possible. If there are clarifications needed on the forms or on the instructions, call the Task Force at (202) 472-3620.

GENERAL INSTRUCTIONS FOR ALL FORMS

Where information is unavailable for any part of any form, indicate that the information is unknown or not applicable. Where some information is known, make the best estimates possible.

Consult the following sources for information on the fields below:

DATA FIELD	SOURCE OF INFORMATION
Site Number	Dun and Bradstreet identifiers will be assigned at Headquarters. Each site must have a unique name, street, and city to receive a D & B number.
County Name	State Highway Maps.
Owner	Town or County Land Records.
SIC Codes	The Standard Industrial Classification Manual published by the OMB.
Waste Characteristics	Proposed RCRA Regulations. See Section 3001 for definitions.
Latitude/Longitude	U.S.G.S. Topographical Maps.
Water/Hydrological Data	Consult the local 208 Agency, Town Health or Zoning Boards, U.S. Geological Surveys, Corps of Engineers, USDA Soil Conservation Services, U.S. Fish & Wildlife Service, HUD Flood Maps, State and EPA files, etc.

INSTRUCTIONS FOR THE IDENTIFICATION AND PRELIMINARY ASSESSMENT FORM (2070-2)

PAGE 1

I.A Site Name	Use a company name, municipal site name, or a geographic name as appropriate. Be sure to use the same spelling and abbreviations on all subsequent forms.
I.B Street	If no street name and number is available, give other geographic information to insure positive identification. If one company has several sites in one city, this field is critical.
I.I Site Description	Provide a generic description of the site, e.g. landfill with 1000 drums of unidentified content.
III.C Area of Site	Estimate. Use decimals if needed.

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IV. Characterization of Site Activity	Leave blank if unknown. Check as many as applicable.

PAGE 3

V. Hazard Description	Check off as many items as are applicable. Indicate specific dates of alleged incidents wherever possible.

PAGE 4

VIII. Past Regulatory Actions	List all known orders, fines, etc. from EPA and State files.

INSTRUCTIONS FOR THE SITE INSPECTION REPORT FORM (2070-3)

PAGE 2

III.D Generator Information	Examine operator's records, markings on drums, etc. Interview employees, past and present, residents, etc.
III.J Weather	Note problems which may not be evident because of extreme cold, snow covering, etc.

PAGE 3

IV.E Latitude/Longitude	Use the coordinates of the approximate center of the site.

PAGE 4

VII.D Substances of Greatest Concern	Use Trade Names or the most common chemical names of those substances which are of the greatest concern on the site. (This is not intended to be a complete listing of all substances found on the site).
VII.D.3&4 Toxicity and CAS Number	Consult Table 26, Physical, Chemical Hazard, and Analytical Data of Industrial Chemicals, CRC Handbook of Analytical Toxicology.

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IX.C Approximate Number of People Affected Within Unit Area	Generally a 1 mile radius is the appropriate unit area.
IX.A.3 Publicly Travelled Areas	Estimate number of people exposed per day.
X.A Depth to Groundwater	Interview local residents, well driller, USGS, etc.
X.B Direction of Flow	Examine topography.
X.C Groundwater Use in Vicinity	Drinking water, process water, irrigation, etc.
X.D Potential Yield of Aquifer	Consult the USGS for an approximate value in gallons/day.

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XIII. Soil Permeability

B. Very high - clear gravel, cavernous limestone, dolomite.

C. High - clear sand, sandstone, fractured igneous and metamorphic rocks.

D. Moderate - fine sand.

E. Low - silt, clay, laminated sandstone, shale, mudstone.

F. Very low - massive clay, massive igneous and metamorphic rocks.

XIII.G Recharge Area	Generally uplands.
XIII.H Discharge Area	Generally valleys.

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XIV. Permit Information	Consult state, local, and EPA files.
XV. Past Regulatory or Enforcement Actions	Consult state, local, and EPA files.

INSTRUCTIONS FOR TENTATIVE DISPOSITION AND FINAL STRATEGY DETERMINATION FORMS (2070-4&5)

KEY WORDS for Remedial Actions (use these terms in completing forms)	Full description of Key Words

IV.A.1 SHORT TERM ACTIONS

Water Supply Closed	
Provide Temp Wtr Sup	Provide Temporary Water Supply
Provide Perm Wtr Sup	Provide Permanent Water Supply
Evacuate Area	
Rstrt Access to Site	Restrict Access to Site
Emrg Dkg/Surf Wtr Dv	Emergency Diking/Surface Water Diversion
Remove Spilld Matrl	Remove Spilled Material
Repackage Wastes	
Repair Bulk Tankage	
Remove Wastes	
Waste Disposal	
Gas Control	
Fire Control	
Subsurf Cutoff Wall	Subsurface Cutoff Wall
Emerg Wste Treatment	Emergency Waste Treatment

IV.B.1 LONG TERM ACTIONS

Analytical Support	
Geohydrologic Survey	
Other Envirmtl Srvy	Other Environmental Surveys
Engineering Reports	
Repackaging	
Removal of Wastes	
Divsn Structr/Regrdg	Diversion Structures/Regrading

KEY WORDS FOR LONG TERM ACTIONS (Continued)

In-situ Chem Trtmnt	In-situ Chemical Treatment
In-situ Bio Trtmnt	In-situ Biolgocial Treatment
In-situ Phys Trtmnt	In-situ Physical Treatment
Encapsulation	
On-site Incineration	
Evacuation/Removal	
Waste Disposal	
Contmntd Soil Dispsl	Contaminated Soil Disposal
Venting/Gas Control	
Capping/Covering	
Cutoff Walls	
Cutoff Trenches/Sump	
Grout Curtain	
Bottom Sealing	
Barrier Walls	
Chemical Fixation	
Chemical Injection	
Leachate Treatment	
Monitoring Wells	

EPA POTENTIAL HAZARDOUS WASTE SITE IDENTIFICATION	REGION	SITE NUMBER

NOTE: The initial identification of a potential site or incident should not be interpreted as a finding of illegal activity or confirmation that an actual health or environmental threat exists. All identified sites will be assessed under the EPA's Hazardous Waste Site Enforcement and Response System to determine if a hazardous waste problem actually exists.

A. SITE NAME		B. STREET *(or other identifier)*	
C. CITY	D. STATE	E. ZIP CODE	F. COUNTY NAME

G. OWNER/OPERATOR *(if known)*

1. NAME	2. TELEPHONE NUMBER

H. TYPE OF OWNERSHIP *(if known)*

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☐ 5. PRIVATE ☐ 6. UNKNOWN

I. SITE DESCRIPTION

J. HOW IDENTIFIED *(i.e., citizen's complaints, OSHA citations, etc.)*	K. DATE IDENTIFIED *(mo., day, & yr.)*

L. SUMMARY OF POTENTIAL OR KNOWN PROBLEM

M. PREPARER INFORMATION

1. NAME	2. TELEPHONE NUMBER	3. DATE *(mo., day, & yr.)*

EPA Form 2070-8 (5-80)

EPA

POTENTIAL HAZARDOUS WASTE SITE LOG

SITE NUMBER

NOTE: The initial identification of a potential site or incident should not be interpreted as a finding of illegal activity or confirmation that an actual health or environmental threat exists. All identified sites will be assessed under the EPA's Hazardous Waste Site Enforcement and Response System to determine if a hazardous waste problem actually exists.

SITE NAME AND STREET ADDRESS *(or other identifier)*

CITY	STATE	ZIP CODE

SUMMARY OF POTENTIAL OR KNOWN PROBLEM

ITEM	DATE OF DETERMINATION OR COMPLETION	RESPONSIBLE ORGANIZATION OR INDIVIDUAL *(EPA, State, Contractor, Other)*	PERSON MAKING ENTRY TO LOG FORM	DATE ENTERED ON LOG *(mo,day,yr)*
1. IDENTIFICATION OF POTENTIAL PROBLEM				
2. PRELIMINARY ASSESSMENT				
APPARENT SERIOUSNESS OF PROBLEM	☐ HIGH ☐ MEDIUM ☐ LOW ☐ NONE ☐ UNKNOWN			
3. SITE INSPECTION				
4. EPA TENTATIVE DISPOSITION *(check appropriate item(s) below)*				
☐ a. NO ACTION NEEDED				
☐ b. INVESTIGATIVE ACTION NEEDED				
☐ c. REMEDIAL ACTION NEEDED				
☐ d. ENFORCEMENT ACTION NEEDED				
5. EPA FINAL STRATEGY DETERMINATION *(check appropriate item(s) below)*				
☐ a. NO ACTION NEEDED				
☐ b. REMEDIAL ACTION NEEDED				
☐ c. REMEDIAL ACTION NEEDED BUT, NO RESOURCES AVAILABLE				
☐ d. ENFORCEMENT ACTION NEEDED				
☐ (1) CASE DEVELOPMENT PLAN PREPARED				
☐ (2) ENFORCEMENT CASE FILED OR ADMINISTRATIVE ORDER ISSUED				
6. STRATEGY COMPLETED				

EPA Form T2070-1 (R.12-79) PREVIOUS EDITION MAY BE USED

EPA

POTENTIAL HAZARDOUS WASTE SITE IDENTIFICATION AND PRELIMINARY ASSESSMENT

REGION	SITE NUMBER *(to be assigned by Hq)*

NOTE: This form is completed for each potential hazardous waste site to help set priorities for site inspection. The information submitted on this form is based on available records and may be updated on subsequent forms as a result of additional inquiries and on-site inspections.

GENERAL INSTRUCTIONS: Complete Sections I and III through X as completely as possible before Section II *(Preliminary Assessment)*. File this form in the Regional Hazardous Waste Log File and submit a copy to: U.S. Environmental Protection Agency; Site Tracking System; Hazardous Waste Enforcement Task Force *(EN-335)*; 401 M St., SW; Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME

B. STREET *(or other identifier)*

C. CITY

D. STATE

E. ZIP CODE

F. COUNTY NAME

G. OWNER/OPERATOR *(if known)*

1. NAME

2. TELEPHONE NUMBER

H. TYPE OF OWNERSHIP

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☐ 5. PRIVATE ☐ 6. UNKNOWN

I. SITE DESCRIPTION

J. HOW IDENTIFIED *(i.e., citizen's complaints, OSHA citations, etc.)*

K. DATE IDENTIFIED *(mo., day, & yr.)*

L. PRINCIPAL STATE CONTACT

1. NAME

2. TELEPHONE NUMBER

II. PRELIMINARY ASSESSMENT *(complete this section last)*

A. APPARENT SERIOUSNESS OF PROBLEM

☐ 1. HIGH ☐ 2. MEDIUM ☐ 3. LOW ☐ 4. NONE ☐ 5. UNKNOWN

B. RECOMMENDATION

☐ 1. NO ACTION NEEDED *(no hazard)*

☐ 3. SITE INSPECTION NEEDED

a. TENTATIVELY SCHEDULED FOR ______

b. WILL BE PERFORMED BY ______

☐ 2. IMMEDIATE SITE INSPECTION NEEDED

a. TENTATIVELY SCHEDULED FOR ______

b. WILL BE PERFORMED BY ______

☐ 4. SITE INSPECTION NEEDED *(low priority)*

C. PREPARER INFORMATION

1. NAME

2. TELEPHONE NUMBER

3. DATE *(mo., day, & yr.)*

III. SITE INFORMATION

A. SITE STATUS

☐ 1. ACTIVE *(Those industrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)*

☐ 2. INACTIVE *(Those sites which no longer receive wastes.)*

☐ 3. OTHER *(specify)*: ______ *(Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)*

B. IS GENERATOR ON SITE?

☐ 1. NO ☐ 2. YES *(specify generator's four-digit SIC Code)* ______

C. AREA OF SITE *(in acres)*

D. IF APPARENT SERIOUSNESS OF SITE IS HIGH, SPECIFY COORDINATES

1. LATITUDE *(deg.—min.—sec.)*

2. LONGITUDE *(deg.—min.—sec.)*

E. ARE THERE BUILDINGS ON THE SITE?

☐ 1. NO ☐ 2. YES *(specify)* ______

T2070-2 (10-79)

Continue On Reverse

Continued From Front

IV. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

'X'	A. TRANSPORTER	'X'	B. STORER	'X'	C. TREATER	'X'	D. DISPOSER
	1. RAIL		1. PILE		1. FILTRATION		1. LANDFILL
	2. SHIP		2. SURFACE IMPOUNDMENT		2. INCINERATION		2. LANDFARM
	3. BARGE		3. DRUMS		3. VOLUME REDUCTION		3. OPEN DUMP
	4. TRUCK		4. TANK, ABOVE GROUND		4. RECYCLING/RECOVERY		4. SURFACE IMPOUNDMENT
	5. PIPELINE		5. TANK, BELOW GROUND		5. CHEM./PHYS. TREATMENT		5. MIDNIGHT DUMPING
	6. OTHER *(specify)*		6. OTHER *(specify)*.		6. BIOLOGICAL TREATMENT		6. INCINERATION
					7. WASTE OIL REPROCESSING		7. UNDERGROUND INJECTION
					8. SOLVENT RECOVERY		8. OTHER *(specify)*:
					9. OTHER *(specify)*:		

E. SPECIFY DETAILS OF SITE ACTIVITIES AS NEEDED

V. WASTE RELATED INFORMATION

A. WASTE TYPE

☐ 1. UNKNOWN ☐ 2. LIQUID ☐ 3. SOLID ☐ 4. SLUDGE ☐ 5. GAS

B. WASTE CHARACTERISTICS

☐ 1. UNKNOWN ☐ 2. CORROSIVE ☐ 3. IGNITABLE ☐ 4. RADIOACTIVE ☐ 5. HIGHLY VOLATILE
☐ 6. TOXIC ☐ 7. REACTIVE ☐ 8. INERT ☐ 9. FLAMMABLE

☐ 10. OTHER *(specify)* ______

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

2. Estimate the amount *(specify unit of measure)* of waste by category; mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	AMOUNT	AMOUNT	AMOUNT	AMOUNT	AMOUNT
UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE
'X' (1) PAINT, PIGMENTS	'X' (1) OILY WASTES	'X' (1) HALOGENATED SOLVENTS	'X' (1) ACIDS	'X' (1) FLYASH	'X' (1) LABORATORY PHARMACEUT.
(2) METALS SLUDGES	(2) OTHER *(specify)*:	(2) NON-HALOGNTD. SOLVENTS	(2) PICKLING LIQUORS	(2) ASBESTOS	(2) HOSPITAL
(3) POTW		(3) OTHER *(specify)*	(3) CAUSTICS	(3) MILLING/ MINE TAILINGS	(3) RADIOACTIVE
(4) ALUMINUM SLUDGE			(4) PESTICIDES	(4) FERROUS SMLTG. WASTES	(4) MUNICIPAL
(5) OTHER *(specify)*			(5) DYES/INKS	(5) NON-FERROUS SMLTG. WASTES	(5) OTHER *(specify)*:
			(6) CYANIDE	(6) OTHER *(specify)*:	
			(7) PHENOLS		
			(8) HALOGENS		
			(9) PCB		
			(10) METALS		
			(11) OTHER *(specify)*		

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V. WASTE RELATED INFORMATION *(continued)*

3. LIST SUBSTANCES OF GREATEST CONCERN WHICH MAY BE ON THE SITE *(place in descending order of hazard).*

4. ADDITIONAL COMMENTS OR NARRATIVE DESCRIPTION OF SITUATION KNOWN OR REPORTED TO EXIST AT THE SITE.

VI. HAZARD DESCRIPTION

A. TYPE OF HAZARD	B. POTENTIAL HAZARD *(mark 'X')*	C. ALLEGED INCIDENT *(mark 'X')*	D. DATE OF INCIDENT *(mo.,day,yr.)*	E. REMARKS
1 NO HAZARD				
2 HUMAN HEALTH				
3. NON-WORKER INJURY/EXPOSURE				
4. WORKER INJURY				
5. CONTAMINATION OF WATER SUPPLY				
6 CONTAMINATION OF FOOD CHAIN				
7. CONTAMINATION OF GROUND WATER				
8. CONTAMINATION OF SURFACE WATER				
9. DAMAGE TO FLORA/FAUNA				
10. FISH KILL				
11 CONTAMINATION OF AIR				
12. NOTICEABLE ODORS				
13. CONTAMINATION OF SOIL				
14. PROPERTY DAMAGE				
15. FIRE OR EXPLOSION				
16. SPILLS/LEAKING CONTAINERS/ RUNOFF/STANDING LIQUIDS				
17. SEWER, STORM DRAIN PROBLEMS				
18. EROSION PROBLEMS				
19. INADEQUATE SECURITY				
20. INCOMPATIBLE WASTES				
21. MIDNIGHT DUMPING				
22. OTHER *(specify).*				

Continue On Reverse

Continued From Front

VII. PERMIT INFORMATION

A. INDICATE ALL APPLICABLE PERMITS HELD BY THE SITE.

- ☐ 1 NPDES PERMIT
- ☐ 2. SPCC PLAN
- ☐ 3. STATE PERMIT *(specify)*: ______
- ☐ 4. AIR PERMITS
- ☐ 5. LOCAL PERMIT
- ☐ 6. RCRA TRANSPORTER
- ☐ 7 RCRA STORER
- ☐ 8. RCRA TREATER
- ☐ 9 RCRA DISPOSER
- ☐ 10. OTHER *(specify)* ______

B. IN COMPLIANCE?

- ☐ 1. YES
- ☐ 2. NO
- ☐ 3. UNKNOWN

4 WITH RESPECT TO *(list regulation name & number)* ______

VIII. PAST REGULATORY ACTIONS

☐ A. NONE ☐ B. YES *(summarize below)*

IX. INSPECTION ACTIVITY *(past or on-going)*

☐ A. NONE ☐ B. YES *(complete items 1,2,3, & 4 below)*

1 TYPE OF ACTIVITY	2 DATE OF PAST ACTION *(mo., day, & yr.)*	3 PERFORMED BY *(EPA/State)*	4. DESCRIPTION

X. REMEDIAL ACTIVITY *(past or on-going)*

☐ A. NONE ☐ B. YES *(complete items 1, 2, 3, & 4 below)*

1. TYPE OF ACTIVITY	2. DATE OF PAST ACTION *(mo., day, & yr.)*	3 PERFORMED BY *(EPA/State)*	4 DESCRIPTION

NOTE: Based on the information in Sections III through X, fill out the Preliminary Assessment *(Section II)* information on the first page of this form.

EPA

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

REGION	SITE NUMBER *(to be assigned by Hq)*

GENERAL INSTRUCTIONS: Complete Sections I and III through XV of this form as completely as possible. Then use the information on this form to develop a Tentative Disposition *(Section II)*. File this form in its entirety in the regional Hazardous Waste Log File. Be sure to include all appropriate Supplemental Reports in the file. Submit a copy of the forms to: U.S. Environmental Protection Agency; Site Tracking System, Hazardous Waste Enforcement Tack Force *(EN-335)*, 401 M St., SW, Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME

B. STREET *(or other identifier)*

C. CITY

D. STATE

E. ZIP CODE

F. COUNTY NAME

G. SITE OPERATOR INFORMATION

1. NAME
2. TELEPHONE NUMBER
3. STREET
4. CITY
5. STATE
6. ZIP CODE

H. REALTY OWNER INFORMATION *(if different from operator of site)*

1. NAME
2. TELEPHONE NUMBER
3. CITY
4. STATE
5. ZIP CODE

I. SITE DESCRIPTION

J. TYPE OF OWNERSHIP

☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☐ 5. PRIVATE

II. TENTATIVE DISPOSITION *(complete this section last)*

A. ESTIMATE DATE OF TENTATIVE DISPOSITION *(mo., day, & yr.)*

B. APPARENT SERIOUSNESS OF PROBLEM

☐ 1. HIGH ☐ 2. MEDIUM ☐ 3. LOW ☐ 4. NONE

C. PREPARER INFORMATION

1. NAME
2. TELEPHONE NUMBER
3. DATE *(mo., day, & yr.)*

III. INSPECTION INFORMATION

A. PRINCIPAL INSPECTOR INFORMATION

1. NAME
2. TITLE
3. ORGANIZATION
4. TELEPHONE NO. *(area code & no.)*

B. INSPECTION PARTICIPANTS

1. NAME	2. ORGANIZATION	3. TELEPHONE NO.

C. SITE REPRESENTATIVES INTERVIEWED *(corporate officials, workers, residents)*

1. NAME	2. TITLE & TELEPHONE NO.	3. ADDRESS

Continued From Front

III. INSPECTION INFORMATION *(continued)*

D. GENERATOR INFORMATION *(sources of waste)*

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE GENERATED

E. TRANSPORTER/HAULER INFORMATION

1. NAME	2. TELEPHONE NO.	3. ADDRESS	4. WASTE TYPE TRANSPORTED

F. IF WASTE IS PROCESSED ON SITE AND ALSO SHIPPED TO OTHER SITES, IDENTIFY OFF-SITE FACILITIES USED FOR DISPOSAL.

1. NAME	2. TELEPHONE NO.	3 ADDRESS

G. DATE OF INSPECTION *(mo., day, & yr.)*	H. TIME OF INSPECTION	I. ACCESS GAINED BY *(credentials must be shown in all cases)* ☐ 1. PERMISSION ☐ 2. WARRANT

J. WEATHER *(describe)*

IV. SAMPLING INFORMATION

A. Mark 'X' for the types of samples taken and indicate where they have been sent e.g., regional lab, other EPA lab, contractor, etc. and estimate when the results will be available.

1. SAMPLE TYPE	2. SAMPLE TAKEN *(mark 'X')*	3. SAMPLE SENT TO	4 DATE RESULTS AVAILABLE
a. GROUNDWATER			
b. SURFACE WATER			
c. WASTE			
d. AIR			
e. RUNOFF			
f. SPILL			
g. SOIL			
h. VEGETATION			
i. OTHER *(specify)*			

B. FIELD MEASUREMENTS TAKEN *(e.g., radioactivity, explosivity, PH, etc.)*

1. TYPE	2. LOCATION OF MEASUREMENTS	3 RESULTS

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IV. SAMPLING INFORMATION *(continued)*

C PHOTOS

1 TYPE OF PHOTOS

☐ a GROUND ☐ b. AERIAL

2 PHOTOS IN CUSTODY OF

D SITE MAPPED?

☐ YES. SPECIFY LOCATION OF MAPS

E. COORDINATES

1 LATITUDE *(deg.-min.-sec.)*

2 LONGITUDE *(deg -min.-sec.)*

V. SITE INFORMATION

A SITE STATUS

☐ 1. ACTIVE *(Those inductrial or municipal sites which are being used for waste treatment, storage, or disposal on a continuing basis, even if infrequently.)*

☐ 2 INACTIVE *(Those sites which no longer receive wastes.)*

☐ 3 OTHER*(specify)* ____________
(Those sites that include such incidents like "midnight dumping" where no regular or continuing use of the site for waste disposal has occurred.)

B. IS GENERATOR ON SITE?

☐ 1 NO ☐ 2. YES*(specify generator's four-digit SIC Code)* ____________

C. AREA OF SITE *(in acres)*

D ARE THERE BUILDINGS ON THE SITE?

☐ 1 NO ☐ 2. YES*(specify)*

VI. CHARACTERIZATION OF SITE ACTIVITY

Indicate the major site activity(ies) and details relating to each activity by marking 'X' in the appropriate boxes.

'X'	A TRANSPORTER	'X'	B. STORER	'X'	C TREATER	'X'	D. DISPOSER
	1. RAIL		1 PILE		1 FILTRATION		1 LANDFILL
	2. SHIP		2. SURFACE IMPOUNDMENT		2. INCINERATION		2 LANDFARM
	3 BARGE		3 DRUMS		3 VOLUME REDUCTION		3 OPEN DUMP
	4 TRUCK		4 TANK, ABOVE GROUND		4 RECYCLING/RECOVERY		4 SURFACE IMPOUNDMENT
	5. PIPELINE		5 TANK, BELOW GROUND		5 CHEM./PHYS./TREATMENT		5 MIDNIGHT DUMPING
	6. OTHER*(specify)*		6 OTHER*(specify)*		6. BIOLOGICAL TREATMENT		6 INCINERATION
					7 WASTE OIL REPROCESSING		7 UNDERGROUND INJECTION
					8 SOLVENT RECOVERY		8 OTHER*(specify)*
					9 OTHER*(specify)*		

E. SUPPLEMENTAL REPORTS If the site falls within any of the categories listed below, Supplemental Reports must be completed. Indicate which Supplemental Reports you have filled out and attached to this for..

☐ 1. STORAGE ☐ 2. INCINERATION ☐ 3. LANDFILL ☐ 4. SURFACE IMPOUNDMENT ☐ 5. DEEP WELL

☐ 6. CHEM/BIO/ PHYS TREATMENT ☐ 7 LANDFARM ☐ 8. OPEN DUMP ☐ 9 TRANSPORTER ☐ 10. RECYCLOR/RECLAIMER

VII. WASTE RELATED INFORMATION

A. WASTE TYPE

☐ 1. LIQUID ☐ 2. SOLID ☐ 3. SLUDGE ☐ 4 GAS

B. WASTE CHARACTERISTICS

☐ 1. CORROSIVE ☐ 2. IGNITABLE ☐ 3. RADIOACTIVE ☐ 4. HIGHLY VOLATILE
☐ 5. TOXIC ☐ 6. REACTIVE ☐ 7. INERT ☐ 8. FLAMMABLE

☐ 9. OTHER*(specify)*

C. WASTE CATEGORIES

1. Are records of wastes available? Specify items such as manifests, inventories, etc. below.

Continued From Front

VII. WASTE RELATED INFORMATION *(continued)*

2. Estimate the amount *(specify unit of measure)* of waste by category, mark 'X' to indicate which wastes are present.

a. SLUDGE	b. OIL	c. SOLVENTS	d. CHEMICALS	e. SOLIDS	f. OTHER
AMOUNT	AMOUNT	AMOUNT	AMOUNT	AMOUNT	AMOUNT
UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE	UNIT OF MEASURE
'X' (1) PAINT, PIGMENTS	X (1) OILY WASTES	X (1) HALOGENATED SOLVENTS	'X (1) ACIDS	X' (1) FLYASH	'X' (1) LABORATORY PHARMACEUT
(2) METALS SLUDGES	(2) OTHER*(specify)*	(2) NON-HALOGNTD. SOLVENTS	(2) PICKLING LIQUORS	(2) ASBESTOS	(2) HOSPITAL
(3) POTW		(3) OTHER*(specify)*	(3) CAUSTICS	(3) MILLING/MINE TAILINGS	(3) RADIOACTIVE
(4) ALUMINUM SLUDGE			(4) PESTICIDES	(4) FERROUS SMELTING WASTES	(4) MUNICIPAL
(5) OTHER*(specify)*			(5) DYES/INKS	(5) NON-FERROUS SMLTG. WASTES	(5) OTHER*(specify)*
			(6) CYANIDE	(6) OTHER*(specify)*	
			(7) PHENOLS		
			(8) HALOGENS		
			(9) PCB		
			(10) METALS		
			(11) OTHER*(specify)*		

D. LIST SUBSTANCES OF GREATEST CONCERN WHICH ARE ON THE SITE *(place in descending order of hazard)*

1. SUBSTANCE	2. FORM *(mark 'X')*			3. TOXICITY *(mark 'X')*				4 CAS NUMBER	5. AMOUNT	6 UNIT
	a. SOLID	b. LIQ.	c. VAPOR	a. HIGH	b MED.	c. LOW	d. NONE			

VIII. HAZARD DESCRIPTION

FIELD EVALUATION HAZARD DESCRIPTION Place an 'X' in the box to indicate that the listed hazard exists. Describe the hazard in the space provided.

☐ A. HUMAN HEALTH HAZARDS

Continue On Page 5

Continued From Page 4

VIII. HAZARD DESCRIPTION *(continued)*

☐ B. NON-WORKER INJURY/EXPOSURE

☐ C. WORKER INJURY/EXPOSURE

☐ D. CONTAMINATION OF WATER SUPPLY

☐ E. CONTAMINATION OF FOOD CHAIN

☐ F. CONTAMINATION OF GROUND WATER

☐ G. CONTAMINATION OF SURFACE WATER

Continue On Reverse

Continued From Front

VIII. HAZARD DESCRIPTION *(continued)*

☐ H. DAMAGE TO FLORA/FAUNA

☐ I. FISH KILL

☐ J. CONTAMINATION OF AIR

☐ K. NOTICEABLE ODORS

☐ L. CONTAMINATION OF SOIL

☐ M. PROPERTY DAMAGE

Continue On Page 7

Continued From Page 6

VIII. HAZARD DESCRIPTION *(continued)*

☐ N. FIRE OR EXPLOSION

☐ O. SPILLS/LEAKING CONTAINERS/RUNOFF/STANDING LIQUID

☐ P. SEWER, STORM DRAIN PROBLEMS

☐ Q. EROSION PROBLEMS

☐ R. INADEQUATE SECURITY

☐ S. INCOMPATIBLE WASTES

VIII. HAZARD DESCRIPTION *(continued)*

☐ T. MIDNIGHT DUMPING

☐ U. OTHER *(specify)*

IX. POPULATION DIRECTLY AFFECTED BY SITE

A. LOCATION OF POPULATION	B. APPROX. NO. OF PEOPLE AFFECTED	C. APPROX. NO. OF PEOPLE AFFECTED WITHIN UNIT AREA	D. APPROX. NO OF BUILDINGS AFFECTED	E. DISTANCE TO SITE *(specify units)*
1. IN RESIDENTIAL AREAS				
2. IN COMMERCIAL OR INDUSTRIAL AREAS				
3. IN PUBLICLY TRAVELLED AREAS				
4. PUBLIC USE AREAS *(parks, schools, etc.)*				

X. WATER AND HYDROLOGICAL DATA

A. DEPTH TO GROUNDWATER *(specify unit)*	B. DIRECTION OF FLOW	C. GROUNDWATER USE IN VICINITY
D. POTENTIAL YIELD OF AQUIFER	E. DISTANCE TO DRINKING WATER SUPPLY *(specify unit of measure)*	F. DIRECTION TO DRINKING WATER SUPPLY

G. TYPE OF DRINKING WATER SUPPLY

☐ 1. NON-COMMUNITY < 15 CONNECTIONS ☐ 2. COMMUNITY *(specify town)* > 15 CONNECTIONS ____________________

☐ 3. SURFACE WATER ☐ 4. WELL

Continue On Page 9

Continued From Page 8

X. WATER AND HYDROLOGICAL DATA *(continued)*

H. LIST ALL DRINKING WATER WELLS WITHIN A 1/4 MILE RADIUS OF SITE

1 WELL	2 DEPTH *(specify unit)*	3 LOCATION *(proximity to population/buildings)*	4 NON-COMMUNITY *(mark 'X')*	5 COMMUNITY *(mark 'X')*

I. RECEIVING WATER

1 NAME

☐ 2 SEWERS ☐ 3 STREAMS/RIVERS

☐ 4 LAKES/RESERVOIRS ☐ 5 OTHER *(specify)*

6 SPECIFY USE AND CLASSIFICATION OF RECEIVING WATERS

XI. SOIL AND VEGITATION DATA

LOCATION OF SITE IS IN

☐ A. KNOWN FAULT ZONE ☐ B. KARST ZONE ☐ C. 100 YEAR FLOOD PLAIN ☐ D. WETLAND

☐ E. A REGULATED FLOODWAY ☐ F. CRITICAL HABITAT ☐ G. RECHARGE ZONE OR SOLE SOURCE AQUIFER

XII. TYPE OF GEOLOGICAL MATERIAL OBSERVED

Mark 'X' to indicate the type(s) of geological material observed and specify where necessary, the component parts.

'X'	A. OVERBURDEN	'X'	B. BEDROCK *(specify below)*	'X'	C. OTHER *(specify below)*
	1 SAND				
	2 CLAY				
	3. GRAVEL				

XIII. SOIL PERMEABILITY

☐ A. UNKNOWN ☐ B. VERY HIGH *(100,000 to 1000 cm/sec.)* ☐ C. HIGH *(1000 to 10 cm/sec.)*

☐ D MODERATE *(10 to 1 cm/sec.)* ☐ E. LOW *(.1 to 001 cm/sec.)* ☐ F. VERY LOW *(.001 to .00001 cm/sec.)*

G. RECHARGE AREA

☐ 1. YES ☐ 2 NO 3. COMMENTS

H DISCHARGE AREA

☐ 1 YES ☐ 2 NO 3. COMMENTS

I. SLOPE

1 ESTIMATE % OF SLOPE

2 SPECIFY DIRECTION OF SLOPE, CONDITION OF SLOPE, ETC.

J. OTHER GEOLOGICAL DATA

Continue On Reverse

Continued From Front

XIV. PERMIT INFORMATION

List all applicable permits held by the site and provide the related information.

A. PERMIT TYPE (e.g., RCRA, State, NPDES, etc.)	B. ISSUING AGENCY	C. PERMIT NUMBER	D. DATE ISSUED (mo., day, & yr.)	E. EXPIRATION DATE (mo., day, & yr.)	F. IN COMPLIANCE (mark 'X')		
					1 YES	2 NO	3 UNKNOWN

XV. PAST REGULATORY OR ENFORCEMENT ACTIONS

☐ NONE ☐ YES *(summarize in this space)*

NOTE: Based on the information in Sections III through XV, fill out the Tentative Disposition *(Section II)* information on the first page of this form.

LANDFILLS SITE INSPECTION REPORT (Supplemental Report)	INSTRUCTION Answer and Explain as Necessary.

1. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc)*
☐ YES ☐ NO

2. EVIDENCE OF IMPROPER DISPOSAL OF BULK LIQUIDS, SEMI-SOLIDS AND SLUDGES INTO THE LANDFILL
☐ YES ☐ NO

3. CHECK RECORDS OF CELL LOCATION AND CONTENTS AND BENCHMARK
☐ YES ☐ NO

4. WASTES SURROUNDED BY SORBENT MATERIAL
☐ YES ☐ NO

5. DIVERSION STRUCTURES ARE EFFECTIVELY CONSTRUCTED AND PROPERLY MAINTAINED
☐ YES ☐ NO

6. EVIDENCE OF PONDING OF WATER ON SITE
☐ YES ☐ NO

7. EVIDENCE OF IMPROPER/INADEQUATE DRAINING
☐ YES ☐ NO

8. ADEQUATE LEACHATE COLLECTION SYSTEM *(If "Yes", specify Type)*
☐ YES ☐ NO

8a. SURFACE LEACHATE SPRING
☐ YES ☐ NO

9. RECORDS OF LEACHATE ANALYSIS
☐ YES ☐ NO

10. GAS MONITORING
☐ YES ☐ NO

11. GROUNDWATER MONITORING WELLS
☐ YES ☐ NO

12. ARTIFICIAL MEMBRANE LINER INSTALLED
☐ YES ☐ NO

13. SPECIFIC CONTAINMENT MEASURES *(Clay Bottom, Sides, etc)*
☐ YES ☐ NO

14. FIXATION *(Stabilization)* OF WASTE
☐ YES ☐ NO

15. ADEQUATE CLOSURE OF INACTIVE PORTION OF FACILITY
☐ YES ☐ NO

16. COVER *(Type)*

16a. THICKNESS

16b. PERMEABILITY

16c. DAILY APPLICATION
☐ YES ☐ NO

EPA Form T2070-3E (10-79)

STORAGE FACILITIES SITE INSPECTION REPORT *(Supplemental Report)*	INSTRUCTION Answer and Explain as Necessary.

1. STORAGE AREA HAS CONTINUOUS IMPERVIOUS BASE

☐ YES ☐ NO

2. STORAGE AREA HAS A CONFINEMENT STRUCTURE

☐ YES ☐ NO

3. EVIDENCE OF LEAKAGE/OVERFLOW *(If "Yes", document where and how much runoff is overflowing or leaking from containment)*

☐ YES ☐ NO

4. ESTIMATE TYPE AND NUMBER OF BARRELS/CONTAINERS

5. GLASS OR PLASTIC STORAGE CONTAINERS USED

☐ YES ☐ NO

6. ESTIMATE NUMBER AND CAPACITY OF STORAGE TANKS

7. NOTE LABELING ON CONTAINERS

8. EVIDENCE OF LEAKAGE CORROSION OR BULGING OF BARRELS/CONTAINERS/STORAGE TANKS *(If "Yes", document evidence. Describe location and extent of damage. Take PHOTOGRAPHS)*

☐ YES ☐ NO

9. DIRECT VENTING OF STORAGE TANKS

☐ YES ☐ NO

10. CONTAINERS HOLDING INCOMPATIBLE SUBSTANCES *(If "Yes", document evidence. Describe location and identity of hazardous waste. Take PHOTOGRAPHS)*

☐ YES ☐ NO

11. INCOMPATIBLE SUBSTANCES STORED IN CLOSE PROXIMITY *(If "Yes", document evidence. Describe location and identity of hazardous waste. Take PHOTOGRAPHS)*

☐ YES ☐ NO

12. ADEQUATE CONTAINER WASHING AND REUSE PRACTICES

☐ YES ☐ NO

13. ADEQUATE PRACTICES FOR DISPOSAL OF EMPTY STORAGE CONTAINERS

☐ YES ☐ NO

EPA Form T2070-3D (10-79)

INCINERATORS SITE INSPECTION REPORT *(Supplemental Report)*	INSTRUCTION Answer and Explain as Necessary.

1. INCINERATION OF ALL SUBSTANCES APPROVED BY REGULATORY AGENCY

☐ YES ☐ NO

LIST ALL SUBSTANCES INCINERATED, INDICATING WHETHER OR NOT APPROVAL EXISTS.

2. COMBUSTION EFFICIENCY MONITORED

☐ YES ☐ NO *(Explain)*

3. TEMPERATURE, GAS FLOW, RETENTION CALCULATIONS, AND COMBUSTION ZONE MONITORED

☐ YES ☐ NO

4. MONITORING EQUIPMENT FUNCTIONING PROPERLY

☐ YES ☐ NO

5. ADEQUATE MAINTENANCE OF EMISSION CONTROL EQUIPMENT

☐ YES ☐ NO

6. MONITORING PORTS IN INCINERATOR *(Indicate Position)*

☐ YES ☐ NO

7. WASTE FLOW RATE MONITORED

☐ YES ☐ NO

8. CUT-OFF DEVICE FUNCTIONING PROPERLY

☐ YES ☐ NO

9. STACK TEST ☐ YES ☐ NO	9a. EPA METHOD

9b. AGENCY CONDUCTING TEST	9c. DATE

10. ADEQUATE METHOD FOR DISPOSAL OF SCRUBBER LIQUOR WASTEWATER *(Describe)*

☐ YES ☐ NO

11. ADEQUATE METHOD FOR DISPOSAL OF ASH QUENCHING WASTEWATER OR ASH *(Describe)*

☐ YES ☐ NO

12. TYPE OF SCRUBBER MEDIUM

13. TYPE OF SCRUBBER

14. MIST ELIMINATOR

☐ YES ☐ NO

EPA Form T2070-38 (10-79)

Continued on reverse

15. OPACITY READING TAKEN

☐ YES ☐ NO VALUE

16. WET STACK

☐ YES ☐ NO

7. STACK HEIGHT

18. STACK DIAMETER

19. CONSTRUCTION MATERIAL OF STACK

20. PERMIT LIMITS

EMISSION LIMITS

21. TYPE OF EQUIPMENT

21a. MAKE

21b. AGE

21c. CONDITION

EPA Form T2070-3B (10-79) (Reverse)

LAND FARM SITE INSPECTION REPORT *(Supplemental Report)*	INSTRUCTION **Answer and Explain as necessary.**

1. STATE PERMIT

☐ YES ☐ NO

2. AREA *(Dimensions of Site)*

3. APPLICATION RATE

4. IMPROPER DISPOSAL OF UNAUTHORIZED MATERIALS IN LAND FARM

☐ YES ☐ NO

5. DIVERSION STRUCTURES ARE EFFECTIVELY CONSTRUCTED AND PROPERLY MAINTAINED

☐ YES ☐ NO

6. EVIDENCE OF PONDING OF LIQUID ON SITE

☐ YES ☐ NO

7. ODORS *(especially hydrogen sulfide) (If YES, indicate)*

☐ YES ☐ NO

8. GENERAL PHYSICAL APPEARANCE OF SOIL *(Color, Sand/Silt/Clay Content)*

9. VEGETATION ON LAND FARM

10. pH

EPA Form T2070-3A (10-79)

SURFACE IMPOUNDMENTS SITE INSPECTION REPORT *(Supplemental Report)*	**INSTRUCTION** Answer and Explain as Necessary.

1. TYPE OF IMPOUNDMENT

2. STABILITY/CONDITION OF EMBANKMENTS

3. EVIDENCE OF SITE INSTABILITY *(Erosion, Settling, Sink Holes, etc.)*
☐ YES ☐ NO

4. EVIDENCE OF DISPOSAL OF IGNITABLE OR REACTIVE WASTE
☐ YES ☐ NO

5. ONLY COMPATIBLE WASTES ARE STORED OR DISPOSED OF IN THE IMPOUNDMENT
☐ YES ☐ NO

6. RECORDS CHECKED FOR CONTENTS AND LOCATION OF EACH SURFACE IMPOUNDMENT
☐ YES ☐ NO

7. IMPOUNDMENT HAS LINER SYSTEM
☐ YES ☐ NO

7a. INTEGRITY OF LINER SYSTEM CHECKED
☐ YES ☐ NO

7b. FINDINGS

8. SOIL STRUCTURE AND SUBSTRUCTURE

9. MONITORING WELLS
☐ YES ☐ NO

10. LENGTH, WIDTH, AND DEPTH
LENGTH WIDTH DEPTH

11. CALCULATED VOLUMETRIC CAPACITY

12. PERCENT OF CAPACITY REMAINING

13. ESTIMATE FREEBOARD

14. SOLIDS DEPOSITION
☐ YES ☐ NO

15. DREDGING DISPOSAL METHOD

16. OTHER EQUIPMENT

EPA Form T2070-3C (10-79)

EPA

POTENTIAL HAZARDOUS WASTE SITE
TENTATIVE DISPOSITION

REGION	SITE NUMBER

File this form in the regional Hazardous Waste Log File and submit a copy to U.S. Environmental Protection Agency, Site Tracking System, Hazardous Waste Enforcement Task Force *(EN-335)*, 401 M St., SW, Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME	B. STREET	
C. CITY	D. STATE	E. ZIP CODE

II. TENTATIVE DISPOSITION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes.

RECOMMENDATION	MARK 'X'	ACTION AGENCY			
		EPA	STATE	LOCAL	PRIVATE
A. NO ACTION NEEDED -- NO HAZARD					
B. INVESTIGATIVE ACTION(S) NEEDED *(If yes, complete Section III.)*					
C. REMEDIAL ACTION NEEDED *(If yes, complete Section IV.)*					
D. ENFORCEMENT ACTION NEEDED *(if yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated.)*					

E. RATIONALE FOR DISPOSITION

F. INDICATE THE ESTIMATED DATE OF FINAL DISPOSITION *(mo., day, & yr.)*	G. IF A CASE DEVELOPMENT PLAN IS NECESSARY, INDICATE THE ESTIMATED DATE ON WHICH THE PLAN WILL BE DEVELOPED *(mo., day, & yr.)*

H. PREPARER INFORMATION

1. NAME	2. TELEPHONE NUMBER	3. DATE *(mo., day, & yr.)*

III. INVESTIGATIVE ACTIVITY NEEDED

A. IDENTIFY ADDITIONAL INFORMATION NEEDED TO ACHIEVE A FINAL DISPOSITION.

B. PROPOSED INVESTIGATIVE ACTIVITY *(Detailed Information)*

1. METHOD FOR OBTAINING NEEDED ADDITIONAL INFO.	2. SCHEDULED DATE OF ACTION *(mo,day, & yr)*	3. TO BE PERFORMED BY *(EPA, Contractor, State, etc.)*	4. ESTIMATED MANHOURS	5. REMARKS
a. TYPE OF SITE INSPECTION				
(1)				
(2)				
(3)				
b. TYPE OF MONITORING				
(1)				
(2)				
c. TYPE OF SAMPLING				
(1)				
(2)				

EPA Form T2070-4 (10-79)

Continue On Reverse

Continued From Front

III. INVESTIGATIVE ACTIVITY NEEDED and PART B - PROPOSED INVESTIGATIVE ACTIVITY *(Continued)*

d. TYPE OF LAB ANALYSIS (1)				
(2)				
e. OTHER *(specify)* (1)				
(2)				

C. ELABORATE ON ANY OF THE INFORMATION PROVIDED IN PART B *(on front & above)* AS NEEDED TO IDENTIFY ADDITIONAL INVESTIGATIVE WORK

D. ESTIMATED MANHOURS BY ACTION AGENCY

1 ACTION AGENCY	2 TOTAL ESTIMATED MANHOURS FOR INVESTIGATIVE ACTIVITIES	1 ACTION AGENCY	2 TOTAL ESTIMATED MANHOURS FOR INVESTIGATIVE ACTIVITIES
a. EPA		b. STATE	
c. EPA CONTRACTOR		d. OTHER *(specify)*	

IV. REMEDIAL ACTIONS

A. SHORT TERM/EMERGENCY STRATEGY *(On Site & Off-Site)* List all emergency actions needed to bring site under immediate control, e.g., restrict access, provide alternate water supply, etc. See instructions for a list of Key Words for each of the actions to be used in the space below.

1 ACTION	2 EST. START DATE *(mo,day,&yr)*	3 EST END DATE *(mo,day,&yr)*	4 ACTION AGENCY *(EPA, State, Private Party)*	5 ESTIMATED COST	6 SPECIFY 311 OR OTHER ACTION, INDICATE THE MAGNITUDE OF THE WORK REQUIRED
				$	
				$	
				$	
				$	
				$	
				$	

B. LONG TERM STRATEGY *(On Site & Off-Site)* List all long term solutions, e.g., excavation, removal, ground water monitoring wells, etc. See instructions for a list of Key Words for each of the actions to be used in the spaces below.

1. ACTION	2 EST START DATE *(mo,day,&yr)*	3. EST END DATE *(mo,day,&yr)*	4 ACTION AGENCY *(EPA, State Private Party)*	5 ESTIMATED COST	6 SPECIFY 311 OR OTHER ACTION, INDICATE THE MAGNITUDE OF THE WORK REQUIRED
				$	
				$	
				$	
				$	
				$	
				$	

C. ESTIMATED MANHOURS AND COST BY ACTION AGENCY

1 ACTION AGENCY	2 TOTAL EST. MANHOURS FOR REMEDIAL ACTIVITIES	3 TOTAL EST COST FOR REMEDIAL ACTIVITIES	1. ACTION AGENCY	2 TOTAL EST MANHOURS FOR REMEDIAL ACTIVITIES	3 TOTAL EST COST FOR REMEDIAL ACTIVITIES
a. EPA			b. STATE		
c PRIVATE PARTIES			d. OTHER *(specify)*		

EPA

POTENTIAL HAZARDOUS WASTE SITE
FINAL STRATEGY DETERMINATION

REGION	SITE NUMBER

File this form in the regional Hazardous Waste Log File and submit a copy to U.S. Environmental Protection Agency, Site Tracking System, Hazardous Waste Enforcement Task Force (EN-335), 401 M St., SW, Washington, DC 20460.

I. SITE IDENTIFICATION

A. SITE NAME	B. STREET	
C. CITY	D. STATE	E. ZIP CODE

II. FINAL DETERMINATION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes.

RECOMMENDATION	MARK 'X'	ACTION AGENCY: EPA	STATE	LOCAL	PRIVATE
A. NO ACTION NEEDED					
B. REMEDIAL ACTION NEEDED, BUT NO RESOURCES AVAILABLE *(If yes, complete Section III.)*					
C. REMEDIAL ACTION *(If yes, complete Section IV.)*					
D. ENFORCEMENT ACTION *(If yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated.)*					

E. RATIONALE FOR FINAL STRATEGY DETERMINATION

F. IF A CASE DEVELOPMENT PLAN HAS BEEN PREPARED, SPECIFY THE DATE PREPARED *(mo., day, & yr.)*	G. IF AN ENFORCEMENT CASE HAS BEEN FILED, SPECIFY THE DATE FILED *(mo., day, & yr.)*

H. PREPARER INFORMATION

1. NAME	2. TELEPHONE NUMBER	3. DATE *(mo., day, & yr.)*

III. REMEDIAL ACTIONS TO BE TAKEN WHEN RESOURCES BECOME AVAILABLE

List all remedial actions, such as excavation, removal, etc. to be taken as soon as resources become available. See instructions for a list of Key Words for each of the actions to be used in the spaces below. Provide an estimate of the approximate cost of the remedy.

A. REMEDIAL ACTION	B. ESTIMATED COST	C. REMARKS
	$	
	$	
	$	
	$	
	$	
	$	
	$	
	$	
D. TOTAL ESTIMATED COST	$	

EPA Form T2070-5 (10-79)

Continue On Reverse

IV. REMEDIAL ACTIONS

SHORT TERM/EMERGENCY ACTIONS *(On Site and Off-Site)* List all emergency actions taken or planned to bring the site under immediate control, e.g., restrict access, provide alternate water supply, etc. See instructions for a list of Key Words for each of the actions to be used in the spaces below.

1. ACTION	2. ACTION START DATE *(mo,day,&yr)*	3. ACTION END DATE *(mo,day,&yr)*	4. ACTION AGENCY *(EPA, State, Private Party)*	5. COST	6. SPECIFY 311 OR OTHER ACTION. INDICATE THE MAGNITUDE OF THE WORK REQUIRED.
				$	
				$	
				$	
				$	
				$	
				$	

. LONG TERM STRATEGY *(On Site and Off-Site)* List all long term solutions, e.g., excavation, removal, ground water monitoring wells, etc. See instructions for a list of Key Words for each of the actions to be used in the spaces below.

1. ACTION	2. ACTION START DATE *(mo,day,&yr)*	3. ACTION END DATE *(mo,day,&yr)*	4. ACTION AGENCY *(EPA, State Private Party)*	5. COST	6. SPECIFY 311 OR OTHER ACTION. INDICATE THE MAGNITUDE OF THE WORK REQUIRED.
				$	
				$	
				$	
				$	
				$	
				$	

MANHOURS AND COST BY ACTION AGENCY

1. ACTION AGENCY	2. TOTAL MAN-HOURS FOR REMEDIAL ACTIVITIES	3. TOTAL COST FOR REMEDIAL ACTIVITIES
a. EPA		$
b. STATE		$
c. PRIVATE PARTIES		$
d. OTHER *(specify)*		$

EPA Form T2070-5 (10-79) REVERSE

HAZARDOUS WASTE SITE ENFORCEMENT AND RESPONSE SYSTEM MONTHLY STATISTICAL SUMMARY[1/]	REGION	
	MONTH	YEAR

[1/] THE INITIAL IDENTIFICATION OF A POTENTIAL SITE SHOULD NOT BE INTERPRETED AS A FINDING OF ILLEGAL ACTIVITY OR CONFIRMATION THAT AN ACTUAL HEALTH OR ENVIRONMENTAL THREAT EXISTS. ALL IDENTIFIED SITES WILL BE ASSESSED UNDER THE EPA HAZARDOUS WASTE SITE ENFORCEMENT AND RESPONSE SYSTEM TO DETERMINE IF A HAZARDOUS WASTE PROBLEM ACTUALLY EXISTS.

NOTE: This form covers actions up to the last day of a given calendar month and is submitted to the Hazardous Waste Enforcement Task Force *(EN-335)* by the 10th day of the following month.

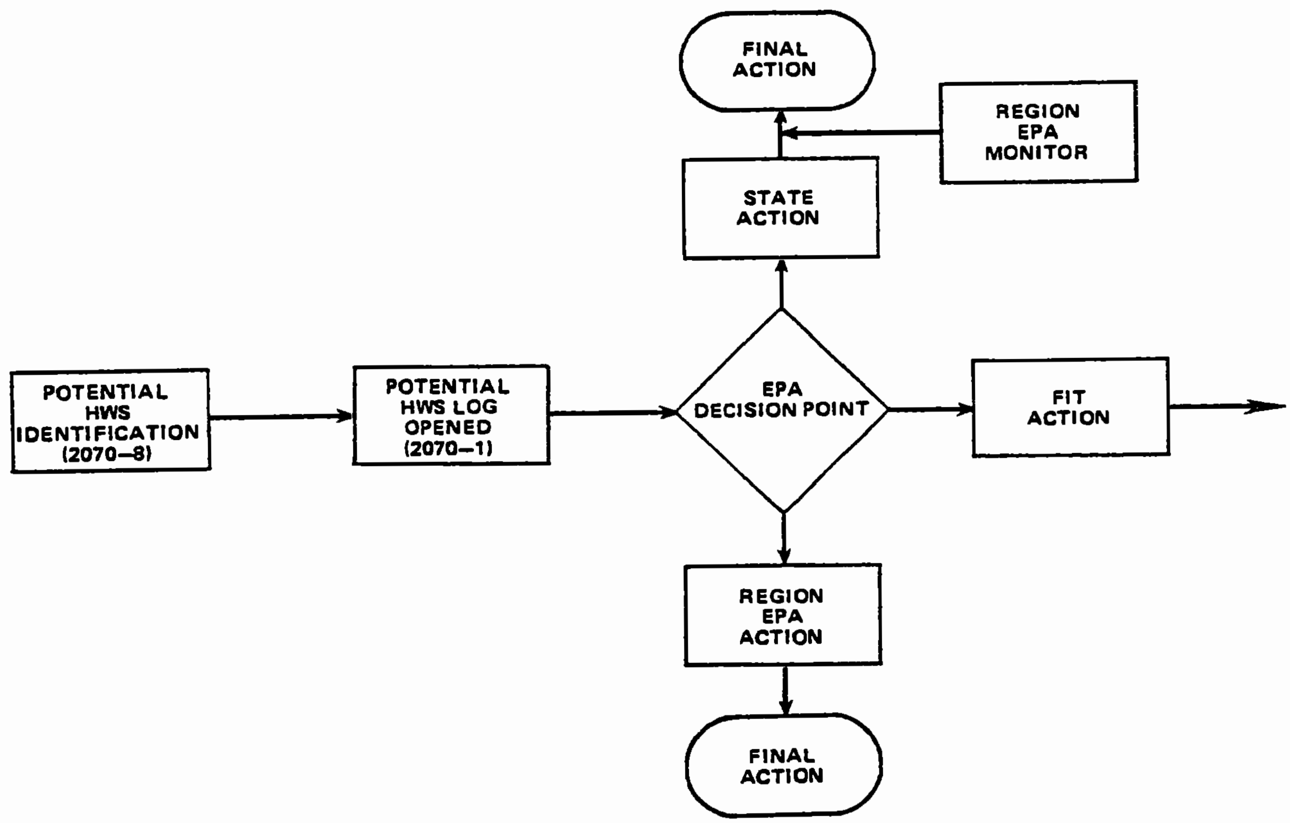
	CUMULATIVE	THIS MONTH
1 NUMBER OF POTENTIAL WASTE SITES OR PROBLEMS ON THE REGIONAL LOG. [1/]		
2. PRELIMINARY ASSESSMENTS COMPLETED.		
3. SITES INSPECTED.		
4. TOTAL NUMBER OF SITES FOR WHICH A TENTATIVE DISPOSITION HAS BEEN MADE.		
TENTATIVE DISPOSITIONS HAVE BEEN MADE BY THE FOLLOWING CATEGORIES		
a. NO ACTION NECESSARY BECAUSE NO IMMINENT HAZARD EXISTS. [2/]		
b. INVESTIGATIVE ACTION NEEDED. [2/] *(to determine whether remedial and/or enforcement action appropriate)*		
c. REMEDIAL ACTION NEEDED. [2/]		
d. ENFORCEMENT ACTION NEEDED. [2/] *(case development plan to be prepared)*		
5. FINAL STRATEGY DETERMINATION *(by category)* TOTAL		
a. NO ACTION NEEDED.		
b. REMEDIAL ACTION TO BE TAKEN BY		
(1) EPA OR EPA CONTRACTOR.		
(2) STATE OR LOCAL GOVERNMENT.		
(3) THIRD PERSONS.		
c. REMEDIAL ACTION NEEDED, BUT NO RESOURCES AVAILABLE.		
d. ENFORCEMENT ACTION TO BE TAKEN BY		
(1) EPA		
(2) STATE		
6. ENFORCEMENT CASES FILED *(judicial actions only)*.		
a. EPA		
b. STATE		
7 ADMINISTRATIVE ORDERS ISSUED.		
a. EPA		
b. STATE		

8. PREPARER OF INFORMATION a. NAME	b. TELEPHONE NUMBER	c. DATE

[2/] The "Investigative Action Needed" block should be used only where there is inadequate information to support any other tentative disposition. If any other categories are chosen the "Investigative Action Needed" category should not be used – regardless of whether or not additional fact-finding will be needed to reach a "Final Strategy Determination".

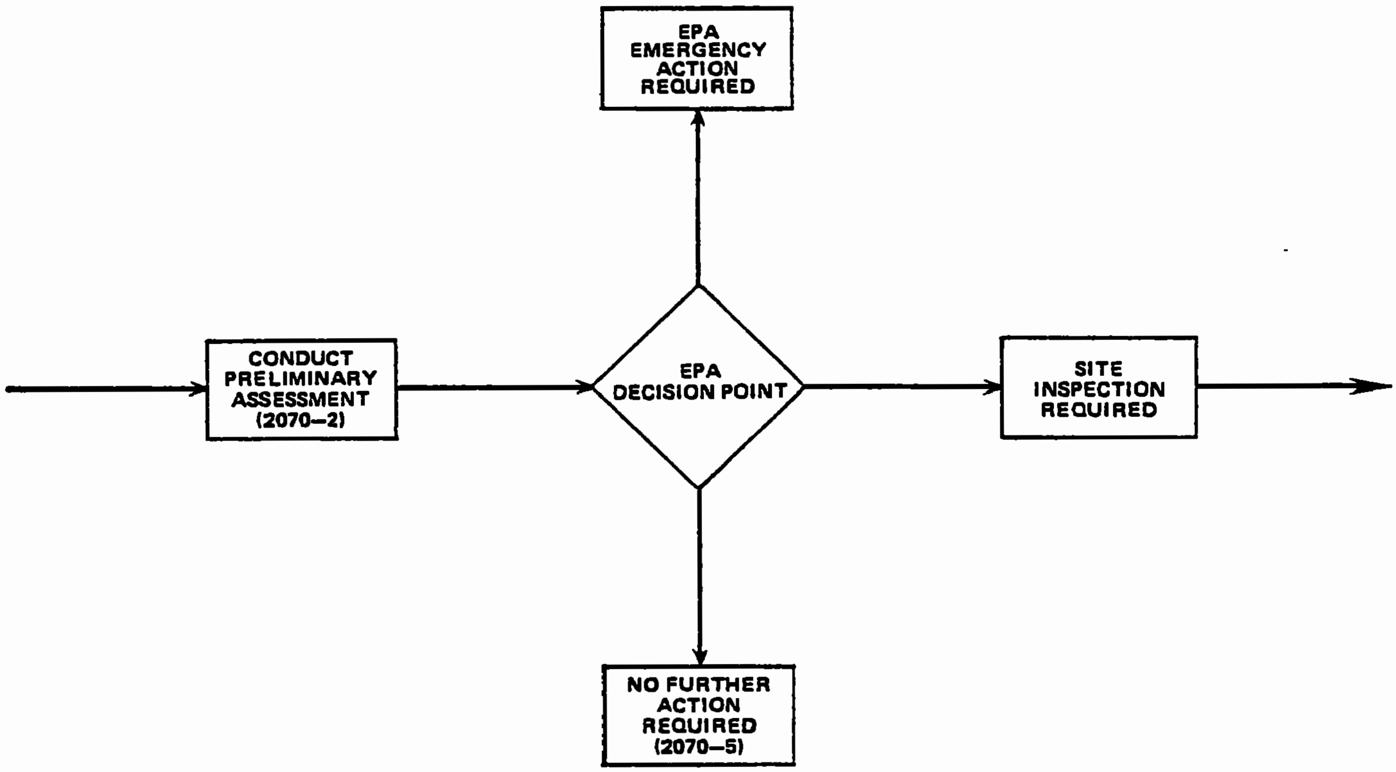
EPA Form T2070-6 (11-79)

IDENTIFICATION PHASE

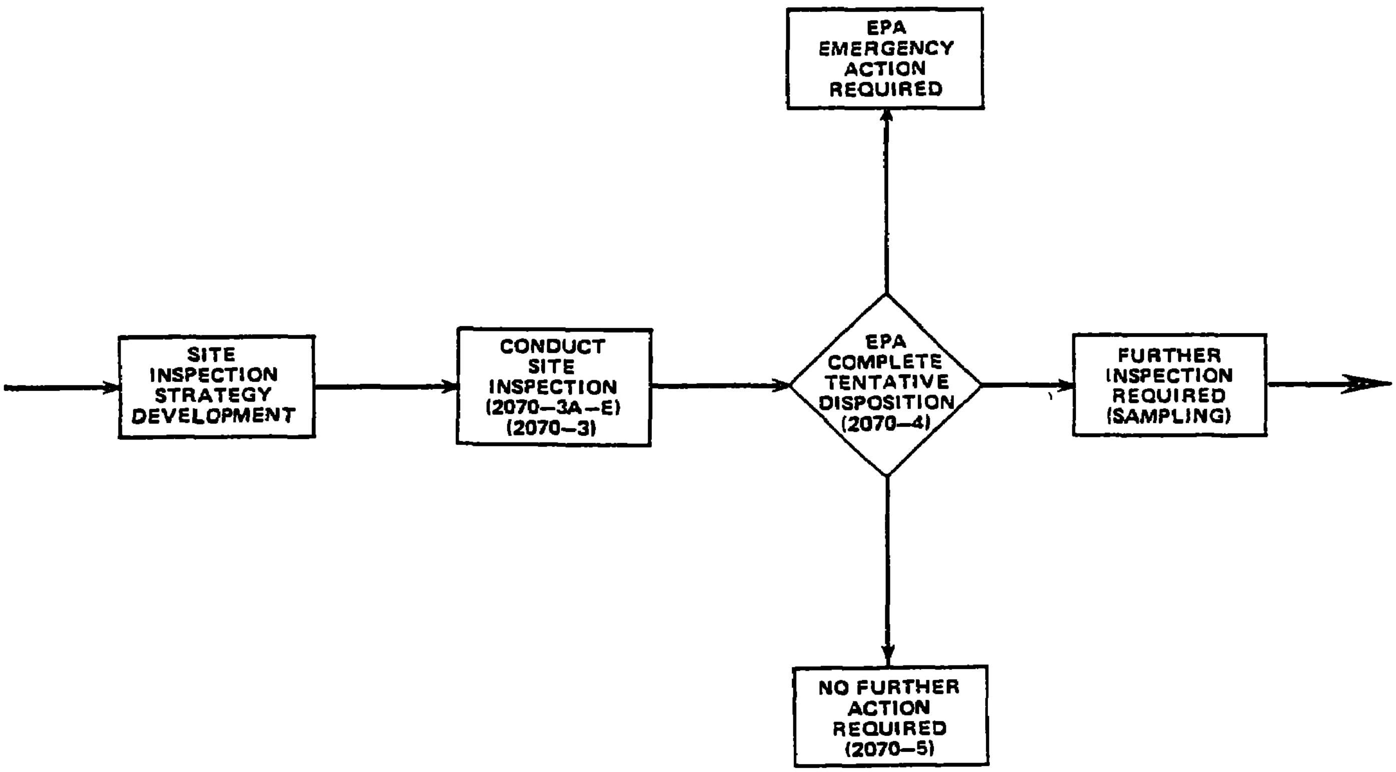


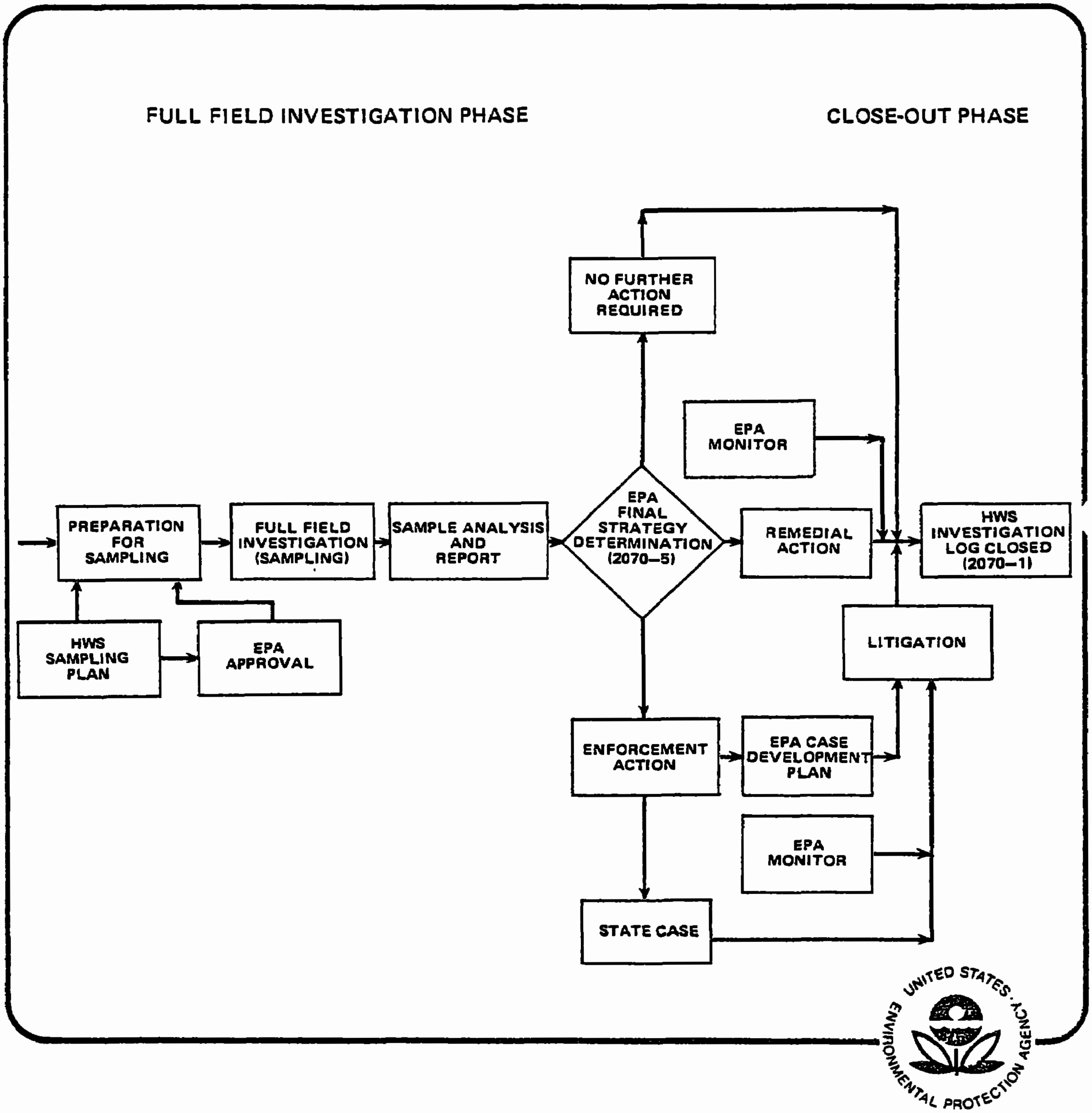
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PRELIMINARY ASSESSMENT PHASE



INSPECTION PHASE




FULL FIELD INVESTIGATION PHASE
CLOSE-OUT PHASE
NO FURTHER ACTION REQUIRED
EPA MONITOR
PREPARATION FOR SAMPLING
FULL FIELD INVESTIGATION (SAMPLING)
SAMPLE ANALYSIS AND REPORT
EPA FINAL STRATEGY DETERMINATION (2070–5)
REMEDIAL ACTION
HWS INVESTIGATION LOG CLOSED (2070–1)
HWS SAMPLING PLAN
EPA APPROVAL
LITIGATION
ENFORCEMENT ACTION
EPA CASE DEVELOPMENT PLAN
EPA MONITOR
STATE CASE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DAY 2

RESPIRATORY PROTECTION

1. INTRODUCTION

A. Objective. The objective of the respiratory protection portion of the course is to provide an understanding of the operation, capabilities, and limitations of respiratory equipment and to teach proper donning and wearing.

1) Self-contained breathing apparatus (SCBA)

2) Air-purifying masks

3) Escape packs

B. Legal Requirements

1) Williams and Steiger Occupational Safety and Health Act of 1970 established standards which state that "approved or accepted respirators shall be used when they are available".

2) 29 CFR 1910.134 gives legal requirements for selection and use of respiratory equipment as promulgated by OSHA and based on ANSI standard Z88.2.

3) 30 CFR Part 11 describes tests for permissibility of respiratory protective apparatus used by NIOSH.

2. THE USE OF RESPIRATORY EQUIPMENT

A. Respirators are used when engineering controls are impossible in hostile environments.

B. Respirators are used in conjunction with proper procedures and the following:

1) Adequate equipment

2) Proper maintenance of equipment

3) Well-trained personnel

4) Continual adherence to above

C. Employer will supply suitable approved respirators and establish a respiratory protection program including the following items (see 29 CFR 1910.134 for details). (Exclusive used of respirators is suggested but not required).

1) Standard operating procedures for selection and use of respirators.

2) Proper selection of respirators based on hazard

3) Training of personnel in use and limitations

4) Regular cleaning and maintenance

5) Proper storage

6) Routine monthly inspections and before and after use

7) Constant monitoring of work area for adverse conditions and worker stress

8) Continual evaluation of respiratory compliance program once in operation.

9) Determination of medical fitness of potential user

D. Only NIOSH-MSHA approved equipment can be used after proper fit testing has been performed.

3. APPROVAL SCHEDULES

A. NIOSH Certified Equipment List gives all approved respiratory apparatus by approval number.

1) An example of an approval designation is TC-13 F-69. "13" is the schedule for SCBA, and "F" indicates the number of revisions the schedule has been through, and "69" is the approval number.

2) 30 CFR Part 11 lists testing schedules for all respiratory equipment and updates or deletes approvals.

a) Subpart H - Self-Contained Breathing Apparatus - Schedule 13

b) Subpart I - Gas Masks - Schedule 14

c) Subpart J - Supplied Air Respirators - Schedule 19

d) Subpart K - Dust, Fume, and Mist Respirators - Schedule 23

e) Subpart L - Chemical Cartridge Respirators - Schedule 23

3) Any equipment which is altered, hybridized or changed in any unapproved way loses its approval by NIOSH-MSHA.

4. EQUIPMENT CLASSIFICATION

A. Air-Purifying Respirators

1) Employ fitering of air by the use of mechanical filters and/or sorbents

2) May not be used in atmospheres which are oxygen deficient (19.5% O_2).

3) May not be used in atmospheres which are IDLH (Immediately Dangerous to Life or Health).

4) May not be used for vapors or gases which do not have adequate warning properties which would indicate the exhaustion of the cartridge filtering capability.

5) Use cartridges which are specific for particle or gas hazard and its concentration.

B. Atmosphere-Supplying Respirators

1) Only positive-pressure-demand units may be used in IDLH atmospheres.

2) Atmosphere-supplying respirators may be used in oxygen-deficient atmospheres.

3) Regulators must be maintained by manufacturer-trained and certified personnel.

5. RESPIRATOR FIT

A. The best fitting respirator will fit only 60% of the normal working population.

B. Leaks in respirator seal will allow toxic gases or vapors to enter mask.

C. The biggest cause of leakage is facial hair.

D. Fit of respirators changes with growth of facial hair, weight loss/gain, dental work, etc.

E. All users must be properly fit-tested.

6. AIR-PURIFYING RESPIRATORS

A. Disposable Dust Respirators

1) These are unapproved but widely used and ineffective due to lack of good facial seal.

2) Approved paper or cloth respirators are approved only for non-toxic particles which cause fibrosis and pneumoconiosis. There are two types:

a) Single use

b) Reusable

B. Mouthbit Respirator

1) Mouthpiece is held in teeth and the nose clamped closed

2) Used for escape only, not for entry

3) Used in situations where hazard is identified and respirator is approved for that hazard.

C. <u>Quarter-Mask Respirator (Type B half mask)</u>

1) Fits from nose to top of chin with high breathing resistance

2) Approved for toxic/non-toxic dusts only

3) Uses two- or four-point suspension with rubber or elastic bands and approved only when worn properly.

D. <u>Half-Mask Respirator (Type A half mask)</u>

1) Fits under chin and over the nose

2) Uses one or two disposable chemical cartridges (there is one fully disposable half-mask respirator).

3) Requires four-point suspension for approval

4) Specific cartridges are available such as organic vapor, pesticide, dusts, spray paints, etc.

5) Remotely mounted cartridges on back or belt are available to help minimize the exposure of the cartridges, which last longer as a result.

E. Full-Face-Mask Respirators

1) Cover entire face from under the chin to above the eyes.

2) Provide much better protection than previously mentioned respirators.

3) May be made of neoprene or silicone rubber.

   a) Neoprene does not tear but will break down especially when attacked by ozone.

   b) Silicone rubber tears when nicked and will allow some acids and organics to permeate; however, is more durable in ozone.

4) Parts have specific requirements

   a) Exhalation valve must give proper seal.

   b) Inhalation valve is only a check valve.

   c) Lens may be polycarbonate or acetate.

F. Powered Air Purifying Respirators

1) Give no breathing resistance.

2) Work even when motor fails.

3) Approved for dusts only.

G. Gas Masks

1) Consist of full-face mask with hose-mounted or chin-mounted canisters.

2) Give high resistance to breathing.

3) Not approved in IDLH atmospheres although canisters approved for concentrations many times the TLV limits

4) High humidity will decrease canister life.

5) Beware of shelf life of canister; if seal is broken, discard within a year or by the shelf date, whichever is sooner.

6) Approved only for hazards with good warning properties

H. Particulate Filters

1) Large particulates dust filter - low toxicity, not less than .05 mg/m^3

2) Small particulates fume filter - low toxicity, not less than .05 mg/m^3

3) High efficiency filters for large and small particles down to 0.3 microns in size with toxicity less than 0.05 mg/m^3. Such small particles are impacted on filter due to Brownian Movement. The lung defense mechanisms will scavenge any particles less than 0.3 microns.

7. ATMOSPHERE-SUPPLYING EQUIPMENT

A. <u>Hose Mask</u>

1) Uses full face-mask

2) User draws clean atmospheric air by blower or lung power

3) Not approved in IDHL atmospheres

4) No more than 75 feet of hose is permissible

5) User can overbreathe supply

B. <u>Airline Respirators</u>

1) Use full face-mask

2) Atmospheric air supplied by a compressor or large air cylinder

3) Deliver continuous low-positive-pressure flow of air

4) Source of air cannot be expendable

5) Require flow of 4 cfm for tight-fitting mask and 6 cfm for loose-fitting mask; must be checked before use.

6) Maximum pressure allowed if 15 cfm

7) Maximum 300 feet of hose is allowed

8) Flow rate must be controlled by the compressor only

C. Modes of Operation

1) Demand

a) Negative pressure from inhalation opens demand valve to draw clean air.

b) Because of negative pressure, contaminated air will also be drawn in along face-piece seal.

c) This mode is air-conserving.

2) Pressure Demand

a) Demand valve is spring-loaded to keep valve open.

b) Exhalation valve is spring-loaded at a pressure slightly greater than the demand valve.

c) Pressure builds up inside face piece enough to close demand valve and exhalation valve.

d) Upon inhalation, pressure is reduced, the demand valve opens, and air is forced into the face piece.

e) If the face piece leaks, the demand valve will remain open and the unit will run continuously.

f) If the face piece should leak for a moment during inhalation, none of the contaminated atmosphere will leak into the mask because the air in the mask will rush out of the mask as opposed to being drawn into the mask in the demand mode.

g) This mode is air-conserving.

8. ESCAPE DEVICES - NOT FOR ENTRY

A. Belt-mounted bottle of compressed air

B. Plastic hood with stainless steel tubing filled with compressed air.

C. Give 5 to 15 minutes of air supply

9. SELF-CONTAINED BREATHING APPARATUS (SCBA)

A. <u>Closed Circuit (uses oxygen rebreathing)</u>

1) Oxygen generators - Navy Type

a) Air is very warm.

b) Will explode with water contact.

2) Compressed oxygen supply type

a) Approved only as demand apparatus.

b) Warm air is inhaled.

c) Recirculates air, purifies CO_2 and replenishes oxygen supply.

3) Available in 30 to 60 minute supplies

4) Not approved in IDLH atmospheres

B. Open Circuit

1) All approved units supply 30 minutes of air.

2) All approved only in the positive-pressure mode of operation.

3) Approved in IDLH atmospheres.

4) Requires training and many hours of practice to use an SCBA efficiently.

5) Beware of quality of air put into the 45 cu. ft., 2200 psi cylinders. Must be at least Grade D.

6) Parts include:

a) Back pack and harness for weight suspension on hips

b) Regulator which can be maintained by persons certified in regulator maintenance. The high pressure hose should never be tightened or loosened with a wrench when the hose is attached to the cylinder.

c) Face piece and breathing tube, which must be clean and the valves of which must be in proper order.

7) The cylinder is marked as follows (see attachment)

a) DOT TYPE RATED PRESSURE

b) CYLINDER NUMBER

c) MANUFACTURER'S SYMBOL, MONTH, YEAR

d) Cylinder also indicates that it can be filled an additional 10%.

8) Do not trust the person who fills the cylinder. Use an oxygen meter, a carbon monoxide indicator, etc., to check the air in your tank.

10. CHECK OUT PROCEDURE - (Attached)

A. Record all inspections.

B. Inspections must be made monthly and before each use.

11. MAINTENANCE

A. Face piece must be sanitized.

1) Do not use water higher than 120°F.

2) Sterilization of face piece will destroy it.

3) Do not use household bleach.

B. Sanitization - obtain sanitizer from manufacturer.

1) Use quaternary ammonium salt solution 50 ppm, hypochlorite solution 50 ppm, or iodine solutions 50 ppm.

2) Immerse for two minutes.

3) Use nothing harder than a bristle brush.

4) Jet action dishwasher may be used without the drying cycle.

5) All parts including headbands and exhalation valve must be removed in cleaning.

12. FIT TESTING (required by 29 CFR 1910.134)

A. <u>Qualitative Test</u>

1) Test atmosphere uses isoamyl acetate or irritant smoke (MSA 5645 ventilation smoke tube, stannic chloride) with proper cartridges.

2) Allow user to move around in atmosphere in a suspended plastic bag (open at bottom) and ask if he detects the test atmosphere with respirator having proper cartridges in place.

3) Irritant smoke works well because it elicits an involuntary reaction.

4) This test can be very subjective but is cheap and quick.

5) Positive-pressure SCBA require no fit testing.

B. <u>Quantitative Test</u>

1) Required when using demand apparatus such as closed circuit SCBA and gas masks.

2) Test is very accurate.

13. PROTECTION FACTORS

A. Each respirator has a given protection factor derived from quantitative fit tests:

$$PF = \frac{\text{concentration of test atmosphere outside}}{\text{concentration of test atmosphere inside}}$$

B. The PF times the TLV gives the maximum allowable concentration for use of that particular respirator.

ATTACHMENT 1

CHECKLIST FOR INSPECTION OF PRESSURE DEMAND
SELF-CONTAINED BREATHING APPARATUS WITHOUT MODE SELECT LEVER

Note: Any discrepancy found should be cause to set unit aside until repair can be done by a certified repair-person

1. PRIOR TO BEGINNING INSPECTION:

   1) Check to assure that high pressure hose connector is tight on cylinder fitting

   2) Bypass valve closed

   3) Mainline valve closed

   4) No cover or obstruction on regulator outlet

2. BACK PACK & HARNESS ASSEMBLY

   A. <u>Straps</u>

      1) Visually inspect for complete set

      2) Visually inspect for frayed or damaged straps that may break during use

   B. <u>Buckles</u>

      1) Visually inspect for mating ends

      2) Check locking function

   C. <u>Backplate & Cylinder Lock</u>

      1) Visually inspect backplate for cracks and for missing rivets or screws.

2) Visually inspect cylinder hold down strap and physically check strap tightener and lock to assure that it is fully engaged.

3. CYLINDER & CYLINDER VALVE ASSEMBLY

A. Cylinder

1) Physically check cylinder to assure that it is tightly fastened to back plate

(M) 2) Check hydrostatic test date to assure that it is current.

(M) 3) Visually inspect cylinder for large dents or gouges in metal

B. Head & Valve Assembly

(M) 1) Visually inspect cylinder valve lock for presence

(M) 2) Visually inspect cylinder gauge for condition of face, needle, and lens

3) Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.) Note function of valve lock.

4. REGULATOR & HIGH PRESSURE HOSE

A. High Pressure Hose & Connector

1) Listen or feel for leakage in hose or at hose-to-cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.)

B. Regulator & Low Pressure Alarm

1) Cover outlet of regulator with palm of hand. Open main-line valve and read regulator gauge (must read at least 1800 PSI and not more than rated cylinder pressure).

2) Close cylinder valve and slowly move hand from regulator outlet to allow slow flow of air. Gauge should begin to

(M) Done on a monthly inspection only.

show immediate loss of pressure as air flows. Low pressure alarm should sound between 650 and 550 PSI. Remove hand completely from outlet and close mainline valve.

3) Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5-10 seconds without any loss of air. Next suck a slight negative on regulator and hold for 5-10 seconds. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus.

4) Open cylinder valve.

5) Place hand over regulator outlet and open mainline valve. Remove hand from outlet and replace in rapid movement. Repeat twice. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Close mainline valve and remove hand from outlet.

6) Ascertain that no obstruction is in or over the regulator outlet. Open and close bypass valve momentarily to assure flow of air through bypass system.

5. FACEPIECE & CORRUGATED BREATHING TUBE

A. <u>Facepiece</u>

1) Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

2) Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, and cracks or large scratches.

3) Visually inspect exhalation valve for visible deterioration or foreign materials build-up.

B. <u>Breathing Tube & Connector</u>

1) Stretch breathing tube and visually inspect for deterioration and holes.

2) Visually inspect connector to assure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.

NOTE: Final test of facepiece would involve a negative pressure test for overall seal and check of exhalation valve. If monthly inspection, mask may now be placed against face and following tests performed. If preparing for use, don backpack, then don facepiece and use following procedure.

<u>Negative Pressure Test on Facepiece</u>

1) With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5-10 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

6. STORAGE OF UNITS

1) Cylinder refilled as necessary and unit cleaned and inspected.

2) Cylinder valve closed

3) High pressure hose connector tight on cylinder

4) Pressure bled off high pressure hose and regulator

5) Bypass valve closed

6) Mainline valve closed

7) All straps completely loosened and laid straight.

8) Facepiece properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals

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(M) would be done only on monthly inspection.

NOTE: Any discrepancy found should be cause to set unit aside until repair can be done by a certified repair-person.

A

PERSONNEL PROTECTION LEVEL DETERMINATION

1. INTRODUCTION

The Project Team Leader is responsible for insuring the health, safety and efficiency of the team. The level of personal protection necessary for the health and safety of the team will be determined by the Leader based on many criteria, some of which are also used in boundary determinations. These factors include surface air and wind characteristics, types and amounts of hazardous waste present at the site based on historical data (or lack of it), the location of the site relative to human traffic, and overt signs of hazards to life and health. Any Team member can seek to upgrade the level of protection established by the Leader. This will be accomplished through consultation with the Leader and the Site Safety Officer, and an agreement will be reached before the Team member enters the exclusion area. The Team members will not arbitrarily upgrade their protections. Under no circumstances will the Team members downgrade the level of personal protection selected. The constituents of various levels of personal protective clothing are attached.

2. LEVEL A

Level A protection will always be worn when the Team enters an enclosed building or warehouse, when know percutaneous hazards exist, or when there is no known historical data on the site. Note that historical data can include observations in and around the area from the off-site investigation. Since Level A provides maximum protection against all known toxic hazards, the decision NOT to use Level A should be noted and justified by the Leader in the site log. Consideration of the stress that can arise from wearing Level A protection should also enter into the Leader's decision, but team comfort is NOT a decision factor. The MSA 401 respirator worn with Level A protection has a wear time of 30 minutes. Therefore, Team members will be brought to the "half-dress" condition approximately every 20 to 30 minutes for air tank changes and heat relief. After three air tanks, Team members will be rotated to reduce the possibility of fatigue or excess stress.

3. LEVEL B

In the absence of known percutaneous hazards, the use of Level A will be at the discretion of the Leader. Level B protection will be the preferred alternative in the absence of evidence that the maximum degree of protection is necessary, but care must be exercised in wearing Level B to avoid percutaneous contamination.

4. LEVEL C

The Level C protection may be worn only when the hazards present have been identified and continuous monitoring is occurring. Level C protection necessitates carrying an emergency air supply (i.e., Robertshaw escape mask). The PTL is responsible for selecting the proper cartridge to be worn with the Ultra-Twin air purifying respirator.

5. LEVEL D

Level D is the basic work uniform of the team. Team members will not be permitted on-site in civilian clothes. Level D with a slung Robertshaw escape mask is the minimum protection allowed on any identified hazardous waste site; this level of protection will be worn only on those sites tentatively identified as presenting no hazards to life or health.

LEVELS OF PROTECTION

LEVEL A

Equipment

1. SCBA-MSA 401
2. CP2000 East Wind encapsulated suit
3. Coveralls, cotton, white
4. Underwear, cotton
5. Gloves, surgical
6. Boots, neoprene, steel toe and shank
7. Booties, butyl rubber or PVC
8. Gloves, disposable* (additional pair)
9. Booties, disposable* (additional pair)
10. Hard Hat*

When to Use

1. Confined facilities
2. Sites containing known percutaneous hazards
3. No established history
4. IDLH atmosphere
5. Site exhibiting signs of acute mammalian toxicity, i.e., dead animals, illnesses associated with past entry into site by humans

Used By

Initial entry team or work party as needed

*Optional

LEVEL B

Equipment

1. SCBA-MSA 401
2. Apron, butyl rubber, ankle length with sleeves
3. Gloves, butyl rubber or neoprene
4. Gloves, surgical
5. Boots, neoprene, steel toe and shank
6. Booties, butyl rubber
7. Coveralls, chemical resistant
8. Underwear, cotton
9. Booties, disposable* (additional pair)
10. Gloves, disposable* (additional pair)
11. Hard hat with face shield*

When to Use

1. O_2 deficient atmosphere
2. No known percutaneous hazards
3. IDLH atmosphere
4. Sites containing unknown but detectable levels of ambient organic chemicals.

Used By

1. Initial Entry Team
2. Work Parties
3. Emergency Response Team
4. Safety Officer
5. PDS Operators

*Optional

LEVEL C

Equipment

1. Ultra-Twin respirator*
2. Robertshaw escape mask
3. Apron, butyl rubber, ankle length with sleeves
4. Gloves, butyl rubber
5. Gloves, surgical
6. Boot, neoprene, steel toe and shank
7. Booties, butyl rubber
8. Coveralls, chemical resistant
9. Underwear, cotton
10. Booties, disposable** (additional pair)
11. Gloves, disposable** (additional pair)
12. Hard hat with face shield**

When to Use

1. Open areas, no IDLH conditions
2. Well-documented history of site
3. Well-documented patterns of prior entry to site
4. Proximity to populated area
5. No evidence of chronic health effects
6. Continuous monitoring must take place

Used By

1. PDS Operators
2. Safety Officer
3. Work Parties

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*Appropriate cartridge must be selected
**Optional

LEVEL D

Equipment

1. Coveralls, cotton
2. Underwear, cotton
3. Boots/shoes, safety
4. Safety glasses
5. Hard hat with optional face shield
6. Ultra twin (readily available)
7. Robertshaw escape mask (readily available)
8. Work gloves

When to Use

1. Site set-up operations in support area
2. On sites that have been investigated and characterized as having no toxic hazards but Robertshaw escape mask will be slung

Used By

Team members working in the support area

B

AMBIENT AIR CHARACTERIZATION

1. INTRODUCTION

A. The explosimeter, oxygen detector, Draeger tubes, radiation detector, HNU photoionizer, and organic vapor analyzer (OVA) are used to determine initially the level of safety at each new site. The OVA in the gas chromatographic (GC) mode, as well as charcoal and tenax tubes, Mylar bags, and intrinsically safe pumps, are used to characterize and identify the chemical compounds present in the air at a given site.

B. There are several objectives for this portion of the course:

1) To discuss the philosophy, use, and limitations of the above-mentioned pieces of analytical equipment as used in hazardous waste site investigations.

2) To describe the general operation of the equipment.

3) To develop a strategy for determining the level of safety upon the initial site entry, using the explosimeter, O_2 meter, radiation detector, and Draeger tubes.

4) To develop a strategy for ambient air characterization, "hotspot" location, and sample screening using the HNU and the OVA.

2. EQUIPMENT USED TO DETERMINE THE LEVEL OF SAFETY UPON INITIAL SITE ENTRY

The initial perimeter characterization equipment used to determine the level of safety at each new site includes:

A. Explosimeter

1) Description and Use. The explosimeter determines the level of organic vapors and gases present in an atmosphere as a percentage of the lower explosive limit (%LEL) by measuring the change in electrical resistance in a Wheatstone bridge circuit.

2) Limitations. The explosimeter cannot be used in atmospheres where the oxygen level is below 19.5%. Silanes, silicones, silicates, and leaded gasoline vapors can destroy the instrument's sensitivity. The explosimeter does not indicate if a given atmosphere is toxic. The instrument must be calibrated frequently.

B. Oxygen Detector

1) Description and Use. The oxygen detector measures the atmospheric O_2 concentration directly by means of a galvanic cell.

2) Limitations. The sensing cell in the oxygen detector has a lifespan of approximately one year. Care must be taken to protect the sensor from immersion or damaging blows.

C. Draeger Tubes

1) Description and Use. The Draeger tubes and pump measure the concentrations of specific inorganic and organic vapors and gases which cause a discoloration that is proportional to the amount of material present.

2) Limitations. The pump must be frequently checked for leaks. Response time is relatively slow.

D. <u>Radiation Survey Meter</u>

1) Brief Introduction to Health Physics

2) Description and Use. The radiation survey meter is a pulse count rate meter. With the pancake detector probe, it acts as a survey meter for alpha-beta-gamma radiation. The Rad-Tad is used to give an audible warning in areas containing dangerous radiation levels. The dosimeter gives an indication of the total amount of radiation encountered over a period of time.

3) Limitations. The radiation survey meter must be used only by persons who have been trained in the proper interpretation of its readings. It must be frequently calibrated and checked. The detector cannot be disconnected while the instrument is in operation.

3. EQUIPMENT USED TO LOCATE "HOTSPOTS"

A. <u>HNU Photoionizer</u>

1) Description and Use. The HNU photoionizer is used to determine the concentration of organic and inorganic vapors and gases with an ionization potential (IP) of less than 11.7 ev.

2) Limitations. The HNU photoionizer does not respond to methane (CH_4) or hydrogen cyanide (HCN). The instrument's sensor cannot be immersed.

B. Organic Vapor Analyzer (OVA)

1) Description and Use. The OVA provides a continuous read-out of the total concentration of organic vapors and gases by the use of a flame ionization detector.

2) Limitations. The OVA can be used only by specially trained operators. It does not respond to inorganic vapors, most importantly HCN.

4. EQUIPMENT USED FOR AMBIENT AIR CHARACTERIZATION AND SAMPLE SCREENING

A. OVA in the Gas Chromatographic (GC) Mode

1) Description and Use. In the GC mode, the OVA is used to characterize and identify specific organic compounds on-site. It can be operated in conjunction with gas-tight syringes, Mylar bags, and air sampling pumps. In this mode it is also used to screen samples prior to submitting them to the laboratory for analysis.

2) Limitations. The OVA can be used only by personnel trained in gas chromatography.

B. Charcoal and Tenax Tubes, Mylar Bags, Air Sampling Pumps

1) Description and Use. Charcoal and tenax tubes chemically absorb organic vapors for subsequent laboratory analysis. Mylar bags are used to collect samples of ambient air for subsequent laboratory analysis. Intrinsically safe air sampling pumps are used to pump ambient air into the absorption tubes and Mylar bags.

2) Limitations. There is the possible loss of organic material due to temperature changes, absorption on container walls, desorption, etc.

5. STRATEGIES FOR DETERMINING THE LEVEL OF SAFETY AND CHARACTERIZING THE AMBIENT AIR

A. Initial Site Entry

Explosimeter, O_2 Meter, Radiation detector, Drager tubes for HCN. Action levels (Refer to Table 1).

B. Ambient Air Characterization

OVA and HNU.

FOUR HEALTH PHYSICS TRAINING OBJECTIVES:

- CHARACTERIZING RADIATION
- USE OF SURVEY INSTRUMENTS
  - PERSONNEL MONITORING
- ACTION LEVEL FOR FIELD INVESTIGATIONS
- RADIATION PROTECTION PROGRAM FOR FIT

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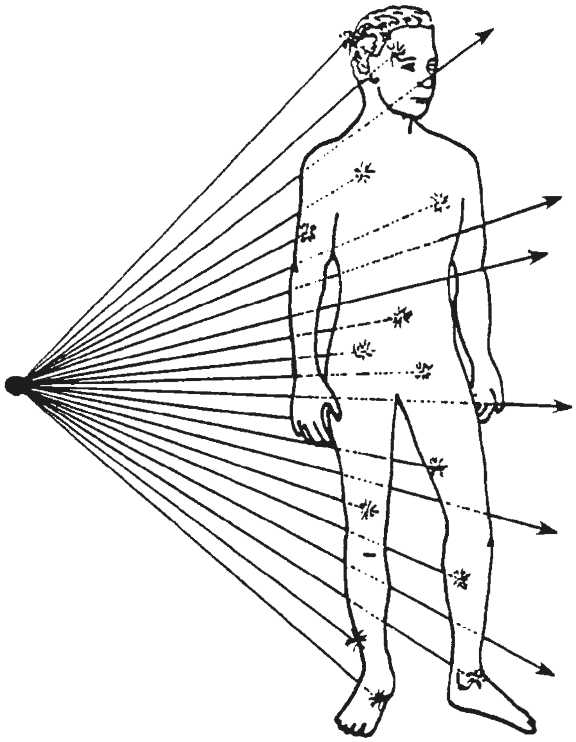
EXTERNAL RADIATION



EXTERNAL RADIATION

Some radiation goes
through the body like X–Rays....

INTERNAL RADIATION

We can receive radiation by swallowing or breathing
radioactive materials....

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CONTAMINATION (Radioactive)

(α, β, γ)

vs.

EXPOSURE

(γ or X—ray)

Roentgen (R)

or

milliRoentgen (mR)

$\downarrow$

Exposure rate (mR/hr)

MONITORING EQUIPMENT	HAZARD	LEVEL	ACTION
EXPLOSIMETER	EXPLOSIVE ATMOSPHERE	$<$20% LEL	COMPLETE ON–SITE INSPECTION.
		$>$20% LEL	COMPLETE ON–SITE INSPECTION WITH CONTINUOUS MONITORING.
		$>$50% LEL	EXPLOSION HAZARD; EVACUATE IMMEDIATELY.
OXYGEN METER	OXYGEN	$<$19.5%	COMPLETE INSPECTION WITH SCBA WITH CONTINUOUS MONITORING. NOTE THE EXPLOSIMETER READINGS ARE NOT VALID IN ATMOSPHERES WITH 1[illegible]% OXYGEN.
		$>$19.5%	COMPLETE INSPECTION.
RADIATION DETECTOR	RADIATION (α,β,γ)	$<$10 MR/HR	COMPLETE INSPECTION.
		10 MR/HR	COMPLETE INSPECTION WITH CONTINUOUS MONITORING.
		$>$10 MR/HR	RADIATION HAZARD; EVACUATE IMMEDIATELY.
DRAEGER TUBES	ORGANIC AND INORGANIC VAPORS AND GASES	SPECIES DEPENDENT	CONSULT "DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS," BY N. IRVING SAX.
HNU PHOTOIONIZER	ORGANIC AND INORGANIC VAPORS AND GASES	SPECIES DEPENDENT	COMPLETE INSPECTION WITH CONTINUOUS MONITORING.
ORGANIC VAPOR ANALYZER Arctic'	ORGANIC VAPORS AND GASES	SPECIES DEPENDENT	COMPLETE ON–SITE INSPECTION WITH CONTINUOUS MONITORING.

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Federal Standard for Radiation Workers:

5 rem/yr or 3 rem/calendar quarter
whole body exposure

rem (Rem) = unit of dose equivalent
For γ radiation 1 Roentgen $\simeq$ 1 Rem

Action level = 10 mR/hr

Site Investigation – 'Worst' Case:

10 mR/hr $\simeq$ 10 mrem/hr
10 mrem/hr x 6 hr/da x 5 workdays/wk $\simeq$ 300 mrem/wk

If you worked at this level all month,
your dose equivalent $\simeq$ 1.2 rem
$\simeq$ 3.6 rem/quarter
$>$ Federal Standard

C

SITE SAFETY PLANS

I. INTRODUCTION

A. Rationale for a Written Safety Plan

1) A written safety plan is an indelible outline of the steps that are to be followed. It eliminates the uncertainties of memory and provides a checklist for preparing to go on site.

2) A written report, prepared for someone else's review, forces you to identify and organize the available data and then construct a logical, coherent, and workable plan based upon these data.

B. Levels of Safety Plan

There are four basic levels which have been described: A, B, C, and D. All except Level A can and should be tailored to the conditions.

1) Level A. This is rarely modified. It is used in confined facilities or sites where there are known percutaneous hazards. It is also used on a site where there is absolutely no established history.

2) Level B. The primary piece of equipment here is the SCBA-MSA 401 unit. The other items listed for Level B can be mixed, matched, added to, or eliminated as the site requires. However, any change requires a justification.

This level is used whenever there is any danger of a respiratory problem. This could mean a possible lack of oxygen, such as the replacement of oxygen by heavier gases generated on landfills, or the potential presence of gases that are hazardous to breathe. This level will be used on any site where you have enough information to eliminate the possibility of cutaneous damage but do not have the information necessary to identify or quantify gases which can cause respiratory damage.

3) Level C. The most important point here is the use of the Ultra-twin respirator. Due to the inherent liabilities of the Ultra-twin, the Robert Shaw Escape Pack must be carried at all times. The other portions can be mixed and matched, as in Level B. The use of Level C must be justified. That means, among other things, that all potential vapors in the area must be identified and quantified. Furthermore, Level C requires constant air monitoring in order to justify its continued use.

4) Level D. This level is basically the use of safety shoes and clothing that are suitable for covering the terrain being examined. Again, this level is flexible and should be tailored to the individual case.

C. Modification of Safety Plans

Safety plans are subject to modifications by the personnel on-site. In those cases where the danger appears to be greater than had originally been anticipated, the site safety officer has the option of withdrawing the team immediately or increasing the level of safety immediately. Underestimating the danger should occur very rarely. If the danger has been overestimated and the site can be examined at a lower level of protection, the site safety officer has this prerogative. However, in order to lower the safety level, the site safety officer or the Team Leader must obtain permission. This can be accomplished with a telephone call justifying the modification.

2. RESOURCES FOR DEVELOPING SITE SAFETY PLANS

A. <u>State Agencies</u>

The name of the relevant agency varies in different states. Basically, however, those agencies that are concerned with hazardous wastes and/or health will be the best source of material.

B. <u>Local Agencies</u>

1) The local health department

2) Any county agency involved with waste management

C. <u>Company Officials</u>

3. DEVELOPMENT OF A SAFETY PLAN

A. <u>Standardized Safety Floor Plan Format</u>

Use of cover memo to explain rationale for choices in the format.

B. <u>Examples of Various Safety Plans, Methods of Development, and Pertinent Information</u>

1) Level D - "Dial-a-Safety Plan"

a) Correlate desk information (cf. #2 above)

b) Visit State offices

c) Visit company officials

d) If a site visit is desired on a preliminary assessment, decide if Level D is appropriate (by using the above information), then call your safety officer and explain your reasoning for entering at Level D. If the safety officer is agreeable, then go on site. If the safety officer is not agreeable, then scratch the site visit.

e) Prepare a report detailing reasons for entry (or no entry) and results.

2) Level B reconnaissance --"Mine Sweeping"-- with a downgrade to Level D if possible

a) Background search

b) Work plan

c) Field procedures

d) Downgrading to Level D

e) Use of safety ropes

3) Level A - "Moonsuits"

a) Background search

b) Reconnaissance visit

c) Development of work plan and safety plan

d) Field procedures

e) Sampling

f) Cleanup

4. SUMMARY AND CONCLUSIONS

D

SITE SAFETY CONSIDERATIONS AND PERSONNEL DECONTAMINATION STATION OPERATION PROCEDURES

1. INTRODUCTION

   A. Objective
   To provide an understanding of how to organize for hazardous waste site investigations, safe entry and return from the site, and personnel decontamination station (PDS) operations.

   B. Sequence of Presentation

   - Organization of the field investigation area
   - Organization for work
   - Entry to the hazardous site
   - Site safety procedures
   - Exit from the hazardous site
   - Decontamination procedures
   - Closing the personnel decontamination station

2. EXPLANATION

   A. Organization of the Field Investigation Area

      1) Hazardous waste site

         a) Definition

b) Perform reconnaissance

c) Determine boundaries

2) Exclusion (control) area

a) Buffer zone around hazardous site

b) Contain gross contamination within the area

c) Always treat as contaminated

d) Size may be adjusted

3) Hot Line

a) Upwind of hazardous site

b) Arbitrary line on ground

c) Should be visually obvious

d) Deliberate attempt to control contamination

e) Location may be adjusted

4) Access Control Points

a) Points to control entry and exit from hazardous site

b) Proper protective equipment required

5) Contamination Reduction Area

a) Every effort made to remove all contamination

b) Set up in clean and clear area

c) Contains the Personnel Decontamination Station (PDS)

6) Contamination Control Line

   a) Separates contaminated zone from clean area

   b) Arbitrary line on ground

7) Administrative area

   a) Houses command post and all support functions

   b) Located unwind of PDS

B. Organization for Work

1) One example of how to organize for a worst-case situation.

2) Team Leader - Duties and responsibilities

3) Equipment Man/PDS Operator - Duties and responsibilities

4) Safety Officer - Duties and responsibilities

5) Work Party - Duties and responsibilities

C. Entry to the Hazardous Site

1) Brief work party

2) Check wind direction

3) Check and bag equipment

4) Check protective equipment

5) Communication checks

6) Entry

7) Maintain contact

D. Site Safety Procedures

1) Observe buddy system

2) Be deliberate in actions

3) Maintain contact

4) Practice contamination avoidance

5) Follow predesignated routes

6) Characterize site

   a) Radiation

   b) Oxygen levels

   c) Explosive hazard

d) Buried metal

7) Monitoring weather conditions

E. <u>Exit from the Hazardous Site</u>

1) Exit time is pre-planned based upon air supply available

2) Leave contamination at site

3) Be deliberate in actions

4) Observe buddy system

F. <u>Decontamination Procedures</u>

(Refer to graphic representation provided.)

G. <u>Closing the Personnel Decontamination Station</u>

1) Hot-line personnel perform equipment decon

2) Dispose of expendable wastes and decon solutions on site

3) Decontaminate protective clothing so that it's ready for future use

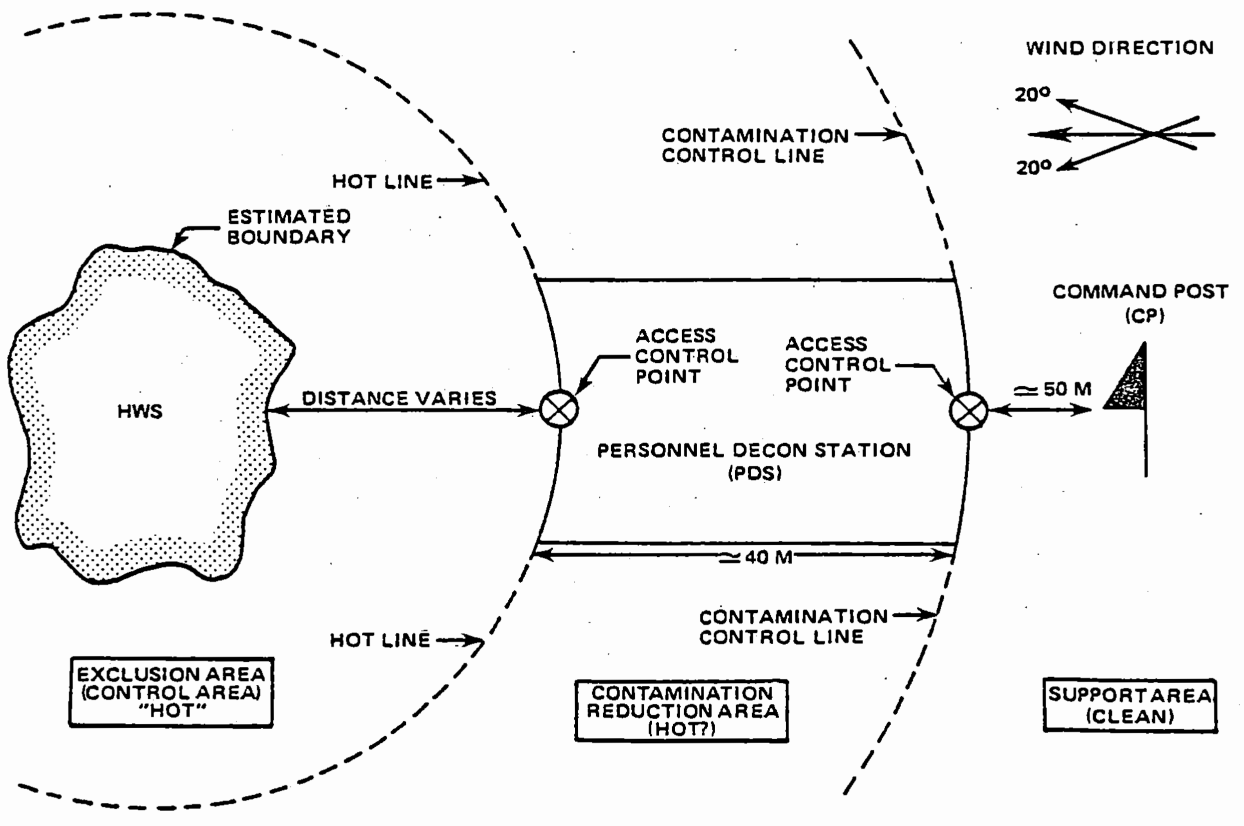
SEQUENCE OF PRESENTATION

FIELD OPERATIONS AND DECONTAMINATION PROCEDURES

- ORGANIZATION OF THE FIELD INVESTIGATION AREA
  - HAZARDOUS WASTE SITE
  - EXCLUSION AREA (CONTROL AREA)
  - CONTAMINATION REDUCTION AREA
  - SUPPORT AREA (ADMINISTRATION AREA)
- ORGANIZATION FOR WORK
- ENTRY TO THE HAZARDOUS SITE
- SITE SAFETY PROCEDURES IN HAZARDOUS AREA
- EGRESS FROM THE HAZARDOUS SITE
- PDS PROCEDURES (DECONTAMINATION)
- CLOSING THE PDS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ORGANIZATION OF THE FIELD INVESTIGATION AREA



SITE SAFETY PROCEDURES

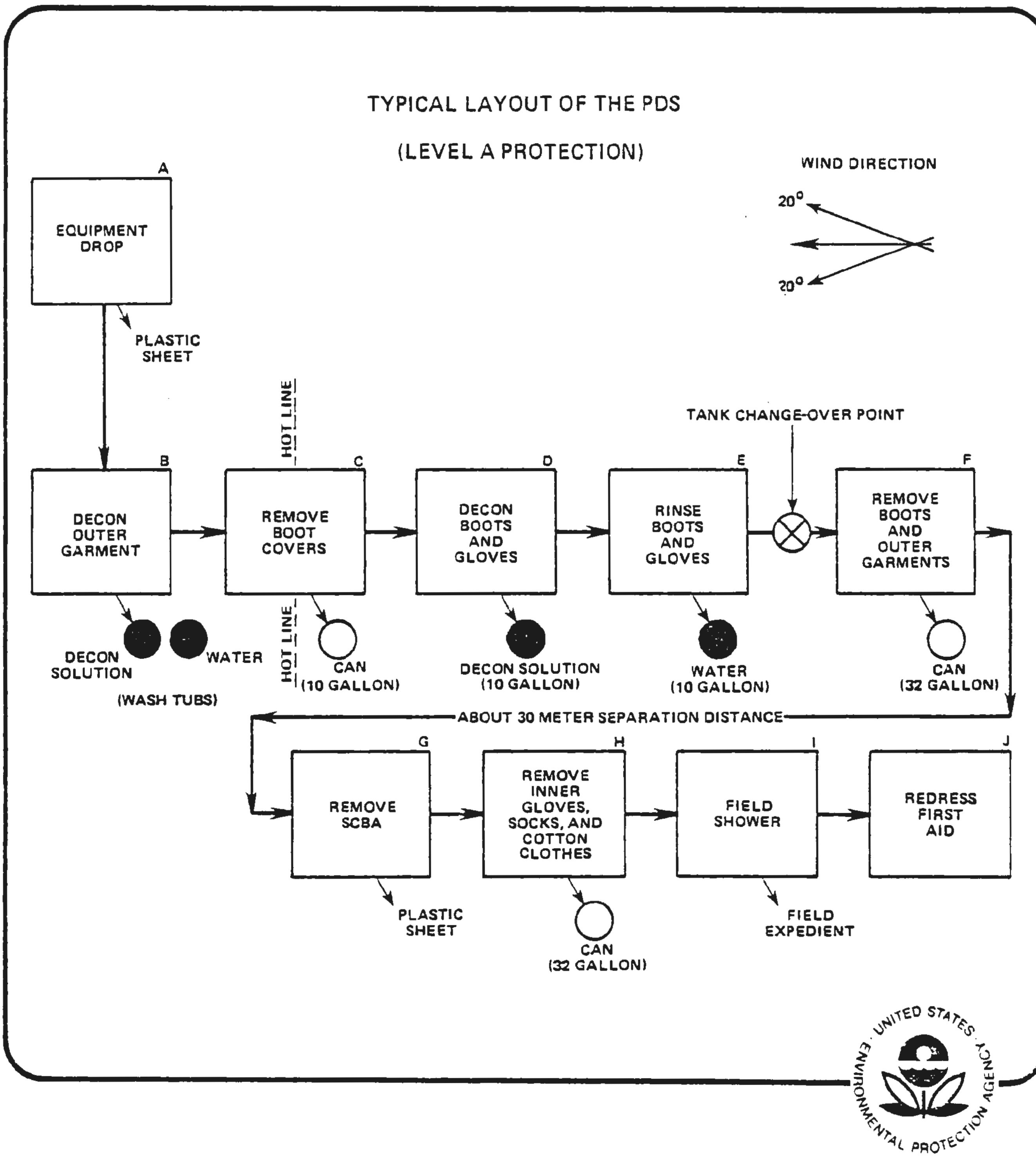
- OBSERVE BUDDY SYSTEM
- PLAN YOUR ACTIONS—BE DELIBERATE
- MAINTAIN CONTACT WITH SAFETY OFFICER
- PRACTICE CONTAMINATION AVOIDANCE
  - DON'T SIT OR KNEEL ON GROUND
  - DON'T GROUND EQUIPMENT
  - AVOID OBVIOUS CONTAMINATION
- DON'T CLIMB OVER BARRELS OR OBSTACLES
- FOLLOW PREDISIGNATED ROUTES
- MONITOR (AS REQUIRED) FOR
  - RADIATION
  - O_2 LEVELS
  - EXPLOSIVE HAZARD
  - BURIED METAL
- MONITOR WEATHER CONDITIONS
  - HEAT STRESS
  - COLD (FROSTBITE)
  - ELECTRICAL STORMS
  - WIND DIRECTION

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

EGRESS FROM THE HAZARDOUS SITE

- EGRESS IS A PLANNED ACTION——NOT A NECESSITY
- DECONTAMINATE KNOWN CONTAMINATION (I.E., GLOVES) AT THE SITE
- MAINTAIN CONTACT WITH SAFETY OFFICER
- BE DELIBERATE
- DON'T LEAVE THE SITE ALONE

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY ·


TYPICAL LAYOUT OF THE PDS
(LEVEL A PROTECTION)
WIND DIRECTION
20°
20°
A
EQUIPMENT DROP
PLASTIC SHEET
HOT LINE
TANK CHANGE-OVER POINT
B
DECON OUTER GARMENT
C
REMOVE BOOT COVERS
D
DECON BOOTS AND GLOVES
E
RINSE BOOTS AND GLOVES
F
REMOVE BOOTS AND OUTER GARMENTS
DECON SOLUTION
WATER
(WASH TUBS)
HOT LINE
CAN (10 GALLON)
DECON SOLUTION (10 GALLON)
WATER (10 GALLON)
CAN (32 GALLON)
ABOUT 30 METER SEPARATION DISTANCE
G
REMOVE SCBA
H
REMOVE INNER GLOVES, SOCKS, AND COTTON CLOTHES
I
FIELD SHOWER
J
REDRESS FIRST AID
PLASTIC SHEET
CAN (32 GALLON)
FIELD EXPEDIENT
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CLOSURE OF PDS

- HOT LINE PERSONNEL PERFORM EQUIPMENT DECON
- DISPOSE OF EXPENDABLE WASTE AND DECON SOLUTIONS ON-SITE
- DECON PROTECTIVE EQUIPMENT FOR FUTURE USE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

E

FIELD SAMPLING

1. OBJECTIVE

The objective of this discussion is to present an overview of procedures and equipment for field environmental and hazardous waste sampling.

2. SAMPLING PLAN

A. General Considerations

1) The uniqueness of many sites calls for imagination in obtaining samples.

2) A sampling plan should be developed for the number, types, and potential locations of samples.

3) Development of a plan makes it possible to anticipate the sample containers and preservation techniques needed.

B. Criteria for Plan Development

1) Objectives of field investigation

2) Personnel safety

3) Background information on the site

4) Potential for off-site migration of contaminants

5) Constraints of laboratory availability and cost-effectiveness.

C. Case Study - Surface Water Sampling Plan

D. Determination of Sampling Location

1) Surface Water

a) Rivers, brooks, or streams running through or adjacent to the leach stream

b) Site surface impoundment

c) Upstream sample for background

2) Soil

a) Stains from spills or leaks

b) Low-running or non-running leachate seeps

c) Subsurface samples

3) <u>Groundwater</u>

a) Existing monitoring wells on site

b) Residential, municipal, or commercial wells close to site

4) <u>Air</u>

a) Upwind

b) Downwind

5) <u>Hazardous Samples</u>

a) Open drums or containers

b) Closed drums or containers

c) Surface impoundments

d) Saturated soil

3. WATER QUALITY SAMPLING

A. Surface Water

1) Surface Water Parameters/Equipment

a) pH meter - used to help establish general water quality, e.g., pH can affect solubility of agents migrating off site

b) Conductivity meter - used to indicate presence of suspended/dissolved agents migrating off site

2) Surface Water Sampling Equipment

a) Containers - For purgeable organics, use 40-ml vials with Teflon-backed septa; must be laboratory cleaned and dried. For metals, use high-density linear polyethylene wide-mouth 8 oz. bottles. For priority pollutant analysis, use half-gallon bottles. 500 ml polyethylene bottles and 16 oz. wide mouth jars can be used for other parameters.

b) Glass tubing - Lengths of 6 to 8 mm glass tubing can be used with a pipet bulb to obtain samples from streams with low flow; must be lab cleaned and dried.

c) Pond/lagoon sampler - Teflon container attached to telescoping aluminum handle or wooden dowel for safely obtaining samples form the shore of a pond or lagoon.

3) Sampling Methods

a) Most surface water samples for hazardous waste site are grab samples.

b) For stream samples, container may be immersed directly. For low-flowing leachate stream, glass pipet may be used.

c) For pond/lagoon sampling, divide surface area into grids. Try to obtain samples from several depths and from the sediment.

d) Sample preservation is best accomplished by placing in cooler. Biodegradation may be a problem with organics. Mercuric chloride may be used if long holding time is anticipated.

e) Field blanks of organic-free water should be used for quality control.

B. Groundwater Sampling

1) Groundwater Parameters

a) Water depth indicator equipment - to establish static level of well for determining well volume.

b) Well logs, if available from driller, may be used to provide information about depth of well - again to help determine well volume.

2) Groundwater Sampling Equipment

a) Air drive pump - Used to discharge well.

b) Bailers - Used to obtain samples; must be chemically inert.

c) Multi-level sampling devices (Bar-Cad) - May be used to obtain samples for vertical profiles of groundwater contamination.

3) Sampling Methods

a) Important to discharge static water in well to obtain true groundwater sample. Discharge of 2 or 3 volumes is perferable. Extensive sampling programs may involve longer pumping periods.

b) Chemically inert bailers (teflon/copper) must be used for organics. Rinse with methanol prior to obtaining sample.

4. SOIL SAMPLING

A. Soil Sampling Parameters/Equipment. Type of soil determines type of equipment.

B. Soil Sampling Equipment

1) For surface soil samples of obviously stained areas, disposable scoops or tongue depressors may be used.

2) A Cu/Be shovel may be used to obtain a quick subsurface sample.

3) A trier may be used to obtain a core sample.

4) Augers may be used to obtain deep soil samples.

C. Soil Sampling Methods

1) Divide surface area into grids; sample from each grid to obtain composite soil sample. 40 ml VOA vials or wide-mouth 8-oz. glass jars may be used.

2) Non-disposable items must be decontaminated.

5. CONCENTRATED HAZARDOUS WASTE SAMPLES

A. Liquid Samples from Drums (open), Lagoons, Tanks, Manholes, etc.

1) Sampling Equipment

a) Glass tubing with pipet bulbs

b) Evacuated sidearm flask attached to plastic tubing

c) Non-sparking hand vacuum pumps to withdraw samples from containers

d) Sample containers attached to a long handle

e) For open containers, use 8 oz. glass bottle with bakelite caps, teflon liners. Leave 10% ullage.

f) Use 40 ml septum vial for closed container

B. Solid Hazardous Waste Samples

1) Parameters - material exposed to air, water may be stabilized.

2) Equipment and methods for obtaining solid samples are similar to those for obtaining soil sample, i.e., grid system, triers, disposable scoops.

6. PACKAGING, LABELING AND SHIPPING SAMPLES

A. DOT Regulations

B. Packaging Equipment

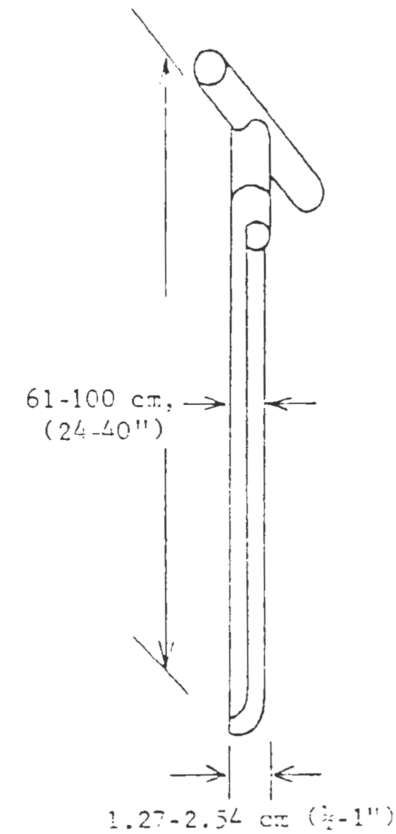
1) Sample bottles - small glass bottles, teflon-lined caps, 10% ullage to allow for expansion

2) Metal 1 gallon paint cans packed with zonolite or vermiculite to absorb shock or absorb spills.

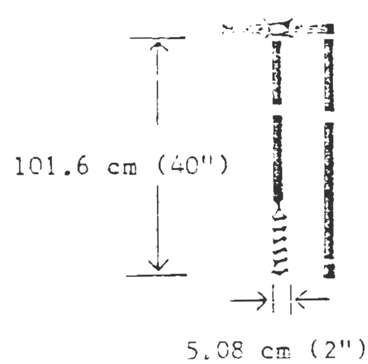
3) Coleman coolers to contain paint cans.

4) Steel gas cylinders with zonolite/vermiculite for hazardous samples from closed containers; lower sample container into cylinder with string.

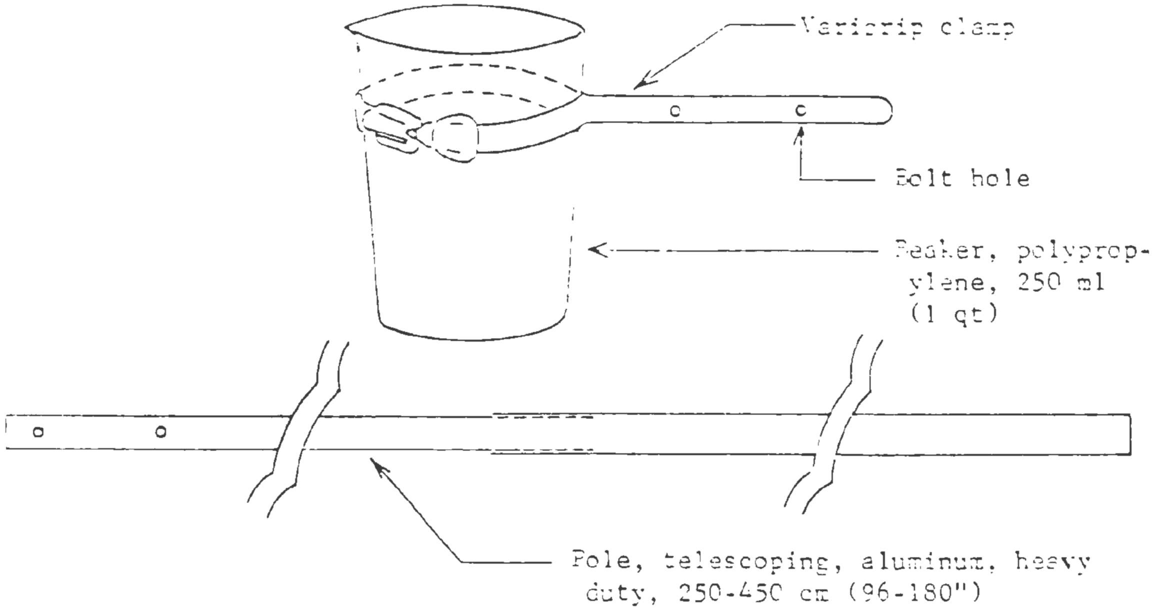
5) Affix appropriate labels and enclose chain of custody form.



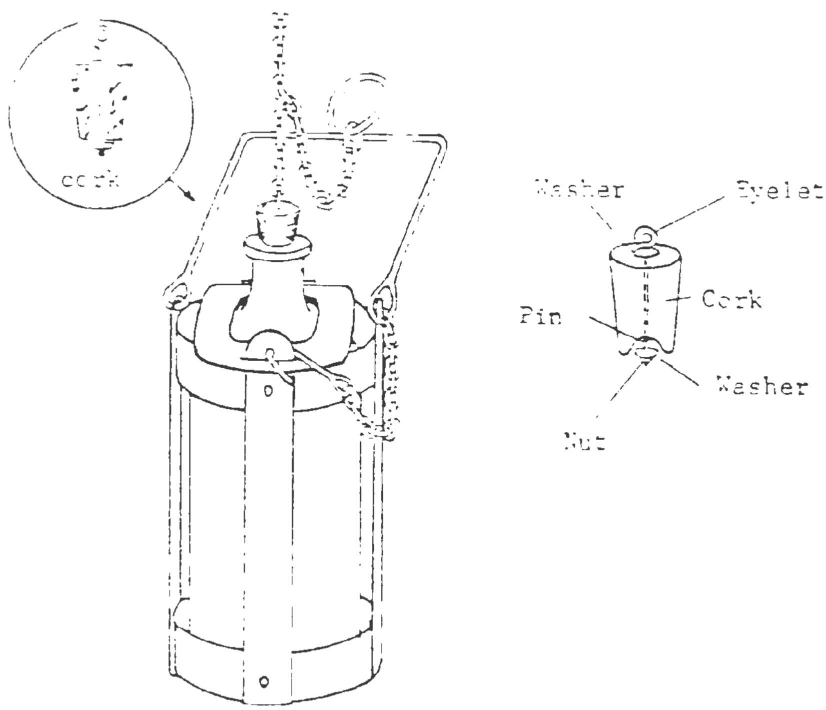
Sampling trier.



Soil auger.

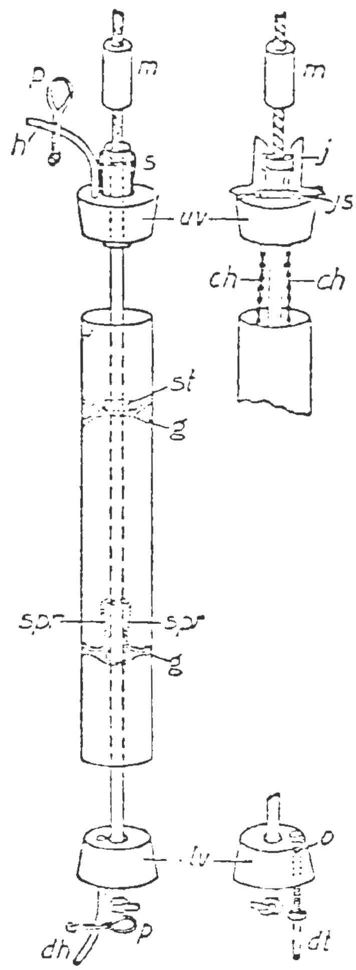


Pond sampler.



Weighted bottle sampler.

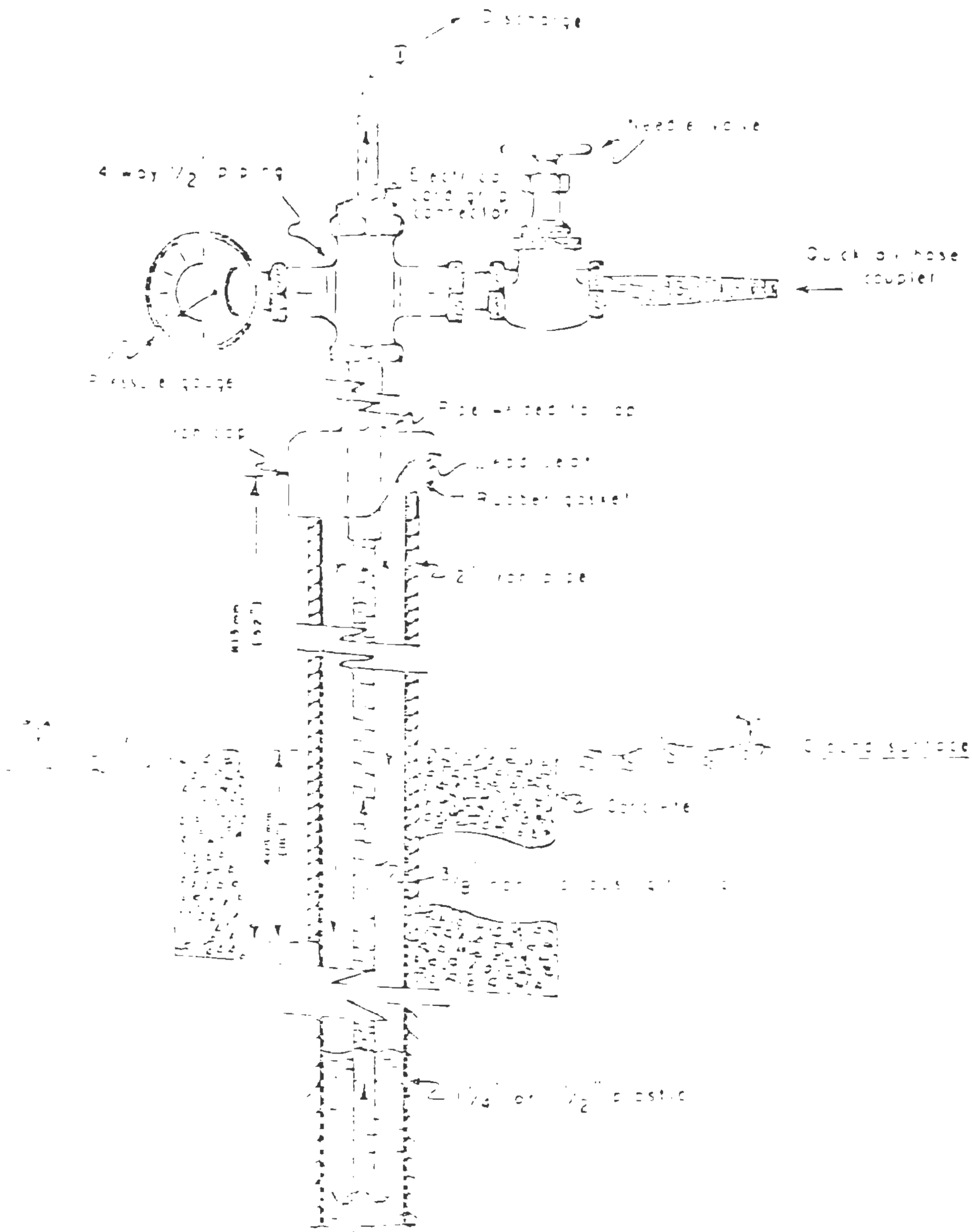
D 510



ch—chain which anchors upper valve to upper interior guide
dh—rubber drain tube.
dt—brass drain tube.
g—interior guide fastened to inner surface of sampler.
h—rubber tube.
j—jaw of release
js—jaw spring
lv—lower valve
m—messenger
o—opening interior of drain tube
p—pinch cock
s—upper release spring operating on horizontal pin, one end of which fits into groove on central rod.
spr—spring fastened to lower internal guide and operating in groove on central rod to provide for release.
st—stop on central rod
uv—upper valve
Left—View of complete sampler with valves open.
Top right—Another type of construction of upper valve and tripping device
Bottom right—Another type of construction of lower valve and drain tube

STRUCTURAL FEATURES OF MODIFIED KEMMERER SAMPLER

(P.S. Welch, Limnological Methods. p. 200. Figure 59.)



[illegible] AND
MECHANISM OF AN AIRLIFT PUMP.

(After Summerfeld & Campbell, 1975)

RANDOM SAMPLING

Random Numbers

03	47	43	73	86	36	96	47	36	61	46	98	63	71	62
97	74	24	67	62	42	81	14	57	20	42	53	32	37	32
16	76	62	27	66	56	50	26	71	07	32	90	79	78	53
12	56	85	99	26	96	96	68	27	31	05	03	72	93	15
55	59	56	35	64	38	54	82	46	22	31	62	43	09	90
16	22	77	94	39	49	54	43	54	82	17	37	93	23	78
84	42	17	53	31	57	24	55	06	88	77	04	74	47	67
63	01	63	78	59	16	95	55	67	19	98	10	50	71	75
33	21	12	34	29	78	64	56	07	82	52	42	07	44	38
57	60	86	32	44	09	47	27	96	54	49	17	46	09	62
18	18	07	92	46	44	17	16	58	09	79	83	86	19	62
26	62	38	97	75	84	16	07	44	99	83	11	46	32	24
23	42	40	64	74	82	97	77	77	81	07	45	32	14	08
52	36	28	19	95	50	92	26	11	97	00	56	76	31	38
37	85	94	35	12	83	39	50	08	30	42	34	07	96	88
70	29	17	12	13	40	33	20	38	26	13	89	51	03	74
56	62	18	37	35	96	83	50	87	75	97	12	25	93	47
99	49	57	22	77	88	42	95	45	72	16	64	36	16	00
16	08	15	04	72	33	27	14	34	09	45	59	34	68	49
31	16	93	32	43	50	27	89	87	19	20	15	37	00	49

HOW TO USE THE TABLE OF RANDOM NUMBERS:

1. Based on available information, segregate the containers (i.e., drums, sacks, etc.) according to waste types.
2. Number the containers containing the same waste types consecutively, starting from 01.
3. Decide on how many samples you wish to take. This number is usually determined by the objective of the sampling. For regular surveillance sampling, the collection of one or two samples is usually adequate. In this case, random sampling is not necessary. But for regulatory or research purposes, more samples (such as one sample for every group of five containers) taken at random will generate more statistically valid data. Hence if there were 20 drums containing the same type of waste, 5 drums have to be sampled.
4. Using the set of random numbers above, choose any number as a starting point.
5. From this number, go down the column, then to the next column to the right, or go in any predetermined direction until you have selected five numbers between 01 and 20, with no repetitions. Larger numbers are ineligible.

   Example: If you were to choose 19 as the starting point on column four, the next eligible numbers as you go down this column are 12 and 04. So far you have chosen only three eligible numbers. Proceed to the next column to the right. Going down and starting from the top of this column, the next eligible numbers are 12 and 13. But 12 is already chosen. Proceeding to the sixth column, the next eligible number is 16. Your five random numbers, therefore, are 19, 12, 04, 13 and 16. Thus the drums with corresponding numbers have to be sampled.

F

EMERGENCY PREPAREDNESS

1. INTRODUCTION

A. Need for Emergency Preparedness

Murphy's Laws are always in effect

B. Advanced Planning

1) Use of Safety Plan

2) Training of Individual Team Members

3) Medical Surveillance and Information on Team Members

4) Availability of Emergency Equipment

C. Anticipation of Problems: Use of preliminary assessments to determine potential physical problems that the Team Members will face.

2. TYPES OF EMERGENCIES

A. Medical Emergencies

5) Heat Exhaustion

6) Frost Bite

7) Stroke

B. Accidents

1) Broken bones

2) Burns

3) Sprains

4) Puncture wounds

C. Equipment Problems

1) Leaks in the Eastwind butyl rubber suit

2) Failure of the MSA 401 SCBA

3) SCBA failure when in butyl rubber suit

4) Failure of the Ultra Twin respirator

3. ADVANCED PLANNING

A. <u>Escape Routes</u>

1) On-site escape - rapid evacuation from hot area to safe area.

2) Off-site escape - best means for evacuation from site in case of catastrophe.

B. <u>Line of Sight</u>

A continuous line of sight must be maintained between work party at advanced portions of hot area and the PDS Operator or the Safety Officer.

1) If men are stationed beyond the PDS in order to maintain the line of sight with the work party, they must be appropriately dressed.

2) Safety Officer must be dressed to same degree as the work party in order to provide an extra man for any needed rescue effort.

C. Rapid Communication between Work Party and Safety Officer

Work party members must have system for rapid and clear distress call back to Safety Officer.

D. Telephone Numbers and Location of Emergency Services

1) Local Police Department

2) Local Ambulance Service

3) Local Hospital

4) Local Fire Department

5) Poison Control Center

E. Adequate and Clear Directions to the Site from the Locality of the Local Fire Department, Police Department, and Hospital

F. <u>Safety Training</u>

1) First Aid Training

2) CPR

3) Rapid removal of incapacitated team member

4) Special treatment in decontaminating procedures to be used on injured persons.

4. ANTICIPATION OF PROBLEMS

A. <u>Thorough Knowledge of Site</u>

B. <u>Thorough Knowledge of Expected Weather Conditions</u>

C. <u>Thorough Understanding of Task to be Performed</u>

D. <u>Thorough Briefing of ALL Team Members on ALL Aspects of the Tasks</u>

5. SUMMARY AND CONCLUSIONS

DAY 4

A

STATION #1

LOCATION AND SETUP OF COMMAND POST;
DRESS OUT

1. INTRODUCTION

Objectives. The objectives of Station I of the Field Exercise are to briefly discuss and present the equipment carried on the FIT Van, to discuss the method by which levels of protection are arrived at, to discuss on-site communications, to dress out in the various levels of protection; to discuss the layout on the Command Post (CP), and to discuss and practice emergency evacuation.

2. CP Layout The FIT Van serves as the primary piece of equipment in the Command Post (CP) and is the nerve center for on-site operations. Criteria for selecting a CP location include:

a. Wind direction

b. Terrain (line-of-sight, avenues of approach, Ingress and Egress)

c. Site location (ownership)

d. Location of roads, power lines, and developed areas.

e. Location of water and power

f. Location of inhabitants

3. FIT VAN EQUIPMENT

This will consist of a rapid overview of the equipment contained on and in a FIT Van. The equipment will be displayed and available for hands-on use as times permits.

4. COMMUNICATIONS

   A. Equipment

      1) CB and UHF Radios

      2) Other methods (horn, bell, flags, boards). Limited only by your imagination and the resources available.

   B. Procedures

      1) Radio

      2) Hand Signals, etc.

5. PERSONNEL AND PERSONAL PROTECTION

   A. Level D - (Demonstration)

   B. Level C - (Dress out of 1 individual by attendees)

   C. Level B - (Dress out of 1 individual by attendees)

   D. Level A -

      1) Dress Out Procedures - 1 Individual

      2) Airtank Change

      3) Stress Factors

      4) Attendees Dress Out in Modified Level A

6. <u>EMERGENCY EVACUATION</u>

A. SITUATIONS

1) Physical Injury

2) Equipment Failure

3) Panic or Distress

B. METHODS

1) Safety Officer

2) Emergency Response Team

3) Buddy System

C. EQUIPMENT

1) Wheelbarrow

2) Stretcher

3) Field Expedient Stretcher

4) Boards

5) Blanket

6) One-Man Carry/Drag

7) Harnesses

8) Swiss Seat

ATTACHMENT TO STATION #1

GENERAL SITE SAFETY PROCEDURES

1. INTRODUCTION

General site safety procedures are intended to protect individuals engaged in on-site activities. Compliance with established safety procedures is unquestionably one of the primary responsibilities of on-site personnel.

2. GENERAL SITE SAFETY PROCEDURES LIST

A. Plan site activities thoroughly ahead of time: Enter the site only to get to a designated point by a designated route for a specific purpose.

B. Always observe the buddy system: Never enter or exit a site alone, and never work alone in an isolated area.

C. Always maintain contact with the Site Safety Officer and Command Post.

D. Practice contamination avoidance: Never sit down or kneel; never ground equipment; avoid obvious sources of contamination such as puddles; avoid unnecessary contact with on-site objects.

E. Decontaminate known sources of contamination (such as gloves and boots) at the site.

F. Keep track of weather conditions and wind direction.

G. Never climb over or under refuse or obstacles.

H. Never assume that a situation is as safe as it appears to be.

I. Be alert to any unusual behavior on the part of other team members which might indicate distress, disorientation, or other ill effects.

J. Be alert to any unusual changes in your own condition; never ignore warning signs or hesitate to report them at once.

K. No eating, drinking or smoking pass the Contamination Control Line. This includes team members at the Personnel Decontamination Station and members of the Emergency Response Team. Avoid all hand to mouth contact while contamination of your clothing or body is possible (i.e., until after showering). Any open wounds must be covered with an air tight bandage; ideally, someone with an open wound should not enter the site. Persons with lesions or sores in the mouth will not enter the site.

COMMUNICATION PROCEDURES

1. GENERAL CONSIDERATIONS

   A. Do not use CB lingo

   B. Use standard procedures and nomenclature.

      1) Begin each transmission by identifying the party you are trying to reach; then identify yourself.

      2) Wait for acknowledgement.

      3) Talk plainly, enunciate each word.

      4) End each transmission with "over".

      5) Phonetic alphabet is given on the following page.

2. RECOMMENDED CALL SIGNS

   A. Command Post (CP) - EAGLE LEADER

   B. Safety Man/PDS - EAGLE SAFETY

   C. Work Parties - RECON ALPHA, RECON BRAVO, etc.

3. TYPICAL TRANSMISSIONS

   A. "Recon Alpha, this is Eagle Leader. Over."

      "Eagle Leader, this is Recon Alpha. Over."

   B. "Recon Alpha, you have been at the site 10 minuites. Begin your exit in 5 minutes. Over."

   C. "Eagle Leader, I understand your transmission and will comply. Over."

   D. "Recon Alpha, this is Eagle Leader. Out."

   NOTE: The party that originated the first transmission is the only party that can terminate the discussion.

PHONETIC ALPHABET

Letters	Numbers
A -- Alpha	1
B -- Bravo	2
C -- Charlie	3
D -- Delta	4
E -- Echo	5 (say Fiver)
F -- Foxtrot	6
G -- Golf	7
H -- Hotel	8
I -- India	9 (say Niner)
J -- Juliet	0 (say Zero)
K - Kilo	
L -- Lima	
M -- Mike	
N -- November	
O — Oscar	
P -- Poppa	
Q — Quebec	
R -- Romeo	
S -- Sierra	
T -- Tango	
U -- Uniform	
V -- Victor	
W -- Whiskey	
X -- X-ray	
Y -- Yankee	
Z -- Zulu	

B

STATION #2

EQUIPMENT OPERATIONS

1. OBJECTIVE

   To demonstrate the problems associated with the field use of the instruments discussed in Tuesday's lecture on air characterization and field sampling.

2. DESCRIPTION OF EXERCISE

   A. The participants will dress in tyvec suits, with disposable rubber gloves, and will wear the SCBA. Following a brief review of the operation of the instruments each person will receive one or more pieces of the equipment.

   B. The following exercises will be performed:

      1) The response of the explosimeter, Draeger tubes, the HNU photoionizer, and the OVA to methane and acetone.

      2) The response of the oxygen meter to methane (oxygen deficiency)

      3) The response of the thyac to a radiation source.

      4) Differentiation between methane and an industrial solvent (acetone)

      5) Operation of the metal detector

      6) Operation of the resistivity meter

MSA MODEL 2A EXPLOSIMETER

1. GENERAL DESCRIPTION AND APPLICATION OF THE INSTRUMENT

The instrument is used to test an atmosphere for concentration of flammable gases and vapors, so that the appropriate decisions can be made about personnel safety on a site. Tests are made with the instrument by drawing a sample of the atmosphere over a heated catalytic filament which forms part of a balanced electrical circuit. Combustibles are burned on the filament which raises its resistance in proportion to the concentration of combustibles in the sample. The resulting unbalance of the circuit cases a deflection of the meter pointer which indicates on the scale the concentration of combustible gases or vapors in the sample. The scale is graduated in percent of the lower explosive limit.

2. OPERATING INSTRUCTIONS

In an area known to be free of combustible gases or vapors, prepare the explosimeter for operation as follows:

A. Lift the end of the rheostat on/off bar and turn the rheostat knob one quarter turn clockwise. The meter pointer will move rapidly upscale and then return to zero or less than zero.

B. Flush fresh air through the instrument by squeezing the aspirator blub five times.

C. Adjust the rheostat knob until the meter pointer rests at zero. Clockwise rotation of the knob causes the meter pointer to move up scale. Avoid clockwise turning which results in moving the pointer much above zero, as this may shorten the life of the detector filament.

D. Place the end of the sampling line at the point where the sample is to be taken.

E. Aspirate the sample through the instrument until the highest reading is obtained. Five squeezes of the bulb are usually sufficient to give maximum deflection.

The graduations on the scale of the meter are in percent of the lower explosive limit. A deflection of the meter pointer between zero and 100% shows how closely the atmosphere being tested approaches the minimum concentration required for the explosion. *When a test is made and the pointer is deflected to the extreme right side of the scale and remains there, then the atmosphere under test is explosive. *If the pointer moves rapidly across the scale and on continued aspiration quickly returns to a position within the scale range or below zero, it is an indication that the concentration of flammable gases or vapors may be above the upper explosive limit.

F. Do not turn the instrument off until you have left the atmosphere being tested and you have flushed the instrument with fresh air.

3. LIMITATIONS AND WARNINGS

A. The instrument is not designed to work in an oxygen-enriched environment (O_2 above 25%) nor will it function properly in an oxygen-deficient atmosphere (below 19.5%). Therefore it should be used in conjunction with the oxygen meter to monitor the oxygen concentration.

B. The instrument will not indicate the presence of explosive or combustible mists or sprays such as lubrication oil or explosive dusts such as grain or coal dusts.

C. Care should be taken when sampling over liquids. Do not draw liquids into the instrument.

D. The following substances may "poison" the detection filament: leaded gasoline, silanes, silicones, silicates, or any silicon containing compound.

E. The relative humidity must be in the range of 10-90%.

F. The instrument has a tolerance of $\pm 40\%$. For example, a reading of 20% LEL could be as high as 28% or as low as 12%.

G. Do not switch the instrument on or off unless you are in a known combustible-free atmosphere.

H. The explosive limits for many gases and vapors are way above the TLV's for those substances.

I. Fuming acids will also "poison" the detection filament.

4. STANDARD OPERATING PROCEDURE GUIDELINES

A. If the % LEL is $<$20% - complete on site inspection.

B. If the % LEL is $>$20% - conduct careful survey to determine the source if possible

C. If the % LEL is $>$50% - withdraw immediately and notify the fire department.

DRAEGER TUBE AIR GRAB SAMPLER

1. GENERAL DESCRIPTION AND APPLICATION OF THE INSTRUMENT

The Drager Tube Air Grab Sampler consists of a bellows pump for drawing air and detector tubes which are chosen as a function of the measurement to be carried out. The detector tubes are available for a variety of gases and concentration ranges, but this may be best described as a semi-quantitative method. There are detector tubes available for gases which are not detected by the organic vapor analyzer and which would actually poison the filament of the explosimeter and oxygen indicator. Some examples would be hydrogen sulfide, sulfur dioxide, sulfur trioxide hydrogen chloride, hydrogen cyanide and chloride. The presence of any of these would obviously affect the level of protection needed on site. However, there must be sufficient background information available which would help determine the identity of the substances so that the proper tube could be selected.

The test is performed by drawing air through the detector tube and observing a color change or stain in the tube. Scale markings on the tube enable determinations of subsurface concentration.

2. OPERATION OF THE INSTRUMENT

A. Break off both tips of the Draeger tube in the break-off eyelet or in the break-off hust.

B. Insert the tube tightly into the pump head with the arrow pointing toward the pump.

C. Fully compress the bellows.

D. Straighten the fingers. The suction process takes place automatically and is completed when the limit chain is taut. (The bellows is calibrated to draw in 100 cm^3 of air per stroke. Since the suction of the pump is caused only by the relaxation of the springs, any subjective influence is excluded.)

E. Repeat the suction process as often as specified in the Tube Operating Instructions. (The nature of the tube filling will vary the resistance of the air coming through the tube, and the "opening time" of the bellows is therefore affected. Range of time is 3 - 40 seconds.)

F. Evaluate the indication as decribed in the tube operating instructions.

G. Remove the spent tube and dispose of it on site.

H. Before putting the bellows pump away, flush it out with air, making a few strokes without a detector tube in a clean environment.

3. LIMITATION AND WARNINGS

A. Try to establish from background information (interviews, etc.) the nature of the site contaminants so that an intelligent selection of a Draeger tube may be made.

B. When drawing air into a tube, keep your eyes on the tube to note any color change or stain development. For example, if you have selected a hydrogen sulfide tube with a sensitivity range of 0.5 to 1.5 ppm, requiring 10 strokes, and you are in an atmosphere of much higher concentration, the tube will quickly become fully developed after only one or two strokes.

C. Read the tube immediately upon completion of the last stroke. Elapsed time may affect the true reading.

D. Some tubes require that an ampule within the tube be broken to release a reagent before air is drawn through.

E. Because the tubes contain silica gel, high humidity may affect results.

F. Many types of tubes have cross sensitivities to other substances and will therefore give incorrect readings in atmospheres containing substances other than the gas being measured. These cross sensitivities are the result of several interactions.

MSA MODEL 245R OXYGEN INDICATOR

1. GENERAL DESCRIPTION AND APPLICATION OF THE INSTRUMENT

The oxygen indicator provides a quick and simple way to determine the concentration of atmospheric oxygen on site, which is essential to consider in making a decision about the level of respiratory protection required for site inspection personnel. Its use in conjunction with the explosimeter also renders information about the explosivity of the site atmosphere, i.e., as the upper explosive limit is reached in an atmosphere, the oxygen level decreases. The oxygen indicator also establishes the limits of oxygen concentration in which the explosmeter can function properly, i.e., 19.5% - 25%.

The actual sensing device consists of an oxygen specific permeable membrane which allows oxygen to pass into the sensor until the partial pressures equalize on both sides of the membrane. Once the oxygen is inside the sensor, there is an electrolyte solution which surrounds two electrodes. An oxidation-reduction reaction occurs in which the amount of current generated is directly proportional to the oxygen concentration. The change in current is detected by the meter circuit and the needle is calibrated to indicate oxygen concentration in percent which is read out directly.

2. CALIBRATION

The sensor is temperature-compensated from 32°F to 104°F. The indicator response time is increased in temperatures beyond the compensated range, partially below 32°F.

To calibrate, press the button on the right side of the case and expose the sensor to fresh air, allow the sensor to be exposed to fresh air until the meter reading stablizes, then set the meter at the 20.8% mark by rotating the calibration screw at top of the indicator case. The calibration is quite stable over long periods of time and will not require large connections until the end of the useful life of the sensor is reached. A need for more frequent and larger calibration is indicative of the need for sensor replacement.

3. OPERATION

After checking the reading of the indicator with fresh air, place the sensor in the atmosphere to be tested, press the button on the right side of the case, and read the oxygen concentration. In sample areas were the temperature is not constant (changes by more than 30°F) or in sampling atmospheres that differ in temperature from that of calibration air (by more than 30°F) the fresh-air reading should be rechecked every hour to obtain the greatest accuracy possible.

4. LIMITATIONS AND WARNING

A. Condensation of moisture on the sensor face will cause low O_2 readings. To avoid this problem, allow the sensor to reach ambient temperature before taking readings.

B. Strong oxidants such as fluorine, chlorine, and ozone will lead to erroneously high oxygen readings when these are present in concentrations exceeding 5,000 ppm or 0.5%.

C. Concentrations of CO_2 greater than 1% will reduce sensor life.

D. Changes in barometric pressure due to altitude will also have an effect on the meter reading. The instrument is calibrated for 20.8% O_2 at sea level (1 atmopshere). At higher altitudes, the meter will therefore indicate a lower percentage of oxygen by volume; however, adequate oxygen to sustain life is dependent on partial pressure rather than percentage by volume and a lower reading at a higher altitude is acceptable. We will anticipate this situation by consulting topographical maps of sites prior to inspection and inform the staff of necessary compensation for the oxygen indicator.

E. Relative humidity operating range is 10 - 90%.

F. Avoid touching sensor with hand or sharp objects, the membrane is easily damaged.

G. Acid mists or other corrosive atmospheres poison the probe.

H. Check atmosphere for explosivity before activating oxygen indicator.

5. STANDARD OPERATING PROCEDURES GUIDELINES

If the oxygen level is $<$ 19.5%, continue inspection with SCBA and identify oxygen-deficient area.

If the oxygen level is $>$19.5%, continue inspection; cartridge respirator may be allowed if other parameters permit.

FISHER M-SCOPE MODEL TW-5 METAL DETECTOR

1. GENERAL DESCRIPTION

The detector consists of the instrument itself, a carrying case, and an aluminum handle. It detects the presence of buried metal objects through the use of an induced electromagnetic field. The instrument consists of two principal components: (1) a directional radio-type transmitter and (2) a directional radio-type receiver. The function of the transmitter is to generate an electromagnetic field in a buried metal object, either through inductive or conductive methods. The directional radio receiver locates the metal object by detecting and tracing this field.

2. USE AND OPERATION

Refer to the operating manual for detailed instructions on assembly and maintenance. To locate a buried metal object such as a drum, the suspected area should be traversed systematically at intervals of three to seven feet. The object will be indicated by elevation in speaker tone and meter reading. Once the object has been approximately located, it may be pinpointed by holding the instrument in normal horizontal operating position and, while standing in one spot, slowly rotating the instrument through a 360° horizontal circle. If the operator's feet are directly over the object, variations in speaker tone and meter reading will be minimal. If not directly over the object, the operator will get a fluctuating reading.

3. MAINTENANCE

Batteries should be checked at least monthly. Spare batteries (type NEDA 1603 9-volt, paperclad) should be obtained.

Before each use, the unit should be checked out over some known buried object.

VICTOREEN MODEL 490 THYAC III SURVEY METER

1. GENERAL DESCRIPTION

The Model 490 is a pulse-count ratemeter and power supply. With the pancake detector probe, it acts as a survey meter for alpha-beta-gamma radiation. Operation range is 0-80,000 cpm or 0-20 mr/hr approximate radiation intensity with appropriate detector.

2. USE AND OPERATION

This instrument should be used only by persons who have been trained in the proper interpretation of its readings and the appropriate safety procedures to be followed in the presence of radiation. Failure to follow instructions may result in inaccurate readings and/or user hazard. Indicated battery and operational (checksource) tests must be performed prior to each use to assure that the instrument is functioning properly. Failure to conduct periodic performance tests in accordance with ANSI N323-1978, paragraphs 4.6 and 5.4, and to keep records thereof in accordance with paragraph 4.5 of the same standard, could result in erroneous readings of potential danger. Do not connect or disconnect any detector while the instrument is on. Wait two minutes after it is turned off before connecting or disconnecting any detector. Failure of transistors will occur if the instructions are not followed.

The ratemeter is designed for 100 hours continuous use on two "D" cells and longer with intermittent use. It requires trained personnel to interpret readings. Be sure to read the instruction manual before using. The instrument is in a weather proof case, which contains the two operating controls on top, the function switch, and response switch.

A low-intensity beta checksource is provided on the case. Temperature limits are -30° to +50°C (limits for batteries may be different). May be used with headset or audio speaker. May be put in plastic bag when appropriate to prevent contamiantion.

3. MAINTENANCE

Do not store with batteries in instrument. Replace batteries as indicated during the battery check done before each use. Recalibrate periodically.

C

STATION #3

DOWNRANGE CONSIDERATIONS

1. OBJECTIVE

The objective of the Downrange Considerations practical exercise is to provide an opportunity to experience the problems associated with operations in a toxic atmosphere. Through participation in an actual sampling exercise under simulated toxic conditions, the attendees will develop an appreciation for the planning, organizing, equipping, and physical hardships of operations in a toxic environment.

2. DEMONSTRATION

A. Using an attendee, the limitations associated with the wearing of protective equipment will be demonstrated.

B. Identification of an individual dressed in protective clothing is difficult.

1) Positive identification of entry party members is essential for control and safety.

2) Identify by system such as:

a) Marking with colored tape

b) Masking tape with name marked by felt tip marker

c) Names marked on hard hats

d) Names written on protective clothing

3) Be sure to put marking in spot visible even when all gear is being worn.

C. Demonstration of simple problems associated with protective clothing.

D. Demonstration of visual acuity problems encountered while wearing a protective mask.

E. Demonstration of dexterity problems encountered while wearing protective gloves.

F. <u>Summary of teaching point for the class.</u>

1) As you increase the use of protective equipment you:

a) Decrease the ability of the individual to perform simple tasks.

b) Decrease individual dexterity and mobility.

- o Ability to carry equipment

- o Ability to turn knobs and adjust equipment

c) Present vision problems.

- o Visual acuity

- o Field of vision

- o Ability to ue optical equipment

2) Because of the encumbrance of protective clothing:

a) Keep tasks simple

b) Plan fewer tasks per individual

3) Wearing of protective equipment will require:

a) More time than normal to do a task

b) More people than normal to do a given task

3. DISCUSSION AND ORGANIZATION OF THE ENTRY PARTY PRACTICAL EXERCISE

A. This practical exercise is based upon an actual sampling mission conducted by the Region II Technical Assistance Team following the explosion and fires in the Chemical Control Corp. site, Elizabeth, N.J.

B. Before entering a site, you need to know:

1) The toxic hazards associated with the site.

2) The specific mission or tasks to be performed in the site.

3) This information then is used to develop the level of protection to be used and the organization of the team.

C. For this exercise, it is assumed that:

1) Air monitoring of the site has revealed:

a) Toxic concentrations above TLV

b) A broad mixture of toxic agents

c) No percutaneous agents.

2) Based upon the air monitoring, personal protection is prescribed as follows:

a) Self-contained breathing apparatus

b) Disposable coveralls

c) Boots

d) Gloves

D. The mission of the entry party will be to take two samples: one soil sample and one water sample.

E. The instructor now selects members of the class for each team position and describes the team member's duties and responsibilities as he selects them.

1) Entry Party Team Captain

a) In charge of the entry party while downrange.

b) Responsible for the overall safety of the party.

c) Acts as the recorder for the sample data.

d) Carries the radio and maintain communications with the hot line party.

e) Stays in the rear of the entry party to observe all operations and safety practices.

f) Monitors the time remaining on air tanks to determine the time required for exiting the site.

g) Carries a clipboard, ball point pen, and radio.

2) Photographer

a) Takes photographs of sample locations and procedures as documentation for subsequent report.

b) Places himself in the middle of the party when entering the site.

c) Instructor issues the team member a Polaroid camera and ball point pen.

3) Monitor

a) Monitors for explosive atmosphere and oxygen content of the air. If the oxygen content is below 19.5% or above 25%, the explosimeter will not operate.

b) Serves at the lead member as the team proceeds down range.

c) Instructor issues the team member an explosive gas meter and an oxygen meter.

4) Sampler

a) Takes one soil sample and one water sample.

b) Places himself in the middle of the party when entering the site.

c) Issued a spatula for taking the soil sample and a glass tube for taking the water sample.

5) Sample carrier

a) Carries the sample bottles.

b) To uncap the bottles, hold them while the sample is put in them, and recap.

c) Wears a double set of gloves for a demonstration to be conducted at the sample point.

d) Places himself in the middle of the party when entering the site.

e) Instructor issues the team member the two sample bottles.

F. Consideration for Other Team Members

1) Use of guides to avoid special hazards which might be present in the site.

2) If entry party will be out of direct line of site of the hot line:

a) Observers stationed on tall buildings, hill tops, or other high observation point.

b) Observers placed within the site at intermediate points where they are in site of the hot line and can still observe the work party.

3) A separate safety observer

4) Additional equipment carriers

G. General Considerations

1) Team entry and exit routes should be planned.

2) A detailed work plan should have been developed and practiced if necessary.

3) There should be an emergency evacuation signal established such as portable air horns, beating a wrench on a container, etc.

H. Dress Out

1) Care must be taken during SCBA checkout to prevent damage to the units.

2) As soon as the entry team is ready, they should be arranged in the proper order and taken to the hot line.

4. DOWNRANGE OPERATIONS

A. Entry

1) Team members hook up air masks.

2) Team captain conducts check of team members and arranges members in proper entry sequence.

3) Team crosses hot line and proceeds toward sample area.

4) Appropriate team members operate the oxygen and explosive gas monitoring equipment.

B. Soil Sample

1) Sample carrier uncaps bottle and holds it out to receive sample.

2) Sampler uses spatula to dig sample and put in bottle.

3) Photographer takes picture (2) of process.

4) Sample carrier recaps bottle.

5) Team captain records time, type of sample, and sample point.

6) Incorrect Techniques

a) Kneeling on ground

b) Squatting in such a manner as to transfer contaminate from boots to clothing.

c) Leaning or sitting on trees, drums, or equipment.

7) Use ground cloth for kneeling or placement of equipment.

C. Water Sample

1) Sample carrier uncaps bottle and holds it out to receive sample.

2) Sampler uses glass tube to take water sample and put it in bottle.

NOTE: Dexterity problems usually occur causing the water sample to flow on the outside of the bottle and over the gloves of the sample carrier.

3) Photographer takes picture of process.

4) Sample carrier recaps bottle.

5) Team captain records time, type of sample, and sample point.

6) Sample holder changes outer gloves.

a) Change of outer gloves avoids contaminating a next sample that might be taken.

b) Change of gloves would be appropriate to prevent contaminating equipment.

c) Gloves could be changed to either a heavier or lighter weight to perform a different operation.

D. Exit

1) The team with the team captain in trail moves from the sample point to the hot line.

2) Samples are deposited for processing by hot line operators.

E. Packaging of Water Sample

1) One team member opens a plastic bags and holds it out to receive the sample.

2) Second team member affixes label to waste sample bottle and drops bottle into plastic bag.

3) First team member seals the plastic bag and puts it into a metal paint can.

4) Can void is filled with vermiculite.

5) Lid is attached to can and secured with metal clips.

6) Can containing the water sample is then put in a cooler filled the vermiculite.

5. SPECIAL CONSIDERATIONS

A. Team Members Feel:

1) Fatigue from the wearing of the mask and equipment.

2) Thirst from minor dehydration.

3) Hot from a temperature buildup due to the protective clothing.

B. Hot Weather Operations

1) Danger of:

a) Heat stroke

b) Heat prostration

c) Dehydration

2) Provide:

a) Fluid replenishment

b) Frequent rest periods

c) Work crew changes

3) Consider starting work earlier in the morning to avoid the hottest part of the day.

4) Establish temperature limits at which operations will be terminated.

C. Cold weather operations

1) Danger of:

a) Frost bite

b) Malfunction of equipment

2) Provide:

a) Frequent rest periods

b) Warming tents or areas

c) Frequent protection equipment checks

d) Work crew changes

D. <u>Prolonged Operations</u>:

1) Problems:

a) Accumulated work crew fatigue

b) Increased danger of accidents

c) Logistics problems associated with air tanks, protective clothing changes, food, and equipment

2) Consideration

a) Larger crews

b) Larger support element

c) More supervisors

d) Multiple work crews

6. SUMMARY

A. Operations in a Toxic Environment Require:

1) More time than normal

2) More people than normal

B. When Planning an Operation:

1) Keep tasks simple

2) Plan every detail of the downrange operation

3) Provide adequate logistical support.

4) Take into consideration any special conditions such as temperature or length of operation.

D

STATION #4

PDS OPERATIONS

1. INTRODUCTION

A. Objective To provide the student practical training in Setting up a Personnel Decontamination Station (PDS), processing contaminated personnel through the PDS, and properly closing the PDS.

B. Presentation of Scenario

1) Worst case situation

2) One work party to be decontaminated

3) Hot line to be moved back because of inadvertent contamination of former areas.

4) Safety Officer is designated. He is to take charge and direct actions of other team members.

2. PRACTICAL EXERCISE

A. Two of the students are dressed in Level A protection. Air supplies are reduced to approximately 6 minutes.

B. Remaining students reestablish PDS

C. Students in Level A exit area

D. PDS operators (dressed in modified Level B) perform step-by-step decontamination procedures.

E. Emphasis placed on proper undressing procedures

F. PDS operators decon equipment and each other (as required), and then close down site.

G. Protective gear is made ready for future use.

3. CRITIQUE

A. Attendees briefed on all deficiencies and shortcomings

B. Attendee questions discussed.

E

HEALTH AND SAFETY RIGHTS AND RESPONSIBILITIES

1. OBJECTIVES

   A. To provide an understanding of EPA's Occupational Medical Monitoring Program guidelines and their importance and limitations regarding employees engaged in hazardous waste site investigation.

   B. Explain the standards, Agency requirements, and availability and use of protective clothing.

   C. Explain the personnel rights and responsibilities under Occupational Health and Safety Act and Agency guidelines.

2. OCCUPATIONAL MEDICAL MONITORING PROGRAM

   A. <u>Legal Requirements</u>

      1) The Occupational Safety and Health Act of 1970, Section 19 states, "It shall be the responsibility of the head of each Federal Agency to establish and maintain an effective and comprehensive occupational safety and health program consistent with the standards promulgated under Section 6." Section 6 C(7).

      2) OSHA Safety and Health Standards, 29 CFR 1910 promulgated under Section 6 of the Act specifically requiring medical

examinations or medical surveillance.

a) 1910.134(b)(10) - Respiratory Protection

b) 1910.441 - Medical Requirements, Commercial Diving Operations

c) 1910.1000 - Toxic and Hazardous Substances

3) The proposed rule on Basic Program Elements for Federal Employee Occupational Health and Safety Programs, 29 CFR 1960.7(c) (7) requires that the agency provide funding for medical surveillance programs for employees.

B. <u>EPA's Occupational Medical Monitoring Program</u>

1) Memorandum of 1/13/77 issued guidelines for establising the Agencywide Health and Monitoring Program

a) Designed basically for laboratory employees

b) Did include employees who collect various types of polluted samples, i.e., stacks, sewage, highly toxic effluents.

c) Maintenance and custodial personnel who occasionally could be exposed to unexpectedly high concentrations of toxicants.

2) Memorandum of 3/6/78 issued Interim Guidelines for the Continuation of the Medical Monitoring Program.

a) Continue baseline examinations for new employees under the 1977 guidelines.

b) Provide screening medical monitoring for employees who had already received the baseline examination.

<u>Minimum</u>:

- o Internal medical and occupational history review
- o Basic blood and urine laboratory tests

3) Guidelines for FY 1980-81 were issued by Memorandum of 10/29/79.

a) Designed basically for laboratory and field workers

b) Recommended inclusion of part time and temporary employees

4) The Agency pays all costs of the Occupational Medical Monitoring Program.

5) The Program is voluntary with the exception of a few persons whose jobs require examinations as a condition of employment.

6) Frequency of examinations or screenings is still annual unless special testing is required because of a particular exposure.

7) Proposed Agency policies are expanding the number of job categories that will require preplacement and periodic health assessment examinations.

   a) Employees required to wear respiratory protection

   b) Employees engaged in field activities whose duties pose a possibility of exposure to toxic or hazardous substances.

8) Types of Examination we have discussed

   a) Baseline (preplacement or pre-employment)

      o Should consist of a complete medical examination

      o Provides a reference point for evaluating subsequent examination findings.

b) Screening Medical Monitoring

- o Detects whether an employee is suffering harmful or potentially harmful effects from work exposure, particularly toxic substances.

- o To determine if environmental controls (personal protective clothing and equipment) are effectively controlling the health hazards from job exposure

8) Types of examination <u>not</u> a part of an Occupational Medical Monitoring Program

a) Fitness Examinations - Must be reasonable and cannot be used to discriminate against an individual.

- o Return to work examinations.

- o "Safety" examinations

- o Examinations at the Request of the Supervisor

b) Health Promotion Examinations

- o Over 40 employees

o Employees in stress positions

c) Health Screening

o Diabetis

o Glaucoma

o TB

9) The EPA Occupational Medical Monitoring Program is not a substitute for a general health care program.

10) Although - Medical conditions noted during medical monitoring examinations not occupationally related are discussed and employee referred to personal physician is warranted.

11) The records established by the Medical Monitoring Program must meet the requirements of the Privacy Act of 1974.

12) OOHS recruiting for a medical doctor to handle the

Agency's medical monitoring program.

13) The Agency Occupational Health and Safety Manual will contain a chapter on the Occupational Medical Monitoring Program.

14) Participation in the Agency's Occupational Medical Monitoring Program is not a guarantee of good health.

C. Questions/Discussion

3. PERSONAL PROTECTIVE CLOTHING

A. Legal Requirements

1) Occupational Safety and Health Act of 1970, Section 6C(7) establishes the requirement for protective equipment.

2) 5 USC 7903 (1966) Clothing and equipment for protection of Federal employees

3) EPA Order 3100.1, Uniforms, Protective Clothing, and Protective Equipment

B. EPA's Protective Clothing and Equipment Program

1) Order 3100.1 established Agency policy "....will be prescribed for use, at Government expense, only where the wearing of such items is necessary because of the nature of the employee's duties."

2) Protective Clothing and Equipment

   a) Employees and visitors required to wear protective clothing and equipment while performing hazardous duties.

   b) Employees responsible for care of protective clothing and equipment, except disposable items.

   c) Personal protective equipment and clothing provided by the Agency.

3) Two ways to provide employees protective equipment and clothing.

   a) Direct issurance

   b) Payment of an allowance to employees

4) The 1972 EPA Order is broad enough to justify the purchase and use of any type of personal protective equipment and clothing required to protect employees involved in hazardous duties.

5) Proposed Chapter in Occupational Health & Safety Manual on Hazardous Waste Site Investigations and Environmental Spill Responses.

   a) Establishes levels of protection

   b) Makes recommendations for protective clothing and equipment at each level.

      - Level A

      - Level B

      - Level C

      - Level D

D. Personnel Rights and Responsibilities

1) Agency Responsibilities

a) Employment and place of employment free from recognized hazards

b) Comply with OSHA standards

c) Develop, implement, and evaluate an occupational safety and health program.

d) Promote employee awareness

e) Acquire, maintain, and require use of personal protective equipment and clothing.

f) Ensure that money is available for training, personal protective equipment, medical surveillance, etc.

g) Provide for evaluation of Agency management officials and supervisors in meeting requirements of the Agency's health and safety program.

h) Discrimination.

2) Supervisory Responsibilities

a) Furnish employees employment free of hazards to the extent of their authority.

b) Comply with all health and safety standards

c) Comply with all rules and regulations issued by the Agency.

Functions under the responsibilities:

Keep records, report injuries and illnesses, investigate accidents and exposure to hazardous conditions, identify and eliminate hazards, conduct inspections, communicate information to their employees, provide training, assure that employees use all required personal protective equipment.

3) Employee Responsibilities

a) Comply with all standards, rules, regulations and orders

b) Use personal protective equipment and clothing

c) Right to report unsafe or unhealthful working conditions

d) Right to request an inspection

e) Authorized time to participate in health and safety activities

f) Access to OSHA and Agency standards, injury and illness statistics, and procedures.

g) Right to appeal to the Department of Labor

h) Right to choose not to perform assigned task

  - o Reasonable apprehension of risk

  - o Reasonable belief no alternative action is available

  - o Disciplinary actions

i) On-the-job conduct regarding health and safety

- Observe all rules, signs and instructions

- Failure to report accidents

- Failure to use protective clothing and equipment

- Endangering the safety or causing injury to personnel or property through negligence.

E. Comments/Discussion

OBJECTIVES OF THE COURSE

- PROVIDE UNDERSTANDING OF EPA'S OCCUPATIONAL MONITORING PROGRAM
- EXPLAIN STANDARDS, AGENCY REQUIREMENTS, AVAILABILITY AND USE OF PROTECTIVE CLOTHING
- EXPLAIN PERSONNEL RIGHTS AND RESPONSIBILITIES

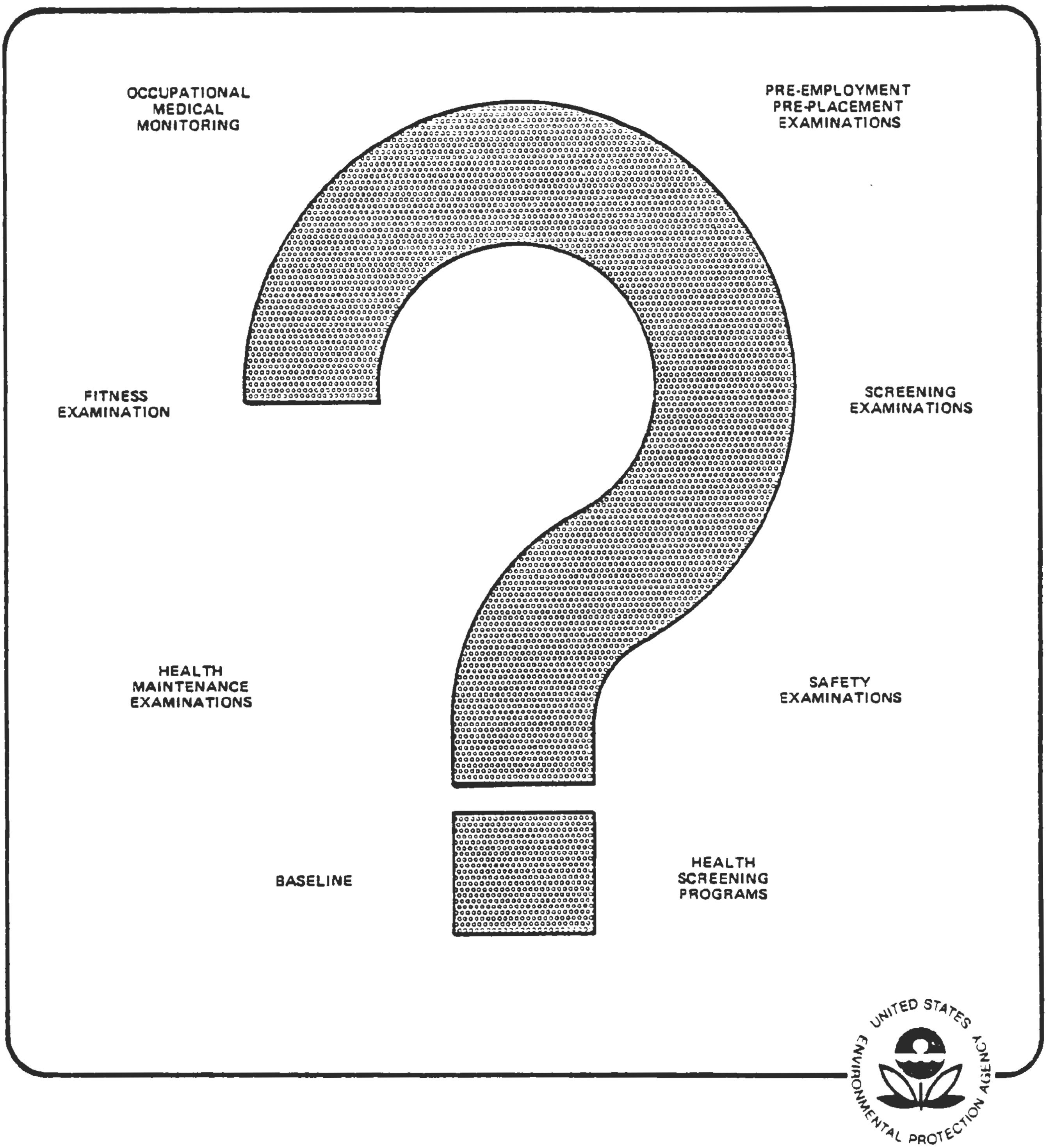
UNITED STATES · ENVIRONMENTAL PROTECTION · AGENCY

OCCUPATIONAL MEDICAL
MONITORING PROGRAM

LEGAL REQUIREMENTS

- OSH ACT OF 1970, SECTION 19
- 29 CFR 1910, OCCUPATIONAL SAFETY AND HEALTH STANDARDS
- AGENCY REQUIREMENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY


OCCUPATIONAL MEDICAL MONITORING
PRE-EMPLOYMENT PRE-PLACEMENT EXAMINATIONS
FITNESS EXAMINATION
SCREENING EXAMINATIONS
HEALTH MAINTENANCE EXAMINATIONS
SAFETY EXAMINATIONS
BASELINE
HEALTH SCREENING PROGRAMS
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EPA'S OCCUPATIONAL MEDICAL MONITORING PROGRAM

- AGENCY PAYS ALL COSTS
- PARTICIPATION IS VOLUNTARY EXCEPT WHERE EXAMINATIONS ARE A CONDITION OF EMPLOYMENT
- FREQUENCY — ANNUALLY
- PARTICULAR EXPOSURE MAY REQUIRE SPECIAL TESTING

EPA'S MEDICAL MONITORING PROGRAM

DOES NOT

- SUBSTITUTE FOR A GENERAL HEALTH CARE PROGRAM
- GUARANTEE YOUR GOOD HEALTH

DOES

- DETECT HARMFUL OR POTENTIALLY HARMFUL EFFECTS FROM WORK EXPOSURE
- DETERMINE IF CONTROLS ARE EFFECTIVE

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PROTECTIVE CLOTHING AND

EQUIPMENT PROGRAM

EPA'S PROTECTIVE CLOTHING AND EQUIPMENT PROGRAM

LEGAL REQUIREMENTS

- 5 USC 7903 – CLOTHING AND EQUIPMENT FOR PROTECTION OF FEDERAL EMPLOYEES
- OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970, SECTION 6(C) (7)
- EPA ORDER 3100.1 – UNIFORMS, PROTECTIVE CLOTHING, AND PROTECTIVE EQUIPMENT

LEVELS OF PROTECTION

LEVEL A – HIGHEST AVAILABLE LEVEL OF BOTH RESPIRATORY AND SKIN CONTACT IS NEEDED.

LEVEL B – HIGHEST LEVEL OF RESPIRATORY PROTECTION IS NEEDED BUT ADVERSE EXPOSURE TO EXPOSED SKIN AREAS IS UNLIKELY.

LEVEL C – AIR-PURIFYING RESPIRATORY PROTECTION AND SKIN CONTACT PROTECTION. EMERGENCY ESCAPE RESPIRATOR REQUIRED.

LEVEL D – BASIC WORK UNIFORM. AIR-PURIFYING RESPIRATOR AVAILABLE.

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LEVELS OF PROTECTION

LEVEL A

PROTECTIVE EQUIPMENT

- SCBA, OPEN CIRCUIT, PRESSURE-DEMAND
- TOTALLY ENCAPSULATED SUIT
- GLOVES
  - INNER – (SURGICAL)
  - OUTER – (CHEMICAL PROTECTIVE)
- BOOTS, STEEL TOE AND SHANK, CHEMICAL PROTECTIVE
- BOOT COVERS – CHEMICAL PROTECTIVE

CRITERIA

- KNOWN HAZARDS

  REQUIRE THE HIGHEST LEVEL OF RESPIRATORY PROTECTION

  WILL CAUSE ILLNESS AS A RESULT OF PERSONAL EXPOSURE

  REASONABLE DETERMINATION THAT PERSONAL EXPOSURE COULD OCCUR TO ANY PART OF THE BODY

- UNKNOWN HAZARDS

  REASONABLE DETERMINATION THAT THE SITE MAY CONTAIN SUBSTANCES LISTED UNDER CRITERIA FOR KNOWN HAZARDS ABOVE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LEVELS OF PROTECTION

LEVEL B

PROTECTIVE EQUIPMENT

- SCBA, OPEN CIRCUIT, PRESSURE-DEMAND
- CHEMICAL PROTECTIVE

  OVERALLS AND LONG-SLEEVED JACKET, OR COVERALLS
- GLOVES

  INNER – (SURGICAL)
  OUTER – (CHEMICAL PROTECTIVE)
- BOOTS, STEEL TOE AND SHANK, CHEMICAL PROTECTIVE
- BOOT COVERS, CHEMICAL PROTECTIVE

CRITERIA

- KNOWN HAZARDS

  REQUIRE THE HIGHEST LEVEL OF RESPIRATORY PROTECTION

  WILL CAUSE ILLNESS AS A RESULT OF PERSONAL EXPOSURE

  REASONABLE DETERMINATION THAT PERSONAL EXPOSURE TO AREAS OF THE BODY NOT COVERED IS UNLIKELY
- UNKNOWN HAZARDS

  REASONABLE DETERMINATION THAT THE SITE MAY CONTAIN SUBSTANCES LISTED UNDER CRITERIA FOR KNOWN HAZARDS ABOVE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LEVELS OF PROTECTION

LEVEL C

PROTECTIVE EQUIPMENT

- AIR-PURIFYING RESPIRATOR, FULL FACEPIECE
- EMERGENCY ESCAPE RESPIRATOR (CARRIED)
- CHEMICAL PROTECTIVE
  - OVERALLS AND LONG-SLEEVED JACKET
  - COVERALLS
- GLOVES
  - INNER – (SURGICAL)
  - OUTER – (CHEMICAL PROTECTIVE)
- BOOTS, STEEL TOE AND SHANK, CHEMICAL PROTECTIVE
- BOOT COVERS, CHEMICAL PROTECTIVE

CRITERIA

- KNOWN HAZARDS

  DO NOT REQUIRE A LEVEL OF RESPIRATORY PROTECTION GREATER THAN THE LEVEL AFFORDED BY AIR-PURIFYING RESPIRATORS

  WILL CAUSE ILLNESS AS A RESULT OF PERSONAL EXPOSURE

  REASONABLE DETERMINATION THAT PERSONAL EXPOSURE TO AREAS OF THE BODY NOT COVERED BY PROTECTIVE CLOTHING IS UNLIKELY

- UNKNOWN HAZARDS

  REASONABLE DETERMINATION THAT THE SITE MAY CONTAIN SUBSTANCES LISTED UNDER CRITERIA FOR KNOWN HAZARDS ABOVE

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

LEVELS OF PROTECTION

LEVEL D

PROTECTIVE EQUIPMENT

- COVERALLS, COTTON
- BOOTS/SHOES, SAFETY
- SAFETY GLASSES
- HARD HAT WITH OPTIONAL FACESHIELD
- ~~AIR~~-PURIFYING RESPIRATOR (READILY AVAILABLE)

CRITERIA

- REASONABLE DETERMINATION THAT HAZARDS DUE TO EXPOSURE TO HAZARDOUS MATERIALS IS UNLIKELY

PERSONNEL RIGHTS AND RESPONSIBILITIES

AGENCY RESPONSIBILITIES

- WORK AND WORKPLACE FREE OF RECOGNIZED HAZARDS
- COMPLY WITH OSHA STANDARDS
- DEVELOP, IMPLEMENT, AND EVALUATE A HEALTH AND SAFETY PROGRAM
- PROMOTE EMPLOYEE AWARENESS
- ACQUIRE, MAINTAIN, AND REQUIRE USE OF PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING
- PROVIDE SUFFICIENT FUNDS
- PROVIDE FOR EVALUATION OF MANAGEMENT OFFICIALS AND SUPERVISORS
- PROVIDE DISCRIMINATION SAFEGUARDS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUPERVISORY RESPONSIBILITIES

- FURNISH EMPLOYEES EMPLOYMENT FREE OF HAZARDS TO THE EXTENT POSSIBLE
- COMPLY WITH ALL HEALTH AND SAFETY STANDARDS
- COMPLY WITH ALL RULES AND REGULATIONS ISSUED BY AGENCY

SUPERVISORY FUNCTIONS

- KEEP RECORDS
- REPORT INJURIES AND ILLNESSES
- INVESTIGATE ACCIDENTS AND EXPOSURES
- IDENTIFY AND ELIMINATE HAZARDS
- CONDUCT INSPECTIONS
- COMMUNICATE INFORMATION TO THEIR EMPLOYEES
- PROVIDE TRAINING
- ASSURE THAT EMPLOYEES USE PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EMPLOYEE RESPONSIBILITIES

- COMPLY WITH ALL STANDARDS, RULES, REGULATIONS, AND ORDERS
- SHALL USE PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING
- RIGHT TO REPORT UNSAFE OR UNHEALTHFUL WORKING CONDITIONS
- RIGHT TO REQUEST AN INSPECTION
- AUTHORIZED TIME TO PARTICIPATE IN HEALTH AND SAFETY ACTIVITIES
- ACCESS TO OSHA AND AGENCY STANDARDS, INJURY AND ILLNESS STATISTICS, AND PROCEDURES
- RIGHT TO APPEAL TO THE DEPARTMENT OF LABOR
- RIGHT TO CHOOSE NOT TO PERFORM ASSIGNED TASK
  - REASONABLE APPREHENSION OF RISK
  - REASONABLE BELIEF NO ALTERNATIVE ACTION IS AVAILABLE
  - DISCIPLINARY ACTIONS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EMPLOYEE CONDUCT AND DISCIPLINE

- OBSERVE ALL RULES, SIGNS, AND INSTRUCTIONS
- FAILURE TO REPORT ACCIDENTS
- FAILURE TO USE PROTECTIVE CLOTHING AND EQUIPMENT
- ENDANGERING THE SAFETY OR CAUSING INJURY TO PERSONNEL OR PROPERTY THROUGH NEGLIGENCE

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY

F

AIR PURIFYING RESPIRATORS

1. INTRODUCTION

A. Objective

1) Discuss the use and applicability of air purifying respirators for use during the investigation of chemical waste sites.

2) Fit-test students with the MSA Ultratwin respirator.

B. Limitations of Air Purifying Respirators

1) Most are negative pressure

2) Not usable in O_2 deficient atmospheres

3) Cannot be used in IDLH atmospheres

4) Materials must exhibit good warning properties

5) Used where contaminants are known

6) Previous characterization and/or background research usually necessary

C. Application

1) Useful within the aforementioned constraints

2) Many facilities scheduled for investigation do not exhibit the chemical, nightmarish complexity typically associated with a classic definition of a hazardous waste site, or do many sites pose significant atmospheric or contact hazards

to investigators in well-ventilated areas during a site walk-through or other activity that does not disturb the soil or containers.

3) Other decision-making factors include a) historical research to confirm the presence of nonexotic chemicals b) determination that those chemicals likely to be encountered have a low odor threshold in comparison to their IDLH values, gradual does response curve, and minor, acute or chronic physiologic impact.

4) An air purifying respirator should be used for applications only when there is a compatible cartridge available and in areas that have demonstrated ambient ventilation.

5) At anytime there is reason to suspect a concentration remotely approaching an IDLH value, or the prospect of outgassing or heavier than air organic vapors, use of an air purifying respirator should be severely limited.

6) One must also confirm that the concentrations to be encountered do not exceed the recommendations of the manufacturer for that particular cartridge or canister.

7) After weighing these and other factors and deriving satisfactory answers, you may wish to consider use of an air purifying respirator.

2. AIR-PURIFYING RESPIRATORS

A. <u>Type</u>

1) 1/4 mask - covers mouth and nose

2) 1/2 mask - covers chin, mouth, and nose

3) Full face mask - covers entire face

4) Powered air purifying respirators

5) Chin mount canisters

6) Belt mount canisters and containers

7) Single use

B. Manufacturers

1) MSA, Willson, Pulmosan, Scott, Norton, Cesco, U.S. Safety, American Optical, 3-M

2) Most manufacture NIOSH-certified equipment, a factor that you should always consider. The bottom-of-line respirators (i.e., single use) may or may not be NIOSH certified.

2.3 MSA Ultratwin

1) MSA selected because of its national availability/distribution network, accessibility of parts, and excellent fit efficiency.

2) Same mold, cheek holes, modified exhalation valve assembly, and speaking diaphragms of MSA 401 SCBA.

3) Important parts include exhalation valve cover (rubber valve, air retention concept, examples of leak rates).

4) Inhalation valves; which cartridges are damaged by water vapor.

5) Cartridge gaskets

6) Options - glasses; Fog Pruf (P and regular); nose cup; cover lens.

3. CARTRIDGES/CANISTERS

A. Concept

1) Cartridges function on three basic principles according to the contaminant: adsorption, absorption, catalytic.

2) Different sorbents are used in each cartridge or canister depending upon manufacturer.

ADSORBENTS

organic vapors - activated charcoal
mercury vapor - activated charcoal with iodine
acid gas - activated charcoal with metal oxides
ammonia - activated charcoal with metal salts.

ABSORBENTS

acid gases - sodium or potassim hydroxide with lime or caustic silicates

CATALYST

carbon monoxide - hopcalite (porous granules of manganese and copper oxides)

MECHANICAL

dusts, mists, fumes, radionuclides, fibers) synthetic wools or similar mechanical filter

B. Protection Factors

1) Definition

2) PF x TLF = crude estimate of maximum exposure

3) Note that cartridges will sorb contaminants in excess of recommended limit but for a proportionately shorter period of time

4) Breakthrough for organics

5) Different respirators illustrate different protection factors (e.g., full face positive-pressure SCBA = 10,000+; full-face air purifying respirators = 100. Note additional protection afforded by SCBA)

C. Types

1) Canisters vs. cartridges (advantages, disadvantages; universal canisters)

2) Plastic vs. metal cartridge bodies; screw-on replaceable vs. non-replaceable filter.

3) Application and limitations discussed on each box and cartridge.

4) MSA manufactures nearly 20 different variations

5) Demonstration acid gas, pesticide, organic, HEPA (Note efficiency difference between HEPA and regular dust), Combination, and ammonia/methyl amine cartridges.

D. Useful Life of Cartridges

1) In traditional industrial use, cartridges are changed whenever the individual begins to smell the material or notice increased resistance to breathing. If you judiciously follow the criteria discussed earlier, this procedure is probably a safe rule of thumb. However, in our practice, even though we would never select an air purifying respirator in a situation even remotely approaching the limitations of a chartridge or in an IDLH atmosphere, we change the filters after each work shift (i.e., daily) or as deemed necessary by the safety officer.

2) Do not use if bent, distorted, or wet.

3) Useful life of generic organic cartridge is strongly dependent on the organic compound encounterd.

4. CLEANING/SANITIZING

RESPIRATOR FIT TESTING

1. OSHA regulations (29 CFR Part 1910.134) require that each person who wears a respirator shall have it properly fitted, test the facepiece for face seal, and wear it in a test atmosphere. In order to wear a respirator, the person must go through a fit test to determine whether the person can obtain a satisfactory fit with a "negative pressure" air-purifying respirator. The results of the fit test will be used to select the specific type, make, and model of "negative pressure" air-purifying respirator for use by the wearer.

   The following policies should be adhered to in the fitting and use of the respirators:

   A. A person must have passed the fit test in order to use any NIOSH/MSHA approved respirators.

   B. If it is found that a person cannot obtain a good respirator-to-face seal because of facial or medical characteristics, the person should not use and/or enter an atmosphere that will require the use of a respirator.

   C. Facial hair such as beards, sideburns, or certain mustaches which may interfere with the fit test are not allowable.

   D. Persons requiring corrective lenses shall be provided with specially mounted lenses inside the full-face mask. Under no circumstances will contact lenses and/or glasses be worn while using full-face respirators.

   E. Although fit testing for positive pressure SCBAs is not required as described in ANSI Z88.2 (draft revision 1978), a less than acceptable respirator-to-face seal will increase the use of air via leakage and therefore reduce effective breathing time. Such leaks may pose a hazard to the user if sufficient air supply is not available to reach an uncontaminated air supply.

   F. A person may only use the specific make(s) and model(s) of full-face, air-purifying respirators for which the person has obtained a satisfactory fit via the qualitative fit-testing procedures. Under no circumstances shall a person be allowed to use any make or model respirator not previously fit tested or having failed a fit-test period.

2. Fit-testing by use of a two-stage, cross-checking procedure provides the necessary quality assurance that the user of an air-purifying, cartridge/canister respirator is properly fitted and has a good facepiece-to-face seal.

A. Stage I

1) Negative Pressure-Sealing Checks for Air-Purifying Respirators

The wearer can perform this test by himself or herself in the field or office after donning the air-purifying respirator. It consists of closing off the inlet of the cartridge(s) to prevent the passage of air. This test is performed by closing off the inlet opening of the respiratory cartridge(s) by covering with the palm of the hand(s) so that it will not allow the passage of air, inhaling gently, and holding the breath for at least ten seconds. If a facepiece collapses slightly and no inward leakage of air into the facepiece is detected, it can be reasonably assumed that the fit of the respirator to the wearer is satisfactory.

This test is made only as a gross determination of fit when the respirator is to be used in relatively toxic atmospheres. Nonetheless, this test shall be used just prior to entering any toxic atmosphere.

2) Positive Pressure-Sealing Check for Air-Purifying Respirators

This test is very much like the negative pressure-sealing check. This test is preferred after donning the air-purifying respirator which contains an exhalation and inhalation valve. The test is conducted by closing off the exhalation valve and exhaling gently. The fit of a respirator equipped with a facepiece is considered to be satisfactory if a slight positive pressure can be built up inside the facepiece for at least ten seconds without detection of any outward leakage of air between the sealing surface of the facepiece and the respirator wearer's face.

This test is also to be used only as a gross determination of fit when the respirator is to be used in relatively toxic atmospheres. This test shall be used just prior to entering any toxic atmosphere.

Note: Both the positive and negative pressure-sealing checks can be used on the MSA Model 401 air mask to determine the gross fit characteristics.

B. Stage II

A person wearing an air-purifying respiratorwill be exposed to two test agents: isoamyl acetate (an odorous vapor) and stannic chloride (an irritant smoke). The air-purifying respirator will be equipped with an air-purifying cartridge which effectively removes the test agents from respired air. If the respirator wearer is unable to detect penetration of the test agent into the respirator, he has achieved a satisfactory fit.

1) Procedures for the Isoamyl Acetate Test

Isomayl acetate or banana oil is a chemical which produces a pleasant banana-smelling organic vapor. It is an easily detectable odor. The isoamyl acetate fit test will beconducted by using a plastic garbage bag as a test hood hung from the ceiling over a coat hanger suspended by twine. Inside the plastic bag, a piece of cloth saturated with isoamyl acetate is to be attached to the top portion of the bag. This procedure will produce a rough concentration of approximately 100 ppm in the test atmosphere inside the plastic bag. Most people can detect isoamyl acetate at 1-10 ppm. The permissible exposure is 100 ppm.

The isoamyl acetate fit test will be performed as follows:

- o The wearer puts on the respirator in a normal manner. If it is an air-purifying device, it must be equipped with a cartridge(s) specifically designed for protection against organic vapors.
- o The wearer enters the test enclosure, so that the head and shoulders are well inside the bag.
- o If the wearer smells banana oil, he returns to clean air and readjusts the facepiece and/or adjusts the headstraps without unduly tightening them.
- o The wearer repeats the second step. If he does not smell banana oil, he is assumed to have obtained a satisfactory fit. If he smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be located, another respirator of the same type and brand should be tried. If this leaks, another brand of respirator with a facepiece of the same type should be tried.

- o After a satisfactory fit is obtained, if the respirator is an air-purifying device, it must be equipped with the correct filter(s), cartridges(s), or canister for the anticipated hazard.

Note: During the test, the subject should make movements that approximate a normal working situation. These may include, but not necessarily be limited to, the following:

- o Normal breathing.
- o Deep breathing, as during heavy exertion. This should not be done long enough to cause hyperventilation.
- o Side-to-side and up-and-down head movements. These movements should be exaggerated, but should approximate those that take place on the job.
- o Talking. This is most easily accomplished by reading a prepared text and/or reciting the alphabet loudly enough to be understood by someone standing nearby.
- o Other exercises may be added depending upon the situation. For example, if the wearer is going to spend a significant part of his time bent over at some task, it may be desirable to include an exercise approximating this bending.

The major drawback of the isoamyl acetate test is that the odor threshold varies widely among individuals. Furthermore, the sense of smell is easily dulled and may deteriorate during the test so that the wearer can detect only high-vapor concentrations. Another disadvantage is that isoamyl acetate smells pleasant, even in high concentrations. Therefore, a wearer may say that the respirator fits although it has a large leak. Therefore, check out these test results carefully and move on to the next atmosphere.

2) Procedures for the Irritant Smoke (Stannic Chloride) Test.

This qualitative test is similar to the isoamyl test in concept. It involves exposing the respirator wearer to an irritating smoke produced by commercially available smoke tubes. These are sealed glass tubes, approximately 12 cm long by 1 cm in diameter, filled with pumice inpregnated with stannic chloride. When the tube ends are broken and air is passed through it, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke.

As a qualitiative means of determining respirator fit, this test has a distinct advantage in that the wearer usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of his giving a false indication of proper fit is reduced.

The irritant smoke test will be conducted by using a plastic garbage bag as a test hood. The bag will be hung from the ceiling over a coat hanger suspended by twine. A small hole is made in the top portion of the bag so that the irritant smoke can be dispensed into the bag when the test subject has entered the bag.

The irritant smoke fit test will be performed as follows:

- The wearer puts on the respirator normally, taking care not to tighten the headstraps uncomfortably. Once the respirator is on, the subject is to enter the suspended bag so that the head and shoulders are well inside the bag hood.
- Once the subject is inside the bag, the tester will begin to add the irritant smoke in small quantities at first, pausing between puffs from the applicator, listening for a reaction.
- If the wearer detects no leakage, the tester may increase the smoke density, still remaining alert to his reactions.
- At this point, if no leakage has been detected, the wearer may cautiously begin the head movements and exercises mentioned in the isoamyl acetate test. The tester should remain especially alert and be prepared to stop producing smoke immediately and remove the subject from the bag.
- If a leakage is detected at any time, the tester should stop the smoke and let the wearer out of the bag to readjust the facepiece or headstrap tension. The tester should then start the test at the second step.
- If at the end of all the movements and exercise the wearer is unable to detect penetration of the irritant smoke into the respirator, the respirator wearer has a satisfactory fit.
- Remove the subject from the test atmosphere.

A

ENFORCEMENT

1. INTRODUCTION

A. Objectives of RCRA

1) Provide technical and financial assistance.

2) Regulate management of hazardous waste.

B. Legislative Authority to Conduct Inspections - 3007 (a)

1) Purposes of inspection.

2) Guidelines governing conduct of inspection.

2. ROLE OF ENFORCEMENT PROGRAM

A. Administrative System

1) Screening reports.

2) Analyzing applicable reports.

3) Tentative disposition of cases.

4) Final strategy determination.

B. Inspection System

1) Enforcement functions of inspection.

2) Overriding criteria that guide the conduct of an inspection.

3. PREPARATION FOR INSPECTION

A. Objectives of Inspection Preparation

B. Responsibility of the Inspector

C. Administrative Preparation

1) Compliance file.

2) Sampling plan.

D. <u>Notification</u>

1) Suspicion of illegal discharges or dumping.

2) Desire to speak with specific individuals.

3) Methods of notification.

4) Information to be conveyed by inspector during notification.

E. <u>Inspection Equipment</u>

4. CONDUCTING THE INSPECTION

A. <u>Scope of Inspection</u>

1) Compliance evaluation.

2) Compliance sampling.

3) Types of inspections.

B. Entry Into a Facility

1) Introduction as EPA inspector.

2) Present proper EPA credentials.

3) Document entry in log book.

4) Consent may be withdrawn.

   a) Equivalent of refused entry.

   b) Warrant may be secured.

5) Consent not required for an inspection to observe and report on things in plain view.

   a) Includes during presentation of credentials.

   b) Inspector's access may be limited without warrant.

C. Pre-Inspection Discussion

1) Discuss provisions of the Act.

2) Furnish copy, if requested.

3) Outline objectives of inspection and order in which operation will be inspected.

4) Advise of right to request and receive split samples.

D. Sampling

1) Sampling plan checklist.

2) Sampling plan of action.

3) May be appropriate to conduct preliminary survey collection.

4) Sampling plan should include:

a) Telephone numbers, addresses and directions to nearest medical facility.

b) Ambulance service.

c) Fire department.

d) Police department.

e) EPA office contact.

5) Sampling points for enforcement purposes.

6) Volume of sample dependent on laboratory protocol and whether splits will be taken.

E) <u>Document Control</u>

1) Serialized documents.

2) Project logbooks.

3) Sample identification documents.

4) Chain of Custody.

   a) Splits aliquoted into similar sample containers.

   b) Identical sample tags.

   c) Possession of samples traceable.

   d) Sample custody.

   e) Field custody considerations.

   f) Transfer of custody and shipment.

5) Evidence audit.

F. Quality Assurance

1) Duplicate samples.

2) Split samples.

3) Spiked samples.

4) Sample preservative blanks.

5) Precision, accuracy and control charts.

5. POST-INSPECTION PROCEDURES

A. Post-Inspection Discussion

1) Discussion limited to specific findings.

2) Certain precautions.

B. Report Preparation

6. REFERENCES

Draft RCRA Inspection Manual, Fred C. Hart Associates, Inc., July 8, 1980.

Draft Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors. National Enforcement Investigations Center, EPA. April 1980.

Draft Guidance Manual for Investigation of Hazardous Waste Disposal Site. Office of Special Control Materials Division, EPA.

NEIC Policies and Procedures Manual. National Enforcement Investigations Center, EPA. May 1978.

SLIDE 1.

Objectives of RCRA

- o Provide techncial and financial assistance for the development of management plans and facilities for the recovery of energy and other resources from discarded materials and for the safe disposal of discarded materials.
- o Regulate the management of hazardous waste.

SLIDE 2

Purposes of Inspection

- Regulation development
- Enforcement (evaluation or sampling)
  - Compliance (§3007(a))
  - Imminent hazards (§7003)

SLIDE 3.

Guidelines for Conduct of Inspection

- Request Access
- Enter at reasonable times
- Conduct inspections with reasonable promptness
- Give sample receipts and, if requested, sample portions equal in volume or weight to the portion retained
- Furnish analytical results; and
- Make inspection results, unless found to be confidential, available to the public

SLIDE 4.

Enforcement Funtions of Inspection

- o Detect and document violations and discover imminent hazards
- o Support enforcement actions (evidence gathering)
- o Determine conformance with compliance and other enforcement orders

SLIDE 5.

Overriding Criteria of an Inspection

- Technical integrity of the inspection must be correct
- Legal requirements concerning the conduct of inspections must be scrupulously adhered to

SLIDE 6.

Objectives of Inspection Preparation

- To obtain and review all Agency information essential to conducting an effective inspection
- To permit completion of the scheduled number of inspections in a timely manner
- To minimize inconvenience to facility owners and operators by not requiring them either to explain or produce information which is already in the hands of the regulatory agency

SLIDE 7.

Preparation Materials

- A listing and copies of the RCRA and applicable state permits as well as TSCA, NPDES, CAA, and UIC requirements applicable to the facility
- A sketch or a copy of the survey map (U.S.G.S.) showing the waste facility location and environmental and geographical features
- Air photos with a scale of 1" = 100'
- A summary of names, titles, locations and phone numbers of the responsible persons (operators, municipal or industrial officials) involved with the facility's hazardous waste program. This information will be contained in the ADP (Automatic Data Processing) system to be developed
- A flow chart or design features of the present and planned facilities (if appropriate, include industrial production processes)
- Inspection reports from previous inspections, containing the compliance history of the site
- The permittee's most recent Monitoring Report
- A letter of notification of inspection to the facility and the response to the letter (if applicable)
- Any other recent correspondence and/or regulatory action, noting the status of requested actions/and or compliance with enforcement actions
- Previous EPA studies, consultant's reports, and laboratory reports describing non-routine analyses
- Citizen's complaints filed against the site
- Annual and other reports submitted by the facility
- State's and/or Region's enforcement history at the site

SLIDE 8.

Responsibility of the Inspector

- o Knowledge of permit conditions, compliance file, monitoring requirements, etc., before on-site visits
- o Knowledge of applicable EPA policies and procedures
- o Knowledge of what to look for in terms of environmental legislation other than RCRA
- o Inspection Scheduling
- o Adequate pre-inspection planning
- o Checking to see that a "Letter of Notification" of inspection has been sent to the facility if appropriate (not required by RCRA but may be useful in certain situations)

SLIDE 9.

Methods of Notification

- o Annual notification letter establishing requirement for inspections but not specifying a date
- o Letter notifying of an inspection within a month
- o Advance notification scheduling specific appointments
- o Unannounced, surprise entry

SLIDE 10.

Information Conveyed in Notification

- o Inspector's name
- o Organizational or agency affiliation
- o Purpose of the inspection
- o Authority under which the inspection is conducted
- o Procedures of the inspection
- o Where inspection to be conducted
- o With whom inspector needs to confer

SLIDE 11.

Inspection Equipment

- o Credentials
- o Safety equipment
- o Facility's compliance file and monitoring schedule
- o Camera (35mm, Polaroid)
- o Pocket tape recorder (for recording field notes)
- o Pocket calculator
- o Tape measure (engineer's tape -- 100 ft.)
- o Checklists
- o Sampling equipment
- o Documentation equipment
- o Level
- o Range finder/Optical tape measure
- o Compass
- o Stopwatch
- o Wind meter or Admiral Beauford Wind Scale
- o Square
- o Tools

SLIDE 12.

Scope of Inspection

- Record review -- an examination of facility records of tests and analyses performed, self-monitoring conducted, sampling performed, amounts and types of waste handled, manifests for wastes transported from or to the site, etc. The main purpose is to determine compliance with the Agency's recordkeeping and reporting requirements. The record review also will indicate evidence of incompatibility of wastes

- Cursory inspection -- a visual inspection documented briefly (grab samples might be taken). This is a possible mechanism for flagging violations under other programs as well as under RCRA, or for dealing with a specific aspect for a restraining order

- Preliminary survey -- an initial visual inspection. During the inspection sampling needs and locations may be identified and a general characterization of the site may be determined

- Comprehensive inspection -- a thorough visual and sampling inspection. This inspection often is preceded by a preliminary survey

- Sampling inspection -- an inspection consisting only of taking samples. This inspection may be triggered by a cursory inspection or preliminary survey in response to indications of potential violations. It is used mostly for enforcement purposes (i.e., case development)

SLIDE 13.

Entry into a Facility

- All inspections should be conducted at reasonable times or during normal working hours.
- Official agency credentials must be presented to the plant representative authorized to give consent to an inspection of the facility.
- Consent must be given by the owner of the premises or the person in charge of the premises at the time of the inspection. The person giving consent may be presented with a statement to sign acknowledging his consent which will be retained by the inspector and included in his inspection report.
- Consent must be secured without any behavior which could be characterized as coercive (either in a verbal or physical sense), such as threats of punitive action.
- The inspector should document the entry in the logbook and note date, time, and name of facility personnel encountered.
- Consent to the inspection may be withdrawn at any time. That segment of the inspection completed before the withdrawal of consent remains valid. Withdrawal of consent is equivalent to refused entry. A warrant should be secured to complete the inspection.
- Consent is not required for observation of things that are in plain view, i.e., that a member of the public could be in a position to observe, including observations made while on private property in areas that are not closed to the public, e.g., matters observed while the inspector presents his credentials. However, a warrantless inspector's access to any portion of the facility may be limited at the discretion of the owner of the facility.
- Consent may be given with "conditions". When such "conditional" consent is proposed, guidance should be sought from the DPO, Enforcement Director, or other appropriate Regional authority, prior to further activity. "Conditions' must be accurately recorded.

SLIDE 14.

Sampling Plan Checklist

- o Background research concerning waste
- o Identify safe sampling equipment
- o Identify safe sampling procedures
  - a. proper location(s)
  - b. volume of samples
  - c. collection procedure
  - d. containment and handling
- o Review chain of custody procedures
- o Review packaging, labelling and shipping requirements
  - a. identify samples
  - b. protect from tampering
  - c. fill out field notebook
  - d. complete sample analysis request sheet
  - e. complete receipt of sample form
- o Arrange for sample delivery

SLIDE 15.

SAMPLING POINTS FOR MOST WASTE RECEPTACLES

Receptacles	Sampling Point
Drum, bung on one end	Withdraw sample through the bung opening.
Drum, bung on side	Sample drums only if they are laying on side with bung up. Withdraw sample through the bung opening.
Barrel, fiberdrum, buckets, sacks, bags	Withdraw samples through the top of barrels, fiberdrums, buckets, and similar receptacles. Withdraw samples through fill openings of bags and sacks. Withdraw samples through the center of the receptacles and to different points diagonally opposite the point of entry.
Vacuum truck and similar containers	Withdraw sample through open hatch. Sample all other hatches.
Pond, pit, lagoons	Divide surface area into an imaginary grid[a]. Take three samples, if possible; one sample near the surface, one sample at mid-depth or at center, and one sample at the bottom. Repeat the sampling at each grid section over the entire pond or site.
Waste pile	Withdraw samples through at least three different points near the top of pile to points diagonally opposite the point of entry.
Storage tank	Sample from the top through the sampling hole.
Soil	Divide the surface area into an imaginary grid[a]. Sample each grid section.

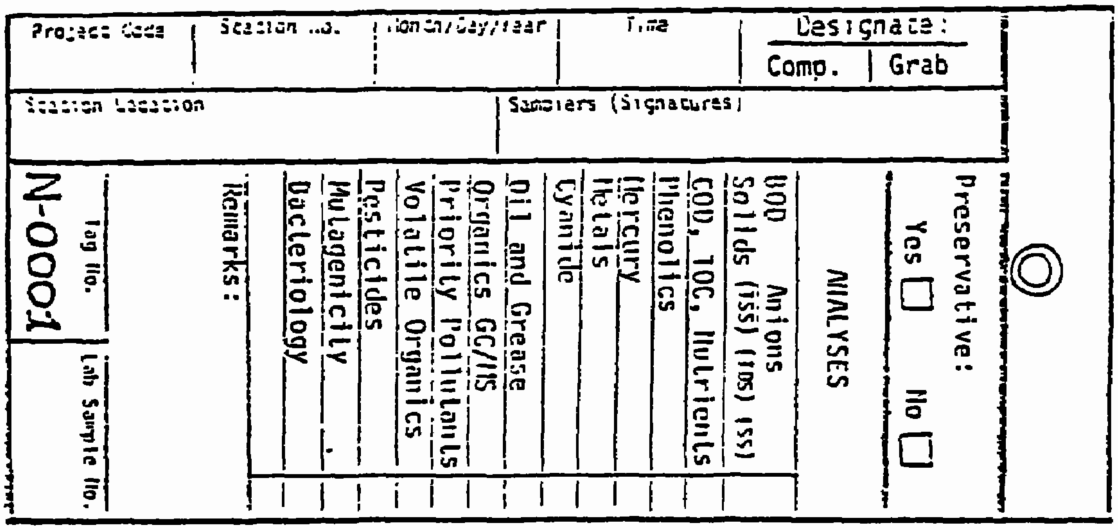
---

a The number of grid sections is determined by the desired number of samples to be collected which, when combined, should give a representative sample of the wastes.

Source: de Vera et al, "Sampling Procedures for Hazardous Wastestreams"; modified slightly by Fred C. Hart Associates, Inc.

SLIDE 16.

SAMPLE IDENTIFICATION TAG


Project Code | Station No. | Month/Day/Year | Time | Designate: Comp. | Grab

Station Location | Samplers (Signatures)

Preservative: Yes ☐ No ☐

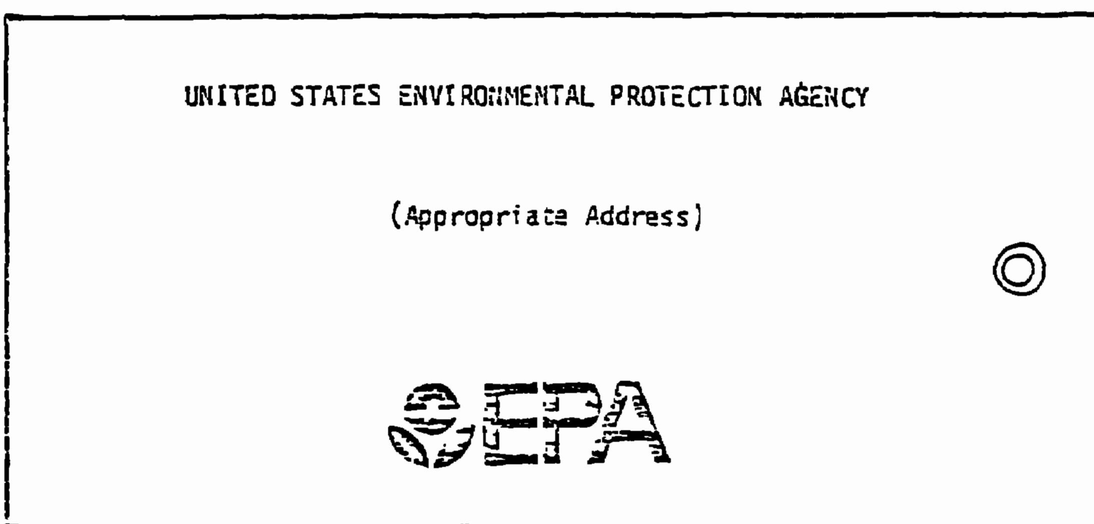
ANALYSES

BOD Anions
Solids (TSS) (TDS) (SS)
COD, TOC, Nutrients
Phenolics
Mercury
Metals
Cyanide
Oil and Grease
Organics GC/MS
Priority Pollutants
Volatile Organics
Pesticides
Mutagenicity
Bacteriology

Remarks:

Tag No. N-0001 | Lab Sample No.

(obverse)


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

(Appropriate Address)

EPA

(reverse)

SLIDE 17.

Sample Custody Considerations

- o A sample is under custody if:

  a. it is in the sampler's actual possession; or

  b. it is in the sampler's view, after being in his/her physical possession; or

  c. it was in the sampler's physical possession and then he/she locked it up to prevent tampering; or

  d. it is in a designated and identified secure area

- o Field Custody Considerations

  a. As few people as possible should handle the samples.

  b. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

- o Tranfer of Custody and Shipment

  a. Samples must be accompanied by a Chain-of-Custody Record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, or to the permanent laboratory.

  b. Whenever samples are split with a facility or government agency, a separate Chain-of-Custody Record is prepared for those samples and marked to indicate with whom the samples are being split.

  c. All packages will be accompanied by the Chain-of Custody Record showing identification of the contents. The original Record will accompany the shipment, and a copy will be retained by the inspector.

  d. If sent by a common carrier, a Bill of Lading should be used. Receipts of Bill of Lading will be retained as part of the permanent documentation.

SLIDE 18.

Chain of Custody Record
Instructions

The Chain of Custody Record will be filled out by providing the information requested. These information requirements are described below.

1. Project Number. The facility's EPA Identification number.

2. Project Name. The name and address of the facility.

3. Sampler(s). The EPA inspector(s) names.

4. Station Number. The number of the station from which a sample was taken.

5. Date. The date a sample was taken.

6. Time. The time a sample was taken.

7. Composite. Indicate if the sample was a composite sample.

8. Grab. Indicate if the sample was a grab sample.

9. Station Location. The direction (north, south, etc.) and proximity of the sample station to a benchmark.

10. Number of Containers. Number of sample containers taken from station and by each method of sampling.

11. Analysis Desired. Type of analysis desired to be performed on the waste, i.e. BOD, metals, insecticide testing.

12. Remarks. Additional information about the samples such as the type of media sampled or type of container sampled.

13. Relinquished by: (Signature). The signature of the sampler(s).

14. Date/Time. The date and time the sample was relinquished.

15. Received by: (Signature). Whoever receives the sample, most likely a shipper, must sign for it.

16. Received for Laboratory by: (Signature). The signature of a person at the lab who officially accepts the samples.

17. Date/Time. The date and time the sample is received by the laboratory.

18. Remarks. Final remarks about the samples after acceptance by the laboratory.

Note: Chain of Custody <u>must</u> continue for handling of the sample at the laboratory.

SLIDE 19.

RECEIPT FOR SAMPLES FORM

U.S. ENVIRONMENTAL PROTECTION AGENCY

RECEIPT FOR SAMPLES

NAME OF FIRM OFFICIAL	TITLE
FIRM NAME	ADDRESS (Street, City, State and Zip Code)
SAMPLE NUMBERS	

SAMPLES COLLECTED (Sample numbers, location, container, label information, sample description, and other positive identification.)

The following samples were collected by the U.S. Environmental Protection Agency and receipt is hereby acknowledged pursuant to the Resource Conservation and Recovery Act, Section 3007(a).

ACKNOWLEDGMENT OF OWNER/OPERATOR OR AGENT

The undersigned acknowledges that the sample(s) and/or document(s) described above were obtained at the location and under the circumstances described.

SIGNATURE (Owner, Operator, or Agent)	TITLE (Owner, Operator or Agent)	
[ ] DUPLICATE SAMPLES REQUESTED AND PROVIDED [ ] DUPLICATE SAMPLES NOT REQUESTED	SAMPLES WERE [ ] PURCHASED	[ ] NONPURCHASED
AMOUNT PAID FOR SAMPLES $ [ ] CASH	[ ] VOUCHER	[ ] TO BE BILLED
NAME OF COLLECTOR (Print or type)	TITLE OF COLLECTOR	SIGNATURE OF COLLECTOR

Note: This form is undergoing Agency review. A final form will be distributed at a later date, accompanied by a separate transmittal notice.

SLIDE 20.

Inspection Precautions

- o The inspector must:

1. Remember that his/her function is to observe and evaluate compliance while on Compliance Inspections. The overall compliance or noncompliance status of the facility is determined by the Enforcement Division upon review of the Inspection Report. Statements regarding compliance status and any legal effects or enforcement consequences should not be discussed with the permittee or facility operating personnel.

2. Realize that it is an unacceptable practice to recommend a particular consultant or consulting firm even if asked to do so. However, it is not unethical to suggest that the permittee, operator, or agent contact a professional society for advice concerning this matter.

3. Make no attempt to substitute his/her own judgment for that of plant operating personnel regarding details of operation.

I. Right of Entry

   A. Statutory Background

      1. Clean Air Act
      2. Clean Water Act
      3. TSCA
      4. RCRA (with recent amendments)

   B. Case Law

      1. <u>Marshall v. Barlows</u>
      2. Contractor cases

   C. How to get a warrant

      1. Contact regional enforcement attorney
      2. Preparation of affidavit

II. Witness for Enforcement Cases

   A. Expert witness or fact witness

   B. What you should expect

   C. Example of examination of a witness

B

AN INTRODUCTION TO SOME SURFACE GEOPHYSICAL METHODS FOR HAZARDOUS SITE ASSESSMENTS

1. INTRODUCTION

A. This section provides a brief introduction to some surface geophysical methods which can be used to assist and enhance site evaluations.

B. Geophysical methods may be:

1) Airborne

2) Surface

3) Downhole

C. They often may be applied equally as well to problems on or under water (fresh or salt) as well as terrestrial sites. This presentation will deal with selected terrestrial applications.

D. Geophysical measurements are generally considered an indirect as opposed to a direct measurement.

1) Coring or augering to evaluate subsurface strata is a direct measurement.

2) Seismic refraction or resistivity soundings are indirect measurements in that subsurface strata are inferred as a result of interpretation of geophysical data.

E. By their nature, these methods respond to changes of physical and/or chemical parameters at some depth. Hence, they can be considered remote sensing methods.

F. Some geophysical methods can provide virtually continuous data coverage along a survey line. Other methods provide station-by-station measurements.

2. REASONS FOR CONSIDERING GEOPHYSICAL OR REMOTE SENSING METHODS

A. To improve confidence levels in site assessments

1) Additional information provides increased confidence.

2) Some geophysical methods can provide details and spatial coverage unattainable by other means.

B. To provide a means of site assessment in cases where drilling could be harmful to the site (karst) or dangerous to personnel (drilling into unknown buried materials).

3. METHODS TO BE CONSIDERED

A. Ground Penetrating Radar (GPR)

B. Electromagnetics (EM)

C. Resistivity

D. Seismic Techniques

E. Metal Detectors

F. Magnetometers

Each method will be discussed separately, outlining basic concepts, advantages and limitations.

4. GROUND PENETRATING RADAR (GPR)

A. GPR produces subsurface information as a result of electromagnetic radar waves being reflected from soil and rock horizons or man-made objects. Data are often presented as a continuous graphic cross-section.

B. Radar reflections occur as a result of changes in the complex dielectric constant, which is an electrical property of materials. The complex dielectric constant varies with many physical and chemical parameters such as cementation, clay content, and moisture.

C. Considerable detail can be obtained by radar such as buried pipes, cables, buried materials, soil horizons and soil piping, rock surface, bedding, fractures and cavities.

D. Interpretation of radar data can assist in understanding complex geologic settings, permeable zones, and direct detection of hydrocarbons.

E. Depth of penetration is often limited and ranges from less that 1 meter to more than 20 meters. Shallow penetrations of 2 meters often can reveal significant information about deeper structures or activity. Example: Piping and deep-seated karst often manifest themselves in shallow data.

F. Degradation of radar performance (depth of penetration) will be caused by increased electrical conductivity (free ions). Performance also seems to be degraded in finer grained materials. Shallow radar performance is not necessarily degraded by increased moisture or even saturated soils and rock. Often, good quality data is obtained in saturated soils and rock.

G. Radar performance is highly site-specific. With few exceptions, at this time no reasonably reliable prediction of performance can be made without on-site testing. Radar performance is also frequency-sensitive, and the optimum antenna (frequency) must be selected based upon depth of penetration and resolution requirements (low frequency antennas provide better penetration and higher frequency antennas provide better detail).

H. A radar antenna can be manually towed over a site or pulled by vehicle to produce a continuous section. Other specialty approaches are available such as common depth point (C.D.P.), static measurements, and even downhole measurements.

I. Radar data can be used "raw" as direct output from a graphic recorder, or it may require computer processing before an interpretation can be made.

5. ELECTROMAGNETICS (EM)

A. EM produces a measurement of bulk electrical conductivity of the subsurface. The measurement is somewhat analogous to resistivity measurements; however, no electrode contact is necessary as current is induced inductively (by coils) into the ground.

B. Data from the EM technique are obtained as a continuous strip chart record or as discrete values from station-by-station measurements. In use, continuous measurements to 6 meters depths may be made by a field team traversing the site; or up to 15 meters depth by vehicle.

C. A change in electrical conductivity can occur as a result of changes in pore space, pore fluids, cementation, soil or rock types, or contamination. Therefore, EM is effective in mapping changes in the natural geohydrologic setting and mapping subsurface plumes from dumps and spills.

D. The continuous coverage of EM methods from less than a meter to 15 meters depth provides significant benefits.

1) Provides excellent spatial resolution

2) Can provide continuous surface coverage

3) Is relatively rapid and very cost effective

4) Raw field data can often be directly interpreted for first approximation results.

E. Station EM measurements are slower but can provide data in areas which cannot be traversed by continuous methods.

F. By carrying out multiple parallel passes, one can approach continuous two-dimensional spatial coverage. Three-dimensional coverage can often be obtained by utilizing multiple depth surveys.

G. Generally, EM techniques are most cost-effectively applied to profiling, lateral coverage at a fixed depth, although some sounding information (determination of the vertical changes) can be obtained.

H. EM performance is degraded by dense cultural features such as buried pipes, cables, fences, etc. Even in the most difficult situation, however, some data can usually be obtained.

I. Although raw EM data can often be utilized for preliminary assessment, there are significant benefits to data processing. Examples:

   1) Spatial corrections of data

   2) Removal of cultural features

   3) Filtering

   4) Obtaining statistical trends

   5) Plotting of composite sets of data

6) Plotting in three-dimensional perspective views

7) Plotting contour maps

6. RESISTIVITY

A. As with EM techniques, resistivity measures bulk electrical properties of the subsurface. This technique requires direct electrical contact with the earth via four probes driven into the soil. Therefore, measurements can only be obtained on a station-by-station basis and are slow compared to the EM technique.

B. Data can be obtained by spatially sampling at a "fixed depth"-- a technique called profiling; or by sounding, using a sequence of variable sampling depths.

C. This technique responds to changes in electrical resistivity* as a result of changes in pore space, pore fluids, cementation, soil or rock type, or contamination (as with the EM technique).

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*resistivity (OHM-Meters) = $\frac{1}{\text{conductivity}}$ (Mhos/Meter)

D. While the EM technique provides a much more effective tool for profiling, resistivity will generally provide more detailed sounding data. When used together in this way, the two methods provide a powerful, cost-effective combination of analytical tools.

E. Sounding data must be plotted vs. electrode spacing, which is related to sampling depth. This data can then be interpreted manually by use of master curves or by computer models for a multilayer earth. The results reveal the changes in resistivity with depth.

F. As with the EM method, resistivity is subject to cultural influences. In addition, near-surface variations can significantly influence results (small inhomogeneities near the potential electrodes). The technique is much slower than EM and therefore more costly, but does provide sounding data and can be adapted for measurements in unique situations.

7. SEISMIC REFRACTION & REFLECTION

A. The refraction method is traditionally applied to shallow problems to define thickness and depths of soil/rock layers as well as provide a measure of density or hardness. The method responds to a change in acoustic impendance from one layer to another, resulting in refraction of seismic waves. The measured value is travel time or velocity (Vp) of the seismic wave.

B. The refraction method has two inherent limitations:

1) Thin layer problem

2) Inverted velocities (high-velocity overlaying lower-velocity material)

C. While shallow surveys up to 50 feet in depth are often accomplished using a sledge hammer source, deeper surveys require larger energy sources.

D. As with the resistivity technique, measurements are made on a station-by-station basis and results must be plotted and interpreted. First-order results may be obtained in the field. Higher-order analysis may be obtained by computer processing.

E. The use of shallow reflection methods is relatively new. While it avoids some of the problems of refraction, there must be a sufficient reflection contrast to be seen, and at present the method is best used with reflectors at depths of about 10 meters and greater. The data will usually require more processing and interpretation than does refraction work. However, reflection does provide some unique possibilities to obtain solutions not reached by the refraction method.

8. METAL DETECTORS

A. Metal detectors are used to detect any type of metallic item. A variety of detector models can be found in the commercial market, which are mostly intended for use in the location of pipes and cables. The small hand-held treasure hunter models are generally intended for shallow targets.

B. Metal detectors respond to the high electrical conductivity of metallic targets.

C. Unfortunately, metal detectors are relativety near-field devices. Their sensitivity falls off as:

$$\frac{1}{(\text{distance})\ \text{exp}\ 6}$$

As a result, standard commercial devices can detect a single 55-gallon drum at a maximum distance of about 8 feet. This distance can be extended to about 10 to 12 feet with special systems.

D. Generally, metal detectors with larger coils will have greater detection distances, and targets with increased surface areas can be detected farther away. It is the surface area that makes the difference, not the mass of a target. This makes a 55-gallon drum a good target for a metal detector. In practice, reliable detection distances may be much less than the distances quoted above due to geologic and cultural noise.

E. Many detection systems are sensitive to capacitative effects (proximity to the operator, weeds, brush, etc.) as well as magnetic (iron oxides) content of soils or to conductive fluids associated with a dump site.

F. Besides improved detection distances, some special systems can provide a measure of target identification. They also provide for continuous recording of the detector output, which is invaluable in detailed site analysis if more than a yes or no answer is required of the detection survey.

G. Most detectors will fail to perform if lateral metallic objects such as fences are nearby. Special systems are available to cope with such problems and can be operated within 12 inches of chain link fences with full vertical sensitivity.

H. Detection surveys are made by the field crew walking over the site, or the system may be vehicle-mounted for coverage of large open areas.

I. In some simple cases, data may be analyzed in the field. In complex situations, data should be computer processed so that all data is spatially corrected as a minimum. Other processing such as performed on EM data may be used to enhance the data and its presentation.

9. MAGNETOMETRY

A. Magnetic surveys as used herein are intended for locating iron or steel (ferrous) objects such as steel drums, as opposed to geologic surveys.

B. A magnetometer responds to changes (distortions) in the earth's magnetic field caused by the presence of ferrous objects. A magnetometer will not detect non-ferrous metal such as aluminum, copper, tin, etc.

C. Compared to a metal detector, magnetometers can detect objects at much greater distances depending upon the specific system and its sensitivity. For example, a total field magnetometer can detect a single 55-gallon steel drum at approximately 30 feet or more.

D. A magnetometer's sensitivity for a discrete target such as a drum falls of as:

$$\frac{1}{(\text{distance})\ \text{exp}\ 3} \qquad \text{total field instruments}$$

$$\frac{1}{(\text{distance})\ \text{exp}\ 4} \qquad \text{gradiometers}$$

E. Even though it has a lower sensitivity, the gradiometer has considerable advantage in mapping and interpretation, as well as in reducing "noise" in the measurements.

F. Since a magnetometer responds to the presence of any ferrous object, operation near cultural features such as steel fences or near roads with passing cars may be an insurmountable problem. Special instruments and techniques are available to cope with these problems.

G. Many magnetometers (Proton) operate on a periodic sampling basis. Such systems should be avoided in favor of continuously sampling and recording systems. As with a metal detector survey, continuous recorded data is vital in assessing complex sites.

H. As with metal detectors, the survey team may walk a traverse or equipment may be vehicle-mounted or towed.

I. In simple cases, data can be directly interpreted in the field. On complex surveys or those requiring a semi-quantitative analysis, data is best processed by a computer.

10. COMPOSITE SURVEYS

A. Confidence levels are usually significantly improved by combining the results of geophysical and/or other methods. If for example, both the results of a seismic and resistivity survey indicate top of rock at a 20-foot depth, then we have a high level of confidence in the interpretation, even without drilling.

B. The results of a combined metal detector and magnetometer survey for buried drums can yield considerable information. For example, if no metal detector response is obtained and a reasonable magnetometer response is, then we may conclude that the drums are buried beyond the range of the metal detector. We now know something about the depth to the top of drums. The magnitude of the magnetic anomaly can then give us an estimate of the number of drums.

11. SUMMARY

A. The geophysical methods can provide many details on subsurface features. In certain cases, some types of geophysical surveys can provide details which would require enough drilling to make swiss cheese of the site. In others, extensive spatial coverage would require both a costly and time-consuming drilling project.

B. In cases where drilling can create problems such as in karst settings or be potentially dangerous such as drilling into explosive materials, the remote-sensing geophysical methods may provide the answers in a safe and cost-effective manner.

C. Geophysics is not a substitute for drilling or direct sampling, but when suitably combined with drilling, produces a far superior site evaluation.

D. Generally, maximum benefit is obtained from geophysical methods if they are used early in the site assessment phase. Often the optimum placement of drill holes is clearly shown by such data. Sometimes this optimum scheduling cannot be achieved. Then the geophysical results can be used to evaluate the placement of existing drill holes to assure they are in representative locations.

E. The geophysical methods are not a panacea in themselves. They need to be properly selected and applied by experienced personnel. Further, they require interpretation by incorporating sound professional geologic and hydrologic knowledge of the site blended with other geophysical and direct approaches.

APPENDICES

APPENDICES

A. Toxicology

B. Chain-of-Custody and Packaging, Marking, Labelling, and Shipping of Hazardous Waste Site Samples

C. EPA Occupational Health and Safety Policy

D. Setting Priorities for Activities Relative to Hazardous Waste Sites

E. Enforcement

F. Open

A

Toxicology

Objectives

Toxicology is the study of the harmful actions of chemicals on biologic tissues. To judge impending or potential toxicity requires an understanding of chemical reactions and interactions and an understanding of biologic mechanisms. The vastness of the subject and the rapid day-by-day increase in knowledge precludes the possibility that any one mind could absorb and retain more than a small fraction of this knowledge. However, certain principles of toxicology are applicable to a large number of chemicals and an understanding of these principles is essential for the development of insight into toxicological judgments.

It is the objective of this course to provide a concise description of the principles involved in human toxicology to prepare students to make reasonable judgments regarding potential and imminent risks of chemical-biologic interactions.

Our strategy will be to present general concepts as a foundation on which to discuss the specifics of the designated hazardous substances.

PRINCIPLES OF TOXICOLOGY

I. HISTORY

The word "Poison" may be used to describe materials or chemicals that are distinctly harmful to the body. In contrast, the word "food" is the term used for materials beneficial and necessary for body function. Experience has shown that there are degrees of harmfulness and degrees of safeness for any chemical. An important factor that determines the degree of harmfulness of a compound is the dose of that compound.

The word "Toxic" may be considered synonomous with harmful in regard to the effects of chemicals. Toxicology, defined as the study of the harmful actions of chemicals on biologic mechanisms, has developed into three principal areas. Environmental toxicology is concerned with harmful effects of chemicals encountered by man either incidentally in the atomosphere, by contact during occupational or recretional activities, or by ingestion. Economic toxicology deals with harmful effects of chemicals administered to biologic tissue for the purpose of achieving a specific drug effect. Forensic toxicology deals with medical and legal aspects of harmful effects of chemicals on humans.

II. PHARMACODYNAMICS

Introduction of chemicals into biologic organisms.

A. Inhalational route: The hazard following exposure to chemicals via the respiratory tract are particularly evident in industrialized urban areas of high-density population. The atmosphere in which people work is contaminated with a variety of chemicals. The American Conference of Governmental Industrial Hygienists has compiled a list of Threshold Limit Values (TLV's). These TLV's refer to airborne concentrations of substances under which it is believed that nearly all humans may be repeatedly exposed, day after day, without adverse effects.

TLV's are expressed as: ppm (parts per million parts of air by volume at 25°C and 760 mm Hg pressure) or as mg of particulate matter per cubic meter of air.

TLV's for respirable dusts, such as talc, cement, or asbestos, which are suspended in the air, are in terms of m.p.p.c.f. (millions of particles per cubic foot of air).

TLV's represent the average concentration over the period of time of measurement. A maximal value of contamination that should not be exceeded, is called the m.a.c. (maximal allowable concentration).

B. Oral route: Another common way by which a chemical enters the body is by mouth. Although it is within the body, the gastrointestinal contents are essentially exterior to the body fluids. Orally ingested chemicals can have a systemic effect on the organism only after absorption. Under ordinary conditions, the first site from which orally ingested chemicals can be effectively translocated is the stomach.

C. Enterohepatic circulation: This is a cycle involving translocation of the chemical from the intestine to the liver, and back to the intestine via the bile. The liver may biotransform or conjugate a chemical and excrete the conjugate which is then carried to the intestine and reabsorbed into the portal circulation. Both molecular size and degree of conjugation influence the biliary excretion of the compounds.

D. Parenteral route: This is the introduction of chemicals into the organism by means of injection of the chemical from a syringe through a hollow needle at specific sites.

III. TYPES OF TOXICITY

A. Nonspecific Action

Nonspecific action is caused by all caustic or corrosive chemicals and involves partial-to-complete destruction of all parts of biologic cells. Generalized destruction of cells can be produced by any chemical that is sufficiently soluble in tissue fluids to gain access to the cells in high concentrations.

B. Selective Action

Within the body normal molecular components of cells are capable of reacting with foreign chemicals. Such components may be referred to as targets for the foreign chemical. If the target chemical reaction alters the function of the cell, such targets are given the general term of "specific receptors". The same chemical may at the same time combine with, react with, or be adsorbed on other sites, but the function of the cells is not influenced by the product which is formed. Such combining sites are referred to as "silent receptors".

IV. BIOLOGIC FACTORS THAT INFLUENCE TOXICITY OF CHEMICALS

Factors that influence toxicity of chemicals are:

(A) Absorption and distribution
(B) Storage
(C) Tolerance
(D) Rate of metabolism
(E) Rate of excretion

A. Absorption and distribution of Chemicals

A chemical agent must come in contact with a reactant chemical in the biologic system if a chemical interaction or physical effect is to occur.

Membranous barriers influence transport of any chemical from the exterior to the interior of a cell.

Absorption across membranous barriers involves a series of steps and exposes the chemical to large endogenous molecules, such as proteins, which may effectively bind or functionally alter the chemical. During this process the chemical is subject to storage by some tissues, as well as excretion by the kidneys, respiratory tract, liver or secretory glands of the body.

.Following absorption the chemical can be:

1. Bound to plasma protein
2. Altered (biotransformed) by specific or nonspecific enzymatic systems present in various organs
3. Deposited in storage tissues
4. Excreted

Any chemical that is taken into the organism is immediately subjected to mechanisms that may alter its distribution within the organism or terminate its existence as a free chemical. (Figure 1)

(B) Storage of Chemicals in the Body

The same mechanisms that are involved in the uptake of a chemical agent are involved in the elimination of the agent from the cell. The rate of elimination depends on the nature of the chemical and the mechanisms that are used to terminate the presence of the chemical in the body. Generally, chemicals that are metabolically converted by the body to derivatives will have short lives within the body. A chemical that is both metabolized and deposited in fat has a short lifespan in the blood and the nonfatty tissues (e.g. thiopental).

Many chemicals are selectively absorbed or combined with proteins or enzymes or even components of bone.

Examples:

Ninety-eight per cent of bishydroxycoumarin (dicumarol) is carried in the blood combined with albumin where it is not free either to produce an effect on cells or to be subject to metabolic attack.

Quinacrine (Atabrine) is distributed so that the liver concentration of the drug after a single dose may be as much as 2,000 times greater than the concentration in the plasma.

Tetracyclines combine with components of newly-formed bone so that reabsorption of bone must take place before the drug can be eliminated.

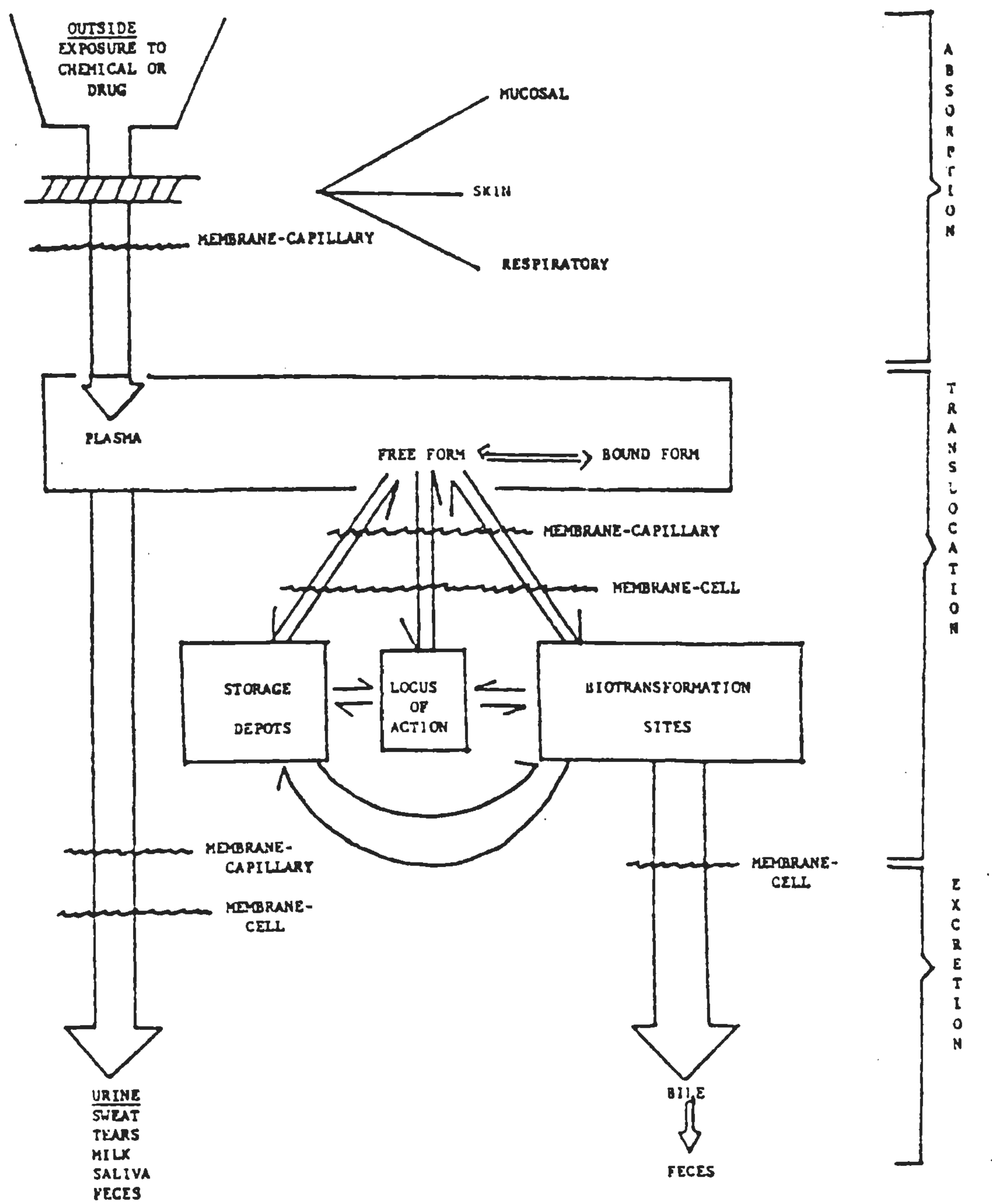
Chlorophenothane (DDT) is stored in fat and remains in the body for months.

Sites of deposition, absorption, or reaction of chemicals within the body act as effective storage depots for chemicals that otherwise may be effectively metabolized or excreted. These sites of storage also effectively prevent high concentrations of the free chemical so that toxic concentrations are not normally achieved until the storage sites have become saturated.

The toxicity of a chemical is therefore influenced by the availability of efficient nonspecific binding sites, or the presence or absence of efficient biotransformation mechanisms.

Toxicity is directly related to the available active concentration of a chemical. Only the free form of a chemical is available for exerting a toxic action.

FIGURE 1. DRUGS AND CHEMICAL PASSAGE IN THE MAMMALIAN ORGANISM



The rate of elimination of a chemical is influenced by the binding and storage of that chemical within the body. Repeated exposure to a chemical, in which the interval between exposures is less than the life of the chemical within the body, would lead to accumulation of that chemical in the organism.

(C) Tolerance

Tolerance occurs when a smaller response results from a fixed dose of a chemical than was obtained on a prior exposure to the same dose. Tolerance is a descriptive term and could be defined as the result of a failure in translocation of the chemical, such as impaired absorption or distribution, or an enhanced termination, i.e. enhanced excretion or metabolic alteration of the chemical in the organism.

CORROSIVES

Acids and acid-like corrosives

Legend:
1 - Mild irritation & reddening
2 - Strong irritation and blistering
3 - Superficial destruction of skin or mucous membrane
4 - Complete destruction of skin or mucose membrane

	Threshold Limit Value (ppm)	Estimated Fatal Dose (g or ml)	Corrosive Effect	Pulmonary Effect
Acetic acid (glacial)	10	20	3	3
Acetic anhydride	5	10	3	3
Acetyl chloride	5	1	4	4
Amyltrichlorocyclane		1	4	
Boron trifluoride	1	1	4	
Bromine	0.1	1	4	4
Calcium chloride		30	2	
Chlorine	1		4	4
Chlorine dioxide	0.1		4	4
Chlorine trifluoride	0.1		4	4
Chlorosulfonic acid		1	4	4
Ethyl chlorocarbonate		1	4	
Formic acid		30	2	
Furoyl chloride		1	4	
Hydrazoic acid	10		2	2
Hydriodic acid	10	1	4	4
Hydrobromic acid	3	1	4	4
Hydrochloric acid	5	1	4	4
Hydrogen bromate		1	4	
Hydrogen iodate		1	4	
Lactic acid		1	4	
Maleic anhydride	1*	10	2	
Nitric acid	2	1	4	4
Osmic acid		1	4	4
Peracetic acid		1	4	
Perchloric acid		1	4	
Persulfate salts		50	3	
Phenylmagnesium chloride		5	3	
Phosphoric acid	1*	1	4	
Phosphorus trichloride	0.5	1	4	
Platinum salts		1	3	3
Sodium acid sulfate		10	3	
Sodium hydrosulfite		30	2	
Sodium sulfite		10	3	
Stannic chloride		1	3	3
Sulfamic acid		5	3	
Sulfur monochloride	1	1	4	4
Sulfur pentafluoride	0.025	1	4	4
Sulfuric acid	1*	1	4	4
Sulfurous acid	10	1	4	4
Tartaric acid		30	1	
Titanium tetrachloride		1	4	4
Trichloroacetic acid		1	4	4

*mg/cu m.

CORROSIVES

Oxalic Acid

Formula: COOH - COOH; soluble in water; fumes when heated to 100 C.

Oxalic acid and oxalates are used as bleaches and metal cleaners in industry and in household products. The leaves of garden rhubarb (Rheum sp) contain a high concentration of oxalate.

The fatal dose by ingestion is estimated to be 5 - 15 g.

Oxalic acid is a corrosive acid. Oxalates combine with serum calcium to form insoluble calcium oxalate. The reduction in available calcium leads to muscular stimulation with convulsions and collapse.

In deaths following oxalic acid poisoning, calcium oxalate crystals are found in the kidney and in other tissues. The kidneys show cloudy swelling, degeneration, and destruction of the tubules. Corrosive changes may be found in the mouth, esophagus, and stomach. Cerebral edema also is a frequent finding.

Signs and Symptoms -

The principal manifestation of oxalic acid poisoning is kidney failure.

Symptoms following ingestion, begin with local irritation and corrosion of the mouth, esophagus, and stomach, with pain and vomiting. These symptoms are followed shortly by muscular tremors, convulsions, weak pulse, and collapse. Death may occur within minutes. After apparent recovery or if oxalate is ingested, acute kidney failure may occur from blocking of kidney tubules of calcium oxalate.

Prolonged skin contact may cause cyanosis and gangrene by local corrosive effect. Prolonged inhalation of fumes produced by boiling oxalic acid solutions leads to oxalic acid poisoning with kidney impairment.

Calcium oxalate crystals, red blood cells, and protein are found in the urine following oxalate intoxication.

Prevention:

Avoid prolonged skin contact. Avoid fumes from boiling oxalic acid.

Emergency measures - Following ingestion, precipitate oxalate by giving calcium in any form orally, such as milk, lime water, chalk, calcium gluconate, calcium chloride, or calcium lactate. Remove skin contamination by washing skin with soap and water and by continuous flushing with water. Remove from further exposure. Seek immediate medical attention.

Prognosis:

If calcium antidotes can be given promptly, recovery is likely.

MISCELLANEOUS ACIDS

Substances Hydrolyzed to Acids

Some commonly used acids and acid-like corrosives listed in the table are used for cleaning metals and other products and in a variety of chemical reactions.

Ingestion of 1 ml of a corrosive acid has caused death. Death may occur up to 1 month after exposure to corrosive fumes such as nitrogen oxide, as in silo gas poisoning.

Corrosive acids destroy tissues by direct chemical action. The tissue protein is precipitated and coagulated in concentrated acid. The intense stimulation by acid also causes loss of vascular tone.

Findings are those of corrosion and irritation.

The principal manifestation of acid poisoning is corrosion.

Ingestion - Severe, burning pain in the mouth, throat, and abdomen followed by vomiting and diarrhea of dark precipitated blood. The blood pressure falls sharply. Brownish or yellowish stains may be found around or in the mouth. Asphyxia occurs from edema of the throat.

After initial recovery, onset of fever indicates perforation of the esophagus or the stomach.

Inhalation of acid fumes or irritating gases causes coughing, choking, and variable symptoms of headache, dizziness, and weakness followed after a 6-8 hour latent period by lung edema with tightness in the chest, air hunger, dizziness, frothy sputum, and cyanosis, bloody sputum, and shortness of breath to chlorine or other corrosive vapor.

Skin contact may produce severe pain and brownish or yellowish stains. Burns usually penetrate the full thickness of the skin, have sharply defined edges, and heal slowly with scar formation.

Eye contact produces edema and corneal destruction from even dilute acids in the eyes. The symptoms are pain, tearing, and photophobia.

Long exposure from inhalation to acid fumes may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of bronchial pneumonia are common. Gastrointestinal disturbances are also noted.

After inhalation of corrosives, diffuse mottling of the lung fields may be seen on x-ray.

Prevention:

The TLV must always be observed. Water bubbler eye fountains and showers must be available where skin or eye contact with acids is possible.

Tight-fitting goggles, rubber aprons, and rubber gloves must be worn when handling acids. Employees must be drilled in the constant use of safety equipment.

Enclosed spaces containing corrosive gases should be thoroughly ventilated before being entered. Use of proper breathing apparatus is advisable.

Emergency measures -

Following ingestion, dilute the acid within seconds by drinking quantities of water or milk. If vomiting is persistent, administer fluids repeatedly. Ingested acid must be diluted approximately 100 times to render it harmless to tissues.

Following Eye Contact:

Flood affected area with quantities of water in a shower or by means of a water bubbler eye fountain for at least 15 minutes. The eyelids must be held apart during the washing. Do not use chemical antidotes. The heat liberated in the chemical reaction may actually increase injury. Eye burns require the immediate attention of an ophthalmologist. If an ophthalmologist is not immediately available, wash the eyes and apply sterile bandages without any medication. Then take the victim to an ophthalmologist.

Following Skin Contact:

Remove acid by flooding with water for at least 15 minutes. If the clothing is contaminated, a stream of water must be directed under the clothing while the clothes are being removed in order to remove the acid rapidly. Do not use chemical antidotes. Treat damaged areas as forthermal burns. Seek immediate medical attention.

Following inhalation:

Use respiratory resuscitation measures. Administer oxygen and use artificial respiration. Remove from further exposure.

Prognosis:

In one series, 32 of 105 persons who ingested acid died. Damage to the esophagus and stomach after ingestion may progress for 2-3 weeks. Death may occur as late as 1 month after ingestion. Approximately 95% of those who ingest acid and recover from immediate effects have persistent damage.

Skin burns from acid are followed by extensive scarring. Skin grafting is required if a good cosmetic effect is desired. Eye damage almost always results in blindness.

After inhalation of corrosive atmospheres, convasescence may be prolonged and frequent relapses may occur. Death may occur 30 days or more after exposure to such corrosive atmospheres.

NITROGEN OXIDES

The nitrogen oxides important in air contamination and in reactions that form atmospheric oxidants include nitric oxide (NO, colorless), nitrogen dioxide (NO_2, brown color), nitrogen trioxide (N_2O_3, colorless), nitric acid (HNO_3), and nitrogen pentoxide (N_2O_5, colorless). Nitrous oxide (N_2O, laughing gas, colorless) and nitrogen tetroxide (N_2O_4, colorless) do not occur in the atmosphere in significant amounts.

Nitrogen oxides are emitted into the atmosphere as a result of combustion of any nitrogen-containing substances. Thus, missile fuels, explosives, cigarettes, and agricultural wastes liberate nitrogen oxides. Nitrogen dioxide also occurs during the rapid decomposition of plant material, as happens in silos. In an enclosed silo, the concentration of nitrogen dioxide may reach as high as 1500 ppm. In addition, combustion at high temperatures of nitrogen-free fuels in the presence of air oxidizes the nitrogen of the air to nitric oxide ($N_2 + O_2 = 2NO$). At 1800 K, 1% of the reactants will be converted, and at 2675 K, 5% of the reactants will be converted. Unmodified auto or diesel exhaust contains 1100 ppm of nitric oxide, producing an emission of 0.13 lb/gallon of fuel or 4 g/mile for a vehicle consuming 1 gallon of fuel each 15 miles. For 1977 and after, federal regulations limit all new automobiles to emission of 0.31 g/mile of nitrogen oxides. Cigarette smoke contains 200-650 ppm of nitrogen oxides, and pipe smoke contains 1100 ppm.

On reaching the air, nitric oxide oxidizes spontaneously to nitrogen dioxide, which gives smog its brown color. This reaction is slow if the concentration of nitric oxide is below 1 ppm, but is speeded by the presence of other contaminants in the air, especially ozone. This color can be seen most clearly by looking into an air-polluted basin from above the temperature inversion boundary on any day with low wind velocity.

The TLV for industrial exposure to nitrogen dioxide is 5 ppm and for submarines in the US Navy 0.5 ppm. The TLV for nitric acid is 1 ppm. A maximum for nitrogen oxides in community air of 0.25 ppm was exceeded for a total of 487 hours in San Francisco in 1967 and for 2594 hours in the same year in Burbank, California.

The taste and odor of threshold for nitrogen dioxide is 1 ppm. Chest discomfort occurs at a concentration of 15 ppm for 1 hour, the sensation becoming unpleasant at 20 ppm. After 1 minute at 50 ppm, chest pain may be felt. Longer exposure at this concentration has caused inflammatory changes in the lungs which ordinarily are reversible. Higher concentrations have been fatal.

Effects seen on the lungs include hemorrhage and irreversible fibrous replacement of functional tissue.

The principal manifestation of nitrogen dioxide poisoning is difficult breathing.

From inhalation, progressive weakness, difficult breathing, cough, and cyanosis begin 1-3 weeks after single or repeated exposure to concentrations of 50-300 ppm. Concentrations above 300 ppm cause lung edema or pneumonia with onset within hours or days.

Lung function tests reveal reduction in inspiratory capacity, reduction in vital capacity, and impaired diffusion capacity. These findings improve as the inflammatory process subsides, but some impairment of function may be permanent.

Prevention:

Wear breathing apparatus or thoroughly ventilate area before entering.

Emergency measures:

Give oxygen for difficult breathing. Seek immediate medical attention.

Prognosis:

Recovery may require 1-6 months. Permanent changes may persist depending on the severity of the original damage.

ATMOSPHERIC OXIDANTS

Atmospheric oxidants are substances with an oxidizing power sufficiently great to liberate iodine from a solution of potassium iodide. One oxidant, ozone (O_3), accelerates the cracking of rubber, a property that can be used to measure the total exposure to ozone over a period of time. These oxidants make up the eye irritants in photochemical smog resulting from the action of sunlight on air containing nitrogen dioxide and certain organic compounds.

Reactions which initiate the formation of oxidants depend on the absorption of light energy. Light in the ultraviolet spectrum is more important since it has greater energy. The following reactions are considered to be important in the absorption of light energy (hv) and the production of monatomic oxygen (O) and free organic radicals (R):

NO_2 + light energy = NO + $\dot{O}$

RCHO + light energy = $\dot{R}$ + HCO

RCHO.R + light energy = $\dot{R}$ + RCO

RONO + light energy = $R\dot{O}$ + NO

RONO + light energy = $\dot{R}$ + NO_2

Other reactions may occur in the dark:

$\dot{O} + O_2 = O_3$

$O_3 + NO = O_2 + NO_2$

$\dot{O} + C_4H_8 = CH_3 + C_3H_5O$

$\dot{C}H_3 + O_2 = CH_3O\dot{O}$

$CH_3O\dot{O} + O_2 = CH_3\dot{O} + O_3$

$CH_3\dot{O} + NO = CH_3ONO$

$CH_3\dot{O} + O_2 = H_2CO + HO\dot{O}$

$O_3 + 2NO_2 = N_2O_5 + O_2$

The following reaction scheme from ethylene (C_2H_4) to peroxyacetylnitrate (PAN) has been proposed:

$$C_2H_4 + O_3 = C_2H_4O_3$$

$$2\ C_2H_4O_3 = HCHO + CH_3O + CH_3CO + O_3$$

$$CH_3CO + O_2 = CH_3CO_3$$

$$CH_3CO_3 + NO_2 = CH_3CO.O.ONO_2\ (PAN)$$

The concentration of ozone does not begin to rise until nitric oxide (NO) has been completely converted to nitrogen dioxide (NO_2). Although nitrogen dioxide alone contributes to the formation of a small amount of ozone, the levels found in urban atmospheres do not occur unless some of the carbon compounds indicated in the above schemes are present. These include aldehydes, ketones, and unsaturated hydrocarbons. The reactivity of these substances in atmospheres forms the basis for the restriction of their use in various solvents for paints, lacquers, and other finishes. Methane (CH_4), which makes up about half of the organic compounds in the atmosphere, does not react. Some of the reaction intermediates are possible contributors to eye irritation, but they are so unstable that analysis or experimental testing has not been possible. PAN has been tested and found to be eye-irritating at concentrations of 0.5 ppm. This concentration is higher than that which is likely to occur in the atmosphere. Combinations of reactants may be more irritating than individuals.

At the peak of oxidant concentration in the atmosphere (shortly after midday), ozone makes up more than 90% of the total. By nightfall ozone falls to a low level, but oxidants may still be present. The chemical make-up of all the dark-reaction oxidants has not been defined. One compound has been identified as PAN.

Electrical discharges such as lightning and intense ultraviolet light also produce ozone. At an altitude of 75,000 feet, the concentration of ozone is raised to 16 ppm by the direct action of sunlight. Unless some means is used to decompose the ozone, the concentration inside pressurized aircraft flying between 30,000 and 40,000 feet reaches 0.3 - 0.4 ppm. Some ozone found at ground level is brought down to this level by atmospheric mixing, but this amount does not exceed 0.01 - 0.03 ppm except during lightning storms.

A standard for community air of 0.1 ppm oxidants has been set in California. In 1967, San Jose, California, exceeded this level for 272 hours, Burbank for 1191 hours, and Pasadena for 1245 hours. In the same year, a level of 0.05 ppm was exceeded for 1032 hours in San Jose, 2198 hours in Burbank, and 2243 hours in Pasadena while San Francisco had 129 hours above 0.05 ppm and 25 hours above 0.1 ppm. The industrial TLV for ozone is 0.1 ppm.

The odor threshold for ozone in insensitive persons is 0.01 ppm, but it is only recognized by all persons at 0.05 ppm. At a concentration of 0.1 ppm of ozone or oxidants, more than 5% of individuals will have symptoms of eye irritation.

Persons with lung diseases such as asthma or emphysema, when exposed to an ambient atmosphere containing 0.1 - 0.15 ppm of oxidants, show increased breathing resistance, increased oxygen consumption , and decreased blood oxygen concentration. Recovery from the effects of oxidant-containing ambient air requires several days.

Experiments have shown that exposure to ozone, 0.2 ppm for 3 hours, reduces visual acuity, increases peripheral vision, decreases night vision, and alters the balance of the muscles controlling the position of the eye.

Asthmatic patients report more attacks when the daily peak of oxidants goes over 0.25 ppm. A level of 0.3 ppm ozone causes cough and some respiratory tract irritation after 30 minutes of exposure. Progressively higher concentrations are more irritating, and lung function is distinctly impaired at concentrations of 0.6 ppm ozone.

Ozone and other oxidants produce their irritant action as a result of their chemical reactivity at the point of contact. These oxidants may be absorbed into the blood stream.

Treatment

The use of activated charcoal adsorbers in rooms has been suggested as a means of lowering air contaminant concentrations.

SULFER OXIDES

The following sulfur oxides occur as atmosphere contaminants: sulfur dioxide (SO_2), sulfur trioxide (SO_3), sulfurous acid (H_2SO_3), and sulfuric acid (H_2SO_4).

Sulfur dioxide reduces visibility by taking part in reactions between organic compounds and nitrogen oxides to form particulates. Oxidation to sulfur trioxide, which then combines with water to form small droplets of sulfuric acid, also reduces visibility.

Sulfur oxides come from fuel oil and coal combustion, from petroleum refining, and from the chemical and metal-lurgic industries.

California has established a maximum of 0.1 ppm sulfur dioxide concentration for 24 hours with no 1-hour value to exceed 0.5 ppm for community air. For industrial exposures, the TLV for sulfur dioxide is 5 ppm; for sulfur trioxide, 2 ppm; for sulfuric acid, 1 mg/cu m; and for sulfurous acid, 10 ppm.

Trained observers can recognize the presence of sulfur dioxide at a concentration of 0.3 ppm, but concentrations up to 1 ppm have little effect on lung function except for possible increase in respiratory rate. Increased resistance to breathing begins to occur at 1.6 ppm in normal individuals and possibly at 0.7 ppm in persons with respiratory disease. Concentrations in air pollution disasters such as occurred in Donora, Pennsylvania, and London, England, have ranged from 1-3 ppm. The eye irritation level is 10 ppm.

The principal manifestation of sulfer dioxide poisoning is difficult breathing. From inhalation, progressive weakness, difficult breathing, cough, lung edema or pneumonia may occur. Lung function tests reveal reduction in inspiratory capacity.

Prevention:

Wear breathing apparatus or thoroughly ventilate area before entering.

Emergency measures:

Give oxygen for difficult breathing. Seek immediate medical attention.

Prognosis:

Recovery may require 1-6 months. Permanent changes may persist depending on the severity of the original damage.

ALKALIES & PHOSPHATES

These agents are used in the manufacture of soaps and cleansers and in chemical synthesis.

The alkalies combine with protein to form proteinates and with fats to form soaps, thus producing soft, deep destruction areas on contact with tissues. The solubility of these products allows further penetration which may continue for several days.

Sodium and potassium hexametaphosphates, polyphosphates, tripolyphosphates, pyrophosphates, and other phosphates form complexes with calcium and are capable of seriously reducing the blood serum calcium. They also have a corrosive effect on mucous membranes and skin.

Findings include gelatinous destruction of tissues at sites of contact.

The principal manifestation of poisoning with the alkalies is corrosion.

Alkali corrosives

Legend: 1 - Mild irritation & reddening; 2 - Strong irritation and blistering; 3 - Superficial destruction of skin or mucous membrane. 4 - Complete destruction of skin or mucous membrane.	Threshold Limit Value (ppm)	Estimated Fatal Dose (LD_{50}) (g)	Corrosive Effect
2-Aminobutane		10	2
2-Aminopropane	5	10	2
Butylamine	5	20	2
Calcium carbide		15	3
Calcium oxide		30	3
Cement (Portland)	30†	60	3
Diethanolamine		20	2
Diethylamine	25	20	2
Diethylene triamine	1	20	2
Dimethylamine	10	20	2
Ethanolamine	3	30	1
Ethylamine	10	20	2
Ethylenediamine	10	10	2
Lithium hydride	0.025*	5	1
Lithium hydroxide		5	4
Methylamine	10	50	1
Potassium carbonate		20	3
Potassium hydroxide		5	4
Sodium carbonate		30	3
Sodium hydroxide (LYE)	2*	5	4
Sodium phosphates		30	2
Sodium silicate		50	2
Triethanolamine		30	2
Tris(hydroxymethyl)-aminomethane		30	1

*mg/cu m.
†Million particles/cu ft.

Ingestion of alkali is followed by severe pain, vomiting, diarrhea, and collapse. The vomitus contains blood and fragments of stomach and intestine. If death does not occur in the first 24 hours, the patient may improve for 2-4 days and then have a sudden onset of severe abdominal pain, board-like abdominal rigidity, and rapid fall of blood pressure indicating delayed stomach or esophageal perforation.

Even though the victim recovers from the immediate damage, swallowing may be difficult due to constriction of the esophagus.

Ingestion of hexametaphosphate, tripolyphosphate, and other phosphates cause a shock-like state, fall of blood pressure, slow pulse, cyanosis, coma, and sometimes tetany as a result of reduction in ionic calcium.

Eye contact with concentrated alkali causes edema and corneal destruction.

Alkalies penetrate skin slowly. Extent of damage therefore depends on duration of contact.

A chronic rash may follow repeated contact with alkalies.

Prevention:

Store corrosive alkalies safely. Water bubbler eye fountains and showers must be available where skin or eye contact with alkalies is possible. Tight-fitting goggles, rubber aprons, and rubber gloves must be worn when handling alkalies in concentrated solutions. Handlers must be drilled in the constant use of safety equipment.

Emergency measures:

Following ingestion, dilute the alkali by giving water to drink immediately and allowing vomiting to occur.

Following eye contact, wash eyes with running water for 30 minutes. Apply sterile bandage and take victim to an opthamologist.

Following skin contact, wash skin with running water until skin is free of alkali as indicated by disappearance of soapiness. Seek immediate medical attention.

Prognosis:

Approximately 25% of those who ingest strong alkali die from the immediate effects. Death may occur as late as 1 month after ingestion. Approximately 95% of those who ingest strong alkali and recover from the immediate effects have persistent constriction of the exophagus.

Corneal damage is almost always permanent.

Skin damage is persistent.

AMMONIA AND AMMONIUM HYDROXIDE

Ammonia (NH_3) is a gas at ordinary temperatures. Ammonium hydroxide (NH_4OH) is a liquid containing 25-29% NH_3; vapor pressure at 27C: 500 mm Hg.

Ammonia is used in organic synthesis, as a refrigerant, and as a fertilizer. Ammonium hydroxide is used in organic synthesis and as a cleaner.

The TLV of ammonia is 25 ppm. The fatal dose of ammonium hydroxide by ingestion is about 30 ml (1 oz) of a 25% concentration.

Ammonia and ammonium hydroxide injure cells directly by alkaline caustic action and cause extremely painful irritation of all mucous membranes.

The pathologic findings in inhalation poisoning are lung edema, lung irritation, and pneumonia. After ingestion, the findings are the same as with alkalies.

The principal manifestation of acute poisoning with these compounds is extreme irritation.

Ingested ammonia causes severe pain in the mouth, chest, and abdomen, with cough, vomiting, and shock-like collapse. Gastric or esophageal performation may occur later with abdominal pain, fever, and rigidity. Lung irritation edema may appear after 12-24 hours' delay.

Ammonia fumes (1000 ppm) cause irritation of the eyes and upper respiratory tract, with cough, vomiting, and redness of the mucous membranes of the lips, mouth, eyes, nose, and throat. Higher concentrations cause swelling of the lips and eye, temporary blindness, restlessness, tightness in the chest, frothy sputum indicating lung edema, cyanosis, and rapid, weak pulse.

If skin contact is prolonged more than a few minutes it causes severe burning pain and corrosive damage.

Following eye contact, concentrated ammonia causes immediate and severe eye pain followed by edema and corneal clouding. Later, cataract formation and destruction of the renina and iris may occur.

Prevention:

Employees working in areas where ammonia is used must be trained in escape methods and in the use of safety equipment, including goggles, breathing equipment, showers, eye fountains, water hoses, exits, and first aid equipment. Ammonia equipment must be constantly inspected to prevent accidents. All valves should be labeled to prevent accidental opening.

If a contaminated area must be entered, a full-face airline mask or self-contained oxygen mask must be worn. Protective clothing is also necessary if the concentration is above 10,000 ppm.

Emergency Measures

1. Dilute ingested poison by giving water or fruit juice.
2. Eye contamination - Wash eyes in a water bubbler eye fountain for at least 15 minutes. The victim should be taken to an ophthalmologist for further treatment.
3. Inhalation - Remove patient from contaminated area and keep at bed rest.
4. Skin contamination - Wash skin for at least 15 minutes.

Antidote: Fruit juice or vinegar may be given by mouth or used externally.

Seek medical attention for lung damage or skin burns or gastrointestinal damage following ingestion.

Prognosis:

Patients who survive 48 hours are likely to recover. Eye contact is frequently followed by permanent blindness.

FLUORINE, HYDROGEN FLUORIDE, AND DERIVATIVES

Both fluorine and hydrogen fluoride are gases at normal temperatures.

Fluorine is used in organic synthesis. Hydrogen fluoride is used in the petroleum industry and in etching glass. Cryolite (sodium aluminum fluoride) is used in many industrial processes. Fluoride salts are used in the prevention of dental caries and in rodenticides. Methyl sulfonyl fluoride is used as a fumigant.

The TLV in air for fluorine is 0.1 ppm. The TLV in air for hydrogen fluoride is 3 ppm. The TLV in air for fluoride salts is 2.5 mg/cu m. The fatal dose of sodium fluoride is 1-4 g. The fatal dose of fluorosilicates is about the same as for fluorides, but that of cryolite is much higher (above 10 g). The LD_{50} for methyl sulfonyl fluoride in experimental animals is 3.5 mg/kg.

Fluorine and fluorides act as direct cellular poisons by interfering with calcium metabolism and various enzymes. Fluorides form an insoluble precipitate with calcium and lower plasma calcium. Hydrogen fluoride (hydrofluoric acid) is directly corrosive to tissues.

Skin or mucous membrane contact with hydrogen fluoride produces deeply penetrating skin burns.

Neutral fluorides in 1-2% concentrations will cause inflammation and damage of mucous membranes. After death, rigor mortis sets in rapidly. Postmortem findings are brain edema, lung edema, and degeneration of liver and kidneys.

In fatalities from inhaling hydrogen fluoride or fluorine, lung edema and bronchial pneumonia are the most prominent findings.

In deaths following prolonged absorption of fluoride, the bone structure shows thickening with calcification in the ligaments. Bone marrow space is greatly reduced.

The principal manifestation of fluorine and fluoride poisoning is corrosion.

Inhalation of hydrogen fluoride or fluorine causes coughing, choking, and chills lasting 1-2 hours after exposure. After an asymptomatic period of 1-2 days, fever, cough, tightness in the chest, rales, and cyanosis indicate pulmonary edema. These symptoms progress for 1-2 days and then regress slowly over a period of 10-30 days.

Ingestion of neutral fluorides such as sodium fluoride causes salivation, nausea, vomiting, diarrhea, and abdominal pain. Later, weakness, tremors, shallow respiration, and convulsions occur. Death is by respiratory paralysis. If death does not occur immediately, jaundice and urine suppression may appear.

Skin or mucous membrane contact with hydrogen fluoride solution results in damage depending on the concentration. Concentrations above 60% result immediately in severe, extremely painful burns. Such burns are deep and heal slowly. Concentrations less than 50% may cause slight immediate irritation of the skin or none at all. The acid penetrates readily, however, and a deep-seated ulceration results if contact continues for more than a few minutes.

Intake of more than 6 mg of fluorine per day results in chronic fluorosis. Symptoms are weight loss, brittleness of bones, anemia, weakness, general ill health, stiffness of joints, and discoloration of the teeth when exposure occurs during tooth formation.

In chronic exposure, x-ray evidence of bonethickening and calcification of ligaments is indicative of fluorosis.

In severe fluorosis, both red and white blood cell counts may be diminished.

Fluorine workers should have urine fluoride determinations at 6-month intervals.

Prevention:

Hydrogen fluoride workers must be carefully instructed in the dangers of skin contact with hydrogen fluoride and in the necessity for immediate removal of even dilute solutions by prolonged washing. Showers and water bubbler eye fountains must be available where hydrogen fluoride is being used. Processes utilizing hydrogen fluoride must be totally enclosed. Workers should wear long rubber gauntlets, long rubber aprons, high rubber boots, and a wide plastic face shield while handling hydrogen fluoride. Forced-air face masks should be worn if the air concentration of hydrogen fluoride is sufficiently high to cause nasal irritation. Tools and benches must be decontaminated immediately by washing with ammonia or lye solutions after hydrogen fluoride is spilled.

Emergency Measures

Wash contaminated area thoroughly with water for 15-45 minutes. Do not wait until symptoms appear before washing. Following inhalation, remove patient to fresh air and keep at complete rest. Seek immediate medical attention.

Following ingestion of neutral fluorides, give soluble calcium in any form: milk, calcium gluconate solution, or calcium lactate solution. For calcium salts, the concentration should be 10 g in 250 ml of water. Give calcium gluconate, 10 g, and Fleet's Phospho-Soda, 30-60 ml diluted 1:4 in water orally to precipitate and remove fluoride from the intestine.

Give milk and cream every 4 hours to relieve irritation of esophagus and stomach.

Seek medical attention following ingestion, as soon as possible.

Prognosis:

After ingestion of neutral fluoride, survival for 48 hours is followed by recovery. After inhalation, survival for 3-4 days is usually followed by recovery. Skin burns require 1-2 months to heal.

In fluorosis from chronic exposure, removal from exposure for a year or more may be necessary before joint stiffness begins to reverse.

PESTICIDES

PESTICIDES

I. HISTORY:

Rodents, insects, nematodes, fungi, weeds and other pests compete with man for food and other supplies, and they also transmit certain diseases to man or his domestic animals. The development of chemical pesticides has created a revolution in the control of these pests. Pesticides have accounted for about 10 percent of deaths from all solid and liquid substances. All pesticides are capable of producing harm to man if ingested or absorbed through the skin in sufficient quantities. Therefore, if spillage occurs, all soiled clothing should be removed immediately and the body promptly washed with water.

II. INSECTICIDES

A. Inorganic. Highly toxic arsenic occurs in many formulations as an insecticide. Arsenic occurs in many formulations as an insecticide. In addition, fluorides, borates and fluorosilicates are used in insecticidal formulations.

B. Botanical.

1. Nicotine is a relative toxic material not frequently used today as an insecticide. The symptoms of nicotine poisoning appear rapidly and result in paralysis of the respiratory muscles and death.

2. Pyrethrum extracts are used as household insecticides because of their rapid action. These compounds are not absorbed through the skin and are rapidly broken down in the intestinal tract. Toxic doses cause excitation, convulsions, tetanic paralysis and death due to respiratory failure.

C. Chlorinated Hydrocarbon Insecticides. These highly stable compounds are valued for their residual action against insects, and feared because of their prolonged storage in mammals.

1. Chlorophenothane [2,2-bis(p-chlorophenyl) 1,1,1-trichloroethane, DDT]. Its main use is for control of typhus, malaria, and other vectorborne diseases. DDT is valued for its persistent or residual action.

(a) Toxicity. The principal action of DDT (nervous system) is characterized by paresthesia of the tongue, lip, face, extremities, and disturbance of equilibrium, confusion and (most characteristic) tremor. Death from DDT is attributed to respiratory arrest. Chlorinated hydrocarbons also have a tendency to sensitize the myocardium to epinephrine and may result in ventricular fibrillation. DDT can produce liver injury and deplete liver glycogen. It is stored in body fat and eliminated very slowly.

(b) Treatment is restricted to efforts to remove the poison and control tremors, convulsions and other central nervous system effects.

2. Chlordane (1,2,4,5,6,7,8,8 - otachloro - 3a4,7,7α-tetrahydro-4,7-methanoindane) contains A and B chlordane, heptachlor and trichlor. Chlordane has caused death in man at doses as low as 104 mg/kg and is more dangerous than DDT.

   Toxicity. Signs and symptoms of acute chlordane intoxication are similar to those produced by DDT. Liver damage may result from chronic intoxication. Chlordane is rapidly absorbed through the skin.

3. Dieldrin, aldrin, isodrin, and endrin are four isomers used as an insecticide. All four isomers have similar pharmacological activity, although endrin and isodrin are two and three times more poisonous than dieldrin and aldrin.

   Toxicity. These compounds produce convulsions. Some patients complain of headache, nausea, vomiting, dizziness, or myoclonic jerking and may not suffer convulsions until later. Hyperthermia following poisoning by chlorinated hydrocarbons is frequently followed by death.

D. Anticholinesterase Insecticides

1. Organic phosphorus compounds are a group of highly toxic organic esters of phosphoric acid which have pharmacological effects resembling those of physostigmine. They are among the more toxic of all chemicals, due to irreversible inhibition of both plasma and red blood cell cholinesterase. Parathion, tetraethylpyrophosphate, (TEPP), and malathion are common examples of such compounds now in use. They are readily adsorbed and symptoms begin promptly and progress rapidly. Respiratory symptoms are usually the first to appear after inhalation of vapor or aerosol, gastrointestinal symptoms usually appear first after ingestion, and localized sweating and muscle fasiculation are usually the first signs observed after cutaneous exposure.

   (a) Toxicity. The organic phosphate compounds inhibit cholinesterase throughout the body resulting in the accumulation of acetylcholine at various receptor sites. Excessive acetylcholine produces nausea, vomiting, abdominal cramps, diarrhea, sweating, increased bronchial and salivary secretions, and bradycardia. When accumulation of acetylcholine occurs near the ends of motor nerves to skeletal muscles, the result is first a stimulation (producing muscular fasciculation), followed by muscle weakness and finally a flaccid paralysis. Until the activities of blood and tissue cholinesterase are restored to normal levels (by partial reversal of inhibition or regeneration of new enzymes), there is an increased susceptibility of the individual to the effects of another exposure to any such compound. The effect of repeated exposures is cumulative. Exposure produces papillary constriction, nasal secretions, tightness in the chest, bronchorrhea, and salivation. If the concentration is high, the patient may show severe respiratory distress, collapse, convulse, and become comatose with intermittent feeble respiratory effects. Death may be produced by sudden arrest of central respiratory function, peripheral neuromuscular weakness or paralysis of the muscles of respiration, airway obstruction by excessive salivary and bronchial secretions and bronchoconstriction.

(b) Treatment.

1. Remove the victim from toxic environment and immediately remove clothing and any liquid contamination. Flood and wash the exposed skin areas thoroughly with water. In the non-breathing victim, immediately institute artificial respiration.

2. Administer atropine, 2 mg, intramuscularly or intravenously as soon as any local or systemic signs or symptoms of an intoxication are noted. Repeat the dose every 3-8 minutes until signs of atropinization (mydriasis, dry mouth, rapid pulse, hot and dry skin) occur.

3. Watch the respiration and remove bronchial secretions if they appear to be obstructing the airway. Incubate if necessary.

4. Administer pralidoxime (2-PAM chloride; Protopam) 2.5 grams in 100 ml of sterile water or 5 percent dextrose and water, intravenously, slowly in 15 to 20 minutes. For infants or children, give 15 mg/kg. If sufficient fluid is not available, give 1 gram of 2-PAM in 3 ml of distilled water by deep intramuscular injection. Repeat every half hour if respiration weakens or if muscular fasciculations or convulsions reoccur.

2. Carbaryl (sevin) is a typical carbamate insecticide. Carbamates are reversible inhibitors of cholinesterase. Reversal is very rapid and carbaryl is rapidly metabolized. A single oral dose of approximately 2.8 mg/kg has resulted in moderately severe poisoning in an adult.

(a) Toxicity. Signs and symptoms of carbaryl poisoning are similar to those seen with other cholinesterase inhibitors.

(b) Treatment. Treatment of poisoning by carbamates is the same as that for organic phosphorus compounds, except that 2-PAM and other oximes are not recommended for routine use.

III. FUMIGANTS. Fumigants are gases or volatile liquids used for control of insects, rodents, and soil nematodes.

A. Hydrogen Cyanide (HCN, Prussic acid). Toxicity and treatment are discussed elsewhere. Many persons are unable to smell the characteristic burnt-almond odor of hydrogen cyanide (inability is an inherited characteristic). Most proprietary fumigants contain a "warning" lacrimatory material or pungent gas with a readily identifiable odor.

B. Methyl Bromide (CH_3Br, monobromomethane) is supplied as a compressed gas and is also used as a refrigerant or fire extinguishing material. The gas is usually sold containing chloropicrin. (See below).

Toxicity. Methyl bromide causes severe burns of the skin. Respiratory exposure produces pulmonary edema as a result of direct irritant actions and may be the immediate cause of death. Symptoms of serious poisoning include headache, disturbance of vision, nausea, vomiting and tremors progressing to convulsions.

IV. RODENTICIDES

A. Warfarin is an anticoagulant rodenticide. It is generally used at a concentration of 0.25%. Warfarin is mixed with cereal or in water.

1. Toxicity. All signs and symptoms are caused by hemorrhage.

2. Treatment. Vitamin K preparations are indicated for treatment.

B. Sodium Monofluoracetate (FCH_2-COONA - "1080") is a white powder with a faint smell of vinegar.

1. Toxicity. Signs and symptoms usually begin with nausea and apprehension and are followed by convulsions. Pulsus alternans may occur, and may be followed by ventricular fibrillation and severe depression. The poison acts by interfering with acetate metabolism.

(a) Control the convulsions and evaluate the cardiac status. Following gastric lavage, administer glycerol monoacetate (monoacetin).

C. Phosphorus is used as a bait rodenticide. A dose of 15 mg may be toxic and 50 mg may be fatal. Acute poisoning produces gastrointestinal irritation after ingestion and the patient may die of cardiovascular failure within 12 hours.

1. Treatment. Copper salts form a semimetallic coating of Cu_3P_2 over the phosporus particles and prevent their further absorption. Potassium permanganate or a hydrogen peroxide solution oxidizes the phosphorus to harmless phosphates. Mineral oil minimizes absorption, but other fats and oils promote absorption.

V. HERBICIDES are chemicals used for controlling weeds.

A. Metallic Poisons. A variety of arsenic, lead, mercury, copper, iron, zinc and boron salts are used as herbicides. In addition, organic compounds of arsenic, mercury and tin are also used.

B. Substituted Phenols. A number of substituted dinitrophenols are used to kill plants along roadsides and rights-of-way. All of these compounds increase oxidative metabolism.

BARIUM

Absorbable salts of barium such as the carbonate, hydroxide, or chloride are used in pesticides. The fatal dose of absorbed barium is approximately 1 g. Barium ion induces a change in permeability of the cell membranes which results in stimulation of all muscle cells indiscriminately. This effect is not antagonized by atropine but is antagonized by magnesium ions. No specific histologic changes are seen.

Clinical Findings

The principal manifestations of barium poisoning are tremors and convulsions.

Symptoms and Signs: (From ingestion or, rarely, from inhalation.) Symptoms and signs include tightness of the muscles of the face and neck, vomitting, diarrhea, abdominal pain, muscular tremors, anxiety, weakness, difficulty in breathing, irregularity of the heart, convulsions, and death from cardiac respiratory failure.

Emergency Measures: If respiration is affected, give artificial respiration, using oxygen if available, until a sulfate antidote can be given and normal respiration has returned.

Antidote: sodium sulfate.

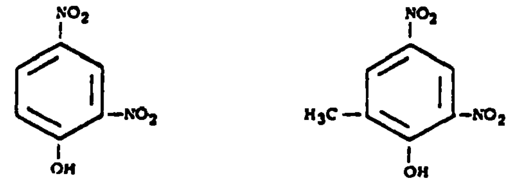
Prognosis:

If a soluble sulfate (e.g., magnesium sulfate or sodium sulfate) is given before symptoms become severe, then recovery will occur. Survival for more than 24 hours has always been followed by recovery.

Gould DB, Sorrell MR, Lupariello AD: Barium sulfide poisoning. Arch Intern Med 132:891, 1973.

Dinitrophenol pesticides

DINITROPHENOL, DINITRO-o-CRESOL



2,4-Dinitrophenol 4,6-Dinitro-o-cresol

Dinitro derivatives of phenol and cresol are used as insecticides and herbicides. Dinitrophenol was formerly used medically as a metabolic stimulator to aid in weight reduction.

The acute fatal dose of dinitrophenol is approximately 1 g; the acute fatal dose of dinitro-o-cresol (DNOC) is 0.2 g. Other compounds with similar toxicities include dinitro-5-secbutylphenol (dinoseb), binapacryl (Morocide), and nitrocyclohexylphenol. Danger is greatest during hot weather, when loss of body heat is impaired.

The dinitro derivatives of various phenols apparently act by inhibiting the synthesis of certain phosphate bonds which are important in conserving energy utilization in the cell. In the absence of the mechanism, cellular respiration is markedly increased.

In victims who die from exposure to dinitro derivatives, postmortem examination reveals degenerative changes of the heart, liver and kidneys.

The principal manifestation of poisoning with the dinitro derivatives is fever.

Acute Poisoning: (From skin contamination, ingestion, or inhalation.) Symptoms are frequently of sudden onset up to 2 days after cessation of exposure and include high fever, prostration, thirst, nausea, vomiting, excessive perspiration, and difficulty in breathing. Later, symptoms progress to anoxia with cyanosis, and finally muscular tremors and coma. Kidney and liver injury may also occur.

Chronic Poisoning: Chronic poisoning has not been reported following agricultural exposure. Toxicity may include skin eruptions, nerve damage, liver damage, kidney damage, and decrease in white blood cell count. In exposed workers, blood concentrations of dinitro derivatives should not exceed 10 μg/g. Take white blood count if exposed person has unexplained fever.

White blood count should be repeated at monthly intervals during exposure.

Emergency Measures: Remove ingested poison by given syrup of ipecac to induce emesis. Remove skin contamination by scrubbing with soap and water after removal of clothing. If the body temperature is elevated, reduce to 37 C by immersion in cool water or by applying cold packs. If the body temperature is above 40 C, ice water is necessary. Oxygen inhalations should be used for respiratory distress or cyanosis. Feed readily digestible food for increased metabolism.

Prognosis

Recovery from severe poisoning is likely if body temperature can be kept below 40 C and if adequate nutrition is supplied.

FLUOROACETATE

The sodium salt of fluoroacetic acid ($CH_2FCOONa$) is a water-soluble, synthetic chemical used as a rodenticide.

The fatal dose is estimated to be 50-100 mg. At least 13 deaths from sodium fluoroacetate have occurred. Fluracetamide has similar toxicity.

Fluoroacetate in the body blocks cellular metabolism. The relationship between this metabolic effect and poisoning has not been elucidated. All body cells, and especially those of the brain, are affected by fluoroacetate as shown by depression of oxygen consumption.

No specific tissue changes are seen in fluoroacetate poisoning. Findings include lung and brain edema, congestion of the kidneys and lungs.

The principal manifestations of acute fluoroacetate poisoning from ingestion or inhalation are vomiting and convulsions. Chronic poisoning does not occur. Symptoms begin within minutes to 4-5 hours, with vomiting, excitability, convulsions, irregularity of the heart and respiration, exhaustion, coma, and respiratory depression. Death is from respiratory failure associated with pneumonia.

Emergency Measures: Ingested poison may be removed by emesis; give syrup of ipecac.

Specific Antidote: Monoacetin (glyceryl monoacetate)

Prognosis

Complete recovery may follow repeated convulsions. Rapid progression of symptoms within 1-2 hours after poisoning is likely to result in death. Survival for more than 24 hours indicates a favorable outcome.

NICOTINE

Exposure to nicotine occurs during processing or extraction of tobacco; during the mixing, storage, or application of insecticides containing nicotine; or during smoking. Nicotine is available in concentrations as a free base, which is volatile, or as the sulfate. Both are liquids, even in pure form. In addition to concentrates, nicotine is also present in a large number of insecticide mixtures in concentrations of 1% or more. Additional less toxic compounds with similar actions are anabasine, nornicotine, and lobeline.

The fatal dose of pure nicotine is about 40 mg (1 drop), a quantity contained in 2 g of tobacco (2 cigarettes). However, tobacco is much less poisonous than would be expected on the basis of its nitocine content. When smoked, most of the nicotine is burned; when ingested, nicotine is poorly absorbed from the tobacco.

Nicotine first stimulates, then depresses and paralyses the cells of the brain and spinal cord. Skeletal muscle, including the diaphragm, is paralyzed.

No specific tissue changes are found after nicotine poisoning. After ingestion, the mouth, pharynx, esophagus, and stomach may show evidence of the caustic effect of nicotine.

The principal manifestations of nicotine poisoning are respiratory stimulation and stomach and intestinal cramps.

Acute Poisoning:

1. Small doses - (From skin contamination or inhalation of tobacco smoke, tobacco dust, or insecticide sprays.) Respiratory stimulation, nausea, vomiting, dizziness, headache, diarrhea, elevation of blood pressure, sweating, and salivation. Gradual recovery follows a period of weakness.
2. Large doses - (From ingestion or skin contamination with insecticide concentrates.) Initially there is burning of the mouth, throat, and stomach, followed by rapid progression of the above symptoms, proceeding to weakness, convulsions, respiratory slowing, heart irregularity, and coma. Death occurs within 5 minutes to 4 hours.

Chronic Poisoning: No cumulative effect from exposure to small amounts of nicotine insecticides has been noted.

Acute Poisoning:

Emergency measures -

a. Wash skin - Remove nicotine from the skin by flooding with water and scrubbing vigorously with soap.
b. Give artificial respiration, using oxygen if available.

Antidote - Atropine.

Chronic Poisoning: Remove from further exposure to dust or smoke.

Prognosis

Survival for more than 4 hours is usually followed by complete recovery.

THALLIUM

Thallium has been used as a rodenticide and as ant killer. Its use as a pesticide is now prohibited. Poisoning has most frequently resulted from the accidental ingestion of thallium rodent or ant baits, which consisted of thallium sulfate or acetate mixed with grain, cookie crumbs, cracker crumbs, honey, or sweetened water.

The most commonly available salts of thallium are the sulfate, acetate, and carbonate. Thallium sulfide and iodide are appreciably less soluble than the other salts.

The fatal dose is approximately 1 g of absorbed thallium.

The principal manifestations of thallium poisoning are loss of hair and pains in the extremities.

A. Acute Poisoning: (From ingestion or skin absorption.) Evidences of poisoning appear in 1-10 days and include pains of the extremities, dizziness, loss of hair, fever, abdominal pain, and nausea and vomiting. Progression of poisoning is indicated by the appearance of lethargy, jumbled speech, tremors, convulsions, and cyanosis. Signs of lung fluid accumulations and pneumonia may precede death in respiratory failure. Kidney damage has also been reported.

B. Chronic Poisoning: (From ingestion or skin absorption.) If absorption of thallium occurs over an extended period, the earliest indications of poisoning are loss of hair, changes in the skin, and occasionally salivation and blue line on the gums. Stomach and intestinal cramps are also common.

Acute Poisoning

1. Emergency measures - Remove skin contamination by scrubbing with soap and water. There are no effective antidotes for thallium intoxication.

   Chronic poisoning: Remove from further exposure.

Prognosis:

If the progression of signs of brain damage (lethargy, delirium, and muscular twitchings) can be halted, recovery is possible. Complete recovery may require 2 months or more.

THIOCYANATE INSECTICIDES: THANITE, LETHANE

Thiocyanate insecticides are ordinarily available in mixtures as concentrated solutions in an organic solvent, as emulsion concentrates, or in combination with other insecticides.

The toxicity of these compounds is moderate compared with that of nicotine. One adult patient died after ingesting a mixture containing approximately 5 g of Lethan-384 and 14 g of lauryl thiocyanate. Other fatalities have been reported following ingestion of similar quantities. The toxicities of ethyl and methyl thiocyanate are considerably greater, reaching 10 mg/kg in experimental animals, because they are converted to cyanide in the body. Thanite has an LD_{50} in rats of 1600 mg/kg.

The thiocyanate insecticides induce coma, cyanosis, and convulsions in rats at doses ranging from 90 mg/kg (Lethane-384) to 1 g/kg (Thanite).

Examinations of animals poisoned by thiocyanate insecticides have not revealed organ damage.

The principal manifestations of acute poisoning with the thiocyanate insecticides is convulsions. Chronic poisoning does not occur.

Symptoms and Signs: (From Ingestion or excessive skin contamination.) Convulsions with respiratory difficulty.

Emergency Measures: Remove skin contamination by scrubbing with soap and water. Remove swallowed poison by giving syrup of ipecac, 15 ml, and 500 ml of tap water or milk. Maintain artificial respiration during convulsions or respiratory difficulty.

Prognosis

If adequate gastric lavage and catharsis can be accomplished before onset of symptoms, recovery is likely. Progression of symptoms after removal of insecticide indicates a poor outcome.

2,4-DICHLOROPHENOXYACETIC ACID

2,4-Dichlorophenoxyacetic acid (2,4-D), its esters and acetates, 2,4,5-T), esters and acetates of 2,4,5-T, 2-methyl-4-chlorophenoxyacetic acid (MCPA), salts and esters of MCPA, and the propionate or butyrate analogs (MCPB, MCPP, 2,4-DB, butyrac, Embutox, tropotox, silvex) of these compounds are used as herbicides. Herbicides with similar actions include erbon, Natrin, and fenac.

Tetrachlorodibenzo-p-dioxine (TCDD) is a potent mutagen in experimental systems and is suspected of being mutagenic in human beings at extremely low doses. It causes chloracne and has been a contaminant in 2,4,5-T.

One fatality has occurred from an amount of 2,4-D not less than 6.5 g. Other fatalities have occurred from varying amounts up to 120g. The LD_{50} for these compounds in animals ranges from 300-700 mg/kg.

The mechanism of poisoning has not been elucidated. No specific tissue changes have been reported.

The principal manifestations of 2,4-D poisoning are weakness and fall of blood pressure.

Emergency Measures: Remove skin contamination by scrubbing with soap and water.

Antidote: For muscle and cardiac irritability, give quinidine sulfate.

Prognosis

Survival for more than 48 hours has been followed by complete recovery. Impotence may persist for several months.

PARAQUAT & DIQUAT

Paraquat or methyl viologen (1,1'-dimethyl-4,4-dipyridylium dichloride), diquat, and difenzoquat (Avenge) are water-soluble herbicides supplied in concentrations of 20-25%. They are inactivated by contact with soil presumably as a result of combination with clay particles in the soil.

More than 10 fatalities from paraquat have been reported in the literature. One individual died after ingesting 3/4 tsp of 19% solution, or an amount less than 10 mg/kg. The fatal dose for human beings has been estimated to be as small as 4 mg/kg, although the oral LD_{50} in rats is 120 mg/kg. The oral LD_{50} for diquat for rats is 200-300 mg/kg, and for difenzoquat it is 470 mg/kg. No fatalities in human beings from diquat have been reported.

Although the mechanism of poisoning has not been elucidated, pathologic findings after paraquat fatalities include heart damage, lung hemorrhages and edema. Damage of the adrenal cortex, kidney damage, and biliary stasis also occur. In experimental studies, diquat has not produced the lung lesion found after paraquat.

Clinical Findings

The principal manifestations of paraquat poisoning are respiratory distress and cyanosis.

Symptoms and Signs: (From ingestion.) Ingestion of paraquat causes burning in the mouth and throat and vomiting. After 2-5 days, bloody sputum, decreased urine output, and ulceration of the tongue, pharynx, and esophagus appear. After 5-8 days, severely poisoned patients show jaundice, fever, increased heart rate, respiratory distress, and cyanosis.

Laboratory identification of paraquat: To 5 ml of neutral fluid, add 0.1 g of sodium bicarbonate followed by 0.1 g of sodium hydrosulfite (dithionite). A blue color develops almost immediately. Absorption maximum is at 625 nm, and 20 μg/ml gives an absorbance of 0.7.

Treatment:

Emergency Measures: Give activated charcoal.

Antidote: No antidote is known.

Prognosis:

Patients have died of lung dysfunction up to 3 weeks after poisoning.

Halogenated Insecticides

Halobenzene derivatives and analogs are synthetic chemicals used as insecticides that are stable for weeks to months after application. They are soluble in fat but not in water. They bioaccumulate in food chains and in body fat.

Commercial insecticide formulas consist of insecticides in technically pure form, dry mixtures of several insecticides, or solutions of one or more insecticides in various organic solvents, especially kerosene, toluene, or other petroleum derivatives. These organic solvents are themselves toxic.

DDT seems to be one of the most toxic of these chemicals, at least in experimental animals. In humans, ingestion of 20 g of DDT in the form of a 10% dry mixture with flour has induced severe symptoms which persisted for more than 5 weeks, with gradual recovery. Virtually all fatalities reported in the literature have resulted from ingestion of DDT in various solvents. The toxicity of these solutions is greater than that of DDT or the solvent alone.

The tolerance of chlorobenzene derivatives in most foods is 0.005-7 ppm, with the exception of methoxychlor (14 ppm).

Fatal doses of the various halobenzene derivative insecticides as estimated on the basis of animal experiments are shown in Table 1 below.

The mechanism of poisoning by these agents is not known. The toxic action does not require metabolic alteration of their chemical structure.

DDT acts chiefly on the brain causing a characteristic hyperexcitability, tremors, muscular weakness. and convulsions. The heart becomes sensitizied so that, at least in experimental animals, injection of epinephrine may induce ventricular fibrillation. Ovotran has caused skin irritation or skin sensitization in human beings.

Inasmuch as most deaths from DDT are complicated by the presence of other insecticides and of solvents, data obtained at autopsy are not reliable. In DDT-poisoned animals, the findings are liver damage and brain damage, as well as heart and kidney damage. The most characteristic finding in experimental animals exposed to the other halobenzene derivatives is liver damage.

Halobenzene derivative insecticides

	LD_{50} (g/kg)
Amiben (3-amino-2,5-dichlorobenzoic acid)	3.5
Bromopropylate, Acarol	5
Chlorbenside (p-chlorobenzyl-p-chlrophenyl sulfide)	0.3
Chlorobenzilate (ethyl-4,4'-dichlorobenzilate)	1
Chloromethyl-p-chlorophenyl sulfone	1
Chloroneb, Demosan	11
p-Chlorophenylbenzenesulfonate, fenson	1.5
Chloropropylate, Acaralate	5
Chloroxuron, Tenoran	3.7
DDD, TDE (Rhothane, mitotane)	3

Halobenzene derivative insecticides (cont'd.)

	LD_{50} (g/kg)
DDT (dichlorodiphenyltrichloroethane)	0.4
Dimite, DMC, chlorfenethol	1
Fluorbenside (p-chlorobenzyl-p-fluorophenyl sulfide)	
Kelthane (bis[p-chlorophenyl]-trichloroethanol)	0.5
Methoxychlor (trichloro-bis[p-methyoxy-phenyl]ethane)	5
Perthane (di-[p-ethylphenyl]dichloroethane)	8
Tedion (tetrachlorodiphenylsulfone)	8

Signs and Symptoms of Intoxication

The principal manifestations of poisoning with these agents are vomiting, tremors, and convulsions.

A. Acute Poisoning:

1. Ingestion of 5 g or more of dry DDT-Severe vomiting begins within 30 minutes to 1 hour; weakness and numbness of the extremities have a more gradual onset. Apprehension and excitement are marked, and diarrhea may occur.

2. Ingestion of more than 20 g of dry DDT-Twitching of the eyelids begins within 8-12 hours; this is followed by muscular tremors, first of the head and neck and then the extremities followed by convulsions. The pulse is normal; respiration is accelerated early and slowed later.

3. The organic solvents present in many commercial insecticides decrease the convulsive effects of DDT and increase the depression of the brain. Onset of slow, shallow breathing within 1 hour after inhaling, ingesting, or absorbing a DDT solution through the skin implicates the solvent rather than the DDT.

B. Chronic Poisoning: Workers with a history of many months' exposure to DDT and having up to 648 ppm of DDT in their body fat have remained completely well, whereas most persons have body fat levels of halogenated insecticides below 15 ppm. These insecticides are all stored for long periods in the body fat, but not in sufficient quantity to induce symptoms on starvation. Liver damage from DDT exposure might be expected from evidence obtained in experimental animals, but no such reports have appeared. Chronic poisoning has not been substantiated in human beings after any halobenzene derivatives.

C. Laboratory Findings:

1. A high urine level of organic chlorine or especially of bis(p-chlorophenyl)acetic acid (DDA) indicates exposure to DDT or to one of the analogous compounds and is indicative of the severity of the exposure.

2. In suspected poisoning, analysis of serum or a fat biopsy is useful for diagnosis. A sample of fat can be taken from subcutaneous tissue. The sample should weigh at least 50 mg. Place sample in previously weighed glass-stoppered vial or vial with Teflon-lined cap and weigh to the nearest 0.1 mg. Prepare at least 5 ml serum

from blood taken after overnight fast. The container should be carefully labelled with the patient's name, weight of sample, date of collection, ana name and address of physician. Send frozen sample to Toxicology Laboratory, Pesticides Program, Food & Drug Administration, US Public Health Service, Atlanta 30333. Containers and further directions are obtainable from the same source. Also, the local health department may be able to arrange for analysis.

Treatment of Halogenated Insecticide Poisoning (Acute)

A. Emergency Measures:

1. Following oral ingestion seek medical attention immediately; syrup of ipecae may be used to induce vomiting if ingested material is not dissolved in a petroleum hydrocarbon. Do not give fats or oils.

2. Scrub skin with soap and water to remove skin contamination.

3. Give artificial respiration with oxygen if respiration is slowed.

Medical care may necessitate use of anticonvulsants to control convulsions. Stimulants are contraindicated.

Prognosis

Recovery has occured except when DDT was ingested dissolved in an organic solvent. If convulsions are severe and protracted, recovery is questionable. If symptoms progress only to tremors, recovery is complete within 24 hours. After convulsions, recovery may require 2-4 weeks.

Deichman, W.B.: Toxicology of DDT and related chlorinated hydrocarbon pesticides. J. Occup. Med. 14:285, 1972.
Morgan, D.T., Roan, E.C.: The metabolism of DDT in man. Essays Toxicol 5:38, 1974.
Siyali, D.S.: Hexachlorobenzene and other organochloride pesticides in human blodo. Med. J. Aust 2:1063, 1972.

BENZENE HEXACHLORIDE
(Gamma Isomer = Lindane)

Benzene hexachloride (hexachlorocyclohexane) is stable for 3-6 weeks after application. It is soluble in fat but not in water.

Wettable powders, emulsions, dusts, and solutions in organic solvents are available for use as insecticides. Both the technical preparation and the gamma isomer (lindane) are used in vaporizers, and serious poisoning has occurred from vapor exposure.

Ingestion of 20-30 g of technical benzene hexachloride will produce serious symptoms, but death is unlikely unless this amount was dissolved in an organic solvent. In the case of lindane, the gamma isomer, 3.5 g/70 kg is considered a dangerous dose. In a girl aged 2 1/2 years, ingestion of 50 or 100 mg/kg caused convulsions with recovery in 24 hours. The tolerance of benzene hexachloride or lindane in food is 10 ppm or less.

Reported instances of serious poisoning have been rare and have resulted from accidental or suicidal ingestion.

Technical benzene hexachloride and lindane stimulate the central nervous system (CNS) to cause hyperirritability, dizziness, and convulsions. Pulmonary edema and vascular collapse may also be of neurogenic origin. Effects of lindane on experimental animals have their onset within 30 minutes and last up to 24 hours; with the technical product, onset of effects may be delayed 1-6 hours and then persist up to 4 days.

Benzene hexachloride is stored in the body fat, being slowly lost through metabolism or excretion in urine, feces, or milk. Of the various isomers of benzene hexachloride, lindane is excreted most rapidly.

Signs and Symptoms of Intoxication

The principal manifestations of poisoning with benzene hexachloride or lindane are vomiting, tremors, and convulsions.

A. Acute Poisoning: (From ingestion or massive skin contamination with a concentrated solution in an organic solvent.) Symptoms begin 1-6 hours after exposure. Vomiting and diarrhea appear first and progress to convulsions. Recovery is likely unless the material contains an organic solvent, in which case difficult breathing, cyanosis, and circulatory failure may progress rapidly.

   Exposure to smaller amounts by skin contamination or by ingestion leads to dizziness, headache, nausea, tremors, and muscular weakness. In addition to these symptoms, exposure to vaporized benzene hexachloride or lindane produces irritation of the eyes, nose, and throat. Such symptoms disappear rapidly upon removal from exposure.

B. Chronic Poisoning: True systemic chronic poisoning has not been reported from any of the isomers of benzene hexachloride.

   Dermatitis from skin contamination with benzene hexachloride has occurred but has improved rapidly upon elimination of exposure.

C. Laboratory Findings: Liver function may be impaired. Specific examination of feces, urine, or fat may reveal presence of benzene hexachloride. Collection and analysis of the fat specimens has been previously described.

Treatment

Treat as for halogenated insecticide poisoning.

Prognosis

A. Acute Poisoning: In acute poisoning not complicated by ingestion of an organic solvent, complete recovery occurs in 1-2 weeks. Progression of symptoms to pulmonary edema and vascular collapse following ingestion of benzene hexachloride or lindane in an organic solvent may make recovery unlikely.

B. Mild Exposure: Symptoms from slight exposure to benzene hexachloride or lindane vaporizers or ingestion of small amounts of benzene hexachloride have lasted not more than 2 weeks.

Solomon, L.M., Fahrner, L., West, D.P.: Gamma benzene hexachloride toxicity: A review. Arch Dermatol. 113:353, 1977.
Starr, H.G., Jr., Clifford, N.J.: Acute lindane intoxication. Arch. Environ. Health 25:374, 1972.

TOXAPHENE
(Chlorinated Camphenes)

Toxaphene consists of chlorinated terpenes with chlorinated camphene predominating. It is stable for 1-6 months after application and is fat-soluble and water-insoluble. Toxaphene is available for insecticidal use in the form of wettable powders, dusts, emulsion concentrates, and concentrated solutions in oil.

The fatal dose of toxaphene for an adult is estimated to be around 2 g. Several members of one family were nonfatally poisoned after eating greens contaminated with toxaphene to the extent of 3 q/kg of greens. The maximum dose ingested by one person was thought to be in the neighborhood of 1 g. Several fatalities in children have followed ingestion of larger but undetermined amounts. The tolerance of toxaphene in foods is 7 ppm. At least 3 fatalities from toxaphene ingestion have been reported.

Toxaphene induces convulsions, salivation, vomiting, and excitability.

Pathologic findings in acute poisoning are hemorrhages and congestion in the brain, lungs, spinal cord, heart, and intestines. Pulmonary edema and degeneration in the brain and spinal cord are also present. In experimentally induced chronic poisoning, degenrative changes were found in the liver and kidney.

Signs and Symptoms of Intoxication

The principal manifestations of toxaphene poisoning are vomiting and convulsions.

A. Acute Poisoning: (From ingestion or skin absorption.)

Confulsions frequently begin without symptoms but may be preceded by nausea and vomiting. In fatal poisoning, convulsions occur at decreasing intervals until respiratory failure supervenes, almost always within 4-24 hours after poisoning. In nonfatal poisoning, cessation of convulsions is followed variably by a period of weakness, lassitude, and amnesia.

B. Chronic Poisoning: (From ingestion, inhalation, or skin absorption.) Instances of chronic poisoning have not appeared in the literature. Experiments in animals indicate that toxaphene is less apt to cause chronic toxicity than DDT but that similar changes in the liver and kidneys are possible.

C. Laboratory Findings: Liver function may be impaired. Analysis of body fat or serum for toxaphene indicates severity of exposure.

Treatment

Treat as for halogenated insecticide poisoning.

Prognosis

In acute poisoning, recovery is likely unless convulsions are progressive and cannot be controlled by barbiturates. Most dangerous is the interval from 4-24 hours after poisoning.

POLYCYCLIC CHLORINATED INSECTICIDES: CHLORDANE, HEPTACHLOR, ALDRIN, DIELDRIN, ENDRIN, MITREX, THIODAN, & KEPONE

These compounds are synthetic fat-soluble but water-insoluble chemicals. Aldrin is stable for 1-3 weeks after application. The others are stable for months to a year or more.

These chemicals, either singly or in mixtures in the form of dusts, wettable powders, or solutions in organic solvents, are used as insecticides for the control of flies, mosquitoes, and field insects.

The toxicity of these polycyclic derivatives for rodents is considerably greater than that of the chlorobenzene derivatives. For example, the experimental fatal dose (LD_{50}) in rats for aldrin or endrin is 10 mg/kg; for dieldrin, it is 40 mg/kg; for heptachlor, 90 mg/kg; for Kepone, 65 mg/kg; for chlordane, 200 mg/kg; for mirex, 300 mg/kg; and for endosulfan (Thiodan), 110 mg/kg. In an average adult, severe symptoms follow ingestion of or skin contamination with 15-50 mg/kg or 1-3 g of chlordane. Other indane derivatives are probably more toxic. In one instance, accidental skin contamination with 30 g of chlorodane as a 25% solution in an organic solvent was fatal to an adult in 40 minutes.

Polycyclic chlorinated insecticides.

Allowable residual tolerance of these indane chemicals in food range from 0-0.1 ppm.

Convulsions from the indane derivatives originate in the central nervous system (CNS).

Pathologic changes include congestion, edema, and scattered hemorrhages in the lungs, kidneys, and brain. The kidneys also show damage.

Signs and Symptoms of Intoxication

The principal manifestations of poisoning with the indane derivatives are tremors and convulsions.

A. Acute Poisoning: (From ingestion, inhalation, or skin contamination of any indane derivative, even in the absence of solvent.) Symptoms of hyperexcitability, tremors, dizziness, and convulsions begin within 30 minutes to 6 hours and are followed by central nervous system (CNS) depression which may terminate in respiratory failure. In one person who ingested 25 mg/kg of chlordane, evidence of kidney damage was indicated.

B. Chronic Poisoning: (From ingestion, inhalation, or skin contamination.) Prolonged exposure to Kepone has caused neurologic symptoms. Both Kepone and mirex have been shown to be carcinogenic in animal experiments. Occasional epileptiform convulsions have occurred in workers from dermal absorption of endosulfan in powder form. EEG findings in poisoning have been suggestive of epilepsy but have reverted to normal when exposure was discontinued. Symptoms may persist for more than 1 week after exposure is discontinued or after acute poisoning.

C. Laboratory Findings: Liver function may be impaired. A fat biopsy or serum test may reveal the presence of indane derivatives.

Treatment

Treat as for halogenated insecticide poisoning. Personnel involved in therapy should wear Neoprene gloves as protection against contamination.

Prognosis

If the liver has previously been damaged, the toxicity of the polycyclic halogenated insecticides is greatly increased. Recovery is likely if onset of convulsions is delayed more than 1 hour and if convulsions are readily controlled.

REFERENCES

Black, A.M.S.: Self-poisoning with dieldrin: A case report and pharmacokinetic discussion. Anesth. Intes. Care 2:369, 1974.

Furie, B., Trubowitz, S.: Insecticides and blood dyscrasias. JAMA 235:1720, 1976.

Glass, W.I.: Dieldrin poisoning: Case report. NZ Med. J. 81:202, 1975.

Harmon, G.E., Reigart, J.R., Sandifer, S.H.: Long-term follow-up of survivors of acute pesticide poisoning. J. SC. Med. Assoc. 71:253, 1975.

Sterrett, F.S., Boss, C.A.: Careless Kepone. Environment 19:30, March 1977.

Zavon, M.R.: Poisoning from pesticides: Diagnosis and treatment. Pediatrics 54:332, 1974.

METALLIC POISONS

METALLIC POISONS

ANTIMONY AND STIBINE

Antimony is used in alloys, type metal, foil, batteries, ceramics, textiles, safety matches, ant paste, and medicinals such as tartar emetic (antimony potassium tartrate). Acid treatment of metals containing antimony releases the colorless gas, stibine (SbH_3).

The TLV in air for antimony is 0.5 mg/cu m. The TLV in air for stibine is 0.1 ppm. The fatal dose of antimony compounds by ingestion is 100-200 mg. Fatalities from antimony poisoning are rare.

The mechanism of poisoning is similar to that of arsenic poisoning, presumably by inhibition of enzymes through combination with sulfhydryl (-SH) groups.

Antimony is strongly irritating to mucous membranes and to tissues. Stibine causes hemolysis and irritation of the central nervous system.

Pathologic findings include degeneration of the liver and other organs. The gastrointestinal tract shows marked congestion and edema.

The principal manifestations of antimony poisoning are gastrointestinal disturbances. Stibine causes hemolysis.

> Following ingestion, the symptoms are nausea, vomiting, and severe diarrhea with mucus and later with blood. Kidney and liver damage may also occur.
>
> Following inhalation (of stibine) headache, nausea, vomiting, weakness, jaundice, anemia, and weak pulse may occur.
>
> Chronic poisoning from fume and dust exposure produces itching skin pustules, bleeding gums, conjunctivitis, laryngitis, headache, weight loss, and anemia.
>
> The red blood cell count may be diminished and urine shows hemoglobin and red cells.

Prevention:

Adequate fume and dust control is necessary to prevent the TLV from being exceeded.

Emergency measures include removal of ingested antimony compounds by emesis and remove patient from further exposure. Seek immediate medical attention.

Prognosis:

Survival for 48 hours indicates that recovery is probable.

ARSENIC AND ARSINE

Arsenic is used in ant poisons, insecticides, week killers, paint, wallpaper, ceramics, medicines, and glass. The action of acids on metals in the presence of arsenic forms arsine gas. Alloys such as ferrosilicon may release arsine upon contact with water since the ferrosilicon may be contaminated with arsenic.

The fatal dose of arsenic trioxide is about 120 mg. The allowable food residue is limited by federal law to 0.65 mg/lb. The TLV in air for arsine is 0.05 ppm; for arsenic, arsenic acid, arsenates, arsenites, and other compounds of arsenic, it is 0.5 mg/cu m. Reduction to 0.002 mg/cu m has been proposed. Organic arsenicals, such as arsphenamine, acetarsone, methane arsonic acid, and dimethylarsinic (cacodylic) acid, release arsenic slowly and are therefore less likely to cause acute poisoning. The fatal dose for these compounds is estimated at 0.1-0.5 g/kg.

Arsenic presumably causes toxicity by combining with sulfhycryl (-SH) containing enzymes and interfering with cellular metabolism.

If death occurs within a few hours, the stomach mucosa shows inflammation but other pathologic changes are absent. If death occurs more than a few hours after poisoning, pathologic examination shows inflammatory changes and partial degeneration of intestinal mucosa. In immediate deaths from arsine poisoning, hemolysis is found. If death is delayed for several days after arsenic in any form, the liver and kidneys show degenerative changes.

The principal manifestations of arsenic poisoning are gastrointestinal disturbances. The principal manifestation of arsine poisoning is hemolysis.

> After ingestion of overwhelming amounts of arsenic (10 times the MLD), initial symptoms are those of violent gastroenteritis: burning esophageal pain, vomiting, and copious watery or bloody diarrhea containing shreds of mucus. Later, the skin becomes cold and clammy, the blood pressure falls, and weakness is marked. Death is from circulatory failure. Convulsions and coma are the terminal signs. If death is not immediate, jaundice and cessation of urine output appear after 1-3 days.
>
> Doses approaching the MLD cause restlessness, nausea, vomiting, headache, dizziness, chills, cramps, irritability, and variable paralysis which may progress over a period of several weeks.
>
> Inhalation of arsenic dusts may cause acute pulmonary edema, restlessness, difficult breathing, cyanosis, cough with foamy sputum, and rales.
>
> Exposure to arsine causes burning and stinging of the face and, after 3-4 hours, tightness of the chest, nausea, altered speech, hemolysis, bloody urine, bronzing of the skin, and enlargement and tenderness of the liver and spleen.
>
> Chronic poisoning from ingestion or inhalation produce damaging of the nervous system, skin bronzing, loss of hair, localized edema, dermatitis, cirrhosis of the liver, nausea, vomiting, abdominal cramps, salivation, anemia, and weight loss. Damage of cardiovascular system and kidneys may also occur. Arsenic and its compounds are carcinogenic.
>
> Following acute poisoning, urine may show red blood cells, protein, and cell casts. Arsenic compounds may appear as barium-like radiopaque material after inges-

tion. In fatal arsenic poisoning, the blood level has ranged from 0.1-1.5 mg/100g. After therapeutic administration of arsenic, the blood level has ranged from 0.01-0.025 mg/100g. After arsine inhalation, the urine contains hemoglobin.

Following chronic poisoning, arsenic can be identified in hair, nails, urine, feces, and vomitus by state or county toxicologic laboratories. Liver or kidney function may be impaired. Blood counts reveal as anemia.

Prevention:

Store arsenic safely. The TLV of arsine in air must be observed at all times. Acid treatment of metals or dilution of acid sludge must be done with adequate fume control.

Emergency Measures

Following ingested arsenic, immediate removal should be by emesis. Seek immediate medical help.

Following chronic poisoning, remove from further exposure and seek medical help.

Prognosis:

In acute arsenic poisoning, survival for more than 1 week is usually followed by complete recovery. Complete recovery from chronic arsenic poisoning may require 6 months to 1 year.

BERYLLIUM

Beryllium is used in alloys for electrical equipment. It is present in some fluorophors used in cathode ray tubes and fluorescent lights, but the use of these fluorophors in fluorescent lamps has been discontinued by most manufacturers.

The fatal dose of beryllium is not known. The TLV in air for beryllium is 0.002 mg/cu m.

Between 1941 and 1966, 760 cases of berylliosis were recorded in a national registry (Massachusetts General Hospital, Boston). Between 1966 and 1973, 76 new cases were recorded. Beryllium appears to inhibit certain magnesium-activated enzymes. The relation between this effect and the pathologic changes induced by beryllium is not understood.

Soluble beryllium salts are directly irritating to skin and mucous membranes and induce acute pneumonitis with pulmonary edema. At least part of the changes present in acute pneumonitis and chronic pulmonary inflammation develop as a result of hypersensitivity to the beryllium in the tissues.

At pathologic examination, fibrous tissue growth is found at the site of beryllium localization. In deaths from acute pneumonitis, the lung alveoli are filled with cells.

The principal manifestation of beryllium poisoning is difficult breathing.

> Following inhalation, acute pneumonitis, with chest pain, bronchial spasm, fever, difficult breathing, cyanosis, cough, blood-tinged sputum, and nasal discharge may be seen. Onset of symptoms occurs 2-5 weeks after an exposure of 1-20 days.
>
> Following skin contact, cuts from beryllium-contaminated objects form deep ulcerations which are slow to heal. Acute dermatitis from contact with dust simulates first and second degree burns.
>
> Following eye contact, dust contamination causes acute conjunctivitis with corneal damage and diffuse irritation.
>
> Following inhalation in chronic pulmonary berylliosis, weight loss and marked difficult breathing begin 3 months to 11 years after first exposure. The disease may pursue a steady downhill course or may be marked by exacerbations and remissions. Right heart failure may occur as a result of increased pulmonary resistance. Fever is variable.

Following chronic skin contact, dermatitis and rash appear in a large percentage of exposed workers. In such persons, patch tests with dilute beryllium solutions show positive reactions.

In chronic pulmonary beryllosis, ex-ray examination reveals a "snowstorm" appearance of the lungs.

Prevention:

Dusts and fumes from beryllium processes must be rigidly controlled. No beryllium is allowable in air.

X-ray examinations of the chest are not useful in controlling exposure or in case-finding. X-ray examination of the chest may become positive without any symptoms, or positive x-ray findings may occur only at the onset of symptoms. Workers may be asymptomatic and have normal x-ray examinations of the chest during exposure to beryllium, and yet they may develop symptoms and positive chest x-ray findings many years after discontinuing exposure.

Emergency measures include complete bed rest, supplemental oxygen for difficult breathing and immediate medical attention. Skin ulcers may require surgical removal.

Prognosis:

Recovery from acute pneumonitis requires 2-6 months. Deaths have been rare. Approximately 2% of those with chronic pulmonary berylliosis die.

CADMIUM

Cadmium is used for plating metals in the manufacture of bearing alloys and silver solders. Cadmium plating is soluble in acid foods such as fruit juices and vinegar. Heating products containing cadmium above the melting point (321 C) releases cadmium fumes.

The fatal dose by ingestion is not known. Ingestion of as little as 10 mg will cause marked symptoms. The TLV in air for cadmium oxide fumes is 0.1 mg/cu m; for cadmium metals and dusts, it is 0.2 mg/cu m. Cadmium is damaging to all cells of the body.

The pathologic findings in cases of fatal cadmium ingestion are severe gastrointestinal inflammation and liver and kidney damage. In fatal acute poisoning from the inhalation of cadmium fumes, pathologic examination reveals inflammation of the lung. Pathologic examination in fatalities following prolonged exposure to cadmium fumes reveals emphysema.

The principal manifestations of cadmium poisoning are gastrointestinal and lung irritation.

> Following ingestion, nausea, vomiting, diarrhea, headache, muscular aches, salivation, abdominal pain, shock, liver damage, and kidney failure may occur.
>
> Inhalation of cadmium fumes causes a metallic taste in the mouth, shortness of breath, pain in the chest, cough with foamy or bloody sputum, weakness, and pains in the legs. Chest examination reveals bubbling rales. Urine formation may be diminished later. Progression of the disease is indicated by onset of fever and by development of signs of lung consolidation.
>
> Chronic poisoning from inhalation produces loss of sense of smell, cough, difficult breathing, weight loss, anemia, irritability, and yellow-stained teeth. The liver and kidneys may be damaged.
>
> After inhalation, early chest x-ray shows a diffuse increase in lung density; later findings are those of bronchial pneumonia. Bloody urine may be seen.

Prevention:

The TLV of cadmium fumes in air must always be observed. Acid foods should never be stored or prepared in cadmium-plated cooking utensils.

Emergency measures should be to remove victim from further exposure. Give milk or beaten eggs every 4 hours to alloy gastrointestinal irritation. Seek immediate medical treatment.

Prognosis:

Symptoms from cadmium ingestion usually last no more than 24 hours. In fume inhalation, the mortality rate has been approximately 15%. Survival for more than 4 days is followed by recovery, but complete recovery may take 6 months.

CHROMIUM

Chromium is used in chemical synthesis, steel-making, electroplating, leather tanning, and as a radiator anti-rust.

The fatal dose of soluble chromate such as potassium chromate, potassium bichromate, or chromic acid is approximately 5 g. The TLV in air for chromium (determined as chromic oxide) is 0.1 mg/cu m. Up to 20% of chromium workers develop dermatitis.

Chromium and chromates are irritating and destructive to all cells of the body. In fatalities from acute poisoning, kidney damage is found.

The principal manifestation of chromium poisoning is irritation or corrosion.

> Following ingestion, dizziness, intense thirst, abdominal pain, vomiting, shock, and kidney damage may occur. Death is from uremia.
>
> Repeated skin contact leads to incapacitating dermatitis with edema, and ulceration which heals slowly. Breathing chromium fumes over long periods causes painless ulceration, bleeding, and perforation of the nasal septum accompanied by a foul nasal discharge. Conjunctivitis, lacrimation, and acute hepatitis with jaundice have also been observed.
>
> The incidence of lung cancer is increased up to 15 times normal in workers exposed to dusty chromite, chromic oxide, and chromium ores.

Prevention:

The TLV in air must always be observed. Chromic mist, fumes, and dust must be controlled. Chromate solutions must not come in contact with the skin.

Emergency measures should be to remove victim from further exposure. Seek immediate medical attention.

Prognosis:

In acute poisoning, rapid progression to kidney failure indicates a poor outcome. Dermatitis and liver damage will respond to removal from further exposure.

LEAD

Lead is used in type metal, storage batteries, industrial paint, solder, electric cable covering, pottery glaze, rubber, toys, gasoline (tetraethyl lead), and brass alloys. Other sources include plastic beads or jewelery coated with lead to give a pearl appearance, bootleg whisky, home-glazed pottery, leaded glass making, the dust in shooting galleries, ashes and fumes from the burning of old painted wood, and artists' pain pigments. The amount of lead in circulation or that has been lost from use is enormous. From 1720-1970, 47,303,551 tons of lead were added to the supply in the USA. In 1968, net imports were 435,000 tons, and 390,000 tons were added from mining. In this same year, 260,000 tons of lead were used in gasoline additives.

The fatal dose of absorbed lead has been estimated to be 0.5 g. Accumulation and toxicity occur if more than 0.5 mg/day is absorbed. The TLV of lead in air is 0.15 mg/cu m. The TLV of lead in food is 2.56 mg/kg. The TLV for tetraethyl lead should not exceed 117 μg/cu m of lead.

The US Public Health Service has estimated that at least 400,000 children in the USA have increased blood levels, and 16,000 of these require treatment each year. Each year, there are 200 deaths from lead encephalopathy; 800 children have permanent brain damage; and 3200 have temporary mental impairment. Most of these fatalities are in children who lived in homes built before 1940. Most of the cases have been discovered in a few hospitals, and it is possible tha the incidence of lead poisoning may be considerably higher.

The most serious toxic effects result from effects of lead on the brain and peripheral nervous system. The brain and liver lead levels may be 5-10 times the blood level. The lead in these tissues is only slowly removable by de-leading agents. Since only uncombined lead is removed effectively by de-leading agents, the increased excretion of lead brought about by such agents is only temporary. The de-leading agent only becomes effective again when further lead has been released from combination.

In acute poisoning, pathologic findings include inflammation of the gastrointestinal mucosa and kidney degeneration. In chronic lead poisoning, cerebral edema and degeneration of nerve and muscle cells occur. The liver may also show damage.

Any symptoms suggestive of brain damage should be considered an emergency. A rapid presumptive diagnosis can be based on the presence of the following: urine, porphyrins above 0.5 mg/liter; blood lead above 80 μg/100 ml; erythrocyte protoporphyrin greater than 190 μg/100 ml of whole blood, or — in the presence of anemia (38% Hgb) — erythrocyte protoporphyrin greater than 500 μg/100 ml of erythrocytes; erythrocyte δ-aminolevulinic acid dehydratase less than 50% of normal, increased protoporphyrin fluorescence of whole blood; and the appearance of radiopaque material on a plain film of the abdomen and radiopaque lead lines in the wrists and knees.

Any positive finding in addition to suggestive symptoms is sufficient indication to start therapy. Any child who has minor symptoms of poisoning can develop acute encephalopathy suddenly if blood lead is above 80 μg/100 ml.

The principal manifestations of lead poisoning are gastrointestinal or central nervous system disturbances and anemia.

For ingestion or rapidly absorbed compounds of lead, metallic taste, abdominal pain, vomiting, diarrhea, black stools, kidney damage, collapse, and coma may be seen.

From chronic ingestion, skin absorption, or inhalation or particulate or organic lead the following may be observed: 1) Early — loss of appetite, weight loss, constipation, irritability, occasional vomiting, fatigue, headache, weakness, metallic taste, lead line on gums, loss of recently developed skills, and anemia. 2) More advanced — Intermittent vomiting, irritability, nervousness, incoordination; vague pains in arms, legs, joints, and abdomen; sensory disturbances of extremities, paralysis of extensor muscles of arms and legs with wrist and foot drop, disturbance of menstrual cycle, and abortion. 3) Severe — Persistent vomiting, ataxia, periods of stupor or lethargy, encephalopathy (with visual disturbances), elevated blood pressure, paralysis, delirium, convulsions, and coma. Severe symptoms occur most frequently in lead poisoning in children or in adults exposed to tetraethyl lead. 4) Exposure to tetraethyl lead or tetramethyl lead causes insomnia, disturbing dreams, emotional instability, hyperactivity, convulsions, and even toxic psychosis.

The following findings are suggestive of lead poisoning: 1) Blood — Hemoglobin below 13 g/100 ml blood. Blooa lead about 20 μg/100 ml indicates exposure to lead above 40 μg/100 ml suggests the need for a search for source of lead and its elimination. Levels above 60 μg/100 ml should be reduced with de-leading agents. Risk of encephalopathy is great at blood lead level over 80 μg/100 ml; level over 100 μg/100 ml should be treated as an emergency. 2) Urine lead excretion greater than 0.08 mg/day or urine coproporphyrin above 0.15 mg/24 hours.

Prevention

Lead-containing paint should not be used indoors. Painters and lead workers must change clothing and bathe before eating. Precautions must be taken to keep lead in air below the TLV. Children must not be allowed to play with lead toys. Emergency measures should include removal of acutely ingested lead by emesis and medical treatment for acute and chronic lead poisoning.

Prognosis

Until recently, the death rate in patients with lead encephalopathy was about 25%. About half of those who survived had permanent mental deterioration. The effect of calcium disodium edetate on the prognosis in lead encephalopathy has not been determined as yet.

Complete recovery from other forms of lead poisoning takes up to 1 year.

MANGANESE

Manganese is used in the manufacture of steel and dry cell batteries.

The TLV in air of manganese is 5 mg/cu m.

The toxic amount of inhalation is not known. Fatalities are rare.

The mechanism of manganese poisoning is not known. Inhalation of manganese fumes or dusts produces progressive deterioration in the brain. Large oral doses of manganese compounds are without systemic effect in experimental animals.

The findings in one death suspected to be from ingesting manganese-contaminated drinking water were atrophy and disappearance of cells of the brain. Experimental animals show inflammatory changes in brain.

The principal manifestations of poisoning with these compounds are brain disturbances.

> Ingestion of manganese-contaminated well water caused lethargy, edema, and symptoms of brain damage.
> Inhalation of manganese dusts caused acute bronchitis, nasopharyngitis, pneumonia, headache, itching, numbness of the extremities, impairment of libido, sleep disturbances, dermatitis, and liver enlargement. Later, there are gradually progressive signs which simulate parkinsonian syndrome. These include weakness in the legs, increased muscle tone, hand tremor, slurred speech, muscular cramps, spastic gait, fixed facial expression, and mental deterioration.

Prevention

Workmen should change clothing and bathe on leaving work. Quarterly physical examinations of all exposed workers will aid in the discovery of early changes.

Batteries must not be buried near water supplies.

Emergency measures include removal from further exposure and immediate medical attention.

Prognosis

While liver and respiratory system damage from manganese are reported to respond to calcium disodium edetate, this antidote has no effect on the symptoms of brain deterioration. If exposure is discontinued when brain symptoms first appear, recovery is possible.

MERCURY

Mercury is a liquid. Air saturated with mercury at 20 C contains about 15 mg/cu m. At 40 C, saturated air contains 68 mg/cu m.

Mercury and its salts are used in the manufacture of thermometers, felt, paints, explosives, lamps electrical apparatus, and batteries. The volatile diethyl and dimethyl mercury compounds are used in treating seeds. Mercurous chloride (calamel) and organic mercurials are used medicinally.

The fatal dose of mercuric salts such as mercuric chloride (corrosive sublimate) is 1 g. Ingested metallic mercury is not toxic since it is not absorbed.

Mercurous chloride, ammoniated mercury, mercury protoiodide, and organic antiseptic mercurials such as acetomeroctol, merbromin, mercocresol, nitromersol, phenylmercuric salts and esters, and thimerosal (Merthiolate) are not likely to cause acute poisoning because they are poorly absorbed. The single fatal dose of these compounds is 2-4 times the fatal dose of soluble inorganic mercury salts. The mercurial diuretics (mersalyl, meralluride, mercurophylline, mercumatilin, mercaptomerin, chlormerodrin, and merethosylline) are almost as toxic as mercuric chloride in experimental animals in comparison to mercury content. The TLV in air of mercury or mercury compounds is 0.05 mg/cu m as mercury. Volatile alkyl mercury compounds such as methyl mercury chloride, methyl mercury cyanide, methyl mercury hydroxide, methyl mercury pentachlorophenate, methyl mercury toluene sulfonate, ethyl mercury chloride (Ceresan), ethyl mercury phosphate, and ethyl mercury toluene sulfonate are twice as toxic as mercuric chloride and the TLV is 0.01 mg/cu m. Other organic mercury compounds, such as hydroxymercuriphenol and cyano-methyl-mercuri-guanidine, are as toxic as an equivalent amount of mercury in mercuric chloride.

Environmental contamination from industrial discharge of organic mercury compounds has resulted in organic mercurial poisoning from eating fish from the discharge area. Seed grains treated with organic mercury fungicides have caused poisoning when used as food. Concentration of alkyl mercury compounds (methyl mercury) should not exceed 0.5 mg/g, in food; for foods at this level, intake should be limited to not more than 0.5 kg/week.

Mercury depresses cellular enzymatic mechanisms by combining with sulfhydryl (-SH) groups; for this reason, soluble mercuric salts are toxic to all cells. The high concentrations attained during kidney excretion lead to specific damage to kidney.

In fatalities from mercury poisoning, the pathologic findings are acute kidney damage. The mucosa of the gastrointestinal tract shows inflammation, congestion, coagulation and corrosion.

Prevention

The TLV must be observed at all times; frequent air sampling is necessary.

Floors in rooms where mercury is used must be impervious and free from cracks. Spilled mercury should be picked up immediately by water pump suction or by a wet sweeping compound. After handling mercury or mercury compounds, the skin must be thoroughly cleaned.

Emergency measures should include removal of ingested mercury by emesis and immediate medical assistance sought. Remove from further exposure.

Prognosis

In acute and chronic poisoning, recovery is likely if dimercaprol treatment is given for at least 1 week. Recovery from mental deterioration caused by chronic mercury poisoning may never be complete. Brain damage from alkyl mercury compounds is more likely to be permanent. Improvement requires 1-2 years.

NICKEL CARBONYL

Nicked carbonyl is formed by passing carbon monoxide over finely divided metallic nickel. Nickel carbonyl is a liquid which boils at 43 C. It is important in the Mond process for refining nickel. It is also used in petroleum refining.

The TLV in air of nickel carbonyl is 0.001 ppm. Inhaled nickel carbonyl decomposes the metallic nickel, which deposits on the epithelium of the lung. This finely divided nickel is rapidly absorbed and damages the lung and brain. Postmortem examinations in deaths caused by nickel carbonyl inhalation reveals edema and congestion of the lungs and brain. Areas of necrosis and hemorrhage are found in the brain and lungs.

The principal manifestation of nickel carbonyl poisoning is difficult breathing.

The principal manifestation of mercury salt poisoning is kidney damage.

Ingestion of mercuric salts causes metallic taste, thirst, severe abdominal pain, vomiting, and bloody diarrhea. Diarrhea of mucus shreds and blood may continue for several weeks. One day to 2 weeks after ingestion, urine output diminishes or stops. Death is from uremia. Esophageal, gastric, or intestinal damage may occur after mercuric chloride.

Inhalation of a high concentration of mercury vapor will be followed within 1-2 days by stomach damage, salivation, metallic taste, diarrhea, pneumonitis, and kidney damage with shutdown. Inhaling volatile organic mercurials in high concentrations causes metallic taste, dizziness, clumsiness, slurred speech, diarrhea, and sometimes fatal convulsions.

Alkyl mercury compounds are concentrated in the brain with ataxia, tremors, and convulsions. Damage tends to be permanent.

Inhalation of mercury vapor, dusts, or organic vapors, or skin absorption of mercury or mercury compounds over a long period causes mercurialism. Findings are extremely variable and include tremors, salivation, stomach pain loosening of the teeth, blue line on the gums, pain and numbness in the extremities, kidney damage, diarrhea, anxiety, headache, weight loss, loss of appetite, mental depression, hallucinations, and evidences of mental deterioration.

The lowest concentrations of methyl mercury in blood associated with identifiable symptoms is 0.2 mg/liter. A tentative blood standard not to exceed 0.1 mg/liter has been set.

Urinary excretion of more than 0.3 mg of mercury/24 hours indicates the possibility of mercury poisoning. An average excretion above 0.1 mg/24 hours urine in a group of mercury workers indicates the need for corrective measures for the work situation. An individual who shows over 0.2 mg/24 hours in urine should be removed from exposure until his urinary concentration falls below 0.05 mg/24 hours.

Workers using organic mercury compounds should be removed from further exposure if the urinary excretion goes above 0.05 mg/24 hours. The county or state health department will make arrangements for mercury analyses.

Inhalation of nickel carbonyl immediately causes cough, dizziness, headache, and malaise, which ordinarily can be relieved by removal to fresh air. Progressive dyspnea, cough cyanosis, fever, rapid pulse, nausea, and vomiting may follow in 12-36 hours, and death from respiratory failure within 4-12 days.

Workers exposed to nickel carbonyl show a high incidence of lung cancer. Some workers develop dermatitis following chronic exposure.

Prevention

The TLV for nickel carbonyl must always be observed. No person with chronic pulmonary disease should work where nickel carbonyl exposure can occur. Contaminated atmospheres can only be entered by using a positive pressure breathing mask.

Emergency measures should include giving 100% oxygen by mask to treat cyanosis and difficult breathing and medical attention immediately sought. Victim should be removed from further exposure.

Prognosis

Survival for more than 14 days is followed by recovery. Cyanosis and difficult breathing are indices of the severity of poisoning.

PHOSPHORUS, PHOSPHINE, PHOSPHIDES

Phosphorus exists in 2 forms: a red, granular, non-absorbed, and non-poisonous form, and a yellow, waxy, water-insoluble and fat-soluble, highly poisonous form which will burn on contact with air. Red phosphorus is sometimes contaminated with yellow phosphorus. The striking surface of a safety match contains 50% red phosphorus. Yellow phosphorus is used in rodent and insect poisons, fireworks, and fertilizer manufacture. The action of water or acids on metals will liberate phosphine if phosphorus is present as a contaminant. Phosphine may also be present in acetylene. Phosphides, used as rat poisons, release phosphine on contact with water. Phosphorus sesquisulfide (tetraphosphorus trisulfide) has low toxicity. The heads of 20 large wooden matches contain 220 mg.

The fatal dose of yellow phosphorus or phosphides is approximately 1 mg/kg. The TLV in air of yellow phosphorus is 0.1 mg/cu m. The TLV in air of phosphine is 0.3 ppm.

Phosphorus causes tissue destruction, with disturbance in carbohydrate, fat, and protein metabolism in the liver. Deposition of glycogen in the liver is inhibited; deposition of fat is increased.

Chronic absorption of phosphorus increases bone formation. These changes lead to destruction of bone; they occur most frequently in the mandible.

The pathologic findings in yellow phosphorus poisoning are jaundice, fatty degradation of the liver and kidneys, and hemorrhages, congestion, and erosion of the gastrointestinal tract. Pathologic findings from phosphine inhalation are pulmonary edema. Zinc phosphide ingestion causes both fatty degeneration and necrosis of the liver and pulmonary edema.

The principal manifestations of poisoning with these compounds are liver damage and collapse.

> Ingestion of yellow phosphorus is followed within 1-2 hours by nausea, vomiting, diarrhea, cardiac abnormalities and a garlic odor of breath and excreta. Death in coma or cardiac arrest may occur in the first 24-48 hours, or symptoms may improve for 1 or 2 days and then return, with nausea, vomiting, diarrhea, liver damage, prostration, fall of blood pressure, tetany, kidney damage, hypoglycemia, and hemorrhages. Respiration abnormalities followed by convulsions, coma, and death may occur up to 3 weeks after poisoning. Phosphide ingestion causes liver damage, jaundice, and pulmonary edema with difficult breathing and cyanosis. Death may occur up to a week after poisoning.
>
> Yellow phosphorus allowed to dry on the skil will ignite and cause second to third degree burns surrounded by blisters. These burns heal slowly.
>
> Inhalation of phosphorus is followed, after 1-3 days, by the symptoms of acute phosphorus poisoning. Phosphine or phosphide inhalation causes fall of blood pressure, difficult breathing, pulmonary edema, collapse, vomiting, cardiac abnormalities, convulsions, and coma. Death usually occurs within 4 days; it may be delayed 1-2 weeks.
>
> Kidney damage may appear after several days from chronic ingestion or inhalation of yellow phosphorus, phospine, or phosphides. The

first symptom is toothache, followed by swelling of the jaw and then destruction of the mandible (phossy jaw). Other findings are weakness, weight loss, loss of appetite, anemia, and spontaneous fractures.

Prevention

The TLV of phosphorus, phosphine, and phosphides in the air must be observed at all times. Special clothing, to be changed daily, should be provided phosphorus workers. Workers must bathe on leaving work and must be educated in the hazards of phosphorus exposure. Safety showers and eye fountains must be provided where yellow phosphorus is being used. Dental examinations should be made frequently, depending on exposure.

Emergency measures should include removal of victim from further exposure. Medical attention should be sought immediately.

Prognosis

In poisoning from ingestion of phosphorus, the fatality rate is about 50%. In phosphine inhalation, survival for 4 days is ordinarily followed by recovery.

ZINC FUMES AND METAL FUME FEVER

Zinc fumes are produced in welding, metal cuttings, and smelting zinc alloys or galvanized iron. Zinc fumes are most often responsible for metal fume fever, but other metal fumes will also cause the disease. Soluble zinc salts, such as zinc chloride, are used in smoke generators.

The TLV in air for zinc oxide fumes is 5 mg/cu m. No fatalities from breathing zinc oxide or zinc chloride fumes have been reported in recent years.

Fumes from zinc or soluble zinc salts irritate the lungs. Other physiologic changes are not known,

The pathologic findings in fatalities from zinc chloride or zinc fume inhalation are pulmonary edema and damage to the respiratory tract.

Clinical Findings

The principal manifestations of acute zinc fume or other metal fume poisoning are muscular aches and fever. Chronic poisoning does not occur.

Inhalation of zinc oxide or other metal oxide fumes causes fever, chills, nausea, vomiting, muscular aches, and weakness. Inhaling fumes of soluble zinc salts such as zinc chloride may cause pulmonary edema with cyanosis and difficult breathing.

Prevention

Zinc chloride smoke generators should not be operated in such a way that workers will be exposed. Fumes from melting zinc must be controlled by proper air exhaust.

Emergency measures should include removal of victim from fumes and immediate medical attention.

Prognosis

In zinc fume fever, recovery occurs in 24-48 hours. In pulmonary edema from zinc chloride fumes, the fatality rate has been 10-40%.

GASES

AIRBORNE POISONS

AIRBORNE POISONS. PARTICULATES AND GASES

I. HISTORY

Pulmonary diseases can be caused by inhalation of insoluble dust particles which induce production of connective tissues. These pulmonary diseases are the pneumoconioses. The dust particles increase the amount of connective tissue and encroach upon the breathing space of the lung, ultimately resulting in respiratory embarrassment As fibrosis advances, emphysema develops to embarrass further respiration. Silicosis is the most frequent disease of this group.

II. PHARMACODYNAMICS

Most irritant gases are corrosive by nature, and when inhaled act primarily to produce acute, local irritation of the upper respiratory tract, bronchi, or alveoli. A mild action produces increased secretion of mucous. A more intense action produces an inflammatory reaction with edema and cellular exudation. Some gases affect primarily the nasal mucosa (ammonia); others act more severely on bronchi (chlorine or hydrogen chloride fumes); and some affect the alveoli (phosgene). Exposure to irritant gases may produce either acute pulmonary disease or an illness seen only after long exposure (weeks). In these chronic cases, the period of illness is also prolonged.

III. TOXICITY

(A) Nonabsorbable dusts

1. Beryllium: Beryllium is one of the most toxic metals used in industry and research. It causes skin and eye lesions as well as pulmonary damage.

2. Silicon: Silicon does not exist free in nature, but as silica (SiO_2) or combined as metallic silicates (granite, clay, mica, asbestos, feldspar). Quartz is the most common form and the form of clinical importance. Wide industrial use of crystalline silica have resulted in exposure of many individuals to silica dust through inhalation.

Silicosis: This is the condition resulting from the inhalation of crystalline silica. This disease usually requires 10 to 25 years to develop and is characterized by nodules of fibrosis scattered uniformly throughout both lungs. Silicosis is clinically characterized by shortness of breath. With advanced silicosis, half of the individuals develop tuberculosis.

3. Asbestos: Asbestos is a hydrated magnesium silicate which occurs in nature in a number of forms and is associated with a number of other metal silicates. Asbestosis is a progressive, diffuse, nonnodular fibrosis of the lungs resulting from the prolonged inhalation of asbestos fibers. The principal symptoms are dyspnea, loss of weight and coughing. Asbestosis may produce a predisposition to lung cancer.

4. Vegetable dusts: Some vegetable dusts contain spores of fungi.

Workers exposed to cotton dusts over a period of more than 20 years develop a slowly, progressive dyspnea, bronchitis and emphysema. These individuals have a predisposition to respiratory tract infections. The disease is thought to be the result of organisms present on cotton fibers and not by a toxic action of the fiber <u>per se</u>. This disease is called byssinosis.

Pulmonary disorders are also described following contact with moldy hay and grain. This disorder is known as farmer's lung. It is not often fatal, but may cause a high morbidity.

After sugar has been expressed from sugar cane, the remaining material is called bagasse. A pulmonary disease, bagassosis, may follow inhalation of bagasse fibers. The disease is characterized by inflammatory and fibrotic lesions of the lung. Again, the disease is not often fatal but may produce a high morbidity.

(B) <u>Noxious Gases and Vapors</u>

1. <u>IRRITATING GASES:</u> The toxicity of irritating gases is the result of their caustic or corrosive nature. In humans the toxicity is manifested at the site of exposure, i.e. on the skin or respiratory tract. Such agents are referred to as "primary irritants" and may cause inflammatory responses or extensive tissue necrosis. The reaction is nonspecific and occurs on all cells regardless of type. Methylbromide, a refrigerant, will produce chemical burns of an intensity directly related to exposure concentration. Gases encountered in smog, such as sulfur dioxide and nitrogen dioxide are converted to sulfurous and nitrous acid in the presence of water (at membranes or in the air) producing a primary irritation. Aldehydes, such as acrolein (allyl aldehyde) and formaldehyde, are strong irritants when inhaled and may cause pulmonary edema resulting in loss of air space and impaired transfer of respiratory gases. In patients with lung diseases mild exposure to primary irritants may lead to serious impairment of pulmonary function.

2. <u>CARBON MONOXIDE (CO)</u>: Carbon monoxide is a colorless, tasteless, and nonirritating gas. There are over 5,000 CO deaths annually in the U.S., making CO the most common cause of death by gas poisoning.

<u>Reaction with hemoglobin</u>: Carbon monoxide combines reversibly with hemoglobin forming carboxyhemoglobin, (COHb), in such a manner as to prevent this blood pigment from transporting the normal blood gases O_2 and CO_2. The COHb combination diminishes the O_2-releasing ability of the remaining hemoglobin, which has not combined with CO.

Carbon monoxide accumulates (reversibly) in the blood because the affinity of human hemoglobin for CO is about 200 times greater than its affinity for oxygen. There is a rapid removal of CO from the plasma into the red blood cell to combine with hemoglobin. Continued formation of COHb keeps the plasma CO tension at a low level and maintains a steep CO gradient from the alveolus to the blood.

COHb, like oxyhemoglobin, is a dissociable compound. When exposure to the gas is terminated, CO dissociates from the hemoglobin and escapes from the blood. COHB dissociation is greatest in the presence of pure oxygen, which displaces CO on the hemoglobin molecule and converts COHb to oxyhemoglobin. The average half-life for COHb in the circulation is 250 minutes. If oxygen is substituted for air the half-life is reduced to 40 minutes.

Factors Governing CO Toxicity are: (a) CO concentration in inspired air; (b) Duration of exposure; (c) Respiratory minute volume; (d) Cardiac output; (e) Oxygen demand of tissues; (f) Hemoglobin concentration of the blood.

Acidosis: Tissue acidosis is associated with CO poisoning. Since tissue cells are forced to operate at lower O_2 tensions, anaerobic metabolism increases lactic acid production. COHb does not transport CO_2 and impairs this function in the residual intact hemoglobin, and CO_2 accumulates at cellular sites.

Acute CO Poisoning:

Diagnosis: The victim is commonly found under circumstances that leave little doubt as to the cause of his condition, e.g. in a closed car. The appearance of the patient also assists in the diagnosis. COHb is bright red in color. This results in the unusual combination of hypoxia associated with a bright red color of the fingernails, mucous membranes and skin ("cherry-red cyanosis"). Final diagnosis depends upon demonstration of COHb in the blood.

Treatment: Transfer the patient to fresh air and administer artificial respiration and pure oxygen. The patient should be kept warm and remain absolutely quiet to keep tissue demands for oxygen at a minimum.

Pathology: The changes that result in tissues are brought about by hypoxia. Tissues most seriously affected are the most sensitive to oxygen deprivation, such as the brain. CO poisoning is sometimes followed by permanent damage to the central nervous system. The heart is also sensitive to hypoxia. Pathological lesions that occur in the heart, brain and other organs are primarily vascular, i.e., small hemorrhages and perivascular infiltration with local necrosis.

Chronic CO Poisoning: Illness may develop (headache, dyspepsia, weakness, dizziness, and polycythemia) as a result of tissue injury induced by repeated exposure to toxic concentrations of CO. The illness may persist and progress long after the noxious agent has disappeared from the body. The m.a.c. is 100 ppm.

3. HYDROCYANIC ACID OR CYANIDE: Hydrocyanic acid (HCN) vapors produce severe toxic effects and death within a few minutes. The action of HCN is due to the cyanide ion. The toxic properties of the gas are shared by all the soluble inorganic cyanide salts. All the pharmacological actions of cyanide result from the cytotoxic hypoxia that it produces.

Pharmacodynamics: Cyanide reacts with iron only in the ferric (trivalent) state. It reacts with iron of cytochrome oxidase to form a cytochrome oxidase-CN complex and with the iron of methemoglobin to form cyanmethemoglobin. Cytochrome oxidase is particularly reactive with cyanide, and when the two combine cellular respiration is inhibited, i.e. a cytotoxic hypoxia. The cytochrome-CN complex is dissociable. Rhodanese, a tissue enzyme, mediates the transfer of sulfur from thiosulfate to cyanide ion to form thiocyanate. The respiratory enzyme is thus freed and cell respiration is restored. Tissue rhodanese is adequate to handle relatively large amounts of cyanide, but the reaction is limited by the endogenous supply of thiosulfate. Formation of cytochrome oxidase-CN complex is minimal in the presence of high concentrations of methemoglobin. Cyanide ion stimulates respiration and depresses brain function. The actions on the myocardium produce cardiac slowing and characteristic changes in the electrocardiogram.

Cyanide is readily absorbed after oral, topical, or parenteral administration. Part of the absorbed cyanide is excreted unchanged by the lungs. The larger portion is converted by the enzyme rhodanese to the relatively non-toxic thiocyanate ion.

Cyanide Poisoning: Symptoms of hyperpnea, cyanosis and unconsciousness following cyanide poisoning occur within seconds to minutes following ingestion or exposure to vapors.

Treatment: Treatment of cyanide poisoning is specific and must be given rapidly if it is to be effective. Diagnosis can be made by characteristic cyanide odor ("bitter almonds") on the breath. This sign in association with asphyxia and cyanosis is pathognomonic. The objective of treatment is to produce a high concentration of methemoglobin ($Hb\text{-}Fe^{+++}$) by administration of nitrite. Methemoglobin competes with cytochrome oxidase ($Cyt.\text{-}Fe^{+++}$) for the cyanide ion. Detoxification of cyanmethemoglobin is achieved by administration of thiosulfate, which, under the influence of rhodanese, reacts with cyanide to form thiocyanate (SCN). Sodium nitrite is one of the best producers of methemoglobin. Immediate therapy with amyl nitrite inhalations followed by slow intravenous injection of sodium thiosulfate should be administered. If symptoms reappear, the above procedure should be repeated with half doses.

IV. REFERENCES

The Pharmacological Basis of Therapeutics, Ed. L.S. Goodman and A. Gilman Chapter 44, pp 930-936.

Drill's Pharmacology in Medicine. Ed. J.R. DiPalma. Chapter 61. pp. 983-988 and Chapter 58, pp. 932-944.

METHEMOGLOBIN

Oxidation of ferrous (Fe^{2+}) hemoglobin to the ferric (Fe^{3+}) state results in a pigment called methemoglobin (MHb). Methemoglobin which is not able to carry oxygen is only temporarily inert since it can be reduced readily to its usual ferrous form. The prophyrin-iron of hemoglobin remains in the ferrous state throughout oxygenation and deoxygenation. Hemoglobin iron is maintained in the ferrous state by the enzymes methemoglobin disphorase (diaphorase I) and methemoglobin reductase (diaphorase II). The methemoglobin combining groups are hydroxyl, cyanide, hydrosulfide, azide, and peroxide. Methemoglobin is produced by quinones, chlorate, nitrites, aromatic amines, and nitro compounds. Over-enthusiastic use of nitrites has led to episodes of mass poisoning. Inorganic nitrates, when reduced to nitrites, produce MHb.

Signs and Symptoms:

Sodium nitrite and other direct formers of MHb have a rapid onset of action. The temporarily inert blood pigment produces a type of anemic hypoxia. The slate-gray-to-bluish cyanotic color of the skin and mucous membrane becomes quite noticeable when about 10% of the hemoglobin becomes MHb. Methemoglobinemia up to about 35% usually causes no serious acute effects other than fatigability and exertional dyspnea. Above 60% methemoglobinemia leads to stupor and unconsciousness. Coma, convulsions, and death occur when 70% of the hemoglobin has become MHb.

Treatment:

Specific antidotal therapy is based on catalyzing the physiological intra-erythrocytic enzymatic reducing mechanisms. The most efficient agent is methylene blue. Methylene blue *in vivo* forms an oxidation-reduction system and acts as an electron acceptor accelerating the rate of reduction of MHb at least 10 fold. Large doses of methylene blue itself can cause MHb formation.

SOLVENTS

Some aliphatic, aromatic and chlorinated hydrocarbons are commonly used as household cleaners or as fuels. Because of their uses, they represent a potential hazard for poisoning. The materials listed below are some of the common solvents encountered and are representative of their toxicities.

BENZENE

Benzene is presently in commercial petroleum, aromatic solvents, and paint and varnish removers. The threshold limit value is 25 ppm. Acute symptoms occur within 30-60 minutes at 7,500 ppm and exposure is fatal within 5-10 minutes at 20,000 ppm.

Absorption, Fate and Excretion - Liquid benzene is absorbed from the gastrointestinal tract. Vapors gain access to the circulation through the respiratory tract. Benzene is mainly deposited in the central nervous system. Approximately 50% of absorbed benzene is excreted through the lungs. The remainder is oxidized to phenol and polyphenols and excreted as conjugation products in the urine.

Acute Poisoning - Symptoms are referable to the central nervous system. There is a preliminary period of excitement and restlessness followed by central nervous system depression and death from respiratory failure.

Chronic Poisoning - The major toxic manifestations result from the action of benzene on the bone marrow. Gastrointestinal symptoms such as anorexia and nausea are common. Benzene may first stimulate leukocyte formation and then cause inhibition of production of the precursors of all of the formed elements of the peripheral blood, resulting in aplastic anemia.

Treatment - Once poisoning has developed it is important to prevent further exposure. Therapy is symptomatic treatment.

GASOLINE

Gasoline is a petroleum distillate containing the distillate fractions of petroleum ether, naphtha and benzene.

Toxicity - Gasoline vapors can sensitize the myocardium to catecholamines so that small amounts of circulating epinephrine may precipitate ventricular fibrillation and lead to sudden death. High concentrations of gasoline vapors lead to rapid central nervous system depression and death from respiratory failure.

Treatment - Treatment consists of symptomatic and supportive measures.

KEROSENE

Kerosene is a common cause of accidental poisoning in children. Approximately 28,000 nonfatal poisonings due to petroleum distillate products occur annually in children under 5 years of age.

Toxicity - The fatal oral dose for an adult is about 3 to 4 ounces. Chief pathological findings are chemical pneumonitis, complicated by bacterial penumonia, and pulmonary edema. Ingestion of large amounts may also damage parenchymatous organs, i.e. liver, kidney and spleen. Signs and symptoms include tinnitus, muscular incoordination, disorientation, drowsiness and eventually coma. Ingestion of kerosene produces local irritation of oropharynx and esophogeal surfaces. Vomiting may result in aspiration of kerosene into the lungs. (The usual clinical course is quite benign, unless large quantities have been ingested, or the kerosene has been aspirated into the lungs).

Treatment - Emetics are definitely contraindicated. Gastric lavage should not be employed unless the risks involved are justified by the excessive quantity ingested or the condition of the patient. Vegetable oil (olive oil) may be administered to dilute the kerosene and decrease its rate of absorption.

CARBON TETRACHLORIDE

Carbon tetrachloride is used as a solvent, cleaner, ingredient in fire-extinguisher fluid and insecticide sprays.

Absorption, Fate and Excretion - Carbon tetrachloride is readily absorbed from the respiratory tract. Absorption is slow following oral ingestion, but the presence of fats or alcohol enhance absorption of carbon tetrachloride.

Toxicity - Applied locally, carbon tetrachloride is an irritant and rubefacient. It depresses the central nervous system and sensitizes the myocardium to cardiac arrhythmias. Carbon tetrachloride is hepatotoxic and nephrotoxic.

Acute Intoxication - Acute exposure produces irritation of the eyes, nose, and throat, nausea and vomiting, dizziness and headache. Continued exposure produces central nervous system depression, coma and death. Sudden death may occur from ventricular fibrillation of the sensitized myocardium.

Chronic Intoxication - Chronic intoxication is usually the result of industrial exposure. The threshold-limit value is 25 ppm. Signs and symptoms are nausea, vomiting, anorexia, central nervous system depression, hepatic and renal damage.

Intoxication by Ingestion - Gastrointestinal symptoms are seen, including hematemesis, abdominal pain, and liver damage. The fatal oral dose is 2 to 4 milliliters.

Treatment - Emergency treatment should be to move the patient to fresh air if exposed to vapors. Empty the stomach immediately by inducing vomiting or gastric lavage and give a laxative to minimize absorption if ingested. If advanced central nervous system depression has occurred, every effort should be made to prevent hypoxia by administration of O_2 and artificial respiration. Do not attempt to elevate blood pressure by use of sympathomimetic drugs because of sensitized myocardium. Renal function and liver function should be observed. Administer glucose and maintain the volume and composition of the body fluids.

B

FROM: "Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors," NEIC, April, 1980.

VIII. CHAIN-OF-CUSTODY

After collection and identification, the samples are maintained under the Chain-of-Custody procedures. If the sample collected is to be split with the owner or operator of the site, or other regulatory agencies, it should be aliquoted into similar sample containers. Sample tags with identical information are attached to each of the samples and are marked as "Company Split" or "Split". If air samples are to be given to the Company, then duplicate samples must be collected. The requesting official is to be notified that the Company must reimburse the Government for the materials used in sampling.

Each person involved with the sample must know Chain-of-Custody procedures. The procedures should be included in the Project Plan or be published and available to all personnel. Due to the evidentiary nature of sample-collecting investigations, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, Chain-of-Custody procedures are followed.

1. <u>Sample Custody</u>

   A sample is under custody if:

   a. It is in your actural possession, or
   b. it is in your view, after being in you physical possession, or
   c. it was in your physical possession and then you locked it up to prevent tampering, or
   d. it is in a designated and identified secure area.

2. <u>Field Custody Procedures</u>

   a. When collecting samples for evidence, collect only that number which provides a fair representation of the media being sampled. To the extent possible, the quantity and types of samples and sample locations are determined prior to the actual field work. As few people as possible should handle the samples.

b. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

c. Sample tags shall be completed for each sample, using waterproof ink unless prohibited by weather conditions.

d. During the course and at the end of the field work, the FIT Leader determines whether these procedures have been followed, and if additional samples are required.

3. <u>Transfer of Custody and Shipment</u>

a. Samples are accompanied by a Chain-of-Custody Record (see following pages). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, or to the permanent laboratory.

b. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed Custody Record enclosed in each sample box or cooler. Shipping containers will be padlocked or custody-sealed for shipment to the laboratory. Preferred procedure includes use of a custody seal* wrapped across filament tape that is wrapped around the package at least twice. The custody seal is then folded over and stuck to itself so that the only access to the package is by cutting the filament tape or breaking the seal to unwrap the tape. The seal is then signed. The "Courier to Airport" space on the Chain-of-Custody Record shall be dated and signed.

c. Whenever samples are split with a facility or government agency, a separate Chain-of-Custody Record is prepared for those samples and marked to indicate with whom the samples are being split.

d. All packages will be accompanied by the Chain-of-Custody Record showing identification of the contents. The original Record will accompany the shipment, and a copy will be retained by the Project Leader.

e. If sent by common carrier, a Bill of Lading should be used. Receipts of Bill of Lading will be retained as part of the permanent documentation.

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* Custody Seals. Custody seals should be made of 1" x 6" U.L. lutho tape with security slots. This tape is backed with a very strong self adhesiv so that once stuck to itself it will not come apart without breaking the seal.

Off'-e of Enforcement

(Appropriate Address)

CHAIN OF CUSTC RECORD

Proj No	Project Name					NO OF CON-TAINERS							REMARKS
SAMPLERS (Signature)													
STA NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION								

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	

Distribution Original Accompanies Shipment, Copy to Coordinator Field Files

B-3

VIII-3

N-0001

X. PACKAGING, MARKING, LABELING, AND SHIPPING OF HAZARDOUS WASTE SITE SAMPLES

A. GENERAL PROVISIONS

Samples that are judged to be environmental samples may be shipped according to letters of understanding granted EPA by DOT [Appendix D]. Other specific exemptions may also apply (e.g., use of Labelmaster, Inc. package #38, or Dow Chemical Co. Imbiber Pack for shipment of Poison B, n.o.s. by United Parcel Service).

The following procedures apply to samples collected from a hazardous waste site (HWS), and which in the judgment of the Project Leader cannot be considered to be "environmental" samples.

- Unanalyzed HWS samples may not be fixed with any preservative or preserved with ice or dry ice.
- If a material identified in the Department of Transportation (DOT) Hazardous Material Table (49 CFR 172.101) is known to be contained in an HWS sample, that sample should be transported as prescribed in the table.
- Unanalyzed HWS samples may be transported by rented or common carrier truck, bus, railroad, and by Federal Express Corporation* (air cargo); but they may not be transported by any other common carrier air transport, even "cargo only" aircraft. Those samples taken from closed drums or tanks, however, must not be transported by Federal Express. (See 1 and 2 in "Packaging, Marking and Labeling Requirements for Unanalyzed Hazardous Waste Site Samples Taken From Closed Containers" on p. X-5).
- If samples are transported by any type of government-owned vehicle, including aircraft, DOT regulations are not applicable. However, EPA and FIT personnel will use the packaging procedures described below except that the Bill of Lading with certification form does not have to be executed (see "Shipping Papers" on p. X-4).

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* These procedures are designed to enable shipment by entities like Federal Express; however, they should not be construed as an endorsement by EPA of a particular commercial carrier.

Irrespective of type sample or container, after completion of the analyses the contractor will repackage the original sample bottles in the coolers or containers received, and return them to the originating Regional office. The packages will be sealed and shipped under custody procedures as they were received. Each originating office should make arrangements with the contractor through the Sample Management Office (VIAR) for the method of return and payment for shipping charges within 30 days after sample shipment. Organic extracts from the samples will be shipped by the analytical contractors to EPA's EMSL/Las Vegas office for archival storage.

B. PACKAGING, MARKING AND LABELING REQUIREMENTS FOR UNANALYZED HAZARDOUS WASTE SITE SAMPLES, EXCLUDING CLOSED CONTAINER SAMPLES

1. Collect sample in a 8-ounce* or smaller glass container with nonmetallic, teflon-lined screw cap. Allow sufficient ullage (approximately 10% by volume) so container is not liquid full at 130°F. If collecting a solid material, the container plus contents shall not exceed one pound net weight.

2. Attach properly completed Sample Identification Tag (see following page) sample container.

3. Seal sample container and place in 2-mil-thick (or thicker) polyethylene bag, one sample per bag. (Tags should be positioned to enable them to be read through bag.)

4. Place sealed bag inside a metal can with incombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely, tightly and effectively.

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* Large quantities, up to one gallon, taken from wells may be collected if the flash point of the sample can be determined to be 73°F or higher. In this case, such should be marked on the outside container (carton, etc.) but only a single (one gallon or less) bottle may be packed in an outside container. Ten percent ullage and requirement 2,5,6, and 7 below must also be followed. On the shipping papers state that "flash point is 73°F or higher".

SAMPLE IDENTIFICATION TAG

Project Code	Station No.	Month/Day/Year	Time	Designate: Comp. / Grab
Station Location		Samplers (Signatures)		

Preservative: Yes ☐ No ☐

ANALYSES

- BOD Anions
- Solids (TSS) (TDS) (SS)
- COD, TOC, Nutrients
- Phenolics
- Mercury
- Metals
- Cyanide
- Oil and Grease
- Organics GC/MS
- Priority Pollutants
- Volatile Organics
- Pesticides
- Mutagenicity
- Bacteriology

Remarks:

Tag No.	Lab Sample No
N-0001	

(obverse)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

(Appropriate Address)

EPA

(reverse)

5. Mark and label this container as indicated in No. 8 below.

6. Place one or more metal cans (or a single 1-gallon bottle; see footnote on p. X-2), surrounded with incombustible packaging material for stability during transport, into a strong outside container, such as a metal picnic cooler or a fiberboard box.

7. Mark and label the outside container and complete shipping papers as described below.

8. Marking and Labeling: Use abbreviations only where specified. Place the following information on a metal can (or bottle), either hand printed or in label form: laboratory name and address and "Flammable Liquid, n.o.s", (if not liquid, write "Flammable Solid, n.o.s.").* Place the following labels on the outside of the can (or bottle).

> "Cargo Aircraft Only"; "Flammable Liquid"; if not liquid, "Flammable Solid" ("Dangerous When Wet" label should be used if the solid has not been exposed to wet environment).

NOTE: If the cans are placed in an exterior container, both that container and inside cans must have the same markings and labels as above. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" should also be marked on the top of the outside container, and upward pointing arrows should be placed on all four sides of the exterior container.

Shipping Papers: Use abbreviations only where specified below.

Complete the carrier-provided Bill of Lading and sign the certification statement (if carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container.

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* Using "Flammable" does not convey the certain knowledge that a sample is in fact flammable, or how flammable, but is intended to prescribe the class of packaging in order to comply with DOT regulations; "n.o.s" means not otherwise specified.

"Flammable Liquid, n.o.s." (or "Flammable Solid, n.o.s", as appropriate); "Cargo Aircraft Only"; "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ____________" or "Net Volume __________" (of hazardous contents), by item, if more than one metal can is inside an exterior container. The net weight or net volume must be placed just before or just after the "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s." description.

A Chain-of-Custody Record form [see SECTION VIII] should also be properly executed, and included in the exterior container.

9. Unless samples are driven to the laboratory, a team member must accompany shipping container(s) to the transport carrier and, if required, open outside container(s) for freight inspection.

C. <u>PACKAGING, MARKING AND LABELING REQUIREMENTS FOR UNANALYZED HAZARDOUS WASTE SITE SAMPLES TAKEN FROM CLOSED CONTAINERS</u>

1. This packaging, marking, labeling and shipping method provides a worst-case procedure for materials classed as "Poison A" (49 CFR 173.328). In the absence of reliable data which exludes the possibility of the presence of "Poison A" chemicals or compounds, these procedures must be followed.

2. These samples may not be transported by Federal Express Corporation (air cargo) or other common carrier aircraft, or by rental, non-government aircraft. (Samples may be shipped by ground transport or government aircraft).

3. Collect sample in a polyethlylene or glass container which is of an outer diameter narrower than the valve hole on a DOT Spec. 3A1800 or 3AA1800 metal cylinder. Fill sample container allowing sufficient ullage (approximately 10% by volume) so it will not be liquid-full at 130°F. Seal sample container.

4 Attach properly completed Sample Identification Tag (see p. X-3) to sample container.

5. With a string or flexible wire attached to the neck of the sample container, lower it into a metal cylinder which has been partially filled with incombustible, absorbent, loose packaging material (vermiculite or earth). Allow sufficient cushioning material between the bottom and sides of the container and the metal cylinder to prevent breakage. After the cylinder is filled with cushioning material, drop the ends of the string or wire into the cylinder valve hole. Only one sample container may be placed in a metal cylinder.

6. Replace valve, torque to 250 ft-lb (for 1 inch opening) and replace valve protector on metal cylinder, using teflon tape.

7. Mark and label cylinder as described below.

8. One or more cylinders may be placed in a strong outside container.

9. Mark and label outside container and complete shipping papers as described below.

10. Marking and Labeling: Use abbreviations only where specified. Place the following information on the side of the cylinder, or on a tag wired to the cylinder valve protector, either hand-printed or in label form.

    "Poisonous Liquid or Gas, n.o.s"; laboratory name and address.*

Place the following label on the cylinder: "Poisonous Gas". (Poisonous Liquid" label not acceptable here, even if liquid.)

* Using "Poisonous" does not convey the certain knowledge that a sample is in fact poisonous, or how poisonous, but is intended to prescribe the class of packaging in order to comply with DOT regulations.

Note: If the metal cylinders are placed in an outside container, both the container and cylinders inside must have the same markings and labels as above. In addition, "Laboratory Sample", and "Inside Packages Comply With Prescribed Specifications" should be marked on the top of the outside container. "THIS SIDE UP" marking should be placed on the outside container and upward pointing arrows on four sides.

Shipping Papers: Complete the shipper-provided Bill of Lading and sign the certification statement (if carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container; use abbreviations only as specified:

> "Poisonous Liquid, n.o.s."; "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight________" or "Net Volume______" (of hazardous contents), by cylinder, if more than one cylinder is inside an exterior container. The net weight or net volume must be placed just before or just after the "Poisonous Liquid, n.o.s" marking.

A Chain-of-Custody Record form [see SECTION VIII] should also be properly executed and included in the container, or with the cylinder.

11. Unless samples are driven to the laboratory, a team member will accompany shipping containers to the transport carrier and, if required, open outside container(s) for freight inspection.

C

EPA OCCUPATIONAL HEALTH AND SAFETY POLICY

"IT IS THE POLICY OF THE ENVIRONMENTAL PROTECTION AGENCY TO ADMINISTER ITS PROGRAMS IN A MANNER WHICH ASSURES SAFE AND HEALTHFUL WORKING CONDITIONS FOR ALL EMPLOYEES. EVERY EMPLOYEE IS RESPONSIBLE FOR IDENTIFYING AND NOTIFYING THE APPROPRIATE SUPERVISOR OF RISKS, HAZARDS, OR UNHEALTHFUL AND UNSAFE CONDITIONS."

Douglas M. Costle

ADMINISTRATOR

EACH EPA EMPLOYEE IS A KEY ELEMENT IN EFFECTIVE IMPLEMENTATION OF THE EPA OCCUPATIONAL HEALTH AND SAFETY PROGRAM OUR NATIONAL HEALTH AND SAFETY LEGISLATION RELIES IMPORTANTLY ON EMPLOYEE INVOLVEMENT: NOT ONLY INVOLVEMENT IN FOLLOWING BASIC RULES AND REGULATIONS, BUT INVOLVEMENT IN DEVELOPING THOSE REGULATIONS; INVOLVEMENT IN HEALTH AND SAFETY COMMITTEE ACTIVITIES, AND MOST IMPORTANTLY – INVOLVEMENT IN BRINGING TO MANAGEMENT'S ATTENTION UNSAFE OR UNHEALTHFUL CONDITIONS AT THEIR WORKSITES.

PLEASE TAKE THE TIME TO PROTECT YOURSELF AND YOUR CO-WORKERS. COMPLETE DETAILS ON THE EPA OCCUPATIONAL HEALTH AND SAFETY PROGRAM ARE CONTAINED IN THE EPA OCCUPATIONAL HEALTH AND SAFETY MANUAL, WHICH IS AVAILABLE FROM YOUR SUPERVISOR. PLEASE CALL FTS-755-4390 IF WE CAN HELP.

William Drayton, Jr.

ASSISTANT ADMINISTRATOR FOR PLANNING AND MANAGEMENT

DESIGNATED AGENCY SAFETY AND HEALTH OFFICIAL

* More than 50 percent of the workers were looking down when struck; about 30 percent were looking straight ahead. Most of the blows were to the top front of the head, usually the forehead, and to a lesser degree to the top center and to the top side and back of the head.

* Cuts and bruises of the scalp were the most prevalent type of injuries (50 percent) with cuts and bruises of the forehead next (35 percent), followed by concussions (25 percent) and neck sprain (10 percent).

Of the workers who were wearing hard hats, the survey showed that more than one-half were furnished them by their employer without cost; two-fifths of the workers said their firm required the wearing of hard hats for certain types of work at specific locations; 12 percent said their employers did not require but encouraged the use of hard hats.

WHIRLPOOL CASE SAID TO ILLUSTRATE WORKER "SELF-HELP" RIGHT:

The recent Supreme Court decision upholding the right of Whirlpool Corp. employees to refuse dangerous work assignments while at the same time denying them the right to strike over the issue or even to prevent dismissal if an employer disagreed about the danger (*OCCUPATIONAL HEALTH & SAFETY LETTER*, March 8) illustrates the court's endorsement of the concept of worker "self-help" in the Occupational Safety & Health Act.

That view was expressed by Dr. William J. Curran, Frances Glessner Lee Professor of Legal Medicine at Harvard School of Public Health, in his commentary in the American Journal of Public Health (Sept. 1980). Dr. Curran is an attorney and industrial hygienist.

In the Whirlpool case, two maintenance workers refused to crawl out on a screen from which a co-worker had plunged to his death nine days previously. A District court ruled that the Secretary of Labor had exceeded his authority in 1973 in saying that the law gave workers the right to refuse hazardous duties. But an appeals court in Cincinnati upheld the workers' right to do so, and the Supreme Court unanimously affirmed the appeals court ruling.

In his analysis, Dr. Curran noted that Supreme Court Justice Potter Stewart, who wrote the opinion, refused to go beyond merely affirming the right of workers to refuse hazardous assignments. He would not order that the workers be paid for the hours they had refused to work, sending this issue back to the lower court for a decision. Whirlpool had sent the two men home for the day and docked them for six hours pay (about $25 each).

Justice Stewart also warned that the Supreme Court ruling should not be interpreted too broadly, observing:

"The employees have no power under the regulations to order their employer to correct the hazardous condition or to clear the dangerous workplace of others. Moreover, any employee who acts in reliance on the regulations runs the risk of discharge or reprimand in the event a court subsequently finds he acted unreasonably or in bad faith."

Dr. Curran commented:

"In these precautions, Justice Stewart was apparently recognizing that the legislative history of the Act in 1970 had indicated that Congress was against the use of the Act to provide 'strike with pay' to protest in an organized manner against dangerous work conditions. The Supreme Court was attempting to make it clear that in most instances it would be up to workers to notify OSHA, and then for OSHA itself to seek injunctions in court to require action by employers to correct alleged hazards.

"We can judge, therefore, that the Supreme Court was endorsing 'self help' and immediate preventive action against imminent danger to life or serious personal injury, but it was not willing to supplant all regular recourse to order law enforcement and court review in labor-management disputes over working conditions."

W.H.O. REPORT RECOMMENDS NOISE EXPOSURE LIMITS, MORE RESEARCH:

The World Health Organization has published the report of its Task Group on Environmental Health Criteria for Noise saying that any level above 75 dB(A) for an eight-hour workshift must be considered as entailing some "predictable" risk which must be taken into account in setting occupational noise standards.

Presidential Documents

Executive Order 12223 of June 30, 1980

Occupational Safety and Health Programs for Federal Employees

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 7902(c) of Title 5 of the United States Code, and in accord with Section 19 of the Occupational Safety and Health Act of 1970, as amended (29 U.S.C. 668), and in order to provide sufficient time for the development of adequate implementing instructions which will govern the new occupational safety and health programs for Federal employees, Section 1-704 of Executive Order No. 12196 of February 26, 1980, is hereby amended to read, "This Order is effective October 1, 1980.".

Jimmy Carter

THE WHITE HOUSE,
June 30, 1980.

Doc. 80-20100
ed 7-1-80; 10:31 am]
.ing code 3195-01-M

Federal Register
Vol. 45, No. 40
Wednesday, February 27, 1980

Presidential Documents

Title 3—

The President

Executive Order 12196 of February 26, 1980

Occupational Safety and Health Programs for Federal Employees

By the authority vested in me as President by the Constitution and statutes of the United States of America, including Section 7902(c) of Title 5 of the United States Code and in accord with Section 19 of the Occupational Safety and Health Act of 1970, as amended (29 U.S.C. 668), it is ordered:

1–1. *Scope of this Order.*

1–101. This order applies to all agencies of the Executive Branch except military personnel and uniquely military equipment, systems, and operations.

1–102. For the purposes of this order, the term "agency" means an Executive department, as defined in 5 U.S.C. 101, or any employing unit or authority of the Federal government, other than those of the judicial and legislative branches. Since section 19 of the Occupational Safety and Health Act ("the Act") covers all Federal employees, however, the Secretary of Labor ("the Secretary") shall cooperate and consult with the heads of agencies in the legislative and judicial branches of the government to help them adopt safety and health programs.

1–2. *Heads of Agencies.*

1–201. The head of each agency shall:

(a) Furnish to employees places and conditions of employment that are free from recognized hazards that are causing or are likely to cause death or serious physical harm.

(b) Operate an occupational safety and health program in accordance with the requirements of this order and basic program elements promulgated by the Secretary.

(c) Designate an agency official with sufficient authority to represent the interest and support of the agency head to be responsible for the management and administration of the agency occupational safety and health program.

(d) Comply with all standards issued under section 6 of the Act, except where the Secretary approves compliance with alternative standards. When an agency head determines it necessary to apply a different standard, that agency head shall, after consultation with appropriate occupational safety and health committees where established, notify the Secretary and provide justification that equivalent or greater protection will be assured by the alternate standard.

(e) Assure prompt abatement of unsafe or unhealthy working conditions. Whenever an agency cannot promptly abate such conditions, it shall develop an abatement plan setting forth a timetable for abatement and a summary of interim steps to protect employees. Employees exposed to the conditions shall be informed of the provisions of the plan. When a hazard cannot be abated without assistance of the General Services Administration or other Federal lessor agency, an agency shall act with the lessor agency to secure abatement.

(f) Establish procedures to assure that no employee is subject to restraint, interference, coercion, discrimination or reprisal for filing a report of an unsafe or unhealthy working condition, or other participation in agency occupational safety and health program activities.

(g) Assure that periodic inspections of all agency workplaces are performed by personnel with equipment and competence to recognize hazards.

(h) Assure response to employee reports of hazardous conditions and require inspections within twenty-four hours for imminent dangers, three working days for potential serious conditions, and twenty working days for other conditions. Assure the right to anonymity of those making the reports.

(i) Assure that employee representatives accompany inspections of agency workplaces.

(j) Operate an occupational safety and health management information system, which shall include the maintenance of such records as the Secretary may require.

(k) Provide safety and health training for supervisory employees, employees responsible for conducting occupational safety and health inspections, all members of occupational safety and health committees where established, and other employees.

(l) Submit to the Secretary an annual report on the agency occupational safety and health program that includes information the Secretary prescribes.

1-3. *Occupational Safety and Health Committees.*

1-301. Agency heads may establish occupational safety and health committees. If committees are established, they shall be established at both the national level and, for agencies with field or regional offices, other appropriate levels. The committees shall be composed of representatives of management and an equal number of nonmanagement employees or their representatives. Where there are exclusive bargaining representatives for employees at the national or other level in an agency, such representatives shall select the appropriate nonmanagement members of the committee.

1-302. The committees shall, except where prohibited by law,

(a) Have access to agency information relevant to their duties, including information on the nature and hazardousness of substances in agency workplaces.

(b) Monitor performance, including agency inspections, of the agency safety and health programs at the level they are established.

(c) Consult and advise the agency on the operation of the program.

1-303. A Committee may request the Secretary of Labor to conduct an evaluation or inspection pursuant to this order if half of a Committee is not substantially satisfied with an agency's response to a report of hazardous working conditions.

1-4. *Department of Labor.*

1-401. The Secretary of Labor shall:

(a) Provide leadership and guidance to the heads of agencies to assist them with their occupational safety and health responsibilities.

(b) Maintain liaison with the Office of Management and Budget in matters relating to this order and coordinate the activities of the Department with those of other agencies that have responsibilities or functions related to Federal employee safety and health, including the Office of Personnel Management, the Department of Health, Education, and Welfare, and the General Services Administration.

(c) Issue, subject to the approval of the Director of the Office of Management and Budget, and in consultation with the Federal Advisory Council on Occupational Safety and Health, a set of basic program elements. The program elements shall help agency heads establish occupational safety and health committees and operate effective occupational safety and health programs, and shall provide flexibility to each agency head to implement a program consistent with its mission, size and organization. Upon request of an agency head, and after consultation with the Federal Advisory Council on Occupational Safety and Health, the Secretary may approve alternate program elements.

(d) Prescribe recordkeeping and reporting requirements.

(e) Assist agencies by providing training materials, and by conducting training programs upon request and with reimbursement.

(f) Facilitate the exchange of ideas and information throughout the government about occupational safety and health.

(g) Provide technical services to agencies upon request, where the Secretary deems necessary, and with reimbursement. These services may include studies of accidents, causes of injury and illness, identification of unsafe and unhealthful working conditions, and means to abate hazards.

(h) Evaluate the occupational safety and health programs of agencies and promptly submit reports to the agency heads. The evaluations shall be conducted through such scheduled headquarters or field reviews, studies or inspections as the Secretary deems necessary, at least annually for the larger or more hazardous agencies or operations, and as the Secretary deems appropriate for the smaller or less hazardous agencies.

(i) Conduct unannounced inspections of agency workplaces when the Secretary determines necessary if an agency does not have occupational safety and health committees; or in response to reports of unsafe or unhealthful working conditions, upon request of occupational safety and health committees under Section 1–3; or, in the case of a report of an imminent danger, when such a committee has not responded to an employee who has alleged to it that the agency has not adequately responded to a report as required in 1–201 (h). When the Secretary or his designee performs an inspection and discovers unsafe or unhealthy conditions, a violation of any provisions of this order, or any safety or health standards adopted by an agency pursuant to this order, or any program element approved by the Secretary, he shall promptly issue a report to the head of the agency and to the appropriate occupational safety and health committee, if any. The report shall describe the nature of the findings and may make recommendations for correcting the violation.

(j) Submit to the President each year a summary report of the status of the occupational safety and health of Federal employees, and, together with agency responses, evaluations of individual agency progress and problems in correcting unsafe and unhealthful working conditions, and recommendations for improving their performance.

(k) Submit to the President unresolved disagreements between the Secretary and agency heads, with recommendations.

(l) Enter into agreements or other arrangements as necessary or appropriate with the National Institute for Occupational Safety and Health and delegate to it the inspection and investigation authority provided under this section.

1–5. *The Federal Advisory Council on Occupational Safety and Health.*

1–501. The Federal Advisory Council on Occupational Safety and Health, established pursuant to Executive Order No. 11612, is continued. It shall advise the Secretary in carrying out responsibilities under this order. The Council shall consist of sixteen members appointed by the Secretary, of whom eight shall be representatives of Federal agencies and eight shall be representatives of labor organizations representing Federal employees. The members shall serve three-year terms with the terms of five or six members expiring each year, provided this Council is renewed every two years in accordance with the Federal Advisory Committee Act. The members currently serving on the Council shall be deemed to be its initial members under this order and their terms shall expire in accordance with the terms of their appointment.

1–502. The Secretary, or a designee, shall serve as the Chairman of the Council, and shall prescribe rules for the conduct of its business.

1–503. The Secretary shall make available necessary office space and furnish the Council necessary equipment, supplies, and staff services, and shall perform such functions with respect to the Council as may be required by the Federal Advisory Committee Act, as amended (5 U.S.C. App. I).

1–6. *General Services Administration.*

1–601. Within six months of the effective date of this order the Secretary of Labor and the Administrator of the General Services Administration shall initiate a study of conflicts that may exist in their standards and other requirements affecting Federal employee safety and health, and shall establish a procedure for resolving conflicting standards for space leased by the General Services Administration.

1–602. In order to assist the agencies in carrying out their duties under Section 19 of the Act and this order the Administrator shall:

(a) Upon request, require personnel of the General Services Administration to accompany the Secretary or an agency head on any inspection or investigation conducted pursuant to this order of a facility subject to the authority of the General Services Administration.

(b) Assure prompt attention to reports from agencies of unsafe or unhealthy conditions of facilities subject to the authority of the General Services Administration; where abatement cannot be promptly effected, submit to the agency head a timetable for action to correct the conditions; and give priority in the allocation of resources available to the Administrator for prompt abatement of the conditions.

(c) Procure and provide safe supplies, devices, and equipment, and establish and maintain a product safety program for those supplies, devices, equipment and services furnished to agencies, including the issuance of Material Safety Data Sheets when hazardous substances are furnished them.

1–7. *General Provisions.*

1–701. Employees shall be authorized official time to participate in the activities provided for by this order.

1–702. Nothing in this order shall be construed to impair or alter the powers and duties of the Secretary or heads of other Federal agencies pursuant to Section 19 of the Occupational Safety and Health Act of 1970, Chapter 71 of Title 5 of the United States Code, Sections 7901, 7902, and 7903 of Title 5 of the United States Code, nor shall it be construed to alter any other provisions of law or Executive Order providing for collective bargaining agreements and related procedures, or affect the responsibilities of the Director of Central Intelligence to protect intelligence sources and methods (50 U.S.C. 403(d)(3)).

1–703. Executive Order No. 11807 of September 28, 1974, is revoked.

1–704. This order is effective July 1, 1980.

Jimmy Carter

THE WHITE HOUSE,
February 26, 1980.

[FR Doc. 80-6330
Filed 2-26-80; 11:39 am]
Billing code 3195-01-M

GPO 868-441

ENVIRONMENTAL
PROTECTION
AGENCY

ORDER

3100.1

December 8, 1972

PERSONNEL - GENERAL

UNIFORMS, PROTECTIVE CLOTHING, AND PROTECTIVE EQUIPMENT

1. PURPOSE. This Order establishes responsibilities and guidelines for the issue and use of uniforms, protective clothing, and protective equipment. This Order implements OMB Circular No. A-30 Revised August 20, 1966, which remains in effect until the Civil Service Commission issues superseding instructions pursuant to Executive Order 11609.

2. REFERENCES.

a. Uniform allowance, 5 U.S.C. 5901 - 5903;

b. Executive Order 11609 (Executive Order 11609 delegates the authority and responsibilities provided in 5 U.S.C. 5903 to the Civil Service Commission.);

c. Protective clothing and equipment, 5 U.S.C. 7903; and

d. Occupational Safety and Health Act, P.L. 91-596, 29 U.S.C. 651, et. seq.

3. POLICY. Uniforms, protective clothing, and protective equipment will be prescribed for use, at Government expense, only where the wearing of such items is necessary because of the nature of the employee's duties. This includes the safety of personnel and contacts with the public in an official capacity requiring an employee's identification on sight.

4. RESPONSIBILITIES.

a. Deputy Assistant Administrator for Administration. The Deputy Assistant Administrator for Administration is responsible for making the final determination as to the categories of employees who may be required to wear uniforms, protective clothing, and protective equipment, the composition of the items, and the circumstances under which they shall be worn.

Dist. Directives

Initiated by
PM-212

b. Assistant Administrators, Regional Administrators, Heads of Staff Offices, Laboratory Directors, and the Executive Officer, Office of the Administrator. These officials are responsible within their jurisdiction for submitting recommendations to the Deputy Assistant Administrator for Administration regarding categories of employees who should be required to wear uniforms, protective clothing, or protective equipment. Recommendations for protective items shall be made in conjunction with respective EPA Safety and Health Officials.

c. Director, Financial Management Division. The Director, Financial Management Division, is responsible for maintaining accounting control of allowances paid to employees for uniforms and collection of refunds of allowance payments due the Government.

d. Director, Contracts Management Division. The Director, Contracts Management Division, is responsible for procuring uniforms, protective clothing, and protective equipment with Government funds for issuance to employees. (Requests for such items should be made on EPA Form 1900-8 in accordance with the EPA Contracts Management Manual.)

e. Director, Facilities and Support Services Division. The Director, Facilities and Support Services Division, is responsible for the accountability and stocking of uniforms, protective clothing, and protective equipment. These will be issued as custodial items in accordance with EPPMR 115-27.5008-4.

f. Director, Occupational Safety and Health Office. The Director, Occupational Safety and Health Office, is responsible for the establishment and management of an agency safety management program for the protection of EPA employees, property, and those for whom it has a responsibility.

5. UNIFORMS. The Agency may supply uniforms as provided for in the Appropriation Act. (See 5 U.S.C. 5901-5902.) Uniforms may be provided to employees in two ways: (1) direct issuance or (2) payment of uniform allowances. Officials listed in subparagraph 4b shall determine the method which is more advantageous to the Government and the employee.

a. Issuance. When uniforms are authorized they may be purchased or rented. Rental contracts shall not include provisions for cleaning or laundry service at Government expense. Uniforms may be purchased outright, stocked and issued, or an agreement may be entered into with a local vendor who will issue uniforms and bill the Agency.

(1) The officials listed in subparagraph 4b shall establish a schedule of initial issuance and annual replacement (see Attachment A). The cost of the initial issue or annual replacement, including the expense of any initial alteration (tailoring), shall not exceed the $125 maximum established by law (5 U.S.C. 5901).

(2) The cost of subsequent alterations or the cost of repair, laundry, and dry cleaning shall be borne by the employee. Uniforms being turned-in do not need to be cleaned beforehand.

(3) Uniforms issued remain the property of the Government and will be turned-in to the local property accountability officer when no longer needed.

b. Allowance. When allowances are to be paid in lieu of issuance, an official listed in subparagraph 4b shall establish an initial uniform requirement (see Attachment A) and annual replacement schedule. He shall estimate the cost of initially required uniforms and reasonable replacement needs (including the cost of initial alterations if any) based on current prices of representatives suppliers and shall specify a definite allowance for the initial purchase and annual replacement, not to exceed the $125 maximum established by law.

(1) The initial allowance shall be paid at the beginning of the service period when a uniform is required and cannot be reclaimed once the uniform has been purchased. Uniforms obtained via allowance become the property of the employee and need not be turned-in.

(2) The replacement allowance for uniforms may be paid (a) in a lump sum on each anniversary date of the employee's service or (b) in quarterly or semiannual amounts. The employee may retain one-quarter of the annual replacement allowance for each quarter or part of a quarter of a year he remains in service. The balance of the allowance shall be recovered from him.

(3) Allowances shall not include payment for subsequent alterations or for repair, washing, or dry cleaning of uniforms/uniform items. Such costs will be borne by the employee.

6. PROTECTIVE CLOTHING AND EQUIPMENT.

a. Protective clothing and equipment will be issued to employees whose duties require them to perform work of an especially dirty or unusual nature and employees whose duties may be hazardous in nature. Expenditures from appropriations are available for the procurement of supplies and materials or equipment and may be made for the purchase and maintenance of items for the protection of personnel in the performance of their assigned tasks as provided under 5 U.S.C. 7903. Guidelines may be found in Occupational Safety Health Standards, 29 CFR 1910 and the EPA Safety Manual (to be issued shortly). A recent decision of the Comptroller General B-174629, 51 Comptroller General 446, in addition to 36 F.R. 10590 which adds section 1910.132 -1910.136 to 29 CFR, provides that protective equipment, including personal protective equipment for eyes, face, head and extremities, and protective clothing, shall be provided, used, and maintained whenever, it is necessary for reasons of hazards or processes of environment encountered in a manner capable of causing injury or physical impairment. Local Safety Officer is also available for advice and guidance. Attachment B contains a general list of protective items.

b. If the clothing or equipment is solely for the protection of the employee without resulting benefits to the Government, and such as the employee might reasonably be expected to furnish as part of the official equipment of his position, appropriated funds would not be available for such purpose.

c. Protective clothing and equipment issued to employees remain the property of the Government in strict adherence to the usual requirements of accountability, responsibility, inventorying, and maintenance.

7. WEARING AND CARE OF UNIFORMS AND PROTECTIVE ITEMS.

a. Uniforms.

(1) After an initial period of ninety days, full-time, permanent employees in the categories listed in Attachment A, may be required by an official listed in subparagraph 4b to wear uniforms while performing their official duties. This may include the time in transit between their homes and places of employment or between EPA duty locations. The uniform shall not be worn when an employee is

participating in non-EPA employment or unauthorized activities. Temporary employees appointed for less than a year will not be required to wear uniforms.

(2) Each employee who has been issued a uniform shall be responsible for its care and will be expected to maintain it in good condition. Loss or destruction may result in financial liability if found to be caused by carelessness or neglect.

b. Protective Items.

(1) Employees and authorized visitors are required to wear protective clothing and equipment provided for their protection while performing hazardous duties.

(2) Each employee who has been issued protective clothing and equipment shall be responsible for its care, except for disposable items such as cotton gloves, plastic aprons, etc. Loss or destruction may result in financial liability if found to be caused by carelessness or neglect.

8. NOTIFICATION OF PAYMENTS TO BE MADE OR REFUNDS TO BE COLLECTED FOR UNIFORMS. The official listed in subparagraph 4b authorizing the wearing of uniforms shall notify the Financial Management Division of allowances to be made or refunds to be collected. The notification shall contain the following information:

a. Employee's name, position title, and organizational unit;

b. Amount and frequency of allowance payments (or the amount to be collected, when appropriate);

c. Period covered by the payment (or refund);

d. Reason for refund; and

e. Certification that the employee has not previously been paid an allowance for this period.

9. STATUS OF BENEFITS AS COMPENSATION. The value of uniforms or protective items furnished or the amount of the uniform allowance paid shall not be construed as pay, salary, or compensation within the meaning of the Civil Service Retirement Act, as amended, or wages within the meaning of the Social Security Act, as amended, or the Internal Revenue Code.

10. SUPERSESSION. All existing instructions and directives previously issued by EPA components which pertain to uniforms, protective clothing, and protective equipment are superseded.

Howard M. Messner
Deputy Assistant Administrator
for Administration

ATTACHMENT A

Standard Articles of Uniforms

Uniforms listed below are approved for the following categories of personnel. Additional uniforms may be added (subject to monetary limitations) as well as additional employee categories when approved by the Deputy Assistant Administrator for Administration.

Chauffeurs

Item Description	Color	If Issued Initial Quantity
Coat, blouse, all purpose weight*	Dark blue or black	2
Trousers, all purpose weight	Dark blue or black	3
Shirts, Long-sleeve*	White	3
Short-sleeve*	White	3
Necktie	Black	4
Cap, visor	Dark blue, black	2

Craft, Custodial, Maintenance, and Supply Employees

Male Employees

Trousers, Wash and Wear	Royal Blue	6
Shirts, Wash and Wear*	Royal Blue	
Long-sleeve		3
Short-sleeve		3

Craft, Custodial, Maintenance, and Supply Employees

Item Description	Color	If Issued Initial Quantity
Female Employees		
Dress, 1-piece * Wash and Wear or*	Royal Blue	6
Slacks, Polyester-cotton blend, with	Royal Blue	6
Blouse*	Royal Blue	6
	Guards	
Coat, blouse all purpose weight*	Dark Blue	3
Trousers, all purpose weight	Dark Blue	3
Trousers, light-weight	Dark Blue	3
Cap	Dark Blue	2
Shirt, long or short sleeve*	Light blue/white	6
Necktie	Dark Blue	4
Overcoat	Dark Blue	1
Raincoat, nylon twill, plastic coated	Dark Blue	1
Cap Cover, with detachable cape of same material as raincoat with plastic insert	Dark Blue	1

Engineering and Scientific Employees
having Environmental Investigative, and Test Functions
or Assigned to Assist in Pollution Emergencies

Item Description	Color	If Issued Initial Quantity
Coveralls*	Royal Blue	3
or		
Trousers, wash and wear	Royal Blue	3
Shirts, wash and wear*	Royal Blue	3

* EPA seal/patch to be affixed to coat, shirt, blouse, or overalls on left side and employee's name patch to be affixed on right side above the breast pockets or centered approximately four inches below the shoulder seams if there are no pockets.

Patches are to be procured by EPA and furnished to employees. EPA seal/patches remain the property of EPA and must be turned-in to the local property accountability officer, upon termination of employment.

ATTACHMENT B

GENERAL TYPES OF PROTECTIVE ITEMS

Goggles, Safety Glasses, Face Shields

Respirators

Hard Hats

Life Belt and Safety Block

Safety-toe Shoes

Electrical Protective Devices

Electrical Hazard Shoes

Radiator Film Badge

Rubber Aprons

Lab Smocks or Coats

Life Jackets

Hearing Protective Devices

Hand and Arm Protective Devices

Rubber Boots

Officials listed in paragraph 4 of the Order will be responsible for determining when protective items should be issued, replaced, and maintained, to employees whose duties require the use of protective items. These items will be provided at Government cost. (See paragraph 6.)

ORDER

PROTECTIVE SERVICES - SAFETY

RESPIRATORY PROTECTION

1. PURPOSE. This Order establishes Agencywide policy, responsibilities, training, and occupational medical monitoring requirements for employees required to use respiratory protective devices.

2. REFERENCES.

   a. Occupational Safety and Health Act, P.L. 91-596, 29 USC 651, et.seq.

   b. CFR 1910, Subpart I, Subsection 134, General Industry Standards

   c. Title 30 CFR Part 11, U.S. Bureau of Mines

   d. American National Standards Institute standards Z 88.2-1969 and K 13.1-1973

   e. EPA Order 3100.1, Uniforms, Protective Clothing, and Protective Equipment.

   f. Cumulative Supplement: NIOSH Certified Equipment, June 1977, or most current issue.

3. BACKGROUND. Inhalation of airborne contaminants can cause serious harm to employees who work in areas where toxic substances are used or stored, or where hazardous wastes and spill exist. Whenever possible, the EPA uses effective local exhaust ventilation to prevent exposure to airborne contaminants but, when it is not feasible to eliminate the hazards, such as during field operations, it is necessary to protect the employee by use of approved respiratory protective devices.

4. POLICY. The EPA shall provide certified respiratory protective devices, and employees shall use such devices when it is necessary due to the nature

of the employee's working environment. All employees whose duties require the use of respiratory protective equipment shall be determined physically able to perform expected duties with the increased resistance to breathing, and shall not have facial hair which will prevent a tight face seal.

5. RESPONSIBILITY.

a. Assistant Administrators and Regional Administrators. These officials are responsible within their jurisdiction for determining the categories of employees required to wear respiratory protective devices and for assuring that monies are available for proper training programs and purchase of the respiratory protective devices.

b. Supervisors. Supervisors are responsible for ensuring that: proper respiratory protective devices are provided, inspected, and maintained for employees after assessment of the need; employees wear respiratory protective devices when they are required; employees are properly trained; records are kept on employee training and maintenance of these devices; and respiratory protective device users are included in the Agency's occupational medical monitoring program and are medically approved for wearing the devices.

c. Occupational Health and Safety Designees. OHS Designees are responsible for assuring that approved programs are available for training the users of respiratory protective devices and for assisting supervisors in selecting the appropriate types and models of approved respiratory protective devices.

d. Employees. Employees are responsible for using and maintaining the respiratory protective devices issued to them in accordance with the instructions and training they receive, and for reporting a malfunction of a device to their supervisor.

e. Personnel Offices and Supervisors. Together, personnel officers and supervisors shall ensure that descriptions of positions requiring the use of respiratory protectives devices contain the medical fitness and facial hair requirements, and that job applicants and reassigned employees are instructed on the importance of these requirements.

f. Director, Office of Occupational Health and Safety. The Director, Office of Occupational Health and Safety, is responsible for establishing policy and guidelines for the Agency's respiratory protection program and for furnishing technical advice and assistance to agency programs.

6. RESPIRATORY HAZARDS. Toxic materials can enter the body in three ways: (1) by ingestion, through the gastro-intestinal tract, (2) by absorption through the skin or through cuts and punctures and (3) by inhalation through the respiratory system. The human respiratory system not only presents the quickest and most direct avenue of entry but also for many agents is the critical target. There are two types of hazardous atmospheres:

a. Oxygen-deficient atmospheres - Air normally is 20.9 percent oxygen by volume. Oxygen concentrations below 16 percent are considered unsafe for human exposure. Current legislation requires that oxygen percentage in a workplace be not less than 19.5 percent. Oxygen-deficient atmospheres can occur when air is displaced by gases and vapors or where there are oxidation processes such as fire, rusting, aerobic bacterial action, etc.

b. Air contaminants - Air contaminants include solid and liquid particulate matter and gaseous material, whether a true gas or vapor, or a combination of these.

7. SITUATIONS REQUIRING RESPIRATORY PROTECTIVE DEVICES. Respiratory protective devices may be required for three different types of situations:

a. When there is a high potential for a sudden release of toxic/flammable gases or vapors or there has been such a release; e.g., connecting anhydrous ammonia tanks or egress from a fire area.

b. When making predetermined entries into environments or locations where there is strong reason to suspect the presence of toxic airborne contaminants; e.g., entering hazardous waste or spill sites or manholes.

c. During infrequent but routine operations, primarily in a laboratory, where engineering controls are not feasible or adequate for the toxicity of the material involved; e.g., bulk solvent transfers in a remote storage building.

It is important to know the type of situation the respiratory protective devices are to be used in, because the selection will depend not only on the situation but also on qualitative and quantitative information from an assessment of the potential hazard and on the degree of control that can be exercised over the situation. The amount of information that can be obtained and the degree of control that can be exercised differs markedly among the three situations.

8. HAZARD ASSESSMENT AND CONTROL. Prior to donning respiratory protective devices, the potential or anticipated hazards shall be assessed and engineering controls shall be used to mitigate the problem.

a. Assessment - The first step to specifying appropriate protection is proper assessment of the hazard. This assessment involves obtaining qualitative and quantitative information on contaminants, or making predictions of potential concentrations in the situation of emergency releases. As a minimum, the assessment shall consist of determining explosivity of the atmosphere, radiation levels, and, in the case of confined spaces, the oxygen content of the atmosphere. First entry for obtaining information shall only be done using air supplied or SCBA respiratory protective devices.

With detailed information, a selection can be made from the various types of available respiratory protective devices for specific contaminant levels by following manufacturers instructions or NIOSH/OSHA recommendations.

b. Control - Respiratory protective devices are not control devices; they are used in the absence of or as adjuncts to inadequate controls. Whenever possible, even when it is known that respiratory protective devices will eventually be required for a situation, engineering controls or substitution of less toxic materials should be used to lessen the hazard or to mitigate the consequences of an untoward event, and thereby lessen the consequences in the event of failure of the respirator. Engineering controls consist of good local exhaust ventilation or isolation and/or enclosure of the process.

9. SELECTION. Respiratory protective devices vary in design, application, and protective capability. The inhalation hazard must be assessed and the specific use and limitations of available equipment understood to assure proper selection. There are three classes of respiratory protective devices:

a. Air purifying devices remove contaminants from the inhaled air stream. They are to be used only in atmospheres containing sufficient oxygen to sustain life and when contaminant concentrations do not exceed specified limits for the device. Basic types are mechanical filter respirators, chemical cartridge respirators, chemical cannister respirators, and combinations of chemical cartridge/cannister and mechanical filter respirators.

b. Atmosphere-supplying

1) Supplied-air devices deliver air through a supply hose connected to the wearer's facepiece. These devices ahll be used only in atmospheres not immediately dangerous to life or health. One basic type is the air-line or hose mask respirator.

2) Self-Contained Breathing Apparatus (SCBA) provides a respirable atmosphere for various periods of time based on the amount of breathing air or oxygen supplied and the demand of the wearer. Basic types are open circuit, for which the exhaled air is discharged from the face piece, and closed circuit, in which the exhaled air is scrubbed for carbon dioxide removal and fortified in oxygen.

c. Combination respirators are any combination of air-purifying and stmosphere-suppling respirator or any combination of supplied-air and self-contained breathing apparatus. These units are bimodal. They are generally used for emergency entry into and escape from atmospheres immediately dangerous to life.

10. LIMITATIONS. The following limitations must be understood by all employees required to wear respiratory protective devices.

a. Chemical cartridge or chemical cannister respirators shall not be worn to protect against gases or vapors which have no properties to warn the user of "break-through," i.e., the contaminant penetrating the adsorptive media. (This caveat is not required for dust respirators; these will plug instead of saturating to restrict breathing.)

b. Some gases and vapors can be absorbed through the skin (e.g., hydrogen cyanide) and others will attack tissue surfaces (e.g., strong acid gases). In many cases protective clothing will be needed in addition to respiratory protective devices.

c. Persons with perforated ear drums shall not wear respirators.

d. Contact lens shall not be permitted while wearing a respirator.

e. Any facial hair lying between the sealing surface of a respirator facepiece and the wearer's skin that will prevent a good seal shall not be allowed. This includes stubble, a moustache, sideburns, or a beard that extends outward between the face and the sealing surface of the respirator.

f. Spectacle temple bars or straps that pass between the sealing surface of a facepiece and the wearer's face prevent a good seal and shall not be permitted with a full-face respiratory protective device.

g. Specific warning signs which require immediate return to fresh air are:

1) Uncomfortable heat in the inhaled air stream coming from the adsorption material in chemical cartridge or chemical cannister respirators. This heat of adsorption indicates a high concentration of contaminant and the potential for immediate "break-through."

2) Indications of "break-through" or a poor faceseal as determined from the warning properties of the contaminant.

3) Any signs of physiological stress resulting from the increased physical effort required to wear a respirator or from the increased resistance to breathing (e.g., light headedness, dizziness, heat stress.)

11. TRAINING. For safe use of respiratory protective devices, it is essential that employees be instructed in their selection, use, fit, and maintenance. Training shall include the following:

a. Instructions in the nature of the hazard, whether acute, chronic, or both, and an honest appraisal of what may happen if the proper device is not used.

b. Explanation of why more positive control is not immediately feasible. This shall include recognition that every reasonable effort is being made to reduce or eliminate the need for respiratory protection.

c. A discussion of why this is the proper type of unit for the particular purpose.

d. A discussion of the device's capabilities and limitations.

e. Instruction and training in actual use.

f. Other special training as needed.

A minimum of six hours of training shall be provided initially, and 2-4 hours annually. This can be a part of occupational health and safety training for other reasons, and it can count as credit for both programs. Records of training and fit testing shall be maintained by the supervisor. Employees shall be issued a pocket card identifying the types of respiratory protective devices they can safely wear.

12. INSPECTION, MAINTENANCE, STORAGE, AND REPAIR. Proper inspection, maintenance, storage, and repair of respiratory protective devices are mandatory to insure a successful respiratory protection program.

a. Inspection. All equipment must be inspected before and after each use. Equipment used only for emergencies shall be inspected at least monthly. A record shall be kept by date and results of all inspections.

b. Maintenance. All respiratory protective devices shall be cleaned and disinfected after each use. Maintenance includes replacement of disposable elements such as filters and cartridges whenever necessary.

c. Repair. Replacement of other than disposable parts and any repair shall be done only by personnel with adequate training and test equipment to insure the equipment is functioning properly after the work is accomplished. Only parts supplied by the manufacturer for the product being repaired shall be used.

d. Storage. Respirators shall be stored in atmospheres that will protect them from dust, sunlight, extreme heat or cold and from sources of damaging chemicals.

13. OCCUPATIONAL MEDICAL MONITORING. Employees shall not be assigned to tasks requiring the use of respiratory protective devices unless they have had a medical evaluation and it has been determined that they are physically capable of performing the work while wearing the devices. An annual medical review should be scheduled for these employees.

14. SAVINGS PROVISION. Changes in the Act or standards and regulations which occur after the effective date of this Order will automatically come under the purview of this Order on the effective date of the change.

ORDER

Protective Services - Safety

Health and Safety Requirements for Employees Engaged in Field Activities

1. PURPOSE. This Order establishes policy, responsibilities, and mandatory requirements for occupational health and safety training/ certification, and occupational medical monitoring of Agency employees engaged in field activities.

2. DEFINITIONS.

a. The term "field activities" as used in this Order means EPA program activities that are conducted by EPA employees outside of EPA administered facilities involving environmental, pesticides, water and wastewater treatment plants, hazardous materials spills and waste sites investigations, inspections, and sampling.

b. The term "health and safety training" means scheduled, formal or informal training courses, approved, sponsored and conducted by EPA or its contracted agents which are designed to develop, improve and upgrade the health and safety knowledge of EPA employees involved in field activities.

c. The term "occupational medical monitoring" means surveillance over the health status of employees by means of periodic medical examinations or screening in accordance with the Agency's Occupational Medical Monitoring guidelines.

d. The term "certification" as used in this order means that the employee has fulfilled the minimum training requirements specified for the level of training/certification received.

3. REFERENCES.

a. 29 CFR 1910, Parts 16, 94, 96, 106, 109, 111, 134, 151, Occupational Health and Safety Standards.

b. Executive Order 12196, Section 1-201, Sec. (k), Occupational Health and Safety Programs for Federal Employees.

c. 29 CFR 1960.20(1), Occupational Safety and Health for the Federal Employee

d. EPA Occupational Health and Safety Manual, Chapter 7(1).

e. EPA Training and Development Manual, Chapter 3, Par. 7(b).

f. Occupational Health and Safety Act of 1971, P.L. 91-596, Sec. 6.

g. EPA Order on Respiratory Protection (Proposed).

h. 49 CFR, Parts 100-177, Transportation of Hazardous Materials.

i. EPA Order 1000.18, Transportation of Hazardous Materials.

j. EPA Order 3100.1, Uniforms, Protective Clothing, and Protective Equipment.

4. BACKGROUND. Field activities are a critical part of most EPA programs. These activities range from routine environmental reconnaisance sampling, inspections, and monitoring, through entering and working in environments with known and suspected hazards. Since protection cannot be built into the field working environment, the protection of personnel involved in field activities takes on the forms of training employees in the application of safe operational procedures, and the proper use of appropriate personal protective clothing and equipment.

5. APPLICABILITY. This Order applies to all EPA organizational units which have employees engaged in field activities.

6. POLICY. It is the policy of the Environmental Protection Agency to carry out its field activities in a manner that assures the protection of its employees to the greatest extent feasible.

7. RESPONSIBILITIES.

a. Assistant Administrators, Regional Administrators, Deputy Assistant Administrators, Laboratory Directors, and Division Directors. These officials are responsible within their jurisdictions for implementing the provisions of this Order and for budgeting the necessary funds for employee training/certification and occupational medical monitoring programs.

b. Supervisors. Supervisors are responsible for complying with the requirements of this Order for employee training/certification and occupational medical monitoring programs. They will identify those employees who require training/certification, and occupational medical monitoring to comply with the provisions of this Order.

c. Employees. Employees are responsible for making known upon request from their supervisors, the extent of their individual occupational health and safety training, and the history of their occupational medical monitoring participation. Employees should notify their supervisor of any hazardous work situation and make suggestions for corrective measures, and for applying the knowledge, skills, and techniques acquired through training/certification in a manner that will help assure their health and safety and that of fellow workers.

d. Occupational Health and Safety Designees. The Occupational Health and Safety Designees are responsible for identifying program areas that require training/certification and occupational medical monitoring; recommending or providing training/certification resources to meet the requirements of this Order; and maintaining records of persons receiving training/certification.

e. Office of Occupational Health and Safety. The Director, Office of Occupational Health and Safety is responsible for establishing policy and requirements for adequate training/certification programs for field activities, developing and maintaining an occupational medical monitoring program, approving health and safety training/certification programs for employees involved in field activities, and for evaluating the results of these training/certification programs.

8. OBJECTIVES.

a. Training/Certification. The objectives of the health and safety training/certification programs for employees involved in field activities are:

1) To assure that EPA employees are aware of the nature of the potential hazards that may be encountered during the performance of field activities;

2) To provide the knowledge and skills necessary to perform the work with the lowest feasible risk to personal health and safety;

3) To assure that Agency program goals can be accomplished in as safe and healthful manner as feasible.

b. Occupational Medical Monitoring. The objectives of the occupational Medical Monitoring program are:

1) To detect any adverse effects of occupational exposure on the employees health.

2) Initiate prompt corrective actions when indicated.

9. TRAINING/CERTIFICATION REQUIREMENTS. Employees shall not be permitted to engage in routine field activities until they have been trained/certified to a level commensurate with the degree of anticipated hazards.

a. Basic Level: All employees shall be provided a minimum of 24 hours of health and safety training prior to their becoming involved in normal, routine field activities. The training shall include but not be limited to classroom instruction in all the following subject areas:

1) Employee Rights and Responsibilities
2) Nature of Anticipated Hazards
3) Emergency Help and Self-Rescue

4) Vehicles - Mandatory Rules and Regulations
5) Safe Use of Field Equipment
6) Use, Handling, Storage, and Transportation of Hazardous Materials
7) Personal Protective Equipment and Clothing
8) Safe Sampling Techniques

In addition to classroom instruction, the employee shall accompany an employee experienced in field activities and perform actual field tasks for a minimum of three days within a period of one month after classroom instruction. Employees satisfactorily completing these requirements will receive certification at the basic level of training from the Occupational Health and Safety Designee.

b. Intermediate Level. All inexperienced employees who are to work with experienced employees in hazardous waste and spill site investigations shall be provided a minimum of 8 hours of additional health and safety training. This training shall include (in addition to the Basic Level requirements) but not be limited to the following subject matter:

9) Site surveillance/observation/plan development
10) Use and decontamination of totally enclosed protective clothing and equipment
11) Field test equipment for radioactivity, explosivity, and others.

In addition to classroom instruction, the employee shall accompany another employee experienced in hazardous waste and spill site investigations and/or cleanup operations and perform actual field tasks for a minimum of three days within a period of three months after classroom instruction. The employee should also be able to provide on-the-job training and instructions to inexperienced employees during normal, routine field activities. Employees satisfactorily completing these requirements will be certified at the Intermediate Level by the Occupational Health and Safety Designee.

c. Advanced Level. All employees who conduct and/or manage hazardous waste and spill site monitoring, sampling, investigations, and cleanup operations shall be provided a minimum of 8 hours additional health and safety training.

The classroom training shall include but not be limited to (in addition to the Basic and Intermediate Level requirements), instruction in the following subject areas:

12) Management of restructed and safe zones
13) Rules of Handling the Press and VIP's
14) Safe Use of Specialized Sampling Equipment

In addition to classroom instruction, the employee shall accompany another employee with experience in managing hazardous waste and spill site investigations and/or cleanup operations and perform actual field tasks for a minimum of three days within a three month period after receiving classroom instruction. After satisfactorily completing these requirements, employees will receive Advanced Level certification from the Occupational Health and Safety Designee.

d. General.

1) An employee may receive certification at the next higher level by completing only the additional training requirements if certified at the next lower level within the previous 9-month period.

2) The Director, Office of Occupational Health and Safety, may certify employees based on an evaluation of previous training, education, and experience. Recommendations for this type certification should be made to the Director by the local Occupational Health and Safety Designee.

10. FREQUENCY OF TRAINING. Employees at the Basic, Intermediate, and Advanced Level shall complete a minimum of 8 hours of classroom instruction annually to maintain their certification. In addition to the classroom intruction, employees shall have demonstrated by performing actual field tasks that they have sufficient practical experience to perform their assigned duties.

11. RECORD OF TRAINING.

a. A record of the level of training/certification shall be maintained in the employee's official personnel file.

b. The Occupational Health and Safety Designee shall maintain a roster of employee training/certification so that a schedule of annual training can be established.

c. The Occupational Health and Safety Designee shall issue a certificate to the employee showing the level of training/certification.

12. OCCUPATIONAL MEDICAL MONITORING REQUIREMENTS. All employees routinely engaged in field activities which present the probability of exposure to hazardous or toxic substances or require the use of respiratory protective equipment shall be included in the Agency's Occupational Medical Monitoring Program. Employees should not be permitted to engage in field activities unless they have undergone a baseline medical examination as defined in the Agency's Occupational Medical Monitoring Guidelines showing physical fitness and providing a base to measure any adverse effects their activities may have on these individuals.

13. SAVINGS PROVISION. Changes in the Act, Executive Order, or EPA and OSHA standards and guidelines which occur after the effective date of this Order will automatically come under the purview of this Order on the effective date of the change.

Full implementation of this Order shall be within 6 months of its effective date.

ENVIRONMENTAL PROTECTION AGENCY

FY 1980-81

MEDICAL MONITORING PROGRAM GUIDELINES

The following information and attachments are intended for use by Agency components that conduct occupational medical monitoring programs. These guidelines outline the minimum essential elements for such a program and should not be regarded as being comprehensive. Some Agency workplaces may have potential exposure hazards that will require medical monitoring procedures not covered in this basic description; however, it is essential that each local program include at least the elements described herein. As more Federal regulations and recommendations appear for employees potentially exposed to toxic chemical and physical agents, program updates and modifications are to be expected. When such changes occur, they will be presented by the Agency's Office of Occupational Health and Safety.

Who should be included in a medical monitoring program?

This medical monitoring program is designed basically for laboratory and field workers whose work regularly poses the possibility of exposure to toxic materials. In addition, the program should meet the needs of other diverse groups of employees whose jobs require preplacement and/or periodic health assessment. Generally, administrative, fiscal, secretarial, statistical, and other support personnel who are exposed to toxic materials indirectly, infrequently, or inconsequentially should not be included. Representative job categories that should have medical monitoring made available on exposure include chemists, microbiologists, toxicologists, physical scientists, and the technical personnel who support these disciplines. Employees who collect various types of polluted samples should be included if the sampling requires exposure to pollutants significantly in excess of ambient concentrations. Maintenance personnel normally should be included, since they are occasionally exposed to toxicants at unexpectedly high concentrations, as should those who perform custodial services in actual laboratories or in areas where toxic materials are stored. Part-time and temporary employees should be included if their jobs are similar to the categories previously mentioned. The decision as to which employees are nominated should rest with the program director or supervisor most familiar with the possible hazards involved.

Is the program voluntary?

Employees whose jobs justify inclusion in the program have the option to participate or not, with the exception of those few persons whose jobs require such examinations as a condition of employment. Future Agency policy may expand the number of job categories that will require preplacement and periodic health assessment. Experience indicates that about 85% of nominated employees will elect to participate in the program. A written record of those deferring or declining participation should be kept to protect the Agency against accusations that such a program was not made available. A simple notation to the effect that an individual has declined is sufficient. Declining employees should be reinvited to participate regularly if they remain eligible for the program. Each facility should review its entire roster periodically to assure the inclusion of all "at-risk" personnel.

Who will pay for the program?

Medical monitoring is the responsibility of the employer, and the Agency must bear the entire cost. When a preexisting or non-job-related condition is detected in the course of a health monitoring examination, the individual is to be referred to his/her private physician for further evaluation, treatment, and followup. The individual must bear these additional costs. When a condition appears to have resulted from employment, the employee may seek compensation and the payment or recovery of medical expenses from the Department of Labor, Office of Workers' Compensation Programs.

Consultation is available from the Agency Office of Occupational Health and Safety when job-related illness is detected or suspected.

How are physician services obtained?

The fact that most EPA operations are able to use purchase orders to obtain local physician services simplifies this procurement. Ideally, the physician chosen should be board certified in occupational medicine; however, this is unrealistic because the number of such physicians available is quite small and most serve as full-time program directors for large industrial corporations.

For the purpose of this program, a local physician in a practice of internal medicine or in general practice will usually suffice. A physician who belongs to the American Occupational Medical Association or a local occupational health society is preferred; the names of these physicians may be obtained from the American Occupational Medical Association, 150 North Wacker Drive, Chicago, Illinois 60606 (312/782-2166).

The important requirements are that the physician is capable, is equipped to conduct a thorough physical examination, and has a high interest in the program. A local physician is in the best position to provide a continuity of service over the years and to handle referrals when non-job-related conditions are detected. On occasion, local U.S. Public Health Service facilities are willing to perform this service. The use of a Federal facility generally offers an economic advantage and is encouraged whenever such services are offered.

How are related laboratory services obtained?

These services must be performed by a clinical laboratory that is competent, is licensed, participates in a proficiency testing program(s), and maintains rigorous quality control. It should be licensed by the Federal government. A number of large interstate laboratories provide satisfactory service, rapid turnaround, and reasonable fees. These laboratories usually provide their own collection and mailing containers at no extra cost, and most have government "rates" that are competitive. Since these are large laboratories, they can provide, at a reasonable additional cost, special tests that may be essential for those employees who have been exposed to specified chemicals. Many hospital and local laboratories can supply only a portion of the laboratory tests that may be needed; also, in performing more complex tests, these hospitals and laboratories may be less reliable than the large interstate laboratories that routinely carry out such procedures.

The local examining physician will be responsible for requesting, interpreting, and evaluating laboratory reports. A laboratory of the physician's choice is preferable, provided that it meets quality and cost reasonability standards.

How often should examinations be offered?

Ideally, the periodicity and content of monitoring examinations should be determined by an evaluation of the occupational risk; i.e., the probability of adverse effects of exposure. When the program was initiated, it was recommended that an annual examination suffice for most participants. Until better criteria are developed from a study of EPA operations and monitoring findings, an annual evaluation is still recommended.

The first, or baseline, examination offered to each participant should consist of a complete medical examination. This examination will be useful in providing reference information for the evaluation of subsequent periodic examination findings. Subsequent monitoring examinations, for most EPA operations, can be of more limited scope.

Is the program a substitute for "general checkups"?

Participants should be advised that this program of medical monitoring examinations is not a direct substitute for "general checkups" or other periodic examinations designed to monitor or promote general health. The occupational medical monitoring program is designed to screen for evidence of adverse effects of occupational exposure, particularly exposure to toxic substances. The examinations do not provide a comprehensive health evaluation; neither do they provide significant screening for many of the common nonoccupational chronic disorders.

Medical examination content recommendations

Current FY 1980-81 recommendations are to continue to provide a comprehensive baseline examination for new participants in the program and to provide periodic screening examinations for other participants.

Periodic monitoring should include, as a minimum, an interim medical and occupational history review, a screening physical examination, basic blood and urine laboratory tests (as discussed below), and a physician's evaluation. The monitoring examination should be supplemented by procedures and special tests only as warranted by exposure to specific significant hazards or stresses.

What are the basic laboratory tests to be included for each participant?

Each individual should receive a basic panel of blood counts and chemistries to evaluate blood-forming, kidney, liver, and endocrine/metabolic function. The following blood tests are considered to be the minimum desirable:

- White blood cell count and differential cell count
- Hemoglobin and/or hematocrit
- Albumin, globulin, and total protein
- Total bilirubin
- Serum glutamic oxalacetic transaminase (SGOT)
- Lactic dehydrogenase (LDH)
- Alkaline phosphatase
- Calcium
- Phosphorus
- Uric acid
- Creatinine
- Urea nitrogen
- Cholesterol
- Glucose

Each employee should have a routine urinalysis that consists of the following:

- Specific gravity
- pH
- Microscopic examination
- Protein

- Acetone
- Glucose

What other tests are recommended?

X-Ray

A baseline chest X-ray should be a standard 14- x 17-inch P-A (posterior-anterior) exposure. The lateral view is not necessary for routine screening purposes. The X-ray may be obtained from the examining physician, a local radiologist, or a local hospital. The film should be read or reviewed by a board-certified radiologist or other competent medical specialist. Subsequent periodic chest X-rays should be performed only when clinically indicated and not as a routine measure.

Electrocardiogram

An electrocardiogram should be included in the baseline examination. It ordinarily should be of the standard 12-lead resting type and interpreted by an internist or cardiologist. Subsequent periodic electrocardiograms should be obtained only when recommended by the examining physician, and not as a routine measure.

Pulmonary function

Pulmonary function testing is desirable as a part of the baseline examination. It may be indicated periodically for employees at respiratory system risk, such as those with significant exposure to toxic dusts and irritants. As a minimum, it should consist of simple tests of lung ventilation: forced expiratory volume in 1 second (FEV_1) and forced vital capacity (FVC).

Other special tests

Workers who are significantly exposed to certain designated materials may require additional special procedures in addition to the basic panel of tests. These tests are listed in Table 1 and are obtainable at an additional cost. The physician should determine who is in need of special tests after reviewing the history forms and after consulting with supervisors and/or medical monitoring coordinators and health and safety designees. Provision should be made for repeating tests when necessary. Consultative assistance is available from the Office of Occupational Health and Safety regarding special tests.

Tests dropped from 1977 guidelines

The following tests, recommended in the 1977 guidelines, are no longer recommended as routine tests for occupational monitoring, either baseline or periodic:

- VDRL or other serologic test for syphilis
- Serum specimen for freezing and storage
- Female cervical cytology test (Pap test)
- Serum glutamic pyruvic transaminase (SGPT)
- Serum triglycerides
- Serum sodium, chloride, and potassium
- Carcino-embryonic antigen

What medical monitoring records and forms are required?

Forms

To provide uniformity of data collection and to expedite analysis, it would be desirable to have an EPA standard form(s) for use in medical monitoring examinations. However desirable, this goal does not appear possible in the immediate future. Private medical examiners use a variety of forms and automated systems to obtain and record medical information. The scope and quality of information-gathering and recording systems used should be at least equal to that of the forms discussed below.

Participants should be advised that the medical monitoring examinations are voluntary and that they are not required to answer any specific questions.

Medical history

The medical history will normally be obtained by having each participant fill out a medical and occupational history form before seeing a physician (Attachment 1 provides an EPA-developed sample). Usually, this is done several days preceding the date of the physical examination. All programs are urged to adopt this form, or its equivalent, since most "standard" medical history forms are too sketchy, especially in terms of occupational history and exposure. The occupational exposure information may be reviewed by occupational health and safety personnel to assist the examining physician in performing an examination of appropriate scope. When completed, the form should be turned over to the physician or physician's designee in a manner safeguarding privacy and confidentiality of the participant.

Physical examination form

The physical examination should be recorded on a standard form such as Government Standard Form 88 (Attachment 2). This form is available in quantity and is used by nearly all governmental health providers. Although the local physician may have similar forms that he or she uses routinely, all workplaces are urged to adopt S.F. 88 to achieve Agencywide uniformity. Sections 60-63, 66-69, and 70-72 are not normally carried out as part of monitoring physical examinations and may be omitted. Audiometry, item 71, is indicated for all employees regularly exposed to high noise levels; i.e., over 85 dB.

Privacy Act

Since the Health Monitoring Program will establish a set of records on individual citizens, it must meet the requirements of the Privacy Act of 1974 (P.L. 93-579). Each participant is required to read and sign a copy of the Privacy Statement (Attachment 3), which explains the authority for collecting the information, uses to be made of the information, rules of confidentiality, and disclosure information. The original of this statement should be made part of the employee's medical monitoring records, and a copy should be provided to the employee. Written requests for release of this information may be made by the employee, and such requests should also be made a permanent part of the record. Each Agency program area will be responsible for seeing that the provisions of this Act are met.

Required reports and actions

The examining physician must communicate all examination findings and opinions to the examinee. In addition, the examining physician should furnish the Agency a written report on any examinee with findings that, in the physician's opinion, indicate an adverse effect of occupational exposure. This report should detail the occupationally related findings and the basis for the physician's opinion. The physician should be instructed, however, not to reveal any specific findings or diagnoses unrelated to occupational exposure in the report to the Agency.

On receipt of such a report, the local medical monitoring coordinator shall promptly send a copy to:

Manager of Medical Monitoring
Office of Occupational Health and Safety (PM-273)
401 M Street, S.W.
Washington, D.C. 20460

Local management, safety officers, and supervisors should take prompt investigative and remedial action after being alerted to a possible occupational health and safety problem by a medical report. Technical assistance is available from the Office of Occupational Health and Safety.

TABLE 1

SPECIAL TESTS

An annual monitoring examination will be satisfactory for most workers. Additional special tests may be indicated for those workers who have significant exposures to chemical or physical agents, in accordance with OSHA or other applicable standards.

Substance	Special Tests
Acrylonitrile	Chest X-ray, fecal occult blood, procto-sigmoidoscopy
Inorganic arsenic	Chest X-ray, sputum cytology
Asbestos	Chest X-ray, pulmonary function
Benzene	Reticulocyte count
Coke oven emissions	Chest X-ray, pulmonary function, sputum cytology, urinary sediment cytology
Cotton dust	Pulmonary function
Dichlorobromopropane	Sperm count (male), serum follicle stimulating hormone, serum luteinizing hormone, serum total estrogen (female)
Inorganic lead	Blood lead, peripheral blood smear morphology, blood zinc protoporphyrin
Noise (above 85 dB)	Audiometry
Organophosphate pesticides	Blood cholinesterase

Primate handlers should have an annual HB_sAg (hepatitis B surface antigen) test and a tuberculin test (unless known to be tuberculin positive).

Environmental Protection Agency

Privacy Statement

Occupational Medical Monitoring Program Records

A. Authority under which the information is requested:

Executive Order 11807 which requires that the Occupational Safety and Health Act, P.L. 91-596 with its standards, Code of Federal Regulations, Title 29, Chapter XVII, Part 1910 of the Code of Federal Regulations be applied to Federal employees; Code of Federal Regulations Title 29, Chapter XVII, Part 1960, Federal Workers Safety and Health. Other authority: FPM Chapter 339 (Medical examination for appointment); FPM Chapter 752 (Adverse actions); FPM Chapter 810 (Claims for disability under worker's compensation); FPM Chapter 831 (Disability retirement); and FPM Chapter 339.

B. Uses to be made of the information:

The purpose of requesting personal information is to enable the Agency Occupational Medical Officer, examining physician, and other health personnel to provide an occupational health program directed primarily to protecting you and your fellow workers from potential hazards in your work environment and the reduction of these hazards. The records will document your health status, changes in physical conditions through the years, and provide an account of any care rendered, advice given, and consultations that are recommended.

This information may be used to determine unusual susceptibility to illness or injury from exposures in your work environment, to determine suitability for assignments, to permit medical surveillance for potential harmful effects of toxicants used in your work, and to provide medical treatment and advice. It may be used to plan, implement and evaluate occupational and preventive health programs, conduct epidemiologic research, teach, and compile statistical data. It may be used to adjudicate claims and determine benefits, and report medical conditions required by law to Federal, State and local agencies. It may be used for other lawful purposes including litigation.

C. Rules of confidentiality:

The information contained in these files will be open to review and usage by the Agency Medical Office, the examining physician and/or duly authorized assistants except as noted below.

Information to be utilized for research, teaching, statistical, or epidemiologic purposes will have all identifying data obliterated and made unrecognizable as to the identity of an individual.

The records will be in the local custody of the examining physician and will be maintained in a locked filing cabinet. Access will be limited to the custodian and/or duly appointed health assistants. A copy of these records may be maintained in the Agency Occupational Medical Office. These will be maintained in locked cabinets with access limited to the Director or to authorized assistants.

Upon death, retirement, resignation, or other termination of Government service, the records will be forwarded to the US Office of Personnel Management or Public Health Service Commissioned Officer Department of Personnel for inclusion with the Official Personnel Records and the custody thereof will fall to the custodian of such records.

Medical information about an applicant, employee or annuitant shall not be made available to the public.

Medical information about an applicant, employee or annuitant may be disclosed to the applicant, employee, or annuitant, or a representative designated in writing, except that medical information concerning a mental or other condition of such a nature that a prudent physician would hesitate to inform a person suffering from it of its exact nature and probable outcome may be disclosed only to a licensed physician designated in writing for that purpose by the individual or his designated representative. The determination on whether information falls into the purview above will rest with the custodian.

The applicant, employee, or annuitant may request release of records or information, and/or designate a representative, in a letter directed to the custodian of the records. The request will give the full name of the representative and indicate the records to be released.

D. Disclosure of information by participants:

Disclosure of the required information is entirely voluntary except for employees for whom disclosure is a condition of employment or where a medical certificate is required before assignment to positions which involve: (a) operation of motor vehicles; (b) exceptional stress; (c) food handling; (d) direct physical contact with people - for example, nurses and physical therapists; (e) work above ground level or around hazardous power-driven machinery; or, (f) strenuous exertion or hazardous duty or physical requirements more arduous than those described on SF-177 - for example, aircraft pilots and flight crew members, underwater divers, and firefighters. Pilots, flight crew members, and divers will not be certified or recertified if the information is not furnished. Other persons may decline to participate in or withdraw from the Occupational Medical Monitoring Program at any time without prejudice to themselves or to their jobs. If the information is not furnished, however, a complete occupational health evaluation cannot be done and will not be attempted; optimum advice and care may therefore not be possible. Delay in certain benefits may result from the lack of available information about an employee.

E. Certification:

I have received a copy of this statement which I may retain and I understand that I may receive additional copies of this statement upon request. I understand that a copy of this statement will be placed in my health records as evidence of this notification.

(Typed or printed name)

(Signature)

(Date)

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DRAFT 3

August 29, 1980

David Weitzman, Manager
Industrial Hygiene Programs
Office of Occupational Health
and Safety

DRAFT

ENVIRONMENTAL PROTECTION AGENCY	MANUAL
CHAPTER 9 HAZARDOUS WASTE SITE INVESTIGATIONS AND ENVIRONMENTAL SPILL RESPONSES	OCCUPATIONAL HEALTH AND SAFETY

1. POLICY AND RESPONSIBILITY.

a. Purpose. This chapter establishes policy, responsibilities, and procedures for the conduct of the Agency occupational health and safety program for hazardous waste site (HWS) investigations and environmental spill (ES) responses.

b. Policy. The EPA is committed to providing safe and healthful working conditions for EPA employees at hazardous waste sites and environmental spills.

c. Background. Executive Order 12196, 29 CFR 1960, and this EPA Occupational Health and Safety Manual require the EPA to provide safe and healthful working conditions for its employees. The EPA is responding to this requirement with this chapter, which is an adaptation of the "Safety Manual for Hazardous Waste Site Investigations", originally drafted by EPA's National Enforcement Investigation Center (NEIC). The draft manual has been developed further by a Work Group of the Hazardous Waste Task Force, NEIC, and the Office of Occupational Health and Safety (OOHS).

d. Discussion. Investigators and response personnel must effectively deal with the potential of facing a very high risk of incurring illness or injury while investigating a HWS or responding to an ES. They cannot anticipate every safety hazard associated with HWS investigations and ES responses,so they must take extraordinary precautions to prevent illness or injury to themselves, other workers, and the public.

Since the investigators and response personnel cannot obtain the ideal objective of complete elimination of risk, they must reduce the risk to the lowest feasible level. No set of rules can be applied uniformly to every situation. The application of the rules presented in this safety manual chapter to a specific HWS investigation or ES response must be based on the judgement of the Project Leader who is responsible for the safety of the investigation or response*. It is imperative, therefore, that the Project Leader assess those variables peculiar to each planned activity in establishing appropriate safeguards.

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*The designation, Project Leader, originated from policies and procedures developed by NEIC for HWS investigations. The corresponding position at spill responses is the On-scene Coordinator. For the purposes of this manual, Project Leader will be used to designate both Project Leaders and On-scene Coordinators.

e. Responsibilities.

(1) Assistant Administrators (AA) and Regional Administrators (RA). AA's and RA's are responsible for:

- developing and implementing a health and safety program, consistent with this manual, for HWS investigations and ES responses conducted under their organizational jurisdiction;

- coordinating the development of their health and safety program with the Director, Office of Occupational Health and Safety (OOHS); and

- submitting their health and safety program to the Director, OOHS, for review to assure consistency of these programs throughout the EPA.

The AA for Planning and Management, as the Designated Agency Safety and Health Official, is responsible for:

- administering the EPA's health and safety program for HWS investigations and ES responses;

- ensuring the allocation of adequate resources in the EPA's Budget to support and monitor these programs; and

- identifying, with designated object class codes, the resources as required by OMB Circular No. A-11.

(2) Officers-in-Charge of Reporting Units (OIC's). OIC's are responsible for:

- implementing the health and safety program for HWS investigations and ES responses conducted by employees of their reporting unit. (See EPA Occupational Health and Safety Manual, CHAP 1, PAR 5, for a detailed description of OIC's health and safety responsibilities);

- assuring that any PL conducting a HWS investigation or ES response is qualified by training or experience, has the equipment to conduct the investigation or response safely, and plans an investigation or response which is safe to all concerned; and

- assuring the completion of semi-annual program reviews and audits.

(3) Safety Committee.

The Safety Committee is responsible for:

- aiding and advising the OIC on employee health and safety matters and policies and procedures for the Agency occupational health and safety program for HWS investigations and ES responses. (See EPA Occupational Health and Safety Manual, CHAP 5 PAR 4, for a detailed description of the Safety Committee's health and safety responsibilities);

- promtly reviewing and approving Safety Plans prepared by each Project Leader and forwarding them to the Safety Designee; and

- advising the OIC on specific programs for medical surveillance.

(The Safety Committee should include or have access to individuals with a variety of technical backgrounds, so while not being able to solve technical problems or totally analyzing proposed activities, it can call to the attention of safety experts areas of concern.)

(4) Occupational Health and Safety Designee.

The Safety Designee is responsible for:

- advising and assisting the OIC in developing, organizing, directing, and evaluating the health and safety program for HWS investigations and ES responses; and

- coordinating accident reporting, recordkeeping and often the medical surveillance program. (See EPA Occupational Health and Safety Manual, CHAP 1, PAR 3 for a detailed description of the Safety Designee's health and saffety responsibilities).

Safety Designees must have either backgrounds and training in recognizing, evaluating, and controlling hazards at HWSs and ESs or access to this expertise. (Safety Designees should have or have access to expertise in field safety, industrial hygiene, respiratory protection, transportation of hazardous materials, occupational medicine, and geology.)

(5) Project Leader.

The Project Leader has the primary responsibility for:

- assuring the availability of personal protective equipment and selecting the level of personnel protection needed for use at HWS investigations and ES responses;

- selecting work practices and engineering controls for HWS investigations and ES responses;

- preparing a Safety Plan prior to the investigation or response (See Appendix 2 for details of the Safety Plan);

- submitting the Safety Plan prior to the investigation or response to the Safety Committee for their review and approval;

- making available to program and support staff copies of the approved Safety Plan;

- assuring that the program and support staff are instructed, trained and certified in the work practices required to ensure safety and in planned procedures for dealing with emergencies, and are informed of the potential hazards associated with the planned investigation or response;

- designating one member of the investigation or response team as the site Safety Officer, and assuring that that person fulfills all safety responsibilities necessary for safe operations;

- supervising the safety performance of the staff to ensure that the required work practices are employed;

- arranging for immediate medical attention and reporting to the Safety Designee any incident that results in injury or overt exposure personnel by hazardous materials;

- assisting the Safety Designee in investigating accidents;

- investigating and reporting in writing to the Safety Designee any problem pertaining to operation and implementation of work practices;

- correcting work errors and conditions that may result in injury or exposure to hazardous materials; and

- assuring the health, welfare and safety of all Staff members at the HWS or ES.

(6) <u>Safety Officer</u>. The Safety Officer is responsible for implementing the Safety Plan at the site.

(7) <u>Employees</u>. Employees are responsible for:

- complying with the health and safety program established by this chapter on HWS investigations and ES responses;

- reporting to their supervisors or the Safety Designee any unsafe condition and all facts pertaining to incidents which resulted in employee injury or exposure to hazardous materials; and

- cooperating in the medical surveillance activities.

(8) <u>Director, Office of Occupational Health and Safety</u>. Under the supervision of the AA for Planning and Management, the Director, OOHS, is responsible for:

- reviewing and coordinating the health and safety programs developed by AA's and RA's for HWS investigations and ES responses for consistency with this chapter (See 1.e. (1));

- auditing investigation and response activities for compliance with Agency policy and practices and good work practices.

- informing responsible EPA officials of any problem areas;

- providing technical support; and

- approving training courses.

The Director, OOHS, is the top technical advisor for EPA on health and safety for HWS investigations and ES responses.

2. HEALTH AND SAFETY PROGRAM REQUIREMENTS

a. Safety Plan. The Project Leader must prepare and obtain approval of a Safety Plan (Appendix 2) before conducting a HWS investigation or ES response.* The Safety Committee, or similar group set up for this purpose, must review the Safety Plan and forward it to the Safety Designee with comments. The Safety Designee and the OIC must approve the Safety Plan before the investigation or response can proceed on-site. The Safety Designee must maintain the Safety Plan on file and available for distribution, provide a copy to each employee participating in the HWS investigation or ES response, and forward an information copy to the Director, OOHS.

b. Audit. The OIC must ensure that semi-annual program reviews, including on-site inspections, of the health and safety program for HWS investigations and ES responses are conducted by persons with appropriate background and training, and that any deficiencies are corrected as soon as possible (or immediately if the deficiency is an imminent hazard). The OIC must forward a copy of the program review and abatement actions to the Director, OOHS, for review. The Director, OOHS, may conduct independent audits.

c. Accident Reporting. The Safety Designee must coordinate the reporting of any incident involving injury or exposure (inoculation, injestion, dermal contact, inhalation) to a hazardous material in accordance with the procedures detailed in CHAP 3 of the Occupational Health and Safety Manual. In addition, the Safety Deesignee must forward a copy of the accident report to the employee's medical record (See 2.f.(3)).

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*For ES responses, generic Safety Plans must be prepared in advance, dealing with groups of possible spills, eg., Safety Plan for acid gas spill, etc. In addition, emergency support groups including fire, rescue and medical staffs, with telephone number, must be grouped together by area for easy access in the event of a hurried departure to a spill. This information must be readily available prior to spill response for attachment to the Safety Plan.

d. Training. The OIC must ensure that all employees, before conducting HWS investigations and ES responses, receive a minimum of 24 hours of training on HWS and ES safety (followed by 24 hour refresher courses annually) and receive training by 3 separate field experiences before conducting investigations and responses. The Safety Designee must obtain the approval of Director, OOHS, of the initial and annual 24 hour courses and must issue a certificate to employees upon completion of the courses and field experiences. In addition, the Safety Designee must maintain records of training and forward individual records to employees' personnel files. EPA ORDER___, "Health and Safety Requirements for Employees Engaged in Field Activities", provides detailed training requirements.

The Safety Designee must keep the Safety Plan, and other appropriate written information describing the potential health and physical injury hazards of a HWS investigation or ES response, in a file that is continuously and readily availably to employees.

e. Emergency Procedures. The Safety Designee must develop procedures to protect personnel in case of emergencies at the HWS or ES. The emergency procedures should include notifying emergency and other affected personnel and the locations and emergency telephone number of the nearest emergency medical facility, ambulance service, fire department, police department and Poison Control Center.

f. Medical Surveillance. EPA ORDER ___ "Health and Safety Requirements for Employees Engaged in Field Activities" provides medical surveillance requirements consistent with the requirements presented below.

(1) Pre-assignment Health Assessment. The OIC must ensure that all employees who work at HWSs and ESs receive a base-line health assessment. These health assessments must be consistent with the EPA Medical Monitoring Guidelines.

The purpose of this pre-assignment assessment is to establish a baseline health record and to seek conditions which would predispose the employee to illness due to exposure to hazardous materials or due to the physical demands of using personal protective equipment. The pre-assignment assessment includes a work history, a medical history, and a physical examination, which includes customary laboratory studies and agent-specific studies when appropriate.

(2) Periodic Health Assessments. The OIC must ensure that all employees who work at HWSs and ESs are offered periodic health assessments. The periodicity and content of these assessments must be determined by the OIC after consultation with an occupational physician, the Safety Designee, the medical monitoring coordinator, and the Project Leader.

These assessments include an updating of the employee's work and medical histories, including occurrences of any accidental exposures previously unreported. The following information must be included in the employee's medical record: names of hazardous materials to which the employees may have been exposed, information on the probability, frequency, and extent of exposures, and any environmental measurements relating to hazardous materials that may have been made. The periodic health assessment must include a physical examination and may also include biochemical or other surveillance of body fluids, and an evaluation of pertinent functional systems of the body (See Appendix 2).

The medical monitoring coordinator at each location is responsible for requesting and helping to schedule examinations and, assisted by the Safety Designee, must furnish employees, prior to each examination, exposure and environmental monitoring data as specified above for inclusion in their medical records.

(3) Records. Medical records must be maintained by the respective occupational physician for the duration of the employee's employment. Upon termination of the employee's employment, including retirement or death, the medical records must be maintained for an extended period of time in a manner that will ensure ready access as needed by the medical monitoring program of the EPA. The extended period of time must be at least 30 years after the individual's last work with hazardous materials. Forward the records to the Medical Monitoring Program Manager, OOHS, if custody of the records cannot be maintained locally.

3. WORK PRACTICES

The work practices specified in this section must be used by all HWS investigators and ES personnel.

a. Personnel Practices.

(1) Protective Clothing. Protective clothing must be worn by all personnel while on a suspected or confirmed HWS or ES unless sufficient data has been acquired to enable the Project Leader to make an informed judgment that pro tective clothing is not needed. In the absence of clear indications that work can proceed safely without protective clothing, required items include chemical-resistant pants, jacket, boots, gloves, and hard hat or head cover, and may include a fully encapsulating chemical protective suit.

Project Leader's must also consider the potential hazards of wearing protective clothing since protective clothing is cumbersome, hastens the on-set of fatigue, increases heat stress, and increases the time the personnel must spend in the high risk area.

(2) Heat Stress. Employees must compensate for the increased heat stress caused by wearing protective clothing in hot weather in order to prevent the on set of heat induced illnesses. Employees must maintain an appropriate work-rest regimen and water and salt balances (see 3.b. (9) for details).

(3) Eye Protection. Devices to provide appropriate eye protection must be worn on any HWS or ES and should meet ANSI Z87.1, "Practice for Occupational and Educational Eye and Face Protection".

(4) Forbidden Practices. The following practices are expressly forbidden during operations on suspected or known HWSs and ESs:

- Smoking, eating, drinking, chewing gum or tobacco; applying cosmetics; storing utensils, food or food containers while on site.
- Ignition of flammable liquids within, on, or through improvised heating devices (barrels, etc.) or space heaters.
- Approach or entry into areas or spaces where toxic or explosive concentrations of gases or dust may exist without proper equipment available to enable safe entry.
- Conduct of on-site operations without off-site backup personnel*

(5) Personal Hygiene. All personnel must wash the affected area immediately after obvious contact with a hazardous substance.

b. Operational Practices.

(1) Information Review and Reconnaissance. The Safety Plan for a HWS investigation or ES response must be based upon a thorough evaluation of existing data and a reconnaissance (see "Waste Disposal Site Hazard Assessment Manual", available from NEIC.) The information search may indicate possible chemical hazards such as the presence of incompatible chemicals, toxic gases, explosives, etc. (see Appendix D). Such indications may provide insight to specific safety precautions needed. Similarly, a perimeter inspection or aerial imagery, followed by an on-site reconnaissance, may reveal safety hazards requiring special attention.

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*On-scene Project Leader's may exericse informed judgment regarding the need for off- site backup at active sites, or in cases where sites have been repeatedly entered or occupied without apparent harm. In any case where doubt exists, backup personnel must be present.

Investigators and response personnel will normally become better able to specify appropriate safety precautions as they get progressively closer to, and measure, hazardous materials in air, runoff, groundwater, soil, spilled material, barrels, etc.

(2) Protection Levels. Although the Project Leader must determine the level of protection which is appropriate for each HWS and ES, four specific Protection Levels have been provided in this chapter as bench marks for the Project Leader to select from (See Appendix 3). The Project Leader must select a level based on aavailable information.

(3) Zones. Two or more zones must be established, clearly delineated, and posted.

° Decontamination Zone. During operations on a suspect or known HWS or ES, a zone must be established for decontamination of equipment and personel and access control just outside the area of suspected contamination. At least one employee will remain in this zone to:

°° Assist in emergency removal of personnel from the HWS or ES in the event of accident or injury. The backup must have readily available protective clothing, breathing apparatus and first aid equipment.

°° Assist in moving equipment, samples and supplies.

°° Provide communication to emergency units.

°° Assist in decontamination or removal of contaminated clothing from the individuals emerging from the contaminated area.

°° As appropriate, prevent entry of unauthorized persons to the HWS or ES while operations are underway.

°° Provide other assistance as necessary, but with the primary objective of facilitating safe transfer of personnel and equipment to and from the affected area.

° Contamination Zone(s). The area(s) which contain, or are suspected of containing, hazardous materials must be clearly delineated and posted. The Project Leader may establish more than one contamination zone for areas of different levels of potential personnel hazard. Only persons authorized by the Project Leader may enter a contamination zone.

(4) Radioactivity and Explosivity. All HWSs and ESs must be checked for radioactivity and explosivity during first entry onto the site. Normal background radioactivity is approximately 0.01 to 0.02 mR/hr. Detecting levels of activity significantly greater than normal background is cause for a very careful survey of the entire site; if levels approaching 2 mR/hr are encountered, the advice of a competent radiation health

physicist must be sought before continuing operations on the site. (EPA's Office of Air, Noise, and Radiation has radiation specialists in each Region as well as staff at HQ, EER-Montgomery and ORD Las-Vegas.)

If explosivity readings greater than 20% LEL* are detected, very careful survey of the area must be made. Readings approaching or exceeding 50% LEL are cause for immediately withdrawing personnel and notifying the emergency, fire, and explosion units. The Project Leader must be consulted before continuing operations.

(5) Buddy System. A minimum of two employees, in constant communication* with each other, are required to perform any work in contamination zones.

(6) Sampling Procedures. Sampling procedures must minimize the risk of personnel exposure to hazardous materials during sampling, packaging, shipping and analysis, and minimize the risk of exposure of others to spilled or residual waste materials. Disposable sampling equipment should be used wherever possible. (See Appendix 4, Sampling Procedures for more details).

(7) Sample Handing. Samples of runoff, ambient air, or groundwater from a HWS or ES or possibly affected areas, may be moved directly into laboratories and handled with normal safety precautions, unless the Project Leader determines that special handling is appropriate. However, samples of liquids or solid materials removed from containers or obviously contaminated spill areas must be assumed to be hazardous materials and handled in compliance with OOHS Safety Manual CHAP 8 "Laboratory Use of Toxic Substances".

(8) Use of Respirators as Personal Protective Devices. A respirator use program must be provided for HWS investigators and ES personnel who enter areas where a potential for inhalation exposure to a hazardous material is present. This program will meet the requirements of the OSHA General Industry Standards for respiratory protection as detailed in 29 CFR 1910.134 and EPA Order __. The respirators must be certified in accordance with the requirements of the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11. The selection and use of respirators must be approved by the Safety Designee.

(9) Use of Respirators. This section provides procedures which must be followed at HWSs and ESs but is not a substitute for the respirator use program described in 3.b.(8) directly above.

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*Lower Explosive Limit

- Self Contained Breathing Apparatus (SCBA). SCBA must be worn on-site when:

  - Containers of unknown or known hazardous materials are being opened.

  - When in enclosed spaces where hazardous materials are present, such as abandoned waste chemical storage buildings or manholes which have received spilled chemicals.

  - When the Project Leader judges that the concentration of hazardous materials in the air is greater than 10 times the OSHA PEL**.

- Cartridge Respirators. Cartridge respirators, which are easier to use but provide less protection than SCBA's, can be worn on-site only when:

  - Hazardous materials in the air are not greater than 10 times the PEL, and have good warning properties.

  - The Project Leader judges that respirators are needed as a precaution against generation of low levels of toxic substances in air due to sampling, handling, decontaminating, or other operations.

  - Extended periods of use on-site, which would cause the capacity of the cartridge to be exceeded, are <u>not</u> required.

  - Measurements have verified that at least 19.5% oxygen is present.

  - Emergency escape respirators are carried by cartridge respirator users. Escape respirator must be donned immediately upon experiencing any warning property such as difficulty breathing, dizziness, or other distress, strong taste,or smell. User must then leave the site.

- Carrying respirators. Cartridge or emergency escape respirators must be carried on-site when the Project Leader judges that, although the risk is very low, hazardous materials may become present in the air during operations. The respirators must be donned immediately upon experiencing any of the warning properties described immediately above. The user must leave the site immediately after donning an escape respirator or if the warning properties persist after donning a cartridge respirator.

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* Radio contact must be maintained when visual contact cannot be maintained.
** Permissible Exposure Level

(10) Heat Stress. The effectiveness of employees rest-regimen should be confirmed by monitoring heart rate. Use the Brouha guideline: pulse rate is counted for the last 30 seconds of the first three minutes after rest begins. If the first recovery pulse (i.e., from 30 to 60 seconds) is maintained at 110 beats per minute or below and deceleration between the first and third minute is at least 10 beats per minute, no increasing strain occurs as the work day progresses.

Employees must replace water and salts lost from sweating. Use either 0.1% salt solution or commercial mixes (such as Gatorade). The commercial mixes may be preferable for employees on low sodium diets. In addition, on days when the potential for heat stress is apparent, advise employees to salt food more than usual.

(11) Sampling Equipment. As a general rule, sampling equipment used on a HWS or ES should be disposable. Sampling instruments and other non-disposable equipment should be kept clean with disposable protective covers. Dippers, scoops, and similar devices for solids samples should be buried on-site, or placed in plastic bags for disposal or later decontamination. Liquid samples from barrels or tanks should be withdrawn in inert tubing, such as glass, and tubing should then be broken and abandoned within the barrel or tank. If incineration or recycling of barrel contents is contemplated, the tubing may be disposed of in other suitable containers, or buried on the sites. The widely discussed Composite Liquid Waste Sampler (or "Coliwasa") is unsuitable because it is extremely difficult to decontaminate under field conditions.

(12) Decontamination. Whenever possible, equipment should be decontaminated prior to leaving the HWS or ES. Equipment which can not be decontaminated at the scene must be double bagged and transported to another area for eventual decontamination. Where possible, verify completeness of decontamination with sniffers, swipe tests, or other appropriate tests (See Appendix 6, Decontamination Procedures, for more detail).

(13) Packaging and Shipping. Hazardous materials must be packaged to withstand shocks, pressure changes, and any other conditions which might cause the leakage of contents incident to ordinary handling during transportation. Shipments of hazardous materials must be in accordance with DOT regulations. (See Appendix 4 for packaging and shipping guidance for hazardous waste samples).

(14) Leaving the Site. Procedures for leaving the suspect contaminated area must be planned before entry. Provision must be made for: decontamination and safe packaging of protective clothing; burial or safe packaging of disposable gear; handling of samples and preparation of samples for shipment; transfer of equipment, gear, and samples from the "contaminated" area to the "clean" area; etc. Sequences will depend on several variables --- such as SCBA inside or outside of protective clothing --- but must be worked out in advance.

(15) HWS and ES Monitoring Equipment. For immediate evaluat-on of potential health hazards, use direct reading instruments such as portable combustible gas and oxygen meters, photoionization meters, gas chromatographs, infrared spectrometers, radiation survey meters, and colorimetric detector tubes. The Project Leader must be aware of the limitation of these portable direct reading instruments when characterizing the unknown chemicals at unknown concentrations at HWSs and ESs.

(16) Decontamination Equipment. Equipment and supplies for decontamination must be available on-site. The equipment and supplies must allow employees to wash exposed areas of their bodies as well as equipment or other items which have been in the contamination zone, and collect the washwater and other contaminated materials for disposal. The equipment must include at least a 20 gallon emergency eye wash and may include a personnel shower.

APPENDIX I

SAFETY PLAN

Assistance in preparing the safety plan can be obtained from the Safety Designee __________ located in Room __________ of Building ____________________ or by telephoning ________________

REVIEW
Safety Committee Chairperson ____

APPROVALS
Project Leader ______________________________

Safety Designee ______________________________

OIC ______________________________

PROJECT LEADER ______________________________

Branch ______________________________

Building ______________________________

Room ______________________________

Phone ______________________________

DATE OF PLAN PREPARATION ______________________

HAZARDOUS WASTE SITE OR ENVIRONMENTAL SPILL RESPONSE

Site Name ________________________ Site No. ______________________________

HAZARDOUS/TOXIC MATERIAL (known or suspected, contaminated media or in storage container, etc.):

____

____

____

____

HAZARD ASSESSMENT(toxic and pharmacologic effects, reactivity, stability, flammability, and operational concernssampling, decontaminating, etc.):

MONITORING PROCEDURES(If required by the Project Leader)

Monitoring the site for identify and concentration of contamination:

Medical surveillance procedures for evidence of personnel exposure:

Personnel monitoring procedures:

DECONTAMINATION AND DISPOSAL

Decontamination Procedures (contaminated: personnel surfaces, materials, instruments, equipment, etc.):

Disposal Procedures (contaminated equipment, supplies, disposable, washwater):

EMERGENCY PROCEDURES

In event of overt personnel exposure (skin contact, inhalation, ingestion):

In event of personnel injury:

In event of potential or actual fire or explosion:

In event of potential or actual ionizing radiation exposure:

____

____

____

____

In event of environmental accident (spread of contamination outside HWS or ES):

____

____

____

____

PERSONNEL POTENTIALLY EXPOSED TO HAZARDOUS MATERIALS

Personnel Authorized to Enter HWS or ES

1. ______________________________________

2. ______________________________________

3. ______________________________________

4. ______________________________________

5. ______________________________________

Other Personnel Assigned to Handle Hazardous Materials (decontaminate, analyze samples)

1. ______________________________________

2. ______________________________________

3. ______________________________________

4. ______________________________________

5. ______________________________________

ALTERNATIVE WORK PRACTICES

(Describe alternative work practices not specified in this Chapter for HWS investigations and ES responses. Indicate work practices specified in the Chapter for which proposed alternative work practices will serve as substitute.)

APPROPRIATE LITERATURE CITATIONS

APPENDIX 2

PERIODIC HEALTH ASSESSMENT

1. ASSESSMENT FOR EVIDENCE OF EXPOSURE.

The nature of a program for providing periodic health assessments is complicated by several factors: (1) many workers handle a variety of hazardous materials so that the medical surveillance should ideally seek evidence of adverse effects from all these substances, (2) the hazardous materials may not be identified, (3) some hazardous materials may have chronic effects such as cancer but have little or no toxicity other than the production of neoplasms, and most tumors do not become evident until many years (often 20-30) after the initiating events.

Biologic monitoring will sometimes be a useful method of detecting exposure and, perhaps, of estimating the degree of exposure. Biologic monitoring usually involves the analysis of body fluids or excreta (usually urine, sometimes blood, rarely expired air) for the hazardous material or a biotransformation product. An example is the detection of reaction products of biphenyl amines in the urines of persons absorbing benzidine or its derivatives. Even if exposure cannot be quantitated, as is sometimes the case, the mere detection of the metabolite, if its presence is specific to the individual hazardous material or class, is sufficient to indicate the need for corrective action.

For chronic effects, medical monitoring will, sometimes for necessity and more often for efficiency, usually concentrate on events likely to precede overt evidence of serious health effects such as tumorigenesis. For example, some carcinogens, such as dimethylnitrosamine, have high acute toxicity, especially to the liver, and evidence of such acute toxicity can be obtained within a few hours or days following exposure. Some tumors, such as those induced by carbon tetrachloride, are normally preceded by marked changes in liver cells, usually detectable by clinical tests. Others, e.g., angiosarcomas induced by such substances as vinyl chloride, will often cause detectable cell changes in nearby tissue as the probable result of space occupation. It should be noted that detection of such toxic changes does not necessarily presage tumor development, but should nevertheless precipitate the institution of corrective work practices. The occupational physician, to be effective, must have relevent information, such as mode and mechanism of toxic action, frequency and severity of exposure, and exposure concentrations, if known. Some of this information will be available in individual safety data sheets for hazardous wastes once identified. However, this information should be supplemented by the Project Leader when appropriate.

In some cases, especially with some lesser known hazardous materials, there will be EPA investigators in research and analysis laboratories who will be better informed on possible biologic monitoring procedures than will the occupational physician. In such cases, the HWS investigators or ES response personnel should discuss the possibilities of specialized testing with the occupational physician and refer the physician to the appropriate EPA investigator for information. It may also be that specialized analytical procedures and equipment will be needed for some of this monitoring, procedures and equipment that may not be available to the medical laboratory but which are available in the research laboratory. The investigators should have such monitoring procedures performed by EPA laboratories only with prior approval by and participation of the occupational physician. This is to ensure that appropriate precautions will be taken; such as (1) precautions necessary to data interpretation, such as standard corrections for dilution of urine, (2) precautions for the individual, such as assurance that invasive procedures will not be used, and (3) precautions for the individual's privacy, such as maintenance of appropriate security for individual records.

2. PREEMPLOYMENT EXAMINATIONS. The U.S. Office of Personnel Management MUST approve the requirement for having a preemployment examination of applicants for a federal employment position.

a. Criteria. The following criteria are recommended for individuals selected for arduous duty positions:

Vision--Binocular vision is required and must be at least 20/40 (Snellen) in one eye and 20/20 in the other, with or without corrective lenses. Near vision must be sufficient to read without strain printed material the size of typewritten characters. Normal depth perception, accommodation, and field of vision are required, as is the ability to distinguish basic colors.

Hearing--Without using a hearing aid, applicant must have no hearing loss in either ear of more than 30 decibels at 500-, 1,000-, or 2,000-cps range.

Speech--Diseases or conditions resulting in indistinct speech are disqualifying.

Olfactory Sense--Applicant must possess a normal sense of smell.

Respiratory System--Any chronic disease or condition affecting the respiratory system that would impair the full performance of duties is disqualifying; e.g., conditions that result in reduced pulmonary function, shortness of breath, or painful respiration.

Cardiovascular System--The following conditions are disqualifying:

a. Organic heart disease (compensated or not)

b. Hypertension with repeated readings that exceed 150 systolic and 90 diastolic without medication

c. Symptomatic peripheral vascular disease and severe varicose veins

Gastrointestinal System--Chronic symptomatic disabling diseases or conditions of the gastrointestinal tract are disqualifying.

Endocrine System--An uncontrolled systemic metabolic disease, such as diabetes or gout, is disqualifying.

Genitourinary Disorders--Chronic, symptomatic diseases or conditions of the genitourinary tract are disqualifying.

Extremities and Spine--Any deformity or disease that would interfere with range of motion or dexterity or that is severe enough to affect adversely the full performance of position duties is disqualifying.

Nervous System--Applicants must possess emotional and mental stability. Applicants with a history of epilepsy or convulsive disorder must have been seizure-free for the past 2 years without medication. Any neurological disorder with resulting decreased neurological or muscular function is disqualifying.

Miscellaneous--Although not mentioned specifically above, any other disease or condition that interferes with the full preformance of duties is also grounds for medical rejection.

b. Medical Examinations.

The arduous duty medical examination must include for each applicant:

A. A complete medical examination, by or under the supervision of a licensed physician, consisting of:

1. The obtaining of a thorough occupational and medical history.

2. The performance of a comprehensive physical examination of the following:

a. head, face, neck, and scalp

b. nose

c. mouth and throat, including general dental condition and hygiene

d. speech

e. ears, including drums

f. eyes, including pupils, ocular motility, field of vision, and fundi

g. lungs and chest

h. heart

i. vascular system

j. abdomen, viscera, and hernia

k. anus and rectum

l. endocrine system

m. genitourinary system

n. upper extremities

o. lower extremities, including feet

p. spine and musculoskeletal system

q. skin and lymphatics

r. identifying body marks, scars, or tatoos

s. neurological system

t. psychiatric system

Pelvic examination of females is not required. Proctosigmoidoscopic examination is not required.

3. The following parameters must be measured/tested and results recorded:

a. height (without shoes)

b. weight (undressed)

c. visual acuity, including distant and near vision corrected and uncorrected

d. color vision, using Ishihara or other color-plate method

e. depth perception

f. hearing acuity, by pure tone audiometry

g. blood pressure

h. pulse rate

4. The following tests must be performed, interpreted, and recorded:

    a. electrocardiogram (12 lead, resting)

    b. chest X-ray (PA single view, 14x17 inches)

    c. pulmonary function (forced vital capacity and forced expiratory volume in 1 second)

    d. urinalysis, complete (pH, glucose, ketones, albumin, occult blood)

    e. blood count, complete (white cell count, red cell count, hemoglobin determination, hematocrit determination, platelet estimation, scan of blood smear, and calculations of MCV, MCH, and MCHC indices)

    f. blood chemistries (cholesterol, glucose, urea nitrogen, uric acid, transaminase (SGOT), bilirubin, calcium, total protein, inorganic phosphate, alkaline phosphatase, lactic dehydrogenase (LDH), creatinine)

B. The applicant shall be advised of findings and counseled to seek medical attention as may be indicated.

C. The examination findings, results, recommendations, and opinions shall be reported to EPA on the Certificate of Medical Examination, Standard Form No. 78, revision of October 1969, Part C, to which may be appended test and other reports.

3. The preemployment medical examination for respirator users should consist of a general medical examination, similar in scope to the arduous duty examination, but with special attention to evaluation of the skin, cardiac and pulmonary systems, and evaluations of any history or symptoms of allergy. The examining physician should also be alert to any personality or psychological factors which may affect respirator use. The physician will usually not be knowledgeable about types and uses of respirators. He or she will need to evaluate the stress that may be associated with the assigned duties and respirator(s) used. Therefore, the physician should be informed of the characteristics of the required respirator(s): use and type, frequency and duration of expected use, use in hot or cold environments, etc. Detailed medical standards for respirator users are not available; the physician must form a medical judgement based on evaluation of respirator demands and stress and on the clinical findings in individual applicants.

APPENDIX 3

PERSONAL PROTECTION LEVEL DETERMINATIONS

a. Introduction

It is of the utmost importance that the Project Leader specify the correct level of protective equipment for each HWS investigation or ES response. The level of protective equipment shall be determined by the type and levels of waste or spill material present at the site. In situations where the types of waste or spill material on-site are unknown or the hazards are not clearly established, the Project Leader must make a reasonable determination of the level of protection that will assure the safety of investigators and response personnel until the potential hazards have been characterized. This level shall be maintained until the hazards have been determined through monitoring, sampling, informational access, or other reliable methods. Once the hazards have been determined, then protective levels commensurate with the hazards will be used.

The appropriate level of protection shall be determined prior to entering a hazardous waste site or responding to an environmental spill. The levels of protection are explained below and itemized in Table 3-1.

Level A

Level A protection must be worn when the Project Leader makes an reasonable determiantion that the highest available level of both respiratory and skin (and eye) contact protection is needed. It should be noted that while Level A provides maximum available protection, it does not protect against all possible hazards. Consideration of the heat stress that can arise from wearing Level A protection should also enter into the Project Leader's decision. (Comfort is not a decision factor, but heat stress will influence work rate, scheduling, and other work practices.)

Level B

The Project Leader must select Level B protection when the highest level of respiratory protection is needed, but hazardous material exposure to the few unprotected areas of the body(i.e., the back of the neck) is unlikely with Level B protective clothing.

Level C

The Project Leader may select Level C when the required level of respiratory protection is known, or reasonably assumed to be, not greater than the level of protection afforded by air purifying respirators; and hazardous materials exposure to the few unprotected areas of the body(i.e., the back of the neck) is unlikely with Level C protective clothing. Level C requires carrying an emergency escape respirator.

Level D

Level D is the basic work uniform. Investigators and response personnel must not be permitted to work in civilian clothes.

b. Protective equipment and criteria

Level A

(1) Personal Protective Equipment

- Open circuit, pressure-demand SCBA
- Totally encapsulated suit
- Gloves, inner (surgical type)
- Gloves, outer, chemical protective
- Boots, chemical protective, steel toe and shank
- Booties, chemical protective

(2) Criteria

- Sites known to contain hazards which
  - require the highest level of respiratory protection (as stated above)
  - will cause illness as a result of personal exposure, and
  - the Project Leader makes a reasonable determination that personal exposure could occur to any part of the body.
- Sites for which the Project Leader makes a reasonable determination that, based on the lack of information to the contrary, the site may be described as stated directly above.

Level B

(1) Personal Protective Equipment

- Open circuit, pressure-demand SCBA
- Chemical protective
  - Overalls and long sleeved jacket, or
  - Coveralls
- Gloves, inner (surgical type)
- Gloves, outer, chemical protective
- Boots, chemical protective, steel toe and shank
- Booties, chemical protective

(2) Criteria

- Sites known to contain hazards which require the highest level of respiratory protection as stated above

  - will cause illness as a result of personal exposure, and

  - the Project Leader makes a reasonable determination that personal exposure to areas of the body not covered by Level B protective clothing is unlikely.

- Sites for which the Project Leader makes a reasonable determination that, based on the lack of information to the contrary, the site may be described as stated above.

Level C

(1) Personal Protective Equipment

- Full face-piece air-purifying respirator

- Emergency escape respirator (carried)

- Chemical protective

  - Overalls and long sleeved jacket, or

  - Coveralls

- Gloves, inner (surgical type)

- Gloves, outer, chemical protective

- Boots, chemical protective, steel toe and shank

- Booties, chemical protective

(2) Criteria

- Sites known to contain hazards which

  - do not require a level of respiratory protection greater than the level afforded by air purifying respirators (nominal protection factor of 10) as stated above,

  - will cause illness as a result of personal exposure, and

  - the Project Leader makes a reasonble determination that personal exposure to areas of the body not covered by Level C protective clothing is unlikely.

- Sites for which the Project Leader makes a reasonable determination that, based on the lack of information to the contrary, the site may be described as stated above.

Level D

(1) Personal Protective Equipment

- Coveralls, cotton
- Boots/shoes, safety
- Safety glasses
- Hard hat with optional faceshield
- Air purifying respirator (readily available)

(2) Criteria

- Sites where the Project Leader makes a reasonable determination that hazards due to exposure to hazardous materials is unlikely.

APPENDIX 4

(These procedures are currently under revision to reflect the May 19, 1980 changes in the Department of Transportation regulations for shipment of hazardous materials.)

PACKAGING, MARKING, LABELING, AND SHIPPING OF HAZARDOUS WASTE SITE AND ENVIRONMENTAL SPILLS SAMPLES

a. General Provisions. Samples that are judged to be environmental samples may be shipped according to letters of understanding granted EPA by DOT. Other specific exemptions may also apply (e.g., use of Labelmaster, Inc. package #38, or Dow Chemical Co. Imbiber Pack for shipment of Poison B, n.o.s. by United Parcel Service).

The following procedures apply to samples collected from a hazardous waste site or environmental spill, and which in the judgment of the Project Leader cannot be considered to be "environmental samples".

° Unanalyzed HWS and ES samples may not be fixed with any preservative or preserved with ice or dry ice.

° If a material specifically identified in the Department of Transportation (DOT) Hazardous Material Table (49 CFR 172.101) is known to be contained in an HWS or ES sample, that sample should be transported as prescribed in the table.

° Unanalyzed HWS and ES samples may be transported by rented or common carrier truck, bus railroad, and by Federal Express Corporation* (air cargo); but they may not be transported by any other common carrier air transport, even "cargo only" aircraft. Those samples taken from closed drums or tanks, however, should not ordinarily be transported by Federal Express. (See 1 and 2 in "Packaging, Marking and Labeling Requirements for Unanalyzed Hazardous Waste Site Samples Taken From Closed Drums").

° If samples are transported by any type of government-owned vehicle, including aircraft, DOT regulations are not applicable. However, EPA and FIT personnel will use the packaging procedures described below except that the Bill of Lading with certification form does not have to be executed (see "Shipping Papers" on under b.8).

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* These procedures are designed to enable shipment by entities like Federal Express; however, they should not be construed as an endorsement by EPA of a particular commercial carrier.

° Irrespective of type sample or container, after completion of the analyses the contractor will repackage the original sample bottles in the coolers or containers received, and return them to the originating Regional office. The packages will be sealed and shipped under custody procedures as they were received. Each originating office should make arrangements with the contractor through the Sample Management Office (VIAR) for the method of return and payment for shipping charges within 30 days after sample shipment. Organic extracts from the samples will be shipped by the analytical contractors to EPA's EMSL/Las Vegas office for archival storage.

b. <u>Packaging, Marking and Labeling Requirements for Unanalyzed Hazardous Waste Site Samples, Excluding Drum Samples</u>.

(1) Collect sample in an 8-ounce* or smaller glass container with nonmetallic, teflon-lined screw cap. Allow sufficient ullage (approximately 10% by volume) so container is not liquid full at 130 F. If collecting a solid material, the container plus contents shall not exceed 1 pound net weight.

(2) Attach properly completed sample identification tag [Figure 4] to sample container.

(3) Seal sample container and place in 2-mil-thick (or thicker) polyethylene bag, one sample per bag. (Tags should be positioned to enable them to be read through bag.)

(4) Place sealed bag inside a metal can with incombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely, tightly and effectively.

(5) Mark and label this container as indicated in No. 8 below.

(6) Place one or more metal cans (or a single 1-gallon bottle*) surrounded with incombustible packaging material for stability during transport, into a strong outside container, such as a metal picnic cooler or a fiberboard box.

(7) Mark and label the outside container and complete shipping papers as described below.

---

* Large quantities, up to one gallon, taken from wells may be collected if the flash point of the sample can be determined to be 73 F or higher. In this case, such should be marked on the outside container (carton, etc.) but only a single (one gallon or less) bottle may be packed in an outside container. Ten percent ullage and requirements 2,5,6, and 7 below must also followed. On the shipping papers state that "flash point is 73° or higher".

(8) Marking and labeling: Use abbreviations only where specifed. Place the following information on a metal can (or bottle), either hand printed or in label form: laboratory name and address and "Flammable Liquid, n.o.s.", (if not liquid, write "Flammable Solid, n.o.s.").* Place the following labels on the outside of the can (or bottle)

> "Cargo Aircraft Only"; "Flammable Liquid"; if not liquid, "Flammable Solid" ("Dangerous When Wet" label should be used if the solid has not been exposed to wet environment).

Note: If the cans are placed in an exterior container, both that container and inside cans must have the same markings and labels as above. "Laboratory Samples" and "THIS SIDE UP" or "THIS END UP" should also be marked on the top of the outside container, and upward pointing arrows should be placed on all four sides of the exterior container.

Shipping Papers: Use abbreviations only where specified below:

Complete the carrier-provided bill of lading and sign the certification statement (if carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container.

> "Flammable Liquid, n.o.s." (or Flammable Solid, n.o.s.", as appropriate); "Cargo Aircraft Only"; "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ________" or "Net Volume ________" (of hazardous contents), by item, if more than one metal can is inside an exterior container. The net weight or net volume must be placed just before or just after the "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s." description.

A Chain-of-Custody Record form should also be properly executed, and included in the exterior container.

(9) Unless samples are driven to the laboratory, a team member must accompany shipping container(s) to the transport carrier and, if required, open outside container(s) for freight inspection.

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* Using "Flammable" does not convey the certain knowledge that a sample is in fact flammable, or how flammable, but is intended to prescribe the class of packaging in order to comply with DOT regulations; "n.o.s." means not otherwise specified.

c. Packaging, Marking and Labeling Requirements for Unanalyzed Hazardous Waste Site Samples Taken from Closed Drums.

(1) All samples from closed drums do no necessarily have to be shipped as below. The Project Leader must make a judgement, based on the information available, as to the hazard class of samples gathered. This packaging, marking, labeling and shipping method provides a worst-case procedure for materials classed as "Poison A" (49 CFR 173.328).

(2) These samples may not be transported by Federal Express Corporation (air cargo) or other common carrier aircraft, or by rental, non-government aircraft. (Samples may be shipped by ground transport or government aircraft.)

(3) Collect sample in a polyethlylene or glass container which is of an outer diameter narrower than the valve hole on a DOT Spec. 3A1800 or 3AA1800 metal cylinder. Fill sample container allowing sufficient ullage (approximately 10% by volume) so it will not be liquid-full at 130° F. Seal sample container.

(4) Attach properly completed Sample Identification Tag (Figure 4) to sample container.

(5) With a string or flexible wire attached to the neck of the sample container, lower it into a metal cylinder which has been partially filled with incombustible, absorbent loose packaging material (vermiculite or earth). Allow sufficient cushioning material between the bottom and sides of the container and the metal cylinder to prevent breakage. After the cylinder is filled with cushioning material, drop the ends of the string or wire into the cylinder valve hole. Only one sample container may be placed in a metal cylinder.

(6) Replace valve, torque to 250 ft-lb (for 1 inch opening) and replace valve protector on metal cylinder, using teflon tape.

(7) Mark and label cylinder as described below.

(8) One or more cylinders may be placed in a strong outside container.

(9) Mark and label outside container and complete shipping papers as described below.

(10) Marking and labeling: Use abbreviations only where specified. Place the following information on the side of the cylinder, or on a tag wired to the cylinder valve protector, either hand-printed or in label form.

"Poisonous Liquid or Gas, n.o.s.", laboratory name and address.* Place the following label on the cylinder: "Poisonous Gas". ("Poisonous Liquid" label not acceptable here, even if liquid.)

Note: If the metal cylinders are placed in an outside container, both the container and cylinders inside must have the same markings and labels as above. In addition, "Laboratory Sample", and "Inside Packages Comply With Prescribed Specifications" should be marked on the top of the outside container. "THIS SIDE UP" marking should be placed on the outside container and upward pointing arrows on four sides.

Shipping Papers: Complete the shipper-provided Bill of Lading and sign the certification statement (if carrier does not provide, use standard industry form) with the following information in the order listed. One form may be used for more than one exterior container; use abbreviations only as specified:

"Poisonous Liquid, n.o.s."; "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight_________" or "Net Volume__________" (of hazardous contents), by cylinder, if more than one cylinder is inside an exterior container. The net weight or net volume must be placed just before or just after the "Poisonous Liquid, n.o.s." marking.

A Chain-of-Custody Record form (Figure 5) should also be properly executed and included in the container, or with the cylinder.

(11) Unless samples are driven to the laboratory, an EPA employee will accompany shipping container to the transport carrier and, if required, open outside container(s) for freight inspection.

---

*Using "Poisonous" does not convey the certain knowledge that a sample is in fact poisonous, or how poisonous, but is intended to prescribe the class of packaging in order to comply with DOT regulations.

APPENDIX 5

SAMPLING PROCEDURES

Containers (drums, tanks, etc.) should only be sampled when necessary to meet enforcement or cleanup requirements. Opening drums or other sealed containers may be hazardous to sampling personnel unless proper safety procedures are followed. Gases can be released, pressurized liquids can be expelled, or explosions can occur. A drum should not be moved or opened unless it can be ascertained beyond reasonable doubt that the drum is structurally sound. Drums standing on end, with bung up, should be opened by pneumatic impact wrench, operated from a remote site (Figure 5.1). Drums on sides may be opened similarly if it is possible to safely rotate the drum so that the bung is high. If the bung can be removed, sampling contained liquids may be safely accomplished by glass tube, which is then broken and discarded within the barrel. A barrel that has a badly rusted bung, or that cannot be sampled as above, may be safely sampled with a hydraulic penetrating device (Figure 5.2) operated remotely. The device is then abandoned in place, and disabled to prevent further withdrawal of liquids. Sealed or closed tanks should be opened remotely, using ropes to lift hatches, etc.

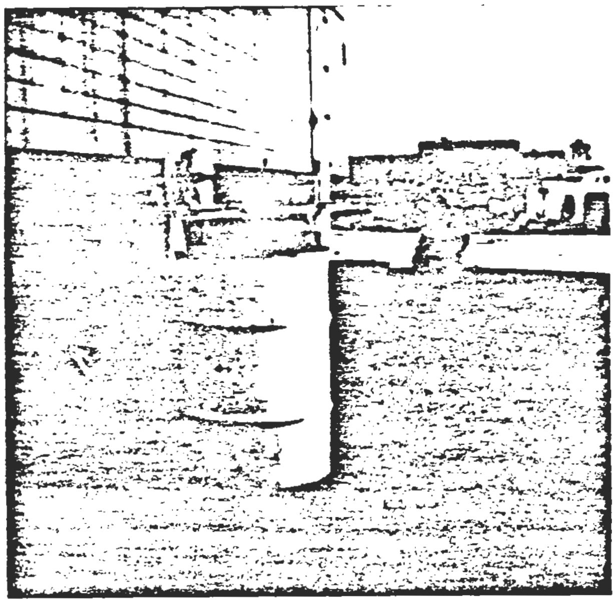
In general, metal sample containers should not be used on HWS investigations and ES responses; if used, they must be grounded, preferably to the drum or tank being sampled, while sample transfer is accomplished. In all cases of entry into closed containers, the local fire departmnt should be asked to stand by. In any case wherein presence of explosives is suspected or known, Army EOD or police bomb squads should be requested to remove or neutralize such materials. In no event may EPA employees handle explosives encountered on sites.

Subsurface sampling of an HWS or ES can also create hazards to employees and the public, unless adequate safety precautions as followed. Biodegradation of refuse in dumps produces methane and other explosive gases. The escaping gases may be ignited by drill rigs or other ignition sources. Drilling into dump sites may cause discarded incompatibles to be mixed and thereby create reactive mixtures. Dump or spill sites where leachate plumes are contained in impervious strata may be interconnected with producing aquifers if drilling is not planned according to competent ground water technology and data.

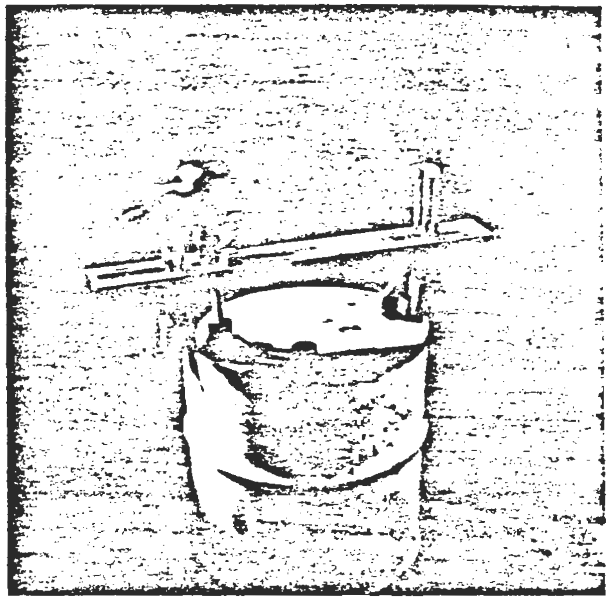
Drilling in HWS investigations and ES responses should be confined to the periphery of sites, with the objective of characterizing the leachate that may be moving away from the site. If subsurface sampling of dump sites is necessary, excavation must be accomplished by hand, and with sparkfree equipment.

All drilling associated with HWS and ES activities must be accomplished under the responsible supervision of a competent geohydrologist, ground water geologist, geological engineer, or a person similarly qualified by experience. Drilling must be preceded by sweeps with metal detectors, and drilling must be limited to areas where the presence of buried drums or tanks is not indicated. Test holes must be cased or plugged when the activites is completed.

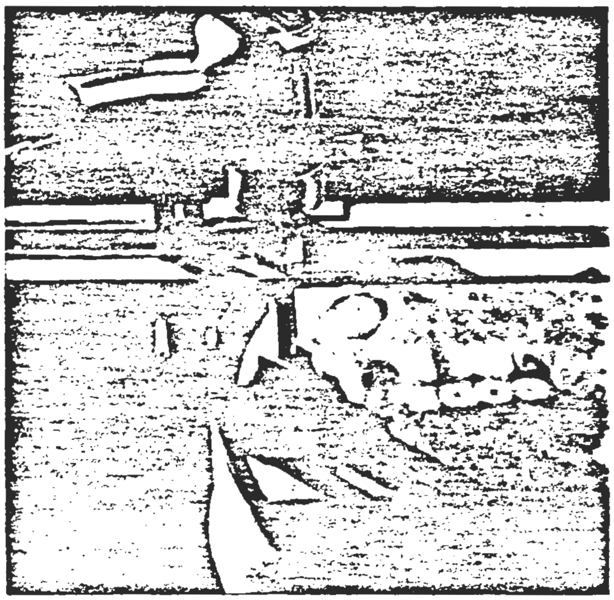
FIGURE 5.1



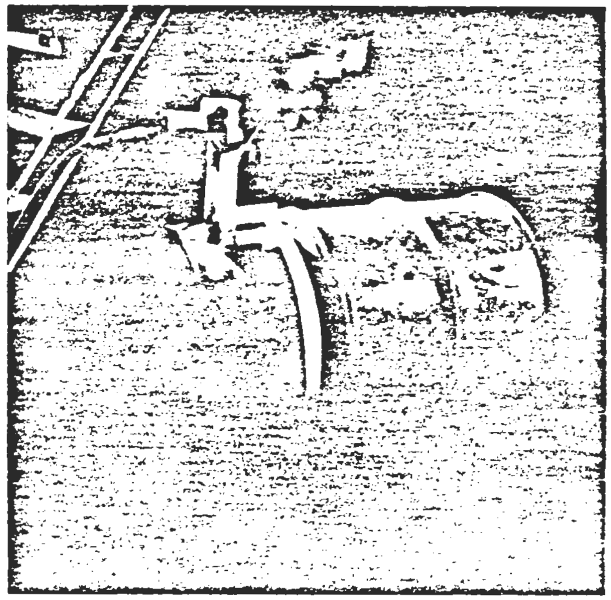
Remote bung removal. Man in background, dressed in protective clothing, operates bung-removal equipment on drum in foreground.



Bung-removal equipment; drum on end.



Equipment closeup.

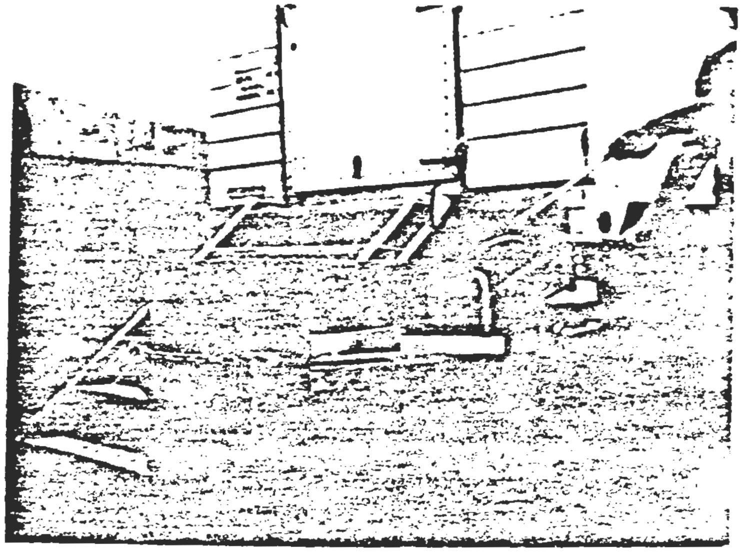


Remote bung-removal setup; drum on side.

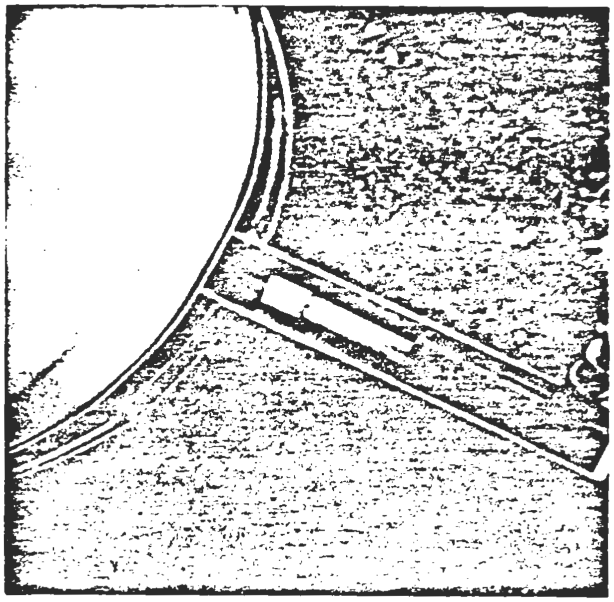
FIGURE 2. REMOTE REMOVAL OF BARREL BUNG

FIGURE 5.2

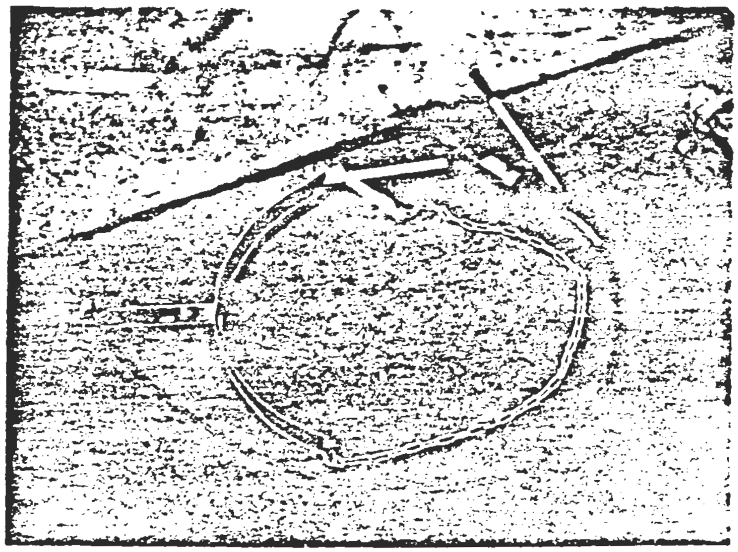
Remote operation of penetrating sampling device.



Drum attachment, connecting tube, and hand-held activator.



Sampling device penetrating drum.



Remote sampling equipment.

FIGURE 3. REMOTE SAMPLING

APPENDIX 6

DECONTAMINATION PROCEDURES

A. Introduction

The need for personnel decontamination can vary greatly. Operations such as walking through an area may require only a simple controlled undressing procedure and bagging of contaminated clothing. In operations in which extensive work is performed in a contaminated area, cross contamination of protective clothing and equipment can occur. In this case, a controlled undressing and bathing facility will be needed.

For those situations in which gross contamination may occur, a sophisticated personnel decontamination station, as illustrated in Figure 6.1, should be established. It provides for a controlled undressing and washing system that is designed to avoid transfer of chemical contamination from protective clothing. The number of stations can be adjusted to the protective clothing system being used. All field personnel should shower as soon as possible after leaving a contaminated area.

Full-decontamination of reusable suits is accomplished in two steps. The first step is performed on-site using solutions selected beforehand in consultation with chemists and toxicologists based on limited knowledge of the hazardous materials on the site at the time (see Figure 6.2). Usually an adequate decontamination solution consists only of water. However, the decontamination solutions may be solutions of water and detergents, water and chemical compounds designed to react with and neutralize specific contaminents, or solvents. After cleansing, protective clothing is turned inside out, if feasible, and sealed in plastic bags for return shipment. The second decontamination step is taken later, after the contaminant has been latoratory-analyzed to determine what decontamination reagents are most suitable for each case. This second cleaning is then performed by personnel wearing disposable protective clothing. Waste decontamination solution from the second step should be treated as hazardous waste and disposed of accordingly.

B. Model for Decontamination Procedures-

Organization of the Personnel Decontamination Station (PDS)

Once the contamination zone and the clean zone have been established, the PDS is set up.

1. Layout of the PDS

An example of a PDS is shown in Figure C-1 and is as follows:

STATION A - A plastic ground sheet on which field equipment is dropped by returning members team.

STATION B - A wash tub filled with a decontamination solution

- A second wash tub filled with rinse solution

- A third wash tub filled with decontamination solution

- A fourth wash tub filled with rinse solution

- Each wash tub should be equipped with a large sponge and brush

STATION C - A bench or stool for personnel to sit on during removal of booties

- A ten (10) gallon pail with plastic liner where disposable boot covers are discarded

STATION D - Two ten (10) gallon buckets filled with decontamination solution

STATION E - A ten (10) gallon bucket filled with rinse solution

STATION F - A 32 gallon trash can with plastic liner (container for rubber items)

STATION G - 30 meters upwind from Station F

- A plastic ground sheet for SCBA drop

STATION H - A bench or stool for personnel

- A 32 gallon trash can with plastic liner (container for cloth items)

STATION I - A field shower set-up

STATION J - A redressing and first aid station. This station defines the boundary between the Contamination Control Area and the Clean Area

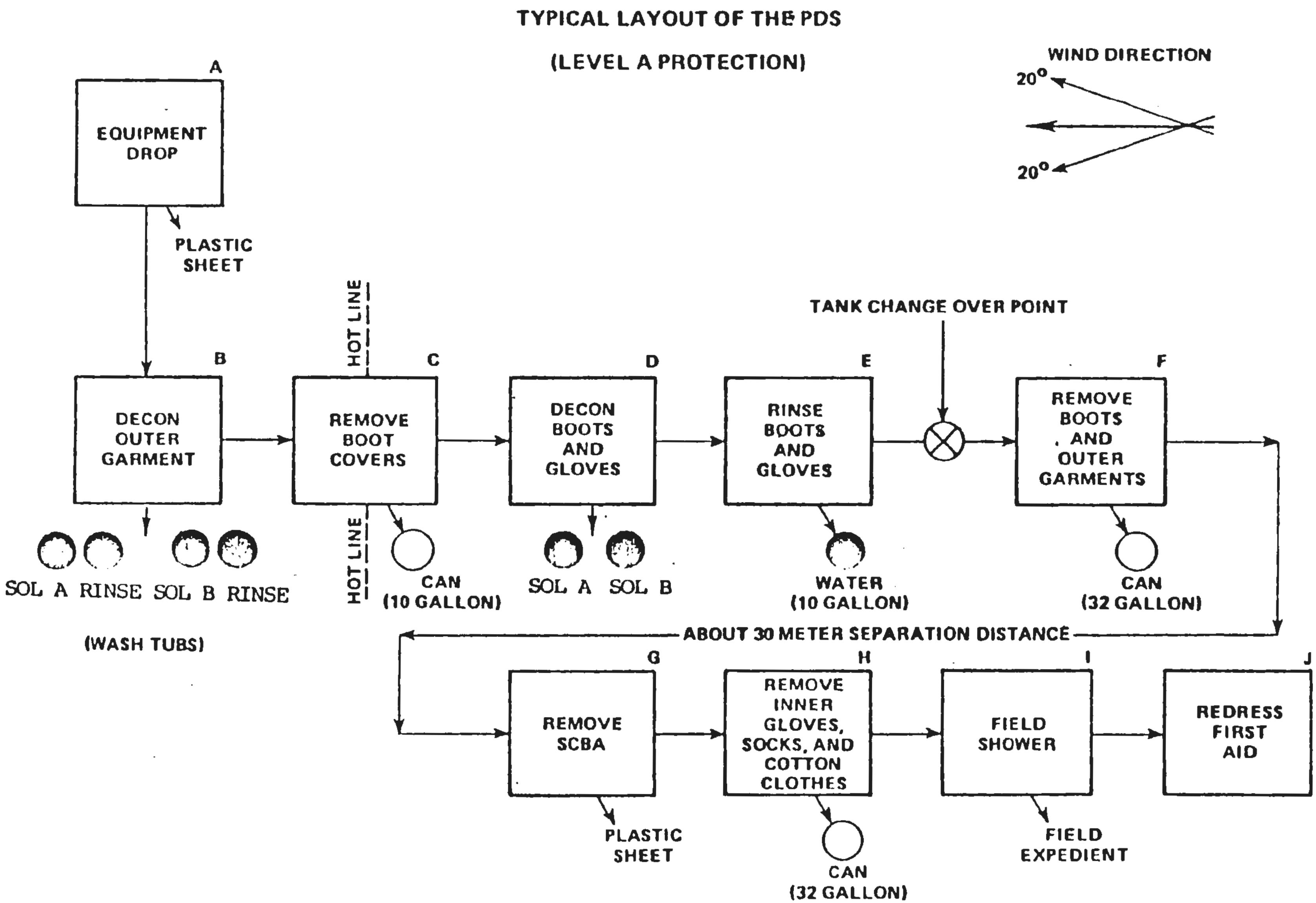

TYPICAL LAYOUT OF THE PDS
(LEVEL A PROTECTION)
WIND DIRECTION
20°
20°
A
EQUIPMENT DROP
PLASTIC SHEET
HOT LINE
TANK CHANGE OVER POINT
B
DECON OUTER GARMENT
C
REMOVE BOOT COVERS
D
DECON BOOTS AND GLOVES
E
RINSE BOOTS AND GLOVES
F
REMOVE BOOTS , AND OUTER GARMENTS
SOL A RINSE SOL B RINSE
(WASH TUBS)
HOT LINE
CAN (10 GALLON)
SOL A SOL B
WATER (10 GALLON)
CAN (32 GALLON)
ABOUT 30 METER SEPARATION DISTANCE
G
REMOVE SCBA
H
REMOVE INNER GLOVES, SOCKS, AND COTTON CLOTHES
I
FIELD SHOWER
J
REDRESS FIRST AID
PLASTIC SHEET
CAN (32 GALLON)
FIELD EXPEDIENT

FIGURE C-1

FIGURE 6.2

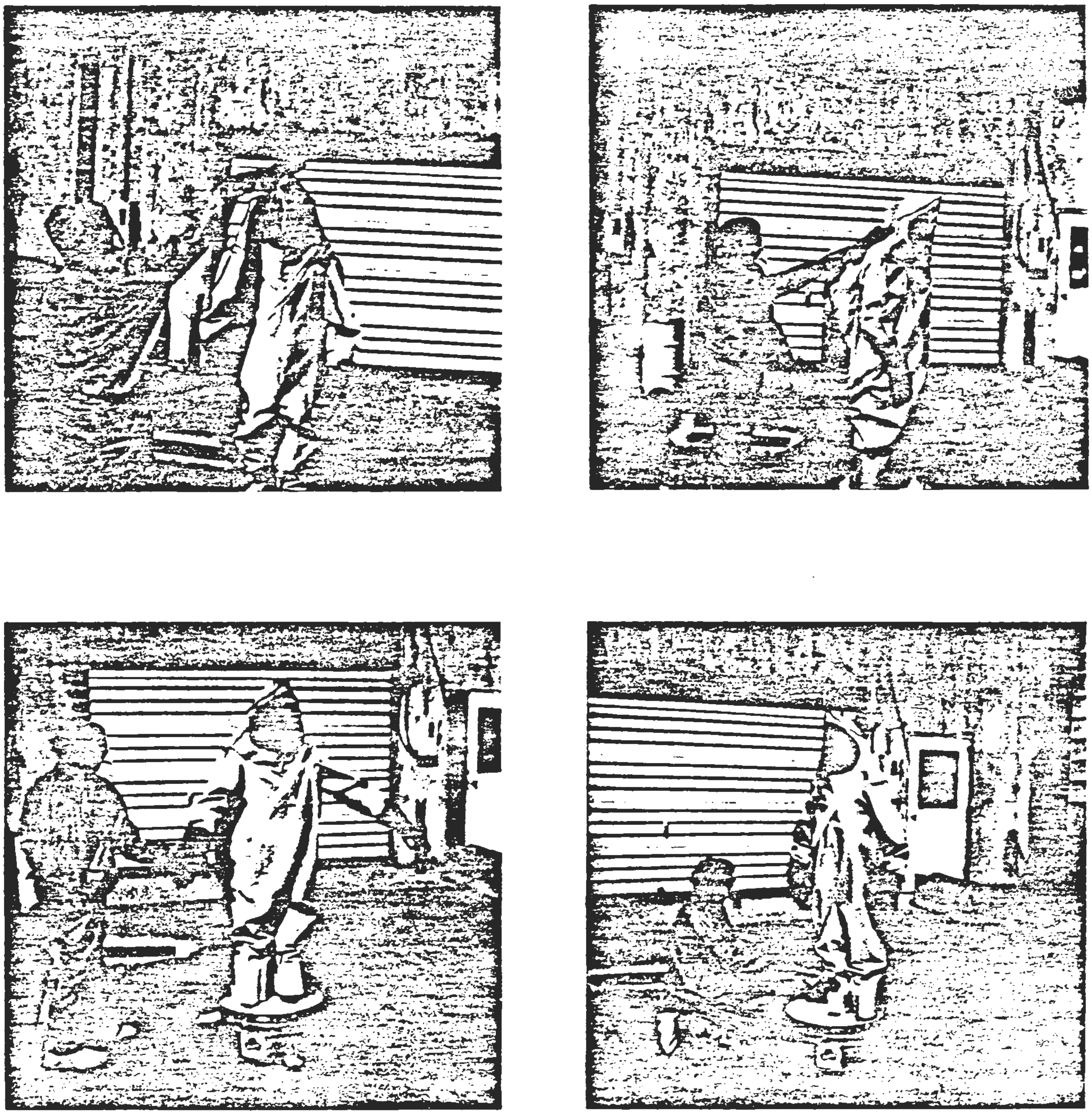


FIGURE 1. ON-SITE DECONTAMINATION OF PROTECTIVE CLOTHING

FIRST AID

GENERAL

First aid is generally defined as the immediate and temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained. Common sense and a few simple rules are the keys to effective first aid.

The first objective is to save life by:

- o Ensuring an open airway and maintaining breathing.
- o Preventing heavy loss of blood.
- o Giving first aid for poisoning.
- o Preventing or reducing shock.
- o Preventing further injury.
- o Sending for medical aid.

The first-aider should also:

- o Avoid panic.
- o Inspire confidence.
- o Do no more than necessary until professional help arrives.

HEAVY BLEEDING

A victim who has profuse bleeding may die within one minute or less, therefore:

- o DO NOT WASTE TIME.
- o USE PRESSURE DIRECTLY OVER THE WOUND.
- o Place a pad, clean handkerchief, clean cloth, etc., directly over the wound and press firmly with one or both of your hands. If a pad or bandage is not available, close the wound with your hand or fingers.

- Hold the pad firmly in place with a strong bandage, necktie, strips of cloth, etc. Unless bones are broken, raise the bleeding part higher than the rest of the body.

- Keep the victim lying down.

- Keep the victim warm to prevent loss of body heat. Cover with blankets, coat, or anything available and put something under him if he is on a cold or damp surface. Do not add heat.

- Give fluids only if victim does not have head or abdominal injuries, probably will not require surgery, and professional help will be more than one hour arriving. If the victim is conscious and can swallow, give him plenty of liquids to drink. Give him sips and do not give stimulants.

- Call a physician.

- APPLY PRESSURE TO PRESSURE POINTS. If direct pressure and elevation do not stop the bleeding apply pressure to pressure points in the body to slow down or stop the flow of blood. (Pressure points are where an artery is close to the bony structure of the body and can be restricted by pressure on the artery against the bone.)

- Use a tourniquet only if victim is bleeding profusely and other methods have failed and the victim's life is in danger.

- DO NOT give the victim alcoholic drinks.

- If the victim is UNCONSCIOUS or if abdominal injury is suspected, DO NOT give him fluids.

BREATHING STOPPED

A person who has stopped breathing will die if breathing is not restored immediately.

If breathing is restored, victims who had stopped breathing need hospitalization.

The following are major factors in breathing stoppage.

Poisonous gases in the air or lack of oxygen

- Move victim to fresh air.

- Begin mouth-to-mouth breathing.

- Control the source of poisonous gases, if possible.

- Keep others away from area.

- DO NOT enter an enclosed area to rescue an unconscious victim without first being equipped with a self-contained or air-supplied breathing apparatus.

Electric shock

- o If electrical hazard persists: indoors, open main electrical breaker if appropriate individual breaker cannot be immediately identified; outdoors, contact power company to turn current off.
- o DO NOT TOUCH the victim until he is separated from the current.
- o Begin mouth-to-mouth resuscitation or cardiopulmonary resuscitation, if needed and if trained in this technique, as soon as the victim is free of contact with the current.
- o DO NOT try to remove a person from an out-of-doors wire unless you have had special training for this type of rescue work.

Heart attack

Laryngeal obstruction

Accident or drowning

When breathing movements stop or lips, tongue, and fingernails become blue, there is need for help with breathing.

When in doubt, begin artificial respiration. No harm can result from its use. Delay may cost the victim his life.

ARTIFICIAL RESPIRATION

General

- o Seconds count. Start immediately.
- o Remove any obvious obstruction from mouth and throat.
- o Place victim in appropriate position and begin artificial respiration.
- o Maintain steady rhythm of 12 breaths per minute.
- o Maintain an open airway and periodically check the victim. Be ready to resume artificial respiration if necessary.
- o Call a physician.
- o DO NOT move the victim unless absolutely necessary to remove from danger.
- o DO NOT wait or look for help.
- o DO NOT stop to loosen clothing or warm the victim.
- o DO NOT GIVE UP.

Mouth-to-mouth breathing for adults

- Place victim in supine position (on back).
- Tilt victim's head back by pressing on his forehead with your other hand.
- Place your cheek and ear over the victim's nose and mouth, looking at his chest. Look, listen and feel for breathing for about 5 seconds.
- Pinch the victim's nose shut with the thumb and forefinger of the hand on victim's forehead. Take a deep breath and place your mouth over the victim's mouth or nose making a leak-proof seal.
- Blow your breath into the victim's mouth or nose until you see the chest rise; repeat these breaths 4 times in rapid succession without allowing the lungs to fully deflate between breaths.
- Maintain the head tilt and again check the victim for breathing for approximately 5 seconds.
- Remove your mouth and let the victim exhale while you take another deep breath. As soon as you hear the victim breathe out, replace your mouth over his mouth or nose and repeat the procedure.
- Repeat this procedure of giving one breath, turning to look, listen and feel for return of air, and blowing again, once every five seconds (12 times per minute).

Manual method of artificial respiration

- Place victim in a face-up position but allow his head to turn to the side to avoid aspiration.
- Place something under the victim's shoulders to raise them to allow the head to drop backward.
- Kneel above victim's head, facing the victim.
- Grasp victim's arm at the wrists, crossing and pressing victim's wrists against the lower chest.
- Immediately, pull arms upward, outward, and backward as far as possible.
- Repeat 15 times per minute.
- If a second person is present, he should hold the victim's head so that it tilts backward and the jaw juts forward.
- This method should be used when mouth-to-mouth resuscitation is advised against.

Cardiopulmonary resuscitation (CPR)

Heart-lung resuscitation is an emergency procedure which requires the ability to recognize a cardiac arrest and special training in its performance. All training programs should adhere to the standards put forth in JAMA "Supplement on Standards for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC)". 18 February 1974, Volume 227, Number 7. *Information provided here on cardiopulmonary resuscitation is not designed to supplant a complete course of instruction under direction of a qualified instructor. Such instruction is strongly recommended for all personnel who must respond to hazardous materials spill sites.*

Emergency cardiopulmonary resuscitation involves the following steps:

- o Airway opened.
- o Breathing restored.
- o Circulation restored.

External cardiac compression should be started after providing four quick breaths and checking for pulse and breathing. If apnea (breathing stoppage) persists, and there is unconsciousness, death-like appearance and absence of carotid pulse, external cardiac compression should be started.

External cardiac compression consists of the application of rhythmic pressure over the lower half of the sternum. This compresses the heart and produces artificial circulation because the heart lies almost in the middle of the chest between the lower sternum and the spine.

External cardiac compression should always be accompanied by artificial respiration. To be effective it requires sufficient pressure to depress the victim's lower sternum 1-1/2 to 2 inches (3.8 to 5.1 centimeters) in an adult; the rate should be once a second. Considerably less effort will be required to achieve such depression in a child. The victim should be on his back on a firm surface. The rescuer stations himself at the side of the patient and places only the heel of one hand over the lower half of the sternum. He then places his other hand on top of the first one and rocks forward so that his shoulders are almost directly above the patient's chest. Keeping the arms straight and elbows locked, he exerts adequate pressure almost vertically downward. The preferred rate of 60 per minute is usually rapid enough to maintain blood flow and slow enough to allow cardiac refill. The compressions should be regular, smooth, and uninterrupted, with compression and relaxation being of equal duration. Under no circumstances should compression be interrupted for more than 5 seconds.

When there are two rescuers, optimum ventilation and circulation are achieved by quickly interposing one inflation after five chest compressions without any pause in compressions (5:1 ratio). Every interruption in cardiac compression results in a drop of blood pressure to zero. One rescuer performs external cardiac compression while the other one keeps the patient's head tilted back and continues ventilation. When there is only one rescuer he must perform both artificial respiration and artificial circulation using a 15:2 ratio; two quick lung inflations after every 15 chest compressions. Periodic palpation of the carotid pulse should be employed to check the effectiveness of external cardiac compressions or the return of a spontaneous heartbeat.

Complications occurring from the use of cardiopulmonary resuscitation may include fracture of the ribs and sternum, laceration of the liver, and fat emboli.

Several rules to follow are:

- o Never compress over the xiphoid process, the lower tip of the sternum. It extends down over the abdomen and pressure on it may cause a dangerous laceration of the liver.
- o Never let the fingers touch the patient's ribs when compressing. Keep just the heel of the hand in the middle of the victim's chest over the lower half of his sternum.
- o Never use sudden or jerking movements to compress the chest.
- o Never compress the chest and abdomen simultaneously. This traps the liver and may cause it to rupture.

SHOCK

Severe injury or emotional upset is usually followed by shock. It can also follow infection, pain, disturbance of circulation from bleeding, stroke, heart attack, heat exhaustion, food or chemical poisoning, extensive burns, etc. The following information pertains to traumatic, injury-related shock rather than to emotional shock, per se.

<u>The signs of shock</u> include:

- o Cold and clammy skin with beads of perspiration on the forehead and palms of hands.
- o Pale face, weakness, dilated pupils, and weak, rapid pulse.
- o Complaint by the victim of feeling cold, or even shaking chills.
- o Frequent nausea or vomiting.
- o Shallow breathing.

<u>To prevent shock</u>:

- o If possible, correct cause of shock (e.g., control bleeding).
- o Keep victim lying down.

- Keep the airway open. If victim is vomiting, turn his head to the side so that the neck is arched.
- Keep victim warm if weather is cold or damp.
- Give fluids only if victim does not have head or abdominal injuries, probably will not require surgery, and professional help will be more than one hour arriving. Give him sips and do not give stimulants. A suggested formula is one pinch baking soda and two pinches salt per glass (10 oz.) of water.
- Reassure victim.
- NEVER give alcoholic beverages.
- DO NOT give fluids to unconscious or semiconscious persons.
- PREVENTION OF SHOCK SHOULD BE CONSIDERED WITH EVERY INJURY.

POISONING

Before medical aid is available, the following should be done.

SPEED IS ESSENTIAL:

- Act before the body has time to absorb the poison.
- When medical aid is available, give physician all possible knowledge available on the poison.

The nature of the poison will determine the first aid measure to use:

Swallowed poisons

- If victim is conscious, give water or milk immediately.

DO NOT INDUCE VOMITING (except on the advice of doctor or Poison Control Center):

- If the victim is unconscious,
- Is in convulsions,
- Is known to have swallowed a petroleum product (kerosene, gasoline, lighter fluid), toilet bowl cleaner, rust remover, drain cleaner, lye, acids for personal or household use, iodine, styptic pencil, washing soda, ammonia water, or household bleach, or has symptoms of severe pain, or a burning sensation in mouth or throat.

DO NOT INDUCE VOMITING if "do not induce vomiting" is indicated in the first aid segment of the chemical data sheets.

- Information on labels may be incorrect; contact physician or Poison Control Center immediately for proper advice.
- Call for medical aid immediately.
- Begin mouth-to-mouth resuscitation if the victim has difficulty breathing.
- If safe (see above), induce vomiting.
- Induce vomiting by use of 10 grams salt in 200 cc of warm water (2 teaspoonfuls in a glass of warm water) or use 30 cc's or one ounce of syrup of ipecac.
- When vomiting begins, place the victim face down with head lower than hips. This prevents vomitus from entering the airways and causing further damage.

Inhaled poisons

- Assist or carry victim to fresh air immediately.
- Apply artificial respiration if breathing has stopped or is irregular.
- Call physician.
- Treat for shock.
- Keep victim as quiet as possible.
- DO NOT give alcohol in any form.
- DO NOT become a victim by exposure to the same poison.
- Rescuer should employ appropriate protective clothing and breathing apparatus until clear of hazard.

EYES

First aid for chemicals in the eyes is the immediate washing of the eyes with large quantities of water. Hold the eyelids open and roll the eye while irrigating with water. Emphasis should be placed on the amount of water, the speed with which it is applied, amd washing the eye "from the inside outward". Eyes should be washed for at least 10 minutes. A delay of 30 seconds can mean the difference between no injury to the eye and permanent loss of vision.

Chemical burns to the eyes can be aggravated by contact lenses. Chemicals spilled in the eyes tend to accumulate under contact lenses. In addition, for proper irrigation, contact lenses need to be removed. It is advisable not to wear contact lenses at a spill site.

In cases of alkaline or acid chemicals in the eyes, irrigation with neutralizing agents should not be used as first-aid treatment. Acids in contact with the cornea will react with protein to form an insoluble barrier. This barrier prevents penetration of the acid into the eye. An alkaline solution does not form this barrier and is free to soak deep into the eye. If this happens with an alkaline solution and an acid neutralizing agent is used, the alkaline solution will be trapped under the insoluble barrier formed by the acid-protein reaction. This will prevent the leaching out of the alkaline solution by irrigation.

Most serious chemical injuries to eyes can be avoided by quickly and properly washing the eyes with large amounts of water.

BURNS

General

- Burns can result from heat (thermal burns) or from chemicals (chemical burns).
- Shock can complicate every type of burn,
- A person with "burn shock" may die unless he receives immediate first aid.
- In "burn shock" the liquid part of the blood is sent by the body into the burned areas. There may not be enough blood volume left to keep the brain, heart, and other organs functioning normally.
- All burns should be seen by a physician or nurse.

Objectives of first aid care for burns are to:

- Prevent and treat shock.
- Prevent contamination.
- Control pain.

Extensive thermal burns

- Place the cleanest available cloth material over all burned body areas to exclude air. Covering for burns should be a clean, thick, dry dressing. Clean newspaper can be substituted if no clean cloth is available.

- Have victim lie down.

- Call physician.

- Place victim's head and chest a little lower than the rest of the body. Elevate the legs slightly if possible.

- If the victim is conscious and can swallow, give him plenty of non-alcoholic liquids to drink (water, tea, coffee, dilute salt solution).

- Move to hospital immediately.

Small thermal burns

- If SKIN IS NOT BROKEN, immerse burned part in clean, cold water to relieve pain, reduce inflammation. Do not apply ice directly to the skin.

- Soak a sterile gauze pad or clean cloth in baking soda solution: 2 tablespoonfuls baking soda (sodium bicarbonate) to 1 quart of lukewarm water.

- Place pad over burn and bandage it loosely.

- DO NOT disturb or open blisters.

Chemical burns

- Immediately flush with water; speed in washing is most important in reducing the extent of injury.

- Flush affected area with plenty of water.

- Remove all contaminated clothing and shoes.

- Place the cleanest available material over the burned area.

- Treat for shock.

- If the burned area is extensive, have victim lie down.

- Keep him down until medical aid is available.

- Place his chest and head a little lower than the rest of the body (raise the legs slightly if possible).

- Maintain an open airway.

- If he is conscious and can swallow, give him plenty of non-alcoholic liquids to drink.

- DO NOT APPLY OINTMENTS, greases, baking soda, or other substances to extensive burns.

ENVIRONMENTAL TEMPERATURE EXTREMES

Heat exhaustion

SYMPTOMS:

- Pale and clammy skin.
- Pulse rapid and weak.
- Victim complains of weakness, headache, or nausea.
- Victim may have cramps in abdomen or limbs.

FIRST AID:

- Have victim lie down with his head level with or lower than his body.
- Move victim to a cool place, but protect him from chilling.
- Give the victim salt water (1 teaspoonful salt to 1 quart water) to drink if he is conscious.
- Loosen tight clothing.
- Call for medical aid.

Heat stroke

SYMPTOMS:

- Flushed and hot skin.
- Pulse rapid and strong.
- Victim often is unconscious.

FIRST AID:

- Call for medical aid.
- Cool body by sponging it with cold water or by cold applications.
- If the victim is fully conscious and can swallow, give him salt water (1 teaspoonful salt to 1 quart water).
- DO NOT give alcohol in any form.

Frostbite

SYMPTOMS:

- o Skin color changes to white or greyish-yellow as frostbite develops.
- o Initial pain which quickly subsides.
- o Victim feels cold and numb; he usually is not aware of frostbite.

FIRST AID:

- o Cover the frostbitten part with a warm hand or woolen material.
- o If fingers or hand are frostbitten, have victim hold his hand in his armpit, next to his body.
- o Bring victim inside as soon as possible.
- o Place frostbitten part in warm water, about 42 C. (108° F.).
- o Gently wrap the part in blankets if warm water is not available or is impractical to use.
- o Let circulation reestablish itself naturally.
- o When the part is warmed, encourage the victim to exercise fingers and toes.
- o Give victim a warm, sweet, non-alcoholic drink.
- o DO NOT RUB with snow or ice. DO NOT USE HOT WATER, hot water bottles, or heat lamps over the frostbitten area.

MOVING THE INJURED

General

Do not move an injured person until an experienced crew arrives, unless there is real danger of his receiving further injury by remaining at accident site.

Control bleeding if possible, maintain breathing, and immobilize all suspected fracture sites before moving.

Treat for shock.

Pulling the victim to safety

Pull the victim head first or feet first, not sideways.

BE SURE HEAD IS PROTECTED.

Lifting the victim to safety

If he must be lifted before a check for injuries can be made, every part of the body should be supported. The body should be kept in a straight line and should not be bent. Once victim is lifted, the lifter is responsible for the victim's safe return to the ground/floor.

Exercise care in the approach of any "downed" co-worker or bystander victim. Rapid action may be called for, but hasty and careless intervention may lead to additional injury or loss of life, avoidable if a few moments are taken to assess the immediacy and severity of the situation. Once again, the exercise of careful, informed judgement and plain common sense is the most important safeguard of personnel health.

D

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE 21 MAR 1980

SUBJECT Setting Priorities for Activities Relative to Hazardous Waste Sites

FROM Kenneth E. Biglane, Director Ken Biglane
Oil & Special Materials Control Division (WH-548)

DM
Douglas MacMillan, Acting Director
Hazardous Waste Enforcement Task Force (EN-335)

To: Regional Hazardous Waste Coordinators

Draft site prioritization criteria were distributed and discussed in August 1979 as part of the first round of Regional/Headquarters meetings on the Hazardous Waste Site Enforcement and Response System. Clearly, as the number of sites on Regional investigation lists grows the issue of risk assessment and prioritization becomes increasingly important.

Since the development of the first set of criteria, a somewhat more sophisticated approach has been developed with contractor assistance. Earlier drafts of this new approach have been reviewed with generally positive ratings by representatives of Regions I, II, and IV and the States of Connecticut and New Jersey.

We recommend that Regions quickly begin to use the attached hazard evaluation system to determine which sites should receive immediate attention. In attempting to determine those sites most likely to present serious hazards to the public or the environment, the system reflects the fact that decisions must sometimes be made on the basis of limited information. We recommend that sites be rated using this method after both the preliminary assessment and site inspection phases of investigations. (Once a site has been fully inspected and the extent of the problem has been well defined, it is obviously necessary to reassess priorities for enforcement or response activities.)

Given the variety of problems which might occur, it is often difficult to objectively compare the danger or harm found at one site with that of another. To some degree the attached ranking system will aid in comparing severity of problems, since concerns regarding public health or sensitivity of the environment are built into the weighing of the various factors. Thus, the ranking system should be employed setting enforcement and response priorities. However, other factors such as immediacy of the threat, probability of a successful outcome, anticipated costs, and the level of public concern must also be considered.

EPA Form 1320-6 (Rev. 3-76)

We encourage you to put this method into immediate use and suggest that you compare the resulting rating scores to your own professional judgments regarding the relative severity of problems as verification of this method. Any comments regarding shortcomings or the value of the rating system will be appreciated. These may be communicated to either Steve Caldwell, OSMCD, 245-3051 or Mike Kilpatrick, HWETF, 472-3500.

Attachments

METHOD FOR RATING RISKS AT HAZARDOUS WASTE SITES

INTRODUCTION

This document describes a method for evaluating the relative risks to the public or environment posed by various hazardous waste sites.* The method takes into account risks which include fires and explosions, direct human exposure to dangerous substances, and contamination of air, land, waters, or the food chain. The method presented for evaluating such risks is to assign numerical scores to a series of rating factors describing the wastes, waste management practices, potential pathways or routes of discharge, and the site environs which could be affected. The method is designed to give a single numerical score, thus allowing comparison among sites under consideration for investigative work or response activities.

Included in the document is a set of scoring forms, instructions, tables describing scoring criteria, and examples based on case histories.

GENERAL CONSIDERATIONS

The critical element in the risk evaluation method is the score assigned for each rating factor (see number 1 below). Very specific criteria for assigning scores are given. Since the method is designed for use when only limited information is available, these criteria will not be applicable for all factors at all sites evaluated. Where some information is available, although inadequate to fully characterize the factor considered, one's best professional judgment should be exercised in assigning a score. If no reliable information is available, the factor may either be ignored or a conservative assumption may be made. A conservative assumption in this case means assuming a worst case scenario (e.g., assume an unknown waste is extremely dangerous). The scorer must also use best professional judgment in deciding if the number of unknown factors is large enough to render the final score invalid.

INSTRUCTIONS

1. Assign Values to Each Rating Factor - Using the scoring form on the following pages, assign a score from 0 to 3 for each rating factor. Sources of information and criteria for assigning scores are given in Table I. For example, assume that in the site under consideration, phenols are the most toxic substance reported in significant amounts. Table I indicates that the Sax's Dangerous Properties of Industrial Materials should be consulted. Sax assigns a toxicity rating of "3" for phenols; thus, according to Table I a score of 3 should be given for toxicity. Continuing with "ignitability" assign scores to all data elements where sufficient information is

*Note that this method is not currently applicable to incinerators.

available to form a judgment. If no information is available (e.g., depth to bedrock is unknown; no surveys have been conducted in the vicinity of the site) leave that section blank. Do not assign scores to "additional points" at this time.

2. Multiply by Assigned Weights - Each rating factor has an assigned weight representing its relative importance. These are given in the "multiplier" column of the scoring form. Multiply each rating factor score by its assigned weight to obtain the "site score" for that rating factor. For example, since phenols are believed present, a score of 3 was assigned to toxicity. The multiplier for toxicity is "7". Thus, the site score for toxicity in the example is (3) X (7) = 21. That number is entered in the "site score" column of the scoring form.

3. Obtain Total Site Scores - Sum all the "site scores" and enter this value on the second page of the form in the appropriate place.

4. "Additional Points" - In order to take into account situations not adequately covered under the rating factors, additional points may be assigned up to a maximum noted on the rating form. Based on available information and best professional judgment, assign points for all five areas under additional points. Be sure to indicate on the form the rationale for assigning additional points. See Table 2 for guidance and examples where additional points should be given. Total all additional points and enter that number in the appropriate space on the second page of the form.

5. Obtain Total Score - Add together "Total Site Scores" and "Total Additional Points" on the second page of the form.

6. Compute "Maximum Possible Site Score" - compute the maximum possible score if each data element considered (i.e., not left blank) had been assigned a score of 3. Do not include rating factors left blank. If values are assigned to all rating factors, the maximum possible score is 492. Additional points are not included in the maximum possible score.

7. Compute the "Normalized Score" - Since complete information is not available on all sites, a means is needed for giving comparable scores among sites where differing amounts of information are available. This is accomplished by converting scores to a 100-point scale (normalized scores). Divide the total score by the "maximum possible score" and multiply by 100 to obtain the "normalized score". Note that it is possible to obtain a normalized score of greater than 100 due to the additional points system.

RATING FORM FOR WASTE DISPOSAL SITES

NAME OF SITE ______________________ ACTIVE: INACTIVE (CIRCLE ONE)

LOCATION ______________________

OWNER/OPERATOR ______________________

RATING FACTOR	SOURCE AND BASIS OF INFORMATION	SITE RATING 0	1	2	3	MULTIPLIER	SITE SCORE	MAXIMUM POSSIBLE SITE SCORE
	WASTE CHARACTERISTICS							
QUANTITY OF HAZARDOUS WASTES						6		
TOXICITY						7		
PERSISTENCE						5		
RADIOACTIVITY						5		
IGNITABILITY						3		
REACTIVITY						3		
CORROSIVITY						3		
INFECTIOUSNESS						3		
SOLUBILITY						4		
VOLATILITY						4		
PHYSICAL STATE						4		
						TOTALS		
ADDITIONAL POINTS FOR LARGE WASTE QUANTITIES								24
ADDITIONAL POINTS FOR OTHER WASTE CHARACTERISTICS								15
	RECEPTORS							
POPULATION IN 1,000 FEET						12		
DISTANCE TO NEAREST DRINKING-WATER WELL						8		
DISTANCE TO NEAREST OFF-SITE BUILDING						8		
ZONING/LAND USE						6		
ENDANGERED SPECIES OR CRITICAL HABITATS						6		
						TOTALS		
ADDITIONAL POINTS FOR OTHER RECEPTORS								30

[illegible]

EVIDENCE OF CONTAMINATION						12		
DISTANCE TO NEAREST SURFACE WATER						8		
DEPTH TO GROUNDWATER						7		
SOIL PERMEABILITY						6		
NET PRECIPITATION						6		
DEPTH TO BEDROCK						4		
BEDROCK PERMEABILITY						4		
						TOTALS		

ADDITIONAL POINTS FOR OTHER PATHWAYS		20

WASTE MANAGEMENT PRACTICES

SITE SECURITY						8		
INCOMPATIBLE WASTES						5		
RATIO OF HAZARDOUS TO NON-HAZARDOUS WASTE QUANTITIES						5		
USE AND CONDITION OF CONTAINERS						4		
USE OF LEACHATE COLLECTION SYSTEM						4		
USE OF LINERS						4		
						TOTALS		

ADDITIONAL POINTS FOR OTHER WASTE MANAGEMENT PRACTICES		20

NUMBER OF MISSING OR ASSUMED

VALUES = ________ OUT OF 29.

PERCENTAGE OF MISSING OR

ASSUMED VALUES = ________ %

TOTAL SITE SCORES ________

TOTAL ADDITIONAL POINTS ________

TOTAL SCORE ________
(SITE SCORES PLUS ADDITIONAL POINTS)

TOTAL MAXIMUM POSSIBLE SITE SCORE ________

NORMALIZED SCORE ________
(TOTAL SCORE DIVIDED BY MAXIMUM SCORE AND MULTIPLIED BY 100)

COMMENTS: ________

PREPARED BY: ________ ON ________ 19 ____

TABLE 1. RATING SCALES AND SOURCES OF INFORMATION FOR EACH OF THE RATING FACTORS

RATING FACTOR	SOURCE OF INFORMATION	RATING SCALE 0	1	2	3
		WASTE CHARACTERISTICS			
Quantity of Hazardous Wastes — Volume[1]	Information derived from local sources	Less than 299 cubic yards	300 to 1189 cubic yards	1190 to 2370 cubic yards	Greater than 2370 cubic yards
Quantity of Hazardous Wastes — Weight[1]		Less than 250 tons	251 to 1000 tons	1001 to 2000 tons	Greater than 2000 tons
Toxicity[2, 3]	Hazardous Properties of Industrial Materials by N. I. Sax National Fire Protection Association's Guide on Hazardous Materials Registry of Toxic Effects of Chemical Substances	Sax's level 0 or NFPA's level 0	Sax's level 1 or NFPA's level 1	Sax's level 2 or NFPA's level 2	Sax's level 3 or NFPA's levels 3 or 4
Persistence	Partition Coefficients (see "Partition Coefficients and Bioaccumulation of Selected Organic Chemicals", Environmental Science and Technology, Vol II, No. 5, May 1977, p. 475.) Scientific Judgement	Not persistent	--	--	Highly persistent
Radioactivity	Information derived from local sources	Not Radioactive	--	--	Well above background
Ignitability[3]	NFPA Guide Lang's Handbook of Chemistry	Flash point of greater than 200°F or NFPA's level 0	Flash point of 140°F to 200°F or NFPA's level 1	Flash point of 80°F to 140°F or NFPA's level 2	Flash point less than 80°F or NFPA's levels 3 or 4
Reactivity[3]	NFPA Guide Proposed RCRA Regulations, Federal Register, December 18, 1978.	NFPA's level 0	NFPA's level 1	NFPA's level 2	NFPA's levels 3 or 4
Corrosivity	Information derived from local sources	pH of 6 to 9	pH of 5 to 6 or 10 to 11	pH of 3 to 4 or 11 to 12	pH of 1 to 3 or 12 to 14
Infectiousness	Information derived from local sources	Not Infectious	--	--	Highly Infectious
Solubility[4]	CRC Handbook of Chemistry and Physics Lang's Handbook of Chemistry Merck Index Handbook of Environmental Data on Organic Chemicals	Insoluble	Slightly soluble	Soluble	Very soluble
Volatility[4]	CRC Handbook of Chemistry and Physics Lang's Handbook of Chemistry Handbook of Environmental Data on Organic Chemicals	Vapor pressure less than 0.1 mm Hg	Vapor pressure of 0.1 to 25 mm Hg	Vapor pressure of 25 to 78 mm Hg	Vapor pressure greater than 78 mm Hg
Physical State[4]	Information derived from local sources	Solid	Sludge	Liquid	Gas

RATING FACTOR	SOURCE OF INFORMATION	RATING SCALE 0	1	2	3
RECEPTORS					
Residential Population within 1000 Feet	Local housing officials or census officers Current topographic maps or aerial photos	0	-	1 to 25	Greater than 25
Proximity to Nearest Drinking Water Well	Information derived from local sources (e.g., Public Health Departments, water supply companies, well drillers, residents)	Greater than 3 miles	1 to 3 miles	1001 feet to 1 mile	0 to 1000 feet
Proximity to Nearest Nonsite-Related Building	Local housing officials or census officers Current topographic maps or aerial photos	Greater than 2 miles	1 to 2 miles	1001 feet to 1 mile	0 to 1000 feet
Zoning/Land Use of Adjacent Area	Information derived from local sources	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential
Endangered Species or Critical Habitats in the Vicinity	National Wildlife Federation and other National environmental groups State and local environmental groups U.S. Fish and Wildlife Service State departments of Fish and Game	No	—	—	Yes
PATHWAYS					
Evidence of Contamination	Information derived from local sources	No evidence of contamination	Indirect evidence of contamination (e.g., suspicious dead vegetation	Positive proof of contamination at any level or direct evidence of contamination (e.g., chemical odors)	Positive proof (i.e., chemical analysis) of contamination at high levels
Distance to Nearest Surface Water	USGS topographic maps or reports Maps and reports from state or local highway Departments or from universities or state geological surveys	Greater than 5 miles	1 to 5 miles	1000 feet to 1 mile	0 to 1000 feet
Depth to Ground Water	USGS water supply papers, ground water bulletins and geologic reports Local well drillers, water suppliers, universities (geology departments), and residents	Greater than 100 feet	51 to 100 feet	21 to 50 feet	Less than 20 feet
Soil Permeability	USDA Soil Conservation Service county maps reports USGS soil maps and reports	Greater than 50% clay (clay soils)	30 to 50% clay (most clay loams, silty clay loams, silty clays, and sandy clays)	15 to 30% clay (most loams and sandy clay loams)	Less than 15% clay (most sandy loams, silty loams, sands and silts)
Net Precipitation [5]	NOAA annual weather summaries General precipitation and evapotranspiration maps	Less than -10 inches	-10 to +5 inches	+5 to +19 inches	Greater than +20 inches

RATING FACTOR	SOURCE OF INFORMATION	RATING SCALE 0	1	2	3
Depth to Bedrock	USDA Soil Conservation Service county maps and reports USGS soil maps and reports	Greater than 60 feet	31 to 60 feet	11 to 30 feet	0 to 10 feet
Bedrock Permeability	USGS water supply papers, ground water bulletins and geologic reports Local well drillers, water suppliers, universities (geology departments), and residents	Impermeable (e.g., unfractured shales, evaporites or crystalline rocks)	Relatively impermeable (e.g., unfractured, fairly-well cemented clastic rocks)	Relatively permeable (e.g., moderately cemented, unfractured, clastic rocks)	Very permeable (e.g., carbonates, well-fractured clastic rocks)
		WASTE MANAGEMENT PRACTICES			
Site Security	Information derived from local sources	Secure fence	Security guard but fence	Remote location or breachable fence	No barriers
Presence/Absence of Incompatible Wastes	Information derived from local sources	No incompatible wastes are present	Present but does not pose a hazard	Present and may pose a future hazard	Present and posing an immediate hazard
Ratio of Hazardous to Non-Hazardous Waste Quantities	Information derived from local sources	Less than 0.01	0.01 to 0.25	0.25 to 0.50	0.50 to 1.0
Use and Condition of Waste Containers	Information derived from local sources	Containers are used and appear to be in good condition	Containers are used but a few are leaking	Containers are used but many are leaking	No containers are used
Use of Leachate Collection System	Information derived from local sources	Yes	--	--	No
Use of Liners	Information derived from local sources	Yes	--	--	No

1. Based on a specific gravity of 1.0
2. "Sax" refers to the book Hazardous Properties of Industrial Materials by N.I. Sax
3. "NFPA" refers to the book Guide on Hazardous Materials by the National Fire Protection Association
4. Solubility, vapor pressure, and physical state at 25° C
5. Annual precipitation minus annual evapotranspiration

TABLE 2 EXAMPLES OF SITUATIONS THAT REQUIRE ADDITIONAL POINTS

WASTE CHARACTERISTICS

- o Substances that are carcinogenic, teratagenic, or mutagenic
- o An high-level radioactive wastes
- o Substances with a very high bioaccumulation potential
- o Priority pollutants
- o Hazardous substance as defined by Sec. 311 of Clean Water Act
- o Very large quantities of wastes

Quantity	Additional Points
5,000 to 9,999 tons	5
10,000 to 19,999 tons	7
20,000 to 49,999 tons	12
50,000 to 74,999 tons	16
75,000 to 100,000 tons	20
over 100,000 tons	24

WASTE MANAGEMENT

- o No training/safety measures for personnel
- o Inadequate treatment systems for collected leachate
- o Site abandonment
- o No waste mapping or records
- o Power lines near sites having explosive or flammable wastes
- o Less than 18 inches of cover over inactive landfills
- o Less than 6 inches of daily cover
- o Grading and surface water control

PATHWAYS

- O Open soil structures
- o Erosion problems

- o Slope stability problems
- o Seismic activity
- o Severity of contamination, e.g., surface seeps on the site vs anomalously-high incidences of birth defects in families bordering the site
- o Surface impoundment used as an evaporation pond for volatile organics

RECEPTORS

- o Use of site by nearby residents, especially children (for example, a site may be remote and/or fenced, but may still be used frequently by children as a play area or by adults with recreational vehicles)
- o Type of building nearby, (e.g., school vs warehouse)
- o Presence of major surface water supplies or aquifers near the site
- o Type of adjacent land use (e.g., dairy farms, meat packing plants, municipal water treatment plant, etc. would cause extreme concern)
- o Presence of economically-important, natural resources

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D. WITNESS GUIDELINES

The role of a RCRA inspector may include serving as a witness in a RCRA enforcement case which is brought to court. The following suggestions are made to prospective witnesses in order to lessen the fears and apprehensions which almost everyone has when first testifying before a board, a commission or a hearing officer or in a court. Even those who have testified previously encounter a certain anxiety when called for a repeat performance. When a witness is properly prepared, both with regard to the subject matter of the testimony and conduct on the witness stand, there should be little fear about testifying.

It is of utmost importance that the witness be thoroughly prepared on to the subject matter of his testimony. Only the witness can recall what occurred in the field and why. Since many cases are tried substantially after field activities are conducted, it is imperative that adequate documentation be originally prepared in order that a witness's memory may be refreshed. A thorough and detailed review of all survey documents is the only way prospective witnesses can be adequately prepared.

In order to assist witnesses on how they should conduct themselves, the following suggestions are given.

The witness will be required to take an oath to tell nothing but the truth. The important point is to remember that there are two ways to tell the truth; one is in a halting, stumbling, hesitant manner, which makes the board member, hearing officer, judge or jury doubt that the witness is telling all the facts in a truthful way; the otl confident, straightforward manner, which inspires faith in whataid. It is important that the witness testify in the latter massist a witness in testifying in such a manner, a list of timts and aids are provided below.

1. General Instructions for a Witness

As a witness in a case involving testimony concppearance of an object, place, condition, etc., try to recollectspecting the object, place, condition, field notes and recorden possible, before the hearing or trial. While making such ar, close your eyes and try to picture the item to recall, if he important points of the testimony. Repeat the test until thoriarized with the features of the testimony to be given.

Before testifying, visit a court trial or boand listen to other witnesses testifying to become familiar withdings and to understand some of the things that will come up fying. When testifying, be present in sufficient time to hearsses testify before taking the witness chair. This, however, ms be possible since, on occasion, witnesses are exlcuded from the

Listen to the questions and then answer calmtly in a sincere manner. The facts should be well known so communicated. Testimony in this manner applies to cross-examill as direct examination.

Wear neat, clean clothes when you are to testifying. Dress conservatively.

Do not chew gum while testifying or taking an oath. Speak clearly and do not mumble. Smoking will not be permitted while testifying.

2. Direct Examination

In a discussion on administrative procedures, E. Barrett Prettyman, Retired Chief Judge, U.S. Court of Appeals for the District of Columbia, gave the following advice:

> The best form of oral testimony is a series of short, accurate, and complete statements of fact. Again, it is to be emphasized that the testimony will be read by the finder of the facts, and that he/she will draw his/her findings from what he/she reads.... Confused, discursive, incomplete statements of fact do not yield satisfactory findings.

During direct examination, stand upright when taking the oath. Pay attention and say "I do" clearly. Do not slouch in the witness chair.

Do not memorize what is to be said as a witness. Prepare answers to possible questions, but by all means do not memorize such answers. It is, however, very important to become as familiar as possible with the facts on which to testify.

During direct examination, elaborate and respond more fully than is advisable during cross-examination. However, when testifying, do not ramble and do not stray from the main point raised in your lawyer's questions. The taking of testimony is a dialogue, not a monologue. If testimony concerns a specialized technical area, the Court or hearing board will find it easier to understand if it is presented in the form of short answers to a logical progression of questions. In addition, letting the lawyer control the direction of testimony will help you avoid making remarks which are legally objéctionable or tactically unwise.

Be serious at all times. Avoid laughing and talking about the case in the halls, restrooms or any place in the building where the hearing or trial is being held.

While testifying, talk to the judge, hearing officer or jury. Look at him/her or them most of the time, and speak frankly and openly as to any friend or neighbor. Keep your hands away from your mouth. Speak clearly and loudly enough so that anyone in the hearing room or courtroom can hear easily. At all times make certain that the reporter taking the verbatim record of testimony is able to hear and record what is actually said. The case will be decided entirely on the words that are finally reported as having been the testimony given at the hearing or trial. Always make sure to give a complete statement in a complete sentence. Half statements or incomplete sentences may convey thoughts in the context of the hearing, but may be unintelligible when read from the cold record many months later.

3. Cross Examination

Concerning cross-examination, Judge Prettyman gives the following advice to prospective witnesses:

Don't argue. Don't fence. Don't guess. Don't make wisecracks. Don't take sides. Don't get irritated. Think first, then speak. If you do not know the answer but have an opinion or belief on the subject based on information, say exactly that and let the hearing officer decide whether you shall or shall not give such information as you have. If a "yes or no" answer to a question is demanded but you think that a qualification should be made to any such answer, give the "yes or no" and at once request permission to explain your answer. Don't worry about the effect an answer may have. Don't worry about being bulldozed or embarrassed; counsel will protect you. If you know the answer to a question, state it as precisely and succinctly as you can. The best protection against extensive cross-examination is to be brief, absolutely accurate, and entirely calm.

The hearing officer, board, or member of a jury wants only the facts, not hearsay, conclusions, or opinions. Testimony about what someone else has told you will not be allowed.

Always be polite, even to the attorney for the opposing party.

Do not be a smart aleck or a cocky witness. This will lose you the respect and objectivity of the trier of the facts in the case.

Do not exaggerate or embroider testimony.

Stop instantly when the judge, hearing officer, or board member interrupts or when the other attorney objects to what is said. Do not try to sneak answers in.

Do not nod for a "yes" or "no" answer. Speak out clearly. The reporter must hear an answer to record it.

If the question is about distances or time and the answer is only an estimate, be certain to state it is only an estimate.

Listen carefully to the question asked. No matter how nice the other attorney may seem on cross-examination, he/she may be trying to hurt you as a witness. Understand the question. Have it repeated if necessary; then give a thoughtful, considered answer. Do not give a snap answer without thinking. Do not be rushed into answering, although, of course, it would look bad to take so much time on each question that the board member, hearing officer, or jury will think the answers are being made up.

Answer the question that is asked--not the question that you think the examiner (particularly the cross-examiner) intended to ask. The printed record shows only the question asked, not what was in the examiner's mind, and a nonresponsive answer may be very detrimental to your side's case. This situation exists when the witness thinks "I know what he/she is after but he/she hasn't asked for it." Answer only what is asked.

Explain answers if necessary. This is better than a simple "yes" or "no." Give an answer in your own words. If a question cannot be answered truthfully with a "yes" or "no," you have a right to explain the answer.

Answer directly and simply the question asked and then stop. Never volunteer information.

If by chance you answer was wrong, correct it immediately; if your answer was not clear, clarify it immediately.

You are sworn to tell the truth. Tell it. Every material truth should be readily admitted, even if not to the advantage of the party for whom you are testifying. Do not stop to figure out whether your answer will help or hurt your side. Just answer the question to the best of your ability.

Give positive, definite answers when at all possible. Avoid saying "I think," "I believe," "in my opinion." If you do not know, say so. Do not make up an answer. Be positive about the important things which you naturally would remember. If asked about little details which a person naturally would not remember, it is best to say that you do not remember.

Do not act nervous. Avoid mannerisms which will make it appear that you are frightened or not telling the truth or not telling all that you know.

Above all, it is most important that you do not lose your temper. Testifying at length is tiring. It causes fatigue. You will recognize fatigue by certain symptoms: (a) crossness, (b) nervousness, (c) anger, (d) careless answers, (e) willingness to say anything or answer any question in order to leave the witness stand. When you feel these symptoms, recognize them and strive to overcome fatigue. Remember that some attorneys on cross-examination are trying to wear you out so you will lose your temper and say things that are not correct or that will hurt you or your testimony. Do not let this happen.

If you do not want to answer a question, do not ask the judge, hearing officer or board member whether you must answer it. If it is an improper question, your attorney will object for you. Do not ask the presiding officer, judge, or board member for advice.

Do not look at your attorney or at the judge, hearing officer, or board member for help in answering a question. You are on your own. If the question is an improper one, your attorney will object. If the judge, hearing officer, or board member then says to answer it, do so.

Do not hedge or argue with the opposing attorney.

There are several questions which are known as "trick questions." That is, if you answer them the way the opposing attorney hopes you will, he can make your answer sound bad. Here are two of them:

"Have you talked to anybody about this matter?" If you say "no," the hearing officer or board member, or a seasoned jury, will know that is not right because good lawyers always talk to the witness before they testify. If you say "yes," the lawyer may try to imply that you were told what to say. The best thing to say is that you have talked to Mr.________________, your lawyer, to the appellant, etc., and that you were just asked what the facts were. All he wants you to do is simply to tell the truth.

"Are you getting paid to testify in this appeal?" The lawyer asking this question hopes your answer will be "yes," thereby implying that you are being paid to say what your side wants you to say. Your answer should be something like, "No, I am not getting paid to testify; I am only getting compensation for my time off from work and the expense it is costing me to be here."

4. References

In addition to the above suggestions and guidelines, several additional references are available for further background:

Expert Witness and Environmental Litigation, J. L. Sullivan and R. J. Roberts, Journal of the Air Pollution Control Assoc., April 1975, Vol. 25, No. 4.

Environmental Litigation and the In-House Engineer, F. Finn; R.C. Heidrick; K. Thompson, Journal of the Air Pollution Control Assoc., Feb. 1977, Vol. 27, No. 2.

Essentials of Cross-Examination, Leo R. Friedman, CEB 1968.

EXPERT WITNESSES AND ENVIRONMENTAL LITIGATION

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Environmental legislation is developing rapidly. In addition, considerable attention is being given to the environmental impact of new technological developments. Governments as well as citizens, often through organized groups are placing unprecedented pressures on many industries and even on other parts of the government. Popular feeling has been extremely strong on such matters and resistance so far has not been strong. This is likely to change substantially and the future may see a rapid increase in the number of environmental suits especially if the continued existence of certain industries is threatened. Expert evidence will be needed to support government legislation and to support actions to preserve the environment. Such measures will have inevitable economic implications and will evoke predictable responses. Reconciling these viewpoints will provide a challenge for the community which will probably depend to a larger extent on interpretation in courts of law. The ability of various experts to give advice through the legal process will be essential if the most effective compromises are to be found. It is the purpose of this paper to discuss the gathering and use of such scientific evidence in environmental lawsuits.

Environmental legislation is developing rapidly. In addition, considerable attention is being given to the environmental impact of new technological developments. Governments as well as citizens, often through organized groups are placing unprecedented pressures on many industries and even on other parts of the government.

To a great extent, present forms of legislation still remain to be tested and to prove their effectiveness. Authorities on the whole have acted with restraint and where prosecutions have been launched the causes have been clear. As a result, suits relating to environmental problems have been comparatively few and in many cases have not been vigorously contested. Companies faced with prosecutions by governments for breaches of regulations have often admitted responsibility and received nominal punishment. In many cases, these settlements are private and unrecorded. Because of this dearth of litigation the need for expert technical witnesses has not been felt very strongly and comparatively little experience has been gained in the environmental area.

This situation is likely to change substantially in the future. Aided by what can only be regarded as an astonishing emergence of public awakening, environmental groups have scored major victories. These have, in some cases, had profound financial implications. Stronger government programs in air and water pollution control are also beginning to have more impact and to threaten the future economic well-being of some industries. As these trends continue and as more developmental projects are stopped or delayed by environmental actions there are bound to be more vigorous reactions from industry and other organizations.

The resulting upsurge in litigation will emphasize the need for more technical experts to assist in providing knowledge of the implications from both the environmental and the economic points of view. All kinds of experts will be required. Until recently, it could be almost taken for granted that expert witnesses in environmental litigation would be engineers or chemists. The types of cases which

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occurred were usually related to specific problems. However, in the past few years the question of the environmental impact of such developments as the supersonic transport, new airports, pipelines, power stations, dams, etc., have brought about marked changes. Biologists, ecologists and social scientists have become involved in legal suits often through a sense of commitment concerning the issues in dispute.

Expert Testimony in Environmental Litigation

Choice of Technical Expert

(i) *Who may qualify as a technical expert—and how to find him.* Generally, anyone who is "qualified by some special skill, training or experience"[1] can be an expert witness. "(T)he witness must have sufficient skill, knowledge or experience in that field or calling as to make it appear that his opinion or inference will probably aid the trier (of fact) in his search for truth."[2]

It is not essential that the witness be a scholar or specialist in his field. "The knowledge may in some fields be derived from reading alone, in some from practice alone, or as is more commonly the case, from both. While the court may rule that a certain subject of inquiry requires that a member of a given profession, as a doctor, an engineer, or a chemist, be called, usually a specialist in a particular branch within the profession will not be required."[3]

The question whether a person qualifies as an expert in a particular field is a matter for the discretion of the trial judge. For this reason—and also to enhance the credibility of their expert in the eyes of the trier of fact—most environmental lawyers choose to err on the side of over-qualification. They avoid the physicist or engineer who is a member of a concerned citizens' group and wants to volunteer his services. "A fellow who is just a volunteer, who does not have practical experience in the field, may be damaging as a witness because of weakness during cross-examination. He may be vulnerable as to his academic experience in the field, as to his practical experience in the field, or as to his empirical study of the problems at hand."[4]

When finances permit,[5] environmental lawyers will tend to select their technical experts on the basis of "academic credentials (to initially impress the judge or the decision makers), professional experience, and attitudes,"[6] the latter quality referring to the ability of the expert to refrain from coloring his testimony with socio-economic judgments adverse to the lawyer's position such as, "Industry should not have to do this."

Where to find these technical experts? There are many sources. Government agencies such as the Ontario Ministry of the Environment have a number of highly qualified technical experts who are their employees. However, while the government may find these experts useful in its own cases, there may be drawbacks to their usefulness to private litigants. For example, in Ontario it is virtually impossible for a government employed technical expert to testify concerning matters within the scope of his employment. The Ontario Public Service Act[7] provides that every civil servant must take an oath of secrecy that "except as I may be legally required, I will not disclose or give to any person any information or document that comes to my knowledge or possession by reason of my being a civil servant."[8] Similar prohibitions may also restrict the availability of experts who are employees of private industry.

More fertile fields in which to recruit competent expert witnesses include university faculties, private practitioners, consulting engineers, recent retirees from government and industry, and authors of technical books and articles. Many professional and technical societies maintain rosters of their membership by specialty. Societies in Canada maintaining such lists include, *inter alia*, the Chemical Institute of Canada and the professional engineering associations of many provinces.[9]

Finally, it has been suggested that when an environmental lawsuit requires more than one technical expert, it is advisable to "have one expert find another. You need someone whose judgment you can trust, because there are a lot of people, particularly in the air pollution field, who hold themselves out to be experts but who are just terrible at it ... One precaution, when you find your first good expert, is to give him the job of finding experts in related fields. He can do a much better job by checking professional reputations in the scientific community than you can by looking at a resume."[10]

(ii) *Delineating the field of expertise.* Many environmental lawsuits do require the services of more than one expert witness. They contain a range of technical issues much broader than the range of competence of any one expert. "The man who knows about radioactive emissions may not know about dissemination in the soil or the atmosphere; and those experts who are knowledgeable about dissemination may have no expertise in the health problems raised by the emissions. And so it goes down the line."[11]

As a result, it is necessary carefully to delineate the field of expertise of any one expert before he takes the stand. The opposition can open a sometimes fatal weakness in the environmental lawyer's case if the latter's expert offers an opinion in an area beyond his competence and then is made to look a fool on cross-examination. Karaganis suggests that to avoid this possibility, the lawyer should "(b)ring the experts in for staff conferences, for allocation of research functions, and have them try the case to (the lawyer) and to one another. One of the best methods of finding out the weaknesses in your case is to let a scientist posit his findings before a group of friendly but critical colleagues. Weaknesses will become very evident, and, believe me, pollution cases are not always solidly on the side of the (plaintiff) and against the defendant. The defendant very often has some good arguments."[12]

(iii) *Limiting factors.* Perhaps the most significant limitation on the lawyer in his choice of expert witnesses is finances. It has been said that .. "(c)ompetent experts will run between four and six hundred dollars a day."[13] and that "(s)everal hundred thousand dollars is not an uncommon expenditure in the development of environmental testimony. Such testimony is little different in terms of the money spent, because of the complexity of the issues involved, from patent litigation. Those ... who are familiar with the development of experts in patent litigation know how costly it can be .... We estimate that the cost of expert testimony in our big cases will run between twenty and thirty thousand dollars per case."[14]

If there are no funds from which to pay these large witness fees, the environmental lawyer may be required to fall back on concerned citizens' groups and conservation organisations for technical experts. As Sive points out, "there are numerous experts who are willing to contribute their time without charge because they are dedicated to the cause of conservation. The dedication exists to an inspiring degree among surprisingly large numbers of expert physical and social scientists and others who are officers, employees, or merely members of major conservation organizations or citizens' groups . . . "[15] The lawyer must keep in mind, however, that volunteer experts obtained through these channels may be particularly vulnerable during the cross-examination. To avoid opening weaknesses in his case, the lawyer should take special care to delineate these persons' fields of expertise and stay within those bounds during direct examination.[16]

It is possible that in important cases, some members of university faculties and others might be persuaded to testify without compensation. "Expert testimony in an important environmental litigation is a mark of prestige in almost anyone's curriculum vitae . . . . It is no derogation of the nobility and selflessness of those who have given many whole days and weeks, with no or ridiculously small compensation, to point out that such recognition may be helpful to the expert witnesses in intangible ways."[17]

Functions of the Technical Expert

(i) *Pre-trial.* In complex environmental litigation, the technical expert can fulfill a variety of important functions at the pre-trial stage. For this reason, the wise lawyer will retain his technical experts as far as possible in advance of the actual trial.

First, having his experts available early in the proceeding gives the lawyer a chance to make effective discovery against the polluter. The lawyer can be educated by the expert about the details necessary to make discovery effective, such as the nature and history of the industry involved; the technology available to correct the pollution problem; efforts, if any, by the industry to alleviate such pollution; the physical and chemical nature of the pollutants; the potential sources of the pollution within the offending plant; and the short and long-term biological effects of the pollutants. If the experts are not available to assist in discovery, important areas of investigation may be foreclosed.

Second, the expert brought in at the pre-trial stage of the litigation also has time to marshall hard evidence that may prove indispensable at trial, analyze the data already collected, and make recommendations for additional research or testing which might buttress the case against the polluter. The importance to courts of such hard evidence is highlighted in *Bortz Coal Company vs. Air Pollution Commission, Commonwealth of Pennsylvania* [18] In that case, the air pollution commission issued an abatement order which, in effect, required the coal company's coke ovens to shut down. The coal company took the Commission to court. In court, the Commission presented as its chief witness one of its own air pollution control engineers. In the words of the court:

> *This engineering witness testified, in addition to his qualifications, to a visit to the scene of Bortz's coke ovens . . and to his observations concerning the emission of smoke from the operation of Bortz's coke ovens . . . . From his observations, he testified that the smoke emissions were in excess of the permissible allowance of smoke as established by the Commission's regulation utilizing the Ringelmann Smoke Chart . . .* [19]

Those observations were rejected because the Commission's expert did not have any hard evidence to back them up. The court said:

> *The problem arises in that this witness, although admittedly an expert, for the purposes of this record did not make any stack tests, nor did he utilize any of the available instrumentation to measure the amount of falling particulate, emitting particulate or smoke density . The Commonwealth here, in effect is ordering the shutdown of Bortz's coke ovens This is no small matter To permit the Commission to order an abatement based solely upon the visual tests strikes at the heart of fairness* [20]

Third, the sooner the expert is able to impart to the lawyer a thorough understanding of the problems in the case the more successful the lawyer is likely to be in formulating and developing an effective trial strategy to implement in the courtroom. A thorough understanding of the technological problems involved can be invaluable to the lawyer in deciding what hard evidence to present, who should be his witnesses, the questions to ask and how far he should go in cross-examining the witnesses for the other side On this score, it has been pointed out that in environmental litigation it is necessary "that the attorney be as expert as, or more expert than the expert."

Lastly, the expert must sit down with the lawyer in a pre-trial conference and carefully prepare his own direct testimony. The lawyer will "try to have the expert well-prepared to present his subtle theories in as articulate and as concrete language as possible. The more vague and ethereal such testimony is, the more likely it is that the opposition's attempts at derision will be complemented and thus furthered, by the general psychological effect the witness has on the court."[21]

This is also the point at which "clashes of temperaments and techniques"[22] are resolved. "Such a conference acquaints both lawyer and witness with their respective methods of presentation, the issues considered crucial and the questions to be asked—in short a complete rapport resulting in a smooth convincing presentation.[23]

(ii) *Trial.* At trial, the technical expert has two principal functions:

- To give testimony interpreting the meaning of technological evidence for the benefit of the fact-finder, i.e., the judge or jury, and
- To give technical advice to the trial lawyer, particularly during cross-examination of the other side's experts.

By far the more important function is the first. The outcome of an entire environmental lawsuit may depend on the efficacy of such testimony. If the lawyer does not perceive the necessity for expert testimony on a particular issue or the pitfalls associated with using technical experts in such areas, the result could be disaster for his client.

Essentially, the subject matter to which expert testimony might be directed can be broken down into the following broad categories: (a) Causal connection; (b) Pollution control technology; (c) Breach of emission standards; (d) Injury; and, (e) Damages.

Each of these categories raises its own special set of problems which may dictate the use of an expert, as will be seen in the following text.

Causal Connection

In many environmental lawsuits, one of the most difficult matters to prove is that the defendant caused the injury. "Numerous scientific and technical problems arise in attempts to link activities of a given defendant allegedly causing pollution with plaintiff's claimed injury from that pollution."[24] These problems can arise in a variety of contexts, for example, showing that air, water or noise pollution from the defendant's operation and not the operations of his neighbors caused the injury; showing that an oil slick which damaged beaches or property came from a particular ship; or showing that health problems resulted from the defendant's pollution and not from disease. In such circumstances the technical expert may prove invaluable in either fingering or exculpating the defendant as the responsible party.

For example, in *Russell Transport Ltd. vs. Ontario Malleable Iron*,[25] technical experts used carefully gathered and documented evidence to prove that pollutants emitted into the air from the defendant's foundry operation caused the plaintiff's injury. The plaintiff corporation operated a new car storage yard adjacent to this foundry. A short while after commencing operations at this location, it came to the plaintiff's attention that the paint on a number of cars in the yard was becoming pitted and corroded. When a chemist inspected the damage on some of these cars, he found particles which were determined through microscopic examination to be "red iron rust, black iron scale, white cast iron, chilled cast iron, grey cast iron or malleable pearl cast iron particles, some of which were spherical in form, and manganese sulphide crystal, . . . particles incident to foundry operations."[26] To show conclusively that these particles came from defendant's foundry, special panels of steel painted in the same way as the cars[27] were exposed in various parts of the plaintiff's premises. After forty-six days the panels were examined and showed marked pitting. It was found that "(t)he plates which were exposed in areas on the plaintiff's property more remote from the defendant's plant show that the surface was affected to a lesser degree."[28]

Causation difficulties requiring the assistance of experts also have arisen in disputes over oil spills. For example, in *United States vs. Tanker Monsoon*,[29] the evidence of an expert witness showed conclusively that the *Monsoon* did not cause an oil spill that fouled a part of the Piscataqua River in New Hampshire, despite substantial circumstantial evidence indicating responsibility. The Coast Guard received a complaint of an oil spill in the river just as the *Monsoon* was finishing discharging a cargo of No. 6 Bunker Oil at a terminal in the same vicinity. There were no traces of oil around the Monsoon's hull or the pier, but she was the only tanker at any of the terminals and the spillage was No. 6 oil. On this basis, the *Monsoon* was charged by the Coast Guard with a violation of the Oil Pollution Act[30] and required to post a $10,000 bond and arrange for the clean-up of the pollution at her own expense before being permitted to set sail. At trial, chemical analysis of an expert "showed conclusively . . . that although the oil spillage was No. 6 oil, it was special Navy oil, an irony which was not pursued—and not the commercial grade carried by the Monsoon."

The testimony of experts on the issue of causation can become crucial in dealing with suspected injuries to health from environmental hazards which are sophisticated and not easily traced. There has been recent experience with this in Toronto in connection with high-lead blood levels, a condition which causes brain damage in children. In *Canada Metal Company Ltd. vs. MacFarlane*,[31] the Ontario Ministry of the Environment issued two stop orders essentially shutting down the plants of the Canada Metal Company and Roto-Cast Limited. "The stop orders were issued immediately after data showing some high-lead blood levels in persons residing near the Canada Metal plant had been received by the Air Management Branch . . . the City of Toronto's Medical Officer of Health."[32] However, the stop orders were quashed by the Supreme Court of Ontario after Dr. Henrietta Sax, a lead expert retained by the defendants testified on the companies' behalf. The Ministry of the Environment did not present any expert testimony in rebuttal, choosing to rely upon an affidavit of the Director of the Air Management Branch citing a staff engineer's report "that soil, vegetation and ambient air quality surveys in the vicinity of the Canada Metal Company plant had shown levels of lead considerably in excess of those found in normal urban environments."[33] The court dismissed this report, saying, "What possible evidentiary value is there in the words 'considerably in excess of those found in the normal urban environment'? There was no evidence as to what the lead levels were in a normal environment, let alone what the deponent in his own mind regarded as a normal urban environment. To say that lead levels in the soil, vegetation and ambient air in the vicinity of the Canada Metal Plant were in excess of those found in a normal urban environment, whatever that means, was absolutely worthless."[34] The court also rejected as unsubstantial, evidence cited in the affidavit of blood tests taken by Dr. Gordon Stopps, Senior Consultant, Environmental Health, for the Ontario Ministry of Health. "(T)he court laid great emphasis on the fact that, of 725 persons tested, 722 were in effect found not to have unsafe blood lead levels. In other words, on the basis of the affidavit, 99.6% of those tested living in the vicinity of the plant showed no unsafe blood lead levels. Even the reasons for high lead level content in the three persons were attributable, in some cases, to other causes."

Pollution Control Technology

It is not unusual for expert witnesses to be called upon to testify whether there is technology available which is capable of averting the pollution problem in question. Such testimony can make or break a case such as a nuisance action, where the relief sought is an injunction against emitting the offending pollutant. In the absence of technology capable of controlling the pollution an injunction might result in closing down the plant and throwing large numbers of people out of work—a prospect some courts find unthinkable. The problem as it exists in many courts in the U.S. was put this way:

> *(The prosecutor) must also show that technology exists capable of curing the problem, because whatever the vogue may become with regard to shutting down polluting industries, courts today are extremely reluctant to enjoin major economic activities. I am currently dealing with one industry in Illinois which employs eleven thousand people. There is not much dispute about the fact that they are causing serious environmental degradation. We demonstrated this to the court, and the court simply said to us, "If you think I'm crazy enough to put eleven thousand workers out of work, you're sadly mistaken." . . . The role of the public prosecutor, however, is to do everything possible to eliminate the emission source. Thus, in terms of proof, the big problem is not proving the pollution but showing that technology exists to deal with it. In every case in which I have been involved, that is the first question the judge has asked . . .*[35]

The question whether technology exists which is capable of curing the pollution problem is also important to Canadian courts, though perhaps to a lesser extent than in the

U.S. Before issuing a preliminary injunction, i.e., a temporary injunction against emitting the offending pollutants, Canadian courts follow the traditional American approach of "balancing the equities," a process which necessarily involves consideration of the overall social and economic effects of such action. Some Canadian courts have applied the same principles in determining whether to issue a permanent injunction. The importance that these courts attach to knowing whether there is technology available capable of alleviating the pollution problem is illustrated in the opinion of MacDonnell, J. A., in *Bottom vs. Ontario Leaf Tobacco*, where he stated:

> *The defendant's factory, employing it is said some two hundred men, has been equipped with every known device for preventing the escape of fumes and smells; it is impossible to avoid the discomfort caused to the plaintiff without stopping the operation of the factory altogether; to grant an injunction prohibiting the present nuisance would mean the closing of the plant, resulting not merely in loss to the defendant but in unemployment disastrous to a small community* .[16]

The court substituted money damages for the injunction.

On the other hand, there have been Canadian cases issuing permanent injunctions against pollution by large industrial operations without even considering whether technology exists capable of alleviating the problem. A classic example is the case of *McKie* vs. *The K.V.P. Co. Ltd.*,[17] where the court, with no idea whether technology capable of curing the pollution problem was available, permanently enjoined a kraft paper mill in the Town of Espanola "from depositing foreign substances or matter in the Spanish river which alter the character or quality of the water flowing over the lands of the plaintiff."[18] In so doing, the court apparently followed the English tradition in granting permanent injunctive relief which eschews as a function of the legislature and not the judiciary consideration of the question whether the exercise of the rights of the plaintiff should be subjugated to the economic interests of the defendant or the community. Several other Canadian cases have taken the same tack.

A noted Canadian authority suggests that this apparent conflict in the approach of Canadian courts towards issuing permanent injunctions is tending to resolve itself in favour of the English tradition.[19] But even if this prediction proves to be correct, Canadian courts cannot help but be influenced by the potential economic impact of decisions affecting major industries. It appears that for this reason alone, the expert witness will continue to be called upon to testify whether technology exists capable of curing the pollution problem under examination.

Breach of Emission Standards

One of the least complex issues calling for the evidence of a technical expert is the question whether a statutory emission standard or regulation has been breached. The issue is usually cut-and-dried—was the level of the pollutant greater than that prescribed in the standard? The services of an expert are required because many pollutants cannot be detected and measured without sophisticated equipment and techniques.

For example, in air pollution cases it is often necessary to undertake stack sampling, a complex technique for determining what pollutants are emitted into the air. An access, usually an outside ladder, must be erected along the side of the smoke stack. Then an opening of approximately 14 in. in diameter must be made into the walls of the stack in order to insert the probe. Once the smoke is collected it must be analyzed in a laboratory to determine if any statutory limitations have been exceeded. If the plaintiff does not have access to the stack, he may undertake a complex testing program using elaborate equipment at the receiving end of the pollution. This is what took place in the *Russell Transport* case,[40] where an analysis of the dust deposits at the receiving end proved that the defendant was responsible for the damage.

Some tests which appear relatively simple to perform create many problems when a layman attempts to present the results as evidence. One of these deceptively simple tests involves the measurement of smoke density using a Ringelmann Chart. The chart comprises a number of shaded squares which represent various densities of smoke. The instructions inform the operator that he must stand with the sun at his back, hold the chart at arm's length and match the shaded area with the smoke emerging from the stack. Recently, it has been suggested that any citizen using the smoke density chart may give evidence at trial.[41] However, to be sure of having this evidence given its full weight, it is advisable to have an expert conduct the test. "Convictions are difficult to obtain because of the notorious inaccuracy of the Ringelmann opacity test. Light conditions, position of the observer, and diameter of the emission stack are factors which can be raised to cast substantial doubt upon the validity of the test. The (plaintiff) must be extremely careful to properly prove that the particular testing device employed is the one referred to in the legislation."[42]

Beyond the practical reasons for having an expert testify there may also be legislative restrictions on who may present evidence. For instance, under Regulation 15 of the Ontario Air Pollution Control Act[43] only a provincial officer may rely upon the smoke density chart to enforce the Act.[44] Similar restrictions exist in some states of the U.S. One such restriction, a practice of the Colorado State Department of Health restricting the certification of experts in the use of Ringelmann opacity readings to employees of the State, was recently struck down by the Colorado District Court.[45]

Injury

The fact of injury is not always obvious and expert testimony might be required to prove that injury did occur. Medical experts often are called to testify on this issue when the activity of the defendant is alleged to be a health hazard. The difficulty with respect to injury to health is that the precise harm from exposure to a pollutant, even in quantities exceeding established limits, might not be detectable or might masquerade as another ailment.

A good example of how medical experts can be used conclusively to prove injury from the pollution of the defendant occurred in *Maryland* vs. *Galaxy Chemical Co. Ltd.*[46] In that case, Galaxy Chemical was emitting into the surrounding atmosphere benzene, methylene chloride and methyl ethyl ketone fumes. These fumes had little odor and were substantially undetectable in the surrounding area without scientific instruments. A number of persons residing in this area complained of headache, nausea, drowsiness, and abdominal pain. However, the majority of persons in the neighborhood, some of whom lived next door to the plant, had no such complaints. If this were the only evidence of injury offered at trial, the action of the State of Maryland would have failed. The court would have concluded that there was no injury, that the complaints of the neighbors were the result of suggestion or attributable to causes other than the fumes from the plant.

The state clinched its case with testimony from medical experts which not only linked the ailments complained of by the neighbors with the fumes from the plant but also suggested that the absence of symptoms in others did not mean that they were unaffected. Three different medical doctors testified that they had examined a number of the complaining neighbors and their laboratory tests confirmed that these people were suffering from pancreatitis, an ailment that can damage the pancreas and lead to diabetes. One of these experts testified that "(i)t was her opinion that the operations of Galaxy Chemical Company were adversely affecting the health of the Valley residents. This opinion was based on several being sick at the same time in the nature of an epidemic and the laboratory abnormalities when present in the Valley which upon leaving became normal again as the patient felt better and improved generally."[47] Each of these experts also testified, in effect, that "(o)ne can have pancreatitis without symptoms and without knowledge." The State was able to extract a similar statement from Dr. Goldstein, a medical expert called on behalf of Galaxy. On the basis of this evidence, the court found:

> *(T)hat the present method of operation of Galaxy Chemical Company constitutes a nuisance . . . Without concluding positively that the present method of operation is a hazard to health, the Court concludes that it may be a hazard to health . . .*[48]

The Court enjoined the company "from emitting into the air beyond its property lines, gases, vapours, odors, which are or may be predicted by reasonable certainty to be injurious to human, plant or animal life or property. . . ."[49]

The chances of success on the issue of injury to health appear to be considerably reduced when medical experts are in doubt as to the *specific* injury caused by a pollutant, even though it is generally accepted that excessive exposure to the pollutant is unhealthy. This lesson was learned by the plaintiffs in *Allyn vs. United States*,[50] where the plaintiffs were denied relief, even though they had proven that they had unusually high carbon monoxide loadings in their blood resulting from repeated exposure to atmospheric carbon monoxide levels exceeding the limit regarded as acceptable by the American Conference of Governmental Industrial Hygienists.[51] The court rejected the claim of the plaintiffs, stating:

> *The Medical experts who testified for the plaintiffs and for the defendant . . . were in agreement that, in the light of the present state of medical knowledge, it cannot be stated positively that carboxyhemoglobin percentages within the range of those reflected by the present record will have a harmful effect on the persons involved, irrespective of whether such persons are non-smokers or smokers. The plaintiffs' expert would merely say that, as to non-smokers, there is a possibility that toxic effects occurred from the levels of carboxyhemoglobin that were reached in the non-smokers . . . He was not prepared to go even this far with respect to the possibility of harmful effects on the smokers. As previously stated, the plaintiff Hurt is a heavy smoker . . .*[52]

The Court concluded "that the plaintiff Hurt has failed to prove that his duties . . . have caused him to be 'exposed to dangerously high concentration of carbon monoxide,' which 'are likely to cause serious disease or fatality'."[53]

Damages

Where money damages are claimed, it is necessary for the court to calculate in terms of cash the extent of the loss suffered by the plaintiff and it is not uncommon for expert witnesses to be called upon by the parties to assist the court in this task. For example, medical experts might be requested to estimate the degree of physical impairment, etc., resulting from a toxic dose of a pollutant.[54] Or real estate experts might be called upon to estimate the drop in market value of property which has deteriorated either physically or aesthetically at the hands of the defendant.[55]

It is important to distinguish the question of damages from the question of injury. Sometimes, the failure of a lawyer or expert to separate these issues in his own mind can affect the witness' credibility resulting in harm to the lawyer's case. This is particularly true in cases where injury itself is in dispute—there is no loss to measure in terms of cash if there is no injury. For example, in *Kamo Electric Cooperative Ltd vs. Cushard*,[56] an expert witness who apparently failed to distinguish damages from injury testified at one point that "(h)e did not think the value of any real estate is ever affected by the appearance of power lines." At the same time, he "put the before and the after values (of the farm affected by the power lines) at $51,700 and $50,150 total damage of $1,550." Needless to say, the electric cooperative that called him as its expert witness lost the case.

Advisory Function.

The usefulness of a technical expert at trial is not confined to giving testimony. The technical expert is also useful as an advisor to the lawyer throughout the course of the trial. Having his expert "on call for momentary advice on technical points . . . particularly when examining the opposing expert"[57] can be a boon to the lawyer faced with unanticipated evidence or a response he doesn't quite understand.

Also, keeping the technical expert on hand throughout the trial facilitates communication between the lawyer and expert so that at the end of the trial day, they can quickly "recap the events of the day, discussing ways to strengthen the weak areas and capitalize on the strong points thus far developed."[58]

Moreover, the technical expert who is available to observe all of the proceedings at trial prior to taking the stand will often be able to present his evidence more effectively. This is usually the case when the opposing experts testify first. The technical expert then has an opportunity to understand the techniques used by the other side for complex measurements such as calculation of optimum chimney height. Technical witnesses who take the stand without understanding the techniques used by the other side may well give testimony which will serve only to confuse the court and unjustifiably cause them to appear incompetent.[59]

Credibility and Flaws in Expert Testimony

The testimony of a technical expert is worthless if it is not believed, and, in general, most courts are inclined to be skeptical of expert opinion. As a result, the credibility of the expert becomes a major issue in almost every case. The lawyer for the other side can be expected to prod on cross-examination every aspect of the technical expert's presentation.[60] If he finds a flaw he will relentlessly pursue it in an attempt to hurt irreparably the cause of the side that called the expert. Such flaws are commonly found

In the manner in which the expert presents his testimony;
In the use by the expert of dubious testing equipment or procedures; or,
In a conflict between the testimony of the expert being exami..ed and the testimony of another expert.

Some experts have been so emotionally wrenched by such attacks that they are paranoid about taking the stand again. This need not happen; the credibility issue may not be a stumbling block to success if the lawyer and his expert properly prepare before the latter takes the stand.

It is no secret that generally courts do not trust the opinion of technical experts. This bias is aptly illustrated in cases where courts have been confronted with conflicts between the scientific evidence of experts and the practical evidence of lay witnesses. For example, in *Southern Canada Power Co Ltd* vs. *The King*,[61] the Supreme Court approved a lower court judgment in which lay testimony of residents in the area as to the cause of a rush of water and ice that washed out a railway embankment was accepted over conflicting expert testimony as to causation. Mr. Justice Davis stated in his opinion that it could be appreciated if the trial judge has disregarded the expert opinion and relied solely upon the testimony of the lay witnesses. Similarly, in *Canadian Copper Co.* vs. *Lindala*,[62] the Ontario Court of Appeals affirmed a trial court opinion preferring the testimony of eye witnesses that crop damage resulted from sulfur fumes from the defendant's plant over the testimony of technical experts that the damage resulted from disease and not the sulfur fumes.

In cases where both sides present expert evidence, this natural bias against trusting expert opinion can crystallize into complete rejection of the opinion of one side's expert if there are flaws to be found in his presentation. Even the expert's looks, mannerisms, and speech are important. They may be attacked if the other side believes that they fail to convey an image of competence and sincerity. As Sive points out, "(o)ne of the most significant . . . problems involves the degree to which opposing counsel will attempt to portray the witness as a composite of several objects of derision, among which are the feminized male, the unworldly sentimentalist, the professor who has never met a payroll, the enemy of the poor who need more kilowatts and hard goods, and the intellectual snob."[63]

The expert's attitude on the stand may also destroy the impact of his testimony. If he appears to be arrogant or argumentative, he risks having his testimony discounted altogether. An example of the harm assuming such a stance can do occurred in *McKie* vs. *The K V P Company Ltd*.[64] In that case, Mr. Justice McRuer, complaining that some of the expert witnesses called for the defendant found it difficult to distinguish between the function of a witness and those of an advocate, rejected outright these witnesses' scientific evidence. He took refuge in the opinion of Sir G. J. Turner, L.J. in *Goldsmith* vs. *The Tunnbridge Wells Improvement Commissioners*[65] which stated, in effect, that with all due respect to scientific gentlemen their scientific examination must have depended much on the state of circumstances which existed at the times of investigation, the force of the stream, the state of the weather, etc. On this basis, he concluded that these experts' scientific evidence was secondary to other evidence as to the facts.

The credibility of a technical expert may also be undermined on cross-examination if the other side can force him to admit that there might have been a defect in his testing procedure or equipment. A good example of this occurred in *Nelson* vs. *C & C Plywood Corporation*,[66] a nuisance action in which the plaintiffs claimed that their well had been poisoned by phenols deposited in the groundwater at the defendant's plant. "(T)he defendant had an engineer testify as to the direction of flow of the groundwater and his conclusion was that the direction was away from the Nelson well." However, the court discounted this testimony when the other side brought out on cross-examination "that the tests he had made were at high-water time." Another expert for the defendant, a chemist, "testified that the phenols found in the Nelson well were not the same phenols deposited by (the defendant)." His testimony was likewise discounted when opposing counsel brought out on cross-examination that "there could have been chemical reaction with other minerals and chemicals in the ground so that the phenols in the well may have a different chemical composition than when deposited (by the defendant)."[67]

Credibility problems commonly crop up when there is a conflict in testimony given by different experts. This can happen quite inadvertently, as when different technical experts are called to give evidence on optimum chimney height. Even in simple cases involving flat terrain the available methods of calculation of chimney heights based on numerous theoretical predictions and empirical observations are very doubtful. Two experts could arrive at such divergent values as to confuse hopelessly a court attempting to resolve, for example, a difference on a specific height between a government authority and an industry. Where the topography of the site is not flat or where the many other possible complicating factors exist the problem is still more confusing. The experts on both sides of a case may be able to feel that they are presenting the truth and will argue in favour of assumptions which suit their purpose.[68] Experiences in court giving evidence on atmospheric diffusion and the calculation of chimney heights are bound to evoke unpleasant memories in any technical witness who has been concerned in them.

The key to avoiding all of these stumbling blocks is preparation and attention to detail. Before he takes the stand, the expert should take pains not to look seedy or *radical*. "Experience has shown that a conservative image is most impressive to the jury, instilling the idea that your expert is a man of great sincerity, competence and integrity. His appearance will be restrained, sans long hair, beard, mod dress and wire rims. His deportment will be quiet, yet self-assured, courteous and poised. . . . His diction should be articulate and understandable to the farthest juror without the aid of a public address system . . . ."[69]

The expert should be reminded "to answer simply and truthfully, not to argue, not to regard cross-examination as a game of wits, not to attempt to figure out whether an answer will be helpful or harmful, and to leave strategy and tactics to the lawyers."[70]

The testimony of the expert should be cast, as far as is possible, in lay language and should proceed in a logical fashion readily understandable to laymen. "The jury will remember little, if any, of testimony given in highly technical jargon."

"It is important that, while obtaining from an expert his opinion, he also states his reason for it. If part of those reasons is based on an exhibit you should have that exhibit identified at the time, as an expert is unlikely to be testifying again in the Court of Appeal."

"It is important that continuous reference be made to the empirical tests, investigations, etc carried out by your witnesses, for such data will have more impression on the jury . . ."[71]

As to the tests performed by the expert, care must be taken that they are carried out in an unimpeachable fashion with reliable equipment. The expert should have on hand detailed accounts of the conditions under which each test was performed, *e g.*, temperature, wind velocity, atmospheric conditions, etc. In addition, the expert should be present, if possible, throughout the trial in order to be better equipped to explain any apparent contradictions between his own testimony and that of other experts giving evidence in the same proceeding.

Conclusion

Environmental litigation is about to mushroom—and with it, the number of scientists entering the court room as expert witnesses. "The social-values and social-conflicts questions, resulting from the 'good guys versus the bad guys' issues, will increasingly give way to factual issues in which the scientists' participation becomes more and more important."[72] More than ever before, lawyer and scientist will be melding their talents to produce hopefully convincing presentations to put before the courts. Their success in meeting this challenge will depend on how well both understand the role of the technical expert in environmental cases.

References

1. *Rex v German*, (1947), Ontario Reports 395, (1947), 4 Dominion Law Reports 69.
2. McCormick on Evidence, at 30 (2nd ed. 1972)
3. *Idem, See Rice v Sockett*, (1913), 27 Ontario Law Reports 410, 8 Dominion Law Reports 84 (H C.), where the court stated that not only a consulting engineer but also persons engaged in cement construction and concrete work were to be classed as experts. *See also, Re Winnipeg Golf Club*, (1928), 3 Dominion Law Reports 522 (Man C A); *Marchyshyn v Fane Auto Works Limited*, (1932), 4 Dominion Law Reports 618 (Alta. C.A.) Regarding the absence of necessity for a specialist in a particular branch within the profession, *see McCaugherty v Gutta Percha & Rubber Co* (1903), 2 Ontario Weekly Reports 204 (C.A).
4. Karanganis, Public Suits *The Search for Evidence*, in Hasset, Environmental Law at 56 (Institute of Continuing Legal Education, University of Michigan, 1971)
5. *See* later text and accompanying footnotes.
6. Karanganis at 57; Klein suggests that "(i)n establishing your experts' credibility, it has been found valuable if a general outline is followed which lists systematically such items as name, residence, occupation, place of work, education, chronological experience, licenses, professional affiliations, authorships, lectures, etc. The expert will respond best if given sufficient latitude to expand each topic in a terse but narrative style, elaborating as necessary, to cover the facts completely and authentically, with emphasis to suit the case requirements." Klein, Making the Most of Your Expert, 46 Conn. B.J. 483, 491, (1972).
7. Revised Statutes of Ontario 1970, c. 386
8. *Idem*, Section 10(1); certainly, a government-employed technical expert may be subpoenaed by the court and required to give opinion evidence concerning matters within the scope of his employment, even though he is directed by his agency to refuse to testify. *Re Diamond and the Ontario Municipal Board*, (1962), Ontario Reports 323, (C A.) However, his information normally will not be available until trial—a severe drawback to adequate preparation and presentation of the case.
9. Technical societies in the United States which may be sources of expert witnesses include the "ASME, ASCE, ASTM, ASM, ASSE, . . as well as the professional societies, including NSPE, CEC, AICE, AIA, . Institutes include such organizations as NSC, AISC, ANSI Members of their respective Code Committees are an excellent source of expertise." S. J. Klein, *Making the Most of Your Expert* 46 Conn B. J. [illegible] (1972)
10. Karanganis, *Public Suits The Search for Evidence* Reference 4, at 58 59 Hadden suggests that "(t)here are many sources of technological information which a lawyer should read in order to be able to talk to his experts and cross examine the defendants intelligently For example local Tuberculosis and Respiratory Disease Association offices can be very helpful in supplying technical articles or suggesting where they can be found The United States Department of Health Education and Welfare publishes long lists of abstracts which may provide useful information, and the local pollution control agency may be useful . . " D Hadden *Private Damage Suits* in C Hassett, *Environmental Law* at 43-44 (Inst. Cont. Leg Ed Ann Arbor 1971)
11. Joseph L. Sax, *New Direction in the Law*, in Hassett *Environmental Law*, at 6-7, (Inst. Cont Leg. Ed., Ann Arbor Mich 1971).
12. Karanganis, *Public Suits The Search for Evidence* Reference 4 at 59
13. Karanganis, *Public Suits The Search for Evidence* Reference 4, at 60 Sive estimates the range to be "from three hundred to seven hundred fifty dollars per day plus expenses" D Sive, *Securing, Examining, and Cross Examining Expert Witnesses in Environmental Cases*, 68 Mich Law Rev 1175 at 1180
14. Karanganis, Reference 4 at 57-60
15. Sive, Reference 13, at 1180
16. *See* later text.
17. Sive, at 1180
18. 279 A. 2d 338 (Pa. Cmwlth, 1971)
19. *Idem*, at 397.
20. *Idem*, at 398.
21. Sive, *Securing, Examining, and Cross-Examining Expert Witnesses in Environmental Cases*, at 1191, Michigan Law Review (1970)
22. *Idem*, Such clashes may be common, resulting from an unfortunate lack of communication between the scientific and legal communities. A survey of the legal community conducted by the Oak Ridge National Laboratory in 1971 highlighted the gap between law and science "Many respondents perceived scientists and engineers to be narrow in their social outlook and provincial in their approach to problems:

    Scientists tend to specialize in professional subareas and the positions they advocate fail to recognize the broader general implications.

    Most scientists remain academicians, aloof from the community

    Scientists . . . tend to measure human responses by slide rules

    . . their political notions are absurd.

    "The veracity and objectivity of scientists and engineers were questioned by a large proportion of the respondents

    Scientists are often arbitrary about matters, believing that they have the only set answers . . (t)he information is inaccurate, based on individual opinion rather than fact.

    Scientists' attitudes are influenced by the propensities of their employers.

    Scientists are too dogmatic, visionary and impractical in their discussion of ecological problems . . . (those) who are environmentalists are too emotional to provide the practical ideas needed.

    Scientists tend to extend their *expertise* in environmental matters into areas of politics and society which are beyond their competence. . ."

    J. Curlin, *Law, Science, and Public Policy: A Problem in Communication*, in W. Thomas, *Scientists in the Legal System* at 40-41, (Ann Arbor Science Pub. 1974).
23. A. Maloney, Q C., *Expert Evidence in Defending a Criminal Case*, at 84, (Law Soc. of Upper Canada Special Lecture Series 1969).
24. J. MacDonald & J. Conway, *Environmental Litigation*, at 161 (University of Wisconsin 1972).
25. (1952) 4 Dom. L.R. 721 (Ont. H.C.)
26. *Idem*, at 723.
27. These panels were furnished by General Motors of Canada, the manufacturer of the new cars stored on the plaintiff's premises.
28. (1952) 4 Dom. L.R. at 728. This evidence might have been improved, for example, by comparing the quantitative rates of deposition on the plaintiff's property with locations in the same general area but more remote from the foundry As a rule, such emissions are relatively coarse and tend to settle

within a distance of a few hundred feet of the cupola. This may have forestalled a possible defence that the plaintiffs were also near to the Canadian Pacific Railroad. Emissions from steam locomotives often contain large particles which can be corrosive. This was mentioned in the proceeding but the defendant did not effectively press this point as an alternative explanation for the damage. One technical witness called by the defendant was obviously ineffectual. He apparently did not satisfy the court that he was sufficiently familiar with the instrument for measuring sulfur dioxide and moreover kept no proper record of wind direction.

29. Environmental Reporter 1707, Vol. 1, No. 7661 (1st Cir. Oct. 21, 1970).
30. United St. Code, Vol. 3, Section 431-437.
31. (1974) Ont. R. 577.
32. II Canadian Environmental Law News 161 (1973).
33. *Idem*, at 164.
34. *Idem*, at 164.
35. Karanganis, *Public Suits: The Search for Evidence*, supra, n. 10 at 50-51.
36. (1935) Ont. R. 205 (C.A.), (1935) 2 Dom. L.R. 699. *See also Canada Paper Co. v. Brown* (1922) 63 Sup. Court Rep. 243, 66 Dom. L.R. 287; *Belisle v. Canadian Cottons Ltd.* (1952) Ont. Weekly Notes 114 (H.C.), (1947) 2 Dom. L.R. 840; *Chadwick v. Toronto* (1914), 32 Ont. L.R. 111 (H.C.), aff'd by C.A., 32 Ont. L.R. 115; *Ramsay v. Barnes* (1913), 5 Ont. Wkly Notes 322.
37. (1948) 1 Dom. L.R. 201 (Ont. H.C.), aff'd by S.C.C. (1949) S.C.R. 698.
38. *Idem*, at 219. However the court's action did not have as much dash as the quoted passage at first blush might indicate. The court suspended the injunction for six months "in order to give the defendant an opportunity to provide other means of disposal of its noxious effluent." *Idem*, at 220. Later, the Parliament of Ontario issued a special act permitting K.V.P. to continue operating.
39. McLaren, *The Common Law Nuisance Actions and the Environmental Battle—Well-Tempered Swords or Broken Reeds?* 10 Osgoode Hall L.J. 505, 552-556 (1972).
40. *Russell Transport v. Ontario Malleable Iron Co. Ltd.*, Ref. 26.
41. D. Estrin & J. Swaigen, *Environment on Trial* (New Press 1974).
42. A. Lucas, *The Role of the Public*, 6 University of British Columbia Law Review (1971).
43. Revised Regulations of Ontario 1970 Reg. 15, Sec. 7, Sub-Section 3.
44. Some suggest that this regulation may be invalid "as there is nothing in the (Environmental Protection Act) itself to authorize a regulation restricting the common law right of a citizen to testify on such an everyday occurrence." *Environment on Trial*, Ref. 42.
45. *Western Alfalfa Corp. v. Air Pollution Variance Board of the State of Colorado*, 3 Environment Reporter Cases 1199 (Col. D. Ct. 1971).
46. 1 Env. Reporter-Cases 1661 (Md. Cir. Ct. 1970) *permanent injunction entered*, 2 Env. Reporter-Cases 1199, (Md. Cir. Ct. 1971).
47. *Idem*, at 1662.
48. *Idem*, at 1666.
49. *Idem*, at 1668.
50. 461 Federal Reporter, 2nd Series, 810 (Ct. Cl. 1972).
51. That level is 50 parts of carbon monoxide per million. It was noted in *Maryland v. Galaxy Chemical Co. Ltd.*, that "in Washington, D.C., for the general population they have adopted a figure of 20 parts per million of carbon dioxide." *Id.* at 1662.
52. *Idem*, at 817.
53. *Idem*. Courts may be reluctant to conclude that some sort of injury must have resulted from over exposure to pollutants because of uneasiness regarding the way in which the so-called "safe" limits might have been set. They may feel that such limits were set on the basis of skimpy evidence of harm or as the result of highly subjective judgments. Some commentators believe that there may be grounds for such suspicions. *See*, for example, the conclusion of J. Hewings in *Water Quality and the Hazard to Health*, University of Toronto, 1968.
54. *See* the discussion of *Allyn v. United States*, Reference 50.
55. *See*, for example, *Kamo Electric Cooperative Ltd. v. Cushard*, 455, South West Reporter, 2d 513 (S. Ct. Mo. 1970).
56. *Idem*.
57. Klein, *Making the Most of Your Expert*, 48 Conn. B.J. 483, 489 (1972). "A chemical engineer, for example, can help with discovery by drafting interrogatories and making the results understandable." D. Hadden, *Private Damage Suits*, in Hassett, *Environmental Law* at 64 (Inst. of Cont. Leg. [illegible] Arbor, Mich. 1971).
58. *Idem*.
59. Note that the lawyer must take care in framing questions [illegible] ask his expert if the latter's opinion is required on [illegible] evidence adduced in his presence at trial. In such circumstances the court, in its discretion, may require the lawyer either to make clear the evidence on which the expert is being requested to base his conclusion or to put his questions in hypothetical form. The reason for imposing this requirement was expressed by the Supreme Court in the following words:

    In cases where the expert has been present throughout the trial and there is conflict between the witnesses, it is obviously unsatisfactory to ask him to express an opinion based upon the evidence which he has heard because the answer to such a question involves the expert in having to resolve the conflict in accordance with his own view of the credibility of the witnesses and the jury has no way of knowing upon what evidence he bases his opinion. When, however, there is no conflict in the evidence, the same difficulty does not necessarily arise and different considerations may therefore arise. ... *Bleta v. The Queen* (1964) S.C.R. 561, 565, 48 Dom. L.R. (2d) 139.

60. "(T)he scientist who accepts the role as expert witness must be aware of the tactics commonly employed during courtroom litigation by opposing attorneys. The most common of these, of course, is an attempt to demean the witness or to make him look silly by confusing him or by asking him apparently simple questions that he cannot answer. Actually, what the opposing attorney does, and this is certainly no trade secret, is to state the factual situation to the expert over and over again but each time picking away at it by slightly changing the circumstances upon which the expert bases his opinion. ..." D. Sive, *Scientists in the Courtroom*, in W. Thomas, *Scientists in the Legal System* at 105-106 (Ann Arbor Science Pub. 1974).
61. (1936), S.C.R. 4, 1 Dom. L.R. 331. The expert witnesses [illegible] disagree among themselves as to the theoretical scientific evidence given.
62. (1920) 51 Dom. L.R. 265 (C.A.). *See Re Hum Fong [illegible]* (1957), O.R. 220 (C.A.) where the same principle was applied in resolving a conflict between lay and expert testimony. [illegible] *Casson v. Haig* (1914) 7 Ont. Wkly. Notes 267 (C.A.) Re [illegible] Ont. Wkly. Notes 437, 26 Ont. Wkly. Reports 696.
63. Sive, at 11.
64. Reference 37.
65. (1866) Law Reports Vol. 1, Chancery 349 at 353.
66. 1 E.R.C. 1131 (S. Ct. Mo. 1970).
67. *Idem*. *See Also* the discussion of *Bortz Coal Co. v. Air Pollution Commission* in text, and the discussion of *A. P. Weaver v. Sanitary Water Board*, Env. R.C. 1497 (Pa. Cmwlth. 1971) where the court invalidated the board's revocation of a mine drainage discharge permit because there were no dye tests performed which might have conclusively shown a causal connection between the mining operation and the pollution of a stream. The court said:

    We are by no means certain of the efficacy of dye tests in this situation or even if such tests are still possible, but it would seem that traces of dye might have surfaced in the Kiser spring had dye been placed, at different times, for example, in the open pit ... and at the exploratory hole five yards to the south of the spring. This may well have yielded conclusive evidence and made unnecessary the bulk of speculative testimony which comprises much of the record. ... *Idem*, at 1501.

68. As a supposition a chimney may be needed to dilute a toxic gas which occurs only in a very rare situation, if at all. It may then be that winds which blow from a significant direction might occur only a small proportion of the time. In calculating heights of chimneys six atmospheric stability categories ranging from A to F are possible. The last is representative of extremely stable air and is the most unfavourable but occurs rarely. Category D representing average stability at nighttime usually is accepted for calculations. Use of this factor could result in a much lower chimney height at less cost though the small risk would be, at least, theoretically greater. On such an issue a cautious expert may be at some difference with another one even if the second uses the same basic formula.
69. Klein, Reference 57, at 493.
70. Sive, Reference 21, at 1194.
71. A. Maloney, Q.C., *Expert Evidence in Defending a Criminal Case*, at 95, (Law Soc. of Upper Canada Special Series 1969).
72. D. Sive, *Scientists in the Courtroom*, in W. Thomas, Scientists in the Legal System, at 104 (Ann Arbor Science Pub. 1974).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

11 APR 1979

MEMORANDUM

OFFICE OF ENFORCEMENT

TO: Regional Administrators
Surveillance and Analysis Division Directors
Enforcement Division Directors

FROM: Assistant Administrator
for Enforcement

SUBJECT: Conduct of Inspections After the Barlow's Decision

I. Summary

This document is intended to provide guidance to the Regions in the conduct of inspections in light of the recent Supreme Court decision in Marshall v. Barlow's, Inc., ___ U.S.___, 98 S. Ct. 1816 (1978). The decision bears upon the need to obtain warrants or other process for inspections pursuant to EPA-administered Acts.

In Barlow's, the Supreme Court held that an OSHA inspector was not entitled to enter the non-public portions of a work site without either (1) the owner's consent, or (2) a warrant. The decision protects the owner against any penalty or other punishment for insisting upon a warrant.

In summary, Barlow's should only have a limited effect on EPA enforcement inspections:

- o Inspections will generally continue as usual;
- o Where an inspector is refused entry, EPA will seek a warrant through the U.S. Attorney;
- o Sanctions will not be imposed upon owners of establishments who insist on a warrant before allowing inspections of the non-public portions of an establishment.

The scope of the Barlow's decision is broad. It affects all current inspection programs of EPA, including inspections conducted by State personnel and by contractors. The Agency's procedures for inspections, particularly where entry is denied, were largely in accord with the provisions of Barlow's before the Supreme Court issued its ruling. Nevertheless, a number of changes in Agency procedure are warranted. Thus, it is important that all personnel involved in the inspection process be familiar with the procedural guidelines contained in this document.

This document focuses on the preparation for and conduct of inspections, including (1) how to proceed when entry is denied, (2) under what circumstances a warrant is necessary, and (3) what showing is necessary to obtain a warrant.

II. Conduct of Inspections

The following material examines the procedural aspects of conducting inspections under EPA-administered Acts. Inspections are considered in three stages: (1) preparation for inspection of premises, (2) entry onto premises, and (3) procedures to be followed where entry is refused.

A. Preparation

Adequate preparation should include consideration of the following factors concerning the general nature of warrants and the role of personnel conducting inspections.

(1) Seeking a Warrant Before Inspection

The *Barlow's* decision recognized that, on occasion, the Agency may wish to obtain a warrant to conduct an inspection even before there has been any refusal to allow entry. Such a warrant may be necessary when surprise is particularly crucial to the inspection, or when a company's prior bad conduct and prior refusals make it likely that warrantless entry will be refused. Pre-inspection warrants may also be obtained where the distance to a U.S. Attorney or a magistrate is considerable so that excessive travel time would not be wasted if entry were denied. At present, the seeking of such a warrant prior to an initial inspection should be an exceptional circumstance, and should be cleared through Headquarters. If refusals to allow entry without a warrant increase, such warrants may be sought more frequently. (For specific instructions on how to obtain a warrant, see Part D.)

(2) Administrative Inspections v. Criminal Investigations

It is particularly important for both inspectors and attorneys to be aware of the extent to which evidence sought in a civil inspection can be used in a criminal matter, and to know when it is necessary to secure a criminal rather than a civil search warrant. There are three basic rules to remember in this regard: (1) If the purpose of the inspection is to discover and correct, through civil procedures, noncompliance with regulatory requirements, an administrative inspection (civil) warrant may be used; (2) if the inspection is in fact intended, in whole or in part, to gather evidence for a possible criminal prosecution, a criminal search warrant must be obtained under Rule 41 of the Federal Rules of Criminal Procedure; and (3) evidence obtained during a valid civil inspection is generally admissible in criminal proceedings. These principles arise from the recent Supreme Court cases of *Marshall v. Barlow's, Inc.*, *supra*; *Michigan v. Tyler*, ____ U.S.____, 98 S.Ct. 1942 (1978); and *U.S. v. LaSalle National Bank*, ____ U.S.____, 57 L. Ed. 2d 221 (1978). It is not completely clear whether a combined investigation for civil and criminal violations may be properly conducted under a civil or "administrative" warrant, but we believe that a civil warrant can properly be used unless the intention is clearly to conduct a criminal investigation.

(3) The Use of Contractors to Conduct Inspections

Several programs utilize private contractors to aid in the conduct of inspections. Since, for the purpose of inspections, these contractors are agents of the Federal government, the restrictions of the Barlow's decision also apply to them. If contractors are to be conducting inspections without the presence of actual EPA inspectors, these contractors should be given training in how to conduct themselves when entry is refused. With respect to obtaining or executing a warrant, an EPA inspector should always participate in the process, even if he was not at the inspection where entry was refused.

(4) Inspections Conducted by State Personnel

The Barlow's holding applies to inspections conducted by State personnel and to joint Federal/State inspections. Because some EPA programs are largely implemented through the States, it is essential that the Regions assure that State-conducted inspections are conducted in compliance with the Barlow's decision, and encourage the State inspectors to consult with their legal advisors when there is a refusal to allow entry for inspection purposes. State personnel should be encouraged to contact the EPA Regional Enforcement Office when any questions concerning compliance with Barlow's arise.

With regard to specific procedures for States to follow, the important points to remember are: (1) The State should not seek forcible entry without a warrant or penalize an owner for insisting upon a warrant, and (2) the State legal system should provide a mechanism for issuance of civil administrative inspection warrants. If a State is enforcing an EPA program through a State statute, the warrant process should be conducted through the State judicial system. Where a State inspector is acting as a contractor to the Agency, any refusal to allow entry should be handled as would a refusal to an Agency inspector as described in section II.B.3. Where a State inspector is acting as a State employee with both Federal and State credentials, he should utilize State procedures unless the Federal warrant procedures are more advantageous, in which case, the warrant should be sought under the general procedures described below. The Regions should also assure that all States which enforce EPA programs report any denials of entry to the appropriate Headquarters Enforcement Attorney for the reasons discussed in section II.B.4.

B. Entry

(1) Consensual Entry

One of the assumptions underlying the Court's decision is that most inspections will be consensual and that the administrative inspection framework will thus not be severely disrupted. Consequently, inspections will normally continue as before the Barlow's decision was issued. This means that the inspector will not normally secure a warrant before undertaking an inspection but, in an attempt to gain admittance, will present his credentials and issue a notice of inspection where required. The establishment owner may complain about allowing an inspector to enter or otherwise express his displeasure with EPA or the Federal government. However, as long as he allows the inspector to enter, the entry is voluntary and consensual unless the inspector is expressly told to leave the premises. On the other hand, if the inspector has gained entry in a coercive manner (either in a verbal or physical sense), the entry would not be consensual.

Consent must be given by the owner of the premises or the person in charge of the premises at the time of the inspection. In the absence of the owner, the inspector should make a good faith effort to determine who is in charge of the establishment and present his credentials to that person. Consent is generally needed only to inspect the non-public portions of an establishment - i.e., any evidence that an inspector obtains while in an area open to the public is admissible in an enforcement proceeding.

(2) Withdrawal of Consent

The owner may withdraw his consent to the inspection at any time. The inspection is valid to the extent to which it has progressed before consent was withdrawn. Thus, observations by the inspector, including samples and photographs obtained before consent was withdrawn, would be admissible in any subsequent enforcement action. Withdrawal of consent is tantamount to a refusal to allow entry and should be treated as discussed in section II.B.3. below, unless the inspection had progressed far enough to accomplish its purposes.

(3) When Entry is Refused

Barlow's clearly establishes that the owner does have the right to ask for a warrant under normal circumstances.[1] Therefore, refusal to allow entry for inspectional purposes will not lead to civil or criminal penalties if the refusal is based on the inspector's lack of a warrant and one of the exemptions discussed in Part C does not apply. If the owner were to allow the inspector to enter his establishment only in response to a threat of enforcement liability, it is quite possible that any evidence obtained in such an inspection would be inadmissible. An inspector may, however, inform the owner who refuses entry that he intends to seek a warrant to compel the inspection. In any event, when entry is

1 FIFRA inspections are arguably not subject to this aspect of Barlow's See discussion, p. 5 and 6.

refused, the inspector should leave the premises immediately and telephone the designated Regional Enforcement Attorney as soon as possible for further instructions. The Regional Enforcement Attorney should contact the U.S. Attorney's Office for the district in which the establishment desired to be inspected is located and explain to the appropriate Assistant United States Attorney the need for a warrant to conduct the particular inspection. The Regional Attorney should arrange for the United States Attorney to meet with the inspector as soon as possible. The inspector should bring a copy of the appropriate draft warrant and affidavits. Samples are provided in the appendix to this document.

(4) Headquarters Notification

It is essential that the Regions keep Headquarters informed of all refusals to allow entry. The Regional Attorney should inform the appropriate Headquarters Enforcement Attorney of any refusals to enter and should send a copy of all papers filed to Headquarters. It is necessary for Headquarters to monitor refusals and Regional success in obtaining warrants to evaluate the need for improved procedures and to assess the impact of Barlow's on our compliance monitoring programs.

C. Areas Where a Right of Warrantless Entry Still Exists

1. Emergency Situations.

In an emergency, where there is no time to get a warrant, a warrantless inspection is permissible. In Camara v. Municipal Court, 387 U.S. 523 (1967), the Supreme Court states that "nothing we say today is intended to foreclose prompt inspections, even without a warrant, that the law has traditionally upheld in emergency situations". Nothing stated in Barlow's indicates any intention by the court to retreat from this position. The Regions will always have to exercise considerable judgment concerning whether to secure a warrant when dealing with an emergency situation. However, if entry is refused during an emergency, the Agency would need the assistance of the U.S. Marshal to gain entry, and a warrant could probably be obtained during the time necessary to secure that Marshal's assistance.

An emergency situation would include potential imminent hazard situations, as well as, situations where there is potential for destruction of evidence or where evidence of a suspected violation may disappear during the time that a warrant is being obtained.

(2) FIFRA Inspections.

There are some grounds for interpreting Barlow's as not being applicable to FIFRA inspections. The Barlow's restrictions do not apply to areas that have been subject to a long standing and pervasive history of government regulation. An Agency administrative law judge held recently that even after the Barlow's decision, refusal to allow a warrantless inspection of a FIFRA regulated establishment properly subjected the owner to civil penalty. N. Jonas & Co., Inc., I.F. & R Docket No. III-121C (July 27, 1978). For the present, however, FIFRA inspections should be conducted under the same requirements applicable to other enforcement programs.

(3) "Open Fields" and "In Plain View" situations.

Observation by inspectors of things that are in plain view, (i.e., of things that a member of the public could be in a position to observe) does not require a warrant. Thus, an inspector's observations from the public area of a plant or even from certain private property not closed to the public are admissible. Observations made even before presentation of credentials while on private property which is not normally closed to the public are admissible.

D. Securing a Warrant

There are several general rules for securing warrants. Three documents have to be drafted: (a) an application for a warrant, (b) an accompanying affidavit, and (c) the warrant itself. Each document should be captioned with the District Court of jurisdiction, the title of the action, and the title of the particular document.

The application for a warrant should generally identify the statutes and regulations under which the Agency is seeking the warrant, and should clearly identify the site or establishment desired to be inspected (including, if possible, the owner and/or operator of the site). The application can be a one or two page document if all of the factual background for seeking the warrant is stated in the affidavit, and the application so states. The application should be signed by the U.S. Attorney or by his Assistant U.S. Attorney.

The affidavits in support of the warrant application are crucial documents. Each affidavit should consist of consecutively numbered paragraphs, which describe all of the facts that support warrant issuance. If the warrant is sought in the absence of probable cause, it should recite or incorporate the neutral administrative scheme which is the basis for inspecting the particular establishment. Each affidavit should be signed by someone with personal knowlege of all the facts stated. In cases where entry has been denied, this person would most likely be the inspector who was denied entry. Note that an affidavit is a sworn statement that must either by notarized or personally sworn to before the magistrate.

The warrant is a direction to an appropriate official (an EPA inspector, U.S. Marshal or other Federal officer) to enter a specifically described location and perform specifically described inspection functions. Since the inspection is limited by the terms of the warrant, it is important to specify to the broadest extent possible the areas that are intended to be inspected, any records to be inspected, any samples to be taken, any articles to be seized, etc. While a broad warrant may be permissible in civil administrative inspections, a vague or overly broad warrant will probably not be signed by the magistrate and may prove susceptible to constitutional challenge The draft warrant should be ready for the magistrate's signature at the time of submission via a motion to quash and suppress evidence in Federal District court. Once the magistrate signs the draft warrant, it is an enforceable document. Either following the magistrate's signature or on a separate page, the draft warrant should contain a "return of service" or "certificate of service". This portion of the warrant should indicate upon whom the warrant was personally served and should be signed and dated by the inspector. As they are developed, more specific warrant-issuance documents will be drafted and submitted to the Regions.

E. Standards or Bases for the Issuance of Administrative Warrants.

The Barlow's decision establishes three standards or bases for the issuance of administrative warrants. Accordingly, warrants may be obtained upon a showing: 1) of traditional criminal probable cause, 2) of civil probable cause, or 3) that the establishment was selected for inspection pursuant to a neutral administrative inspection scheme.

1. Civil specific probable cause warrant.

Where there is some specific probable cause for issuance of a warrant, such as an employee complaint or competitor's tip, the inspector should be prepared to describe to the U.S. Attorney in detail the basis for this probable cause.

The basis for probable cause will be stated in the affidavit in support of the warrant. This warrant should be used when the suspected violation is one that would result in a civil penalty or other civil action.

2. Civil probable cause based on a neutral administrative inspection scheme.

Where there is no specific reason to think that a violation has been committed, a warrant may still be issued if the Agency can show that the establishment is being inspected pursuant to a neutral administrative scheme. As the Supreme Court stated in Barlow's:

"Probable cause in the criminal law sense is not required. For purposes of an administrative search, such as this, probable cause justifying the issuance of a warrant may be based not only on specific evidence of an existing violation, but also on a showing that "reasonable legislative or administrative standards for conducting an . . . inspection are satisfied with respect to a particular [establishment]". A warrant showing that a specific business has been chosen for an OSHA search on the basis of a general administrative plan for the enforcement of the act derived from neutral sources such as, for example, dispersion of employees in various type of industries across a given area, and the desired frequency of searches in any of the lesser divisions of the area, would protect an employers Fourth Amendment rights."

Every program enforced by the Agency has such a scheme by which it prioritizes and schedules its inspections. For example, a scheme under which every permit holder in a given program is inspected on an annual basis is a satisfactory neutral administrative scheme. Also, a scheme in which one out of every three known PCB transformer repair shops is inspected on an annual basis is satisfactory, as long as, neutral criteria such as random selection are used to select the individual establishment to be inspected. Headquarters will prepare and transmit to the Regions the particular neutral administrative scheme under which each program's inspections are to be conducted. Inspections not based on specific probable cause must be based on neutral administrative schemes for a warrant to be issued. Examples of two neutral administrative schemes are provided in the appendix. (Attachments II and III)

The Assistant U.S. Attorney will request the inspector to prepare and sign an affidavit that states the facts as he knows them. The statement should include the sequence of events culminating in the refusal to allow entry and a recitation of either the specific probable cause or the neutral administrative scheme which led to the particular establishment's selection for inspection. The Assistant U.S. Attorney will then present a request for an inspection warrant, a suggested warrant, and the inspector's affidavit to a magistrate or Federal district court judge.[2]

3. Criminal Warrants.

Where the purpose of the inspection is to gather evidence for a criminal prosecution, the inspector and the Regional Attorney should request that the U.S. Attorney seek a criminal warrant under Rule 41 of the Federal Rules of Criminal Procedure. This requires a specific showing of probable cause to believe that evidence of a crime will be discovered. Agency policy on the seeking of criminal warrants has not been affected by Barlow's. The

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2 The Barlow's decision states that imposing the warrant requirement on OSHA would not invalidate warrantless search provisions in other regulatory statutes since many such statutes already "envision resort

distinction between administrative inspections and criminal warrant situations is discussed in Section II.A.2.

F. Inspecting with a Warrant

Once the warrant has been issued by the magistrate or judge, the inspector may proceed to the establishment to commence or continue the inspection. Where there is a high probability that entry will be refused even with a warrant or where there are threats of violence, the inspector should be accompanied by a U.S. Marshal when he goes to serve the warrant on the recalcitrant owner. The inspector should never himself attempt to make any forceful entry of the establishment. If the owner refuses entry to an inspector holding a warrant but not accompanied by a U.S. Marshal, the inspector should leave the establishment and inform the Assistant U.S. Attorney and the designated Regional Attorney. They will take appropriate action such as seeking a citation for contempt. Where the inspector is accompanied by a U.S. Marshal, the Marshal is principally charged with executing the warrant. Thus, if a refusal or threat to refuse occurs, the inspector should abide by the U.S. Marshal's decision whether it is to leave, to seek forcible entry, or otherwise.

The inspector should conduct the inspection strictly in accordance with the warrant. If sampling is authorized, the inspector must be sure to carefully follow all procedures, including the presentation of receipts for all samples taken. If records or other property are authorized to be taken, the inspector must receipt the property taken and maintain an inventory of anything taken from the premises. This inventory will be examined by the magistrate to assure that the warrant's authority has not been exceeded.

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2 continued from page 8.

to Federal court enforcement when entry is refused". There is thus some question as to whether the existence of a non-warrant Federal court enforcement mechanism in a statute requires the use of that mechanism rather than warrant issuance. We believe that the Barlow's decision gives the agency the choice of whether to proceed through warrant issuance or through an application for an injunction, since the decision is largely based on the fact that a warrant procedure imposes virtually no burden on the inspecting agency. In addition, an agency could attempt to secure a warrant prior to inspection on an *ex parte* basis, something not available under normal injunction proceedings. Several of the acts enforced by EPA have provisions allowing the Administrator to seek injunctive relief to assure compliance with the various parts of a particular statute. There may be instances where it would be more appropriate to seek injunctive relief to gain entry to a facility than to attempt to secure a warrant for inspection, although at this point we cannot think of any. However, since the warrant process will be far more expeditious than the seeking of an injunction, any decision to seek such an injunction for inspection purposes should be cleared through appropriate Headquarters staff.

G. Returning the Warrant.

After the inspection has been completed, the warrant must be returned to the magistrate. Whoever executes the warrant, (i.e., whoever performs the inspection), must sign the return of service form indicating to whom the warrant was served and the date of service. He should then return the executed warrant to the U.S. Attorney who will formally return it to the issuing magistrate or judge. If anything has been physically taken from the premises, such as records or samples, an inventory of such items must be submitted to the court, and the inspector must be present to certify that the inventory is accurate and complete.

III. Conclusion

Except for requiring the Agency to formalize its neutral inspection schemes, and for generally ending the Agency's authority for initiating civil and/or criminal actions for refusal to allow warrantless inspections, Barlow's should not interfere with EPA enforcement inspections.

Where there is doubt as to how to proceed in any entry case, do not hesitate to call the respective Headquarters program contact for assistance.

Marvin B. Durning

Marvin B. Durning

APPENDIX

The Appendix contains three attachments.

Attachment I is a warrant application, affidavit and warrant to conduct an inspection, where the Agency has specific probable cause to believe that a civil violation of an EPA regulation or Act has occured. In particular, care should be taken in spelling out the specific facts that give rise to probable cause. Note also, that the scope of the warrant is carefully articulated.

Attachment II is a warrant application, affidavit and warrant to conduct an inspection in which the establishment to be inspected has been selected under a neutral administrative inspection scheme. Note the extraordinary detail of the administrative scheme describe in paragraphs 8-20 of the affidavit. Such detail should not be necessary for most EPA neutral administrative inspection schemes. Note also the executed inventory and return of service forms attached to Attachment II.

Attachment III contains a neutral administrative scheme for CFC inspections. In implementing such a scheme, the Regions must still utilize neutral criteria in selecting the individual establishment to be inspected.

Attachment I

UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF LOUISIANA

IN THE MATTER OF CLEAN LAND AIR AND WATER, CORPORATION, D/B/A CLAW: ROLLINS ENVIRONMENTAL SERVICES OF LOUISIANA INCORPORATED; ENVIRONMENTAL PURIFICATION ADVANCEMENT INCORPORATED; EPA, INC.; IN IBERVILLE PARISH, LOUISIANA	: : : : : : : : :	NO. 78-43 m APPLICATION FOR WARRANT TO ENTER, INSPECT, PHOTOGRAPH, SAMPLE, COLLECT INFORMATION, INSPECT AND COPY RECORDS

TO THE UNITED STATES MAGISTRATE, by the United States of America, Environmental Protection Agency, through James Stanley Lemelle, Assistant United States Attorney for the Middle District of Louisiana, hereby applies for a warrant pursuant to section 308 of the Federal Water Pollution Control Act, 33 U.S.C. 1318, and the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6927, for the purpose of conducting an inspection as follows:

To enter to, upon, or throu. . the premises of a waste disposal operation known by various names including the CLAW facility, which consists of three sites, to wit: an injection well site, a field office and storage tanks, and waste pits and landfill site located in Iberville Parish, Louisiana in or near the Bayou Sorrells community. The facility can be reached for disposal purposes by truck or barge. The ownership and operation of the CLAW facility waste disposal operation has been known by several different names, to wit: Clean Land Air Water Corporation (CLAW); EPA, Incorporated; Environmental Purification Advancement; Environmental Purification Abatement (EPA, Inc.) and Rollins Environmental Services of Louisiana. A company letterhead using the names of CLAW and EPA, Inc. lists an address of Route 2, Box 380B, Plaquemine, Louisiana 70764. It is reported in the newspapers and elsewhere, that on July 28, 1978 - three days after the death of the truck driver on the CLAW facility - that the injection well on the CLAW facility was sold to the Rollins Environmental Services of Louisiana. Unsubstantiated reports say that CLAW no longer has any assets, leaving the pits and landfills under the ownership of EPA, Inc. and the injection well under the ownership of Rollins. CLAW and EPA, Inc. are reported to be different company and/or corporate names for the same people. Despite these possible ownership changes, the CLAW facility apparently continues to be operated as a single unit. Further, it is reported that CLAW or Rollins is under a federal court order to honor its contract with a client to accept waste. For purposes of this application, affidavit and warrant, the three sites and all operations will be referred to as CLAW.

The field office and storage tanks are in or on the edge of Bayou Sorrells; the injection well site is about 1.6 miles northwest of Bayou Sorrells on the road; the waste open pits-landfills are located approximately 7.7 miles northwest of Bayou Sorrels on the levee road. The address of the CLAW facility is Clean Land Air Water Corporation EPA Incorporated, Route 2, Box 380 B, Plaquemine, Louisiana. These CLAW facilities are known to EPA inspectors and well known to local people.

The CLAW facility is an establishment subject to the requirements and prohibitions of the Federal Water Pollution Control Act, including but not limited to sections 301, 308 and 311, and sections 3007 and 7003 of the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*)

On Friday, August 4, 1978, Edward McHam, an employee of the U.S. Environment Protection Agency, requested permission to enter and inspect the said premises. Despite such request, employees of said facility refused to grant access to said premises to Mr. McHam, a duly authorized inspector of the Environmental Protection Agency.

The determination to inspect said premises was based on the following:

The sheriff's office of Iberville Parish requested EPA's assistance and reported a death at said premises.

Local unrest and fear of the facility was reported to the Enforcement Division of Region VI, Dallas, Texas on Tuesday, August 1, 1978 and EPA was requested to inspect the facility which is a disposal site for chemical wastes and numerous oil wastes of a hazardous and toxic nature.

Much local unrest, and agitation and complaints have been reported on television and in newspapers concerning the operation of the CLAW facility as well as the untimely death of a 19 year old truck driver at said facility while he was discharging waste into an open pit at the facility. The death was possibly caused by his inhalation of toxic fumes caused by a reaction of mixing incompatible toxic wastes in the open pit. Allegedly two eye witnesses to the death of the driver reported the presence of choking fumes in the area when they opened the doors to their truck to assist the driver who died. They also reported that his truck was parked at the edge of the open pit truck ramp, with doors open at the time of his death. Subsequent laboratory tests of waste taken from the pits have shown waste materials present in the pit, which, when mixed with the spent caustic being discharged from the driver's truck could have caused the death. Final autopsy reports are still pending. It is reported and alleged that CLAW facility officials directed the driver to take and discharge his wastes at the truck ramp in the open pit, rather than in the injection well. Discharging toxic waste into an open pit, at the edge of a pit, is not a safe, desirable, or acceptable practice since toxic chemical reactions are very probable and can result in the death of anyone nearby.

Edward McHam made a preliminary inspection in which he obtained two pit samples and observed evidence of oil, hazardous wastes, waste spillage and a "sloppy" operation which appears to be dangerous to the environment as well as hazardous to the health and welfare of citizens. He further observed high water markings on the adjacent trees at the pit site and a lack of levees between the sites and the Grand River and other waterways. In addition, there may be hazardous wastes and conditions which may pose a substantial present, or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

The inspection will be commenced in daytime within regular business hours and will begin as soon as practicable after issuance of this warrant and will be completed with reasonable promptness.

The inspection will be conducted by the United States Environmental Protection Agency (EPA) inspectors, who will be accompanied by the United States Marshal to ensure entry so that the EPA inspectors may perform an inspection of the premises, inspect and copy records, take photographs, gather information and evidence and collect samples in accord with 33 USC 1318 and 42 USC 6927.

A return will be made to the Court upon completion of the inspection.

WHEREFORE, it is respectfully requested that a warrant to enter and inspect the CLAW facility be issued.

Respectfully submitted,

DONALD L. BECKNER
UNITED STATES ATTORNEY

James Stanley Lemelle

JAMES STANLEY LEMELLE
Assistant U.S. Attorney

AFFIDAVIT

STATE OF LOUISIANA

PARISH OF EAST BATON ROUGE

I, Edward McHam, being duly sworn, hereby depose and say:

1. I am a duly authorized employee of the United States Environmental Protection Agency, and my title is Chemical Engineer, Surveillance and Analysis Division, Region VI, which includes the State of Louisiana. In my capacity, I am responsible for inspecting facilities subject to various federal environmental statutes as directed by my supervisors.

2. On Tuesday, August 1, 1978 from about 7:45 p.m. to 8:45 p.m., I made a preliminary inspection of the CLAW facility and took two samples at the open pits. On Wednesday, August 2, 1978, I took a few photographs of the facilities from around 3:30 p.m. until 5:30 p.m. On Thursday, August 3, 1978 accompanied by another EPA employee, I visited the facility and area from about 11:30 a.m. to 2:00 p.m. and also took a few additional photographs. These brief visits to the site have only involved facility employees a few minutes each time in order to obtain passes from the field office and to open gates at various guard houses.

3. On Friday, August 4, 1978, a local deputy sheriff, state and local officials and I were refused admittance to the CLAW facility. Also, CLAW officials were no longer at the field house or available elsewhere to issue passes to enter. My previous sampling and inspection was not sufficient for laboratory purposes and needs to be resumed.

4. Information I have gathered in the local community, in newspapers, on television, from laboratory

tests of the samples, from the Iberville Sheriff's Office, and at the CLAW facility strongly suggest and support the need to enter and inspect the facilities for possible Section 301, 311 and other violations of the Federal Water Pollution Control Act. Further, it is possible that there are hazardous wastes and conditions on the premises as defined in Section 1004(5) of the Resource Conservation and Recovery Act of 1976, (42 USC 6903)(5) which constitute an imminent hazard under section 7003 of the Resource Conservation and Recovery Act of 1976 (42 USC 6973). These observations are:

a. Obvious spillage of waste material on the grounds of the CLAW facility subject to entering waterways.

b. Contaminated landfills with obviously exposed and damaged barrels with their contents emptied or nearly empty.

c. Drainage from landfills into a "fishing" lake and other adjacent areas leading to various waterways.

d. Open pits containing oil wastes and hazardous, toxic chemical wastes with the appearance of overflow wastes on the adjacent grounds as well as high water marks on trees next to the open pits equal to or higher than the pits.

e. The lack of levees between the facility grounds and drainage areas to the Grand River, "fishing lake", bayous and barrow ditches.

f. Copies of a few facility log records and other documents which were previously copied by the local Sheriff's office. These records indicate the receipt and content of oil and hazardous chemical wastes accepted at the facility.

g. Poor maintenance and sloppy "housekeeping" practices at the facility which leads a reasonable person to recognize the likelihood of these prohibited pollutants entering into nearby waterways including waters of the United States and its tributaries, as well as posing a threat to the environment and the public health and welfare of the United States.

b. The reported death of a 19 year old truck driver at the CLAW (EPA, Inc.) open pits on July 25, 1978 while he was discharging waste into an open pit at the facility. The death was possibly caused by his inhalation of toxic fumes caused by a reaction of mixing incompatible toxic wastes in the open pit. Two eye witnesses to the death of the driver reported the presence of choking fumes in the area when they opened the doors to their truck to assist the driver who died. They also reported that his truck was parked at the edge of the open pit with the doors open at the time of death. Subsequent laboratory tests of waste taken from the pits have shown waste materials were present in the pit which, when mixed with the spent caustic being discharged from the driver's truck could have caused the death. Final autopsy reports are still pending. It is allegedly reported that CLAW facility officials directed the driver to take and discharge his wastes to the truck ramp on the edge of an open pit. Discharging toxic waste into an open pit at the edge of a pit is not a safe, desirable, or acceptable practice since toxic chemical reactions are very probable and can result in the death of anyone nearby.

5. Section 308 of the Federal Water Pollution Control Act, 33 USC 1318, and section 3007 of the Resource Conservation and Recovery Act of 1976, (42 USC 6927), providing for entry, inspection, record inspection and copying and sampling are reasonable, in the public interest and necessary in order to carry out the provisions of these Acts, which Acts are designed to protect the environment, as

well as the public health and welfare. In the instant matter it is reasonable to assume the need for inspection based on the information and observations set out in paragraph 4 above and in the public interest.

Edward C. McHam

EDWARD C. MC HAM
CHEMICAL ENGINEER
UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY

Subscribed and sworn to before me
at Baton Rouge, State of Louisiana,
this 10 of August, 1973.

U.S. Magistrate

UNITED STATES DISTRICT COURT

MIDDLE DISTRICT OF LOUISIANA

IN THE MATTER OF
CLEAN LAND AIR AND WATER,
CORPORATION, d/b/a CLAW;
ETC., ET AL.

NO. 78-15M

WARRANT OF ENTRY, INSPECTION
AND MONITORING PURSUANT TO
33 U.S.C.§1318 and 42 U.S.C.§6927

TO: THE UNITED STATES OF AMERICA, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, THROUGH ITS DULY DESIGNATED REPRESENTATIVE OR REPRESENTATIVES, THE UNITED STATES MARSHAL OR ANY OTHER FEDERAL OFFICER

An application having been made by the United States of America, United States Environmental Protection Agency, for a warrant of entry, inspection and monitoring pursuant to 33 U.S.C.§1318 and 42 U.S.C.§6927, as part of an inspection program designed to assure compliance with the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act), 33 U.S.C.§1251, et seq., and the Resource and Recovery Act of 1976 (42 U.S.C.§6901, et seq.), and an affidavit having been made before me by Edward McGan, a duly authorized employee of the United States Environmental Protection Agency, that he has reason to believe that on the premises hereinafter described there exist a danger to the public's health, welfare and safety and to the property, rivers and environment of the United States, and that in order to determine whether the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act), 33 U.S.C.§1251, et seq., and the Resource and Recovery Act of 1976 (42 U.S.C.§6901, et seq.), and the rules, regulations and orders issued pursuant to the Acts have been or are being violated, an entry on, and inspection and monitoring of the said described property is required and necessary;

And, the Court being satisfied that there has been a sufficient showing that reasonable legislative or administrative standards for conducting an inspection and investigation have been satisfied with respect to the said described property and that probable cause exist to issue a warrant for the entry, inspection, investigation and monitoring of the said described premises:

IT IS HEREBY ORDERED AND COMMANDED that the United States of America, United States Environmental Protection Agency, through its duly designated representative or representatives, the United States Marshal, or any other federal officer are hereby entitled to and shall be authorized and permitted to have entry upon the following described property which is located in the Middle District of Louisiana:

> "Those premises known as the Claw Corporation waste disposal facility in Iberville Parish, Louisiana, also known as EPA, Inc., Clear Land Air Water Corporation, Environmental Purification Advancement, Environmental Purification Abatement and possibly as the Rollins Environmental Services of Louisiana, or which are owned or operated by any other person or company, corporation or partnership, which premises and property are more particularly and further described as follows:
>
> "From the intersection of La. Highway 75 and La. Highway 3066, proceed South for approximately 7 miles; turn right and travel across the Bayou-Sorrel-Pontoon Bridge, a distance of approximately 0.2 miles; turn right, proceed northwest on Route 2, the Lower Levee Road, for approximately 1.6 miles at which point the pavement ends; at this point turn right, travel approximately 0.1 miles to the entrance of the injection well, which is believed to be owned by Rollins Environmental Services of Louisiana, Incorporated, all as is shown on the attached photos identified as Government Exhibits 1 and 2."
>
> "From the Rollins Environmental Services of Louisiana, Incorporated office, proceed South on the shell/gravel road for approximately 1.4 miles until the road deadends. This is the location of the field office of Clean Land Air and Water (CLAW), and storage tanks which are believed to be owned by Rollins Environmental Services of Louisiana Incorporated, all as is shown on the attached photos identified as Government Exhibits 3, 4, and 5.

"From the field office of CLAW, return to the site of the intersection at the paved lower levee road and the road leading to the deep well injection site (Rollins Environmental). Proceed northwest on the unpaved shell/gravel lower levee road approximately 6.1 miles to the entrance road and bridge leading to the gate guard house and gate of the EPA, Inc. waste disposal pits. This same entrance road is 7.7 miles northwest along the lower levee road from the intersection of the lower levee road and Bayou Sorrel Pontoon Bridge Road.

IT IS FURTHER ORDERED that the entry, inspection, investigation and monitoring authorized herein shall be conducted during regular working hours or at other reasonable times, within reasonable limits and in a reasonable manner from 6:00 a.m. to 10:00 p.m.

IT IS FURTHER ORDERED that the warrant issued herein shall be for the purpose of conducting an entry, inspection, investigation and monitoring pursuant to 33 U.S.C.§1318 and 42 U.S.C.§6927 consisting of the following:

(1) entry to, upon or through the above described premises, including all buildings, structures, equipment, machines, devices, materials and sites to inspect, sample, photograph, monitor or investigate the said premises;

(2) access to, seizure of and copying of all records pertaining to or related to the operation of the facility, equipment, waste materials which are accepted and stored on the premises and records which are required to be maintained under 33 U.S.C.§1318(a)(A), and 42 U.S.C.§6901, et seq., including any rules and regulations and orders promulgated thereto;

(3) inspection, including photographing, of any monitoring equipment or methods required by 33 U.S.C.§1318(a)(A), and 42 U.S.C.§6927;

(4) inspection, including photographing, of any equipment, processes or methods used in sampling, monitoring or in waste characterization;

(5) inspection, including photographing, of any equipment or methods used to dispose of or store waste substances;

(6) sample and seize any pollutants, effluents, runoff, soil, or other materials or substances which may reasonably be expected to pollute the waters of the United States under various conditions or threaten the public health, safety or welfare of the people of the United States;

(7) seize, inspect, sample, and photograph any evidence which constitutes or relates to or is part of a violation of the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act, 33 U.S.C.§1251, et seq., and the Resource and Recovery Act of 1976 (42 U.S.C.§6901, et seq.);

(8) take such photographs of the above authorized procedures as may be required or necessary.

IT IS FURTHER ORDERED that a copy of this warrant shall be left at the premises at the time of the inspection.

IT IS FURTHER ORDERED that if any property is seized, the officer conducting the search and seizure shall leave a receipt for the property taken and prepare a written inventory of the property seized and return this warrant with the written inventory before me within 10 days from the date of this warrant.

IT IS FURTHER ORDERED that the warrant authorized herein shall be valid for a period of 10 days from the date of this warrant.

IT IS FURTHER ORDERED that the United States Marshal is hereby authorized and directed to assist the representatives of the United States Environmental Protection Agency in such manner as may be reasonably necessary and required to execute this warrant and the provisions contained herein, including but not limited to gaining entry upon the premises, the inspection and monitoring thereof, the seizure and sampling of materials, documents or equipment, and the photographing of the premises, and the materials or equipment thereon.

DATED this 10 day of August, 1978.

[signature]

UNITED STATES MAGISTRATE

-4-

inspector presents credentials). However, if the inspector does not have a warrant the owner may limit the inspector's access to any portion of the facility.

If an inspector is refused entry into a facility for the purposes of an inspection under Section 3007 of RCRA, certain procedural steps must be carefully followed. These steps are as follows:

1. Present proper identification to the facility representative authorized to consent to an inspection. Consent must be given at the time of the inspection.

2. Thoroughly document the event, noting time, date, and facility personnel encountered.

3. If entry is denied, ask the reason for denial.

4. If the problem is beyond the inspector's authority, suggest that the official contact an attorney to obtain legal advice on his/her responsibility under Section 3007 of RCRA.

5. Under no circumstances discuss potential penalties or do anything which may be construed as threatening.

6. If entry is denied a second time, exist from the premises and document any observations made pertaining to the denial, particularly any suspicions of violations being covered up.

7. Report all aspects of denial of entry to the Enforcement Division for appropriate action to be taken including help in obtaining a search warrant (see Appendix III).

8. An Enforcement Division attorney will assist the inspector in the preparation of the documents necessary to obtain a search warrant and will arrange for a meeting with the inspector and a U.S. Attorney. The inspector will bring a copy of the appropriate draft warrant and affidavits to the meeting.

9. The Enforcement Division attorney will inform the appropriate Headquarters Enforcement attorney of any refusals to enter and send a copy of all papers filed to Headquarters.

10. The attorney will then secure the warrant and forward it to the inspector, and/or the U.S. Marshall.

Conducting an inspection under a search warrant will differ from conducting a normal inspection. The following procedures should be complied with in these situations:

1. Use of a Warrant to Gain Entry

   a. If there is a high probability that entry will be refused even with a warrant or where there are threats of violence, the inspector should be accompanied by a U.S. Marshall.

   b. The inspector should never himself/herself attempt to make any forceful entry of the establishment.

   c. If entry is refused to an inspector holding a warrant but not accompanied by a U.S. Marsnall, the inspector should leave the establishment and inform the Enforcement Division Attorney.

2. Conducting The Inspection

   a. The inspection must be conducted strictly in accordance with the warrant. If the warrant restricts the inspection to certain areas of the premises or to certain records, those restrictions must be adhered to.

   b. If sampling is authorized, all procedures must be carefully followed including presentation of receipts for all samples taken. The facility should also be informed of its right to retain a portion of the samples obtained by the inspector.

   c. If records or property are authorized to be taken, the inspector must provide receipts and maintain an inventory of all items removed from the premises.

Inspectors should consult NEIC's procedures for further guidance (see Appendix III).

C. PRE-INSPECTION DISCUSSION

During the initial inspection, the inspector should, if necessary, discuss the provisions of the Act and, if requested, furnish a copy of the Act and appropriate regulations. The inspector then should outline the objectives of the inspection and the order in which various aspects of the

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LOUIS W. ADAMS
Ecology and Environment, Inc.

National Program Manager,
Oil and Hazardous Materials Spill Control
Hazardous and Radioactive Materials Specialist

EDUCATION:

M.B.A., Business Administration, University of Alabama, 1967
B.S., Chemical Engineering, Drexel Institute of Technology, 1957
Military training in explosive ordnance disposal and radiological safety

EXPERIENCE:

Mr. Adams is national program manager for E & E's TAT. He directs the company's 11 teams one in each city where EPA has a regional office as well as in Cincinnati, where the Environmental Emergency Response Team is located. His responsibilities include program decision-making authority, access to E & E's president and to the program's Technical Advisory Committee for resolution of managerial or technical problems, interface with the administrative services department, program and TAT staff coordination, project expediting, implementation of quality assurance and quality control functions, and interface with E & E's staff.

Mr. Adams joined E & E as Region II TAT leader for the EPA project. He directed TAT activities, assigning manpower to and taking part in oil and hazardous materials spill responses while fulfilling his managerial, communication, and documentation responsibilities. In responding to oil and chemical spills within a region which includes New York, New Jersey, Puerto Rico, and the Virgin Islands, Mr. Adams was involved in determining the extent of the spill; assessing environmental damage; coordinating activities with federal, state, and local officials; assisting the on-scene coordinator and, upon occasion, acting as his field representative; and monitoring cleanup activities. He provided support to the EPA in the investigation of hazardous waste sites, supervising containment and cleanup activities and assisting in Federal Emergency Management Agency (FEMA) damage assessments.

In addition to fulfilling the administrative, managerial, and communication responsibilities of a TAT leader, Mr. Adams provided support to the National Project Management office in the development of technical and administrative special projects, including the development of standard operating procedures regarding entry into hazardous waste sites and the coordination of the project's respiratory protection program.

Louis W. Adams (Cont.)

SPECIAL EXPERIENCE:

EPA TAT Responses (Region II TATL)

Mr. Adams spent three weeks in Puerto Rico assisting the EPA and the FEMA in assessing the damages resulting from hurricanes Frederick and David. The assessment included damage surveys of waste and drinking water systems and containment and cleanup of oil released from damaged tankers and planes. Under Mr. Adams' direction, Region II TAT members also aided in the coordination of FEMA damage surveys in Chautauqua County, New York, following a severe flash flood.

He monitored the collection of toxic materials at a hazardous waste landfill in Edison, New Jersey. He assisted the EPA, Coast Guard, and state representatives in collecting data, developing a sampling plan, and providing technical support for an operations center in response to an intense chemical fire that erupted in a warehouse in Elizabeth, New Jersey. In Wellsville, New York, Mr. Adams monitored cleanup operations of a fire involving pesticides and herbicides which, when extinguished with water, entered and contaminated Dyke Creek and the Genesee River.

He responded to a major oil spill in Oldwick, New Jersey, monitoring the containment and cleanup of 7,000 gallons of oil, and assisting in the investigation of the resultant fishkill. Mr. Adams represented the on-scene coordinator, determining the proper procedures for cleanup of a salt brine spill in Linden, New Jersey. In another response situation in Linden, he provided technical assistance, conducted water quality surveys, and assessed the resulting fishkill after the derailment of a tank car containing 30,000 gallons of sulfuric acid. He performed perimeter and on-site inspections for eight hazardous waste sites, compiling and reviewing background information on these and eight other sites within the region, and conducted Spill Prevention, Control, and Countermeasure (SPCC) inspections for oil bulk storage and distribution centers. Mr. Adams directed the cleanup of a 50,000-gallon jet fuel spill on Staten Island, New York; the asbestos contamination of a drainage area in the Bronx, New York; and a methyl alcohol spill in Edison, New Jersey.

Hazardous and Radioactive Materials--Army

During his 21-year military career as a Chemical Corps officer, Mr. Adams developed a wealth of experience in the handling, transportation, security, and disposal of hazardous and radioactive materials. As radiation protection officer, he supervised packaging, loading, and transporting of hazardous and radioactive materials in accordance with Interstate Commerce Commission and Atomic Energy Commission regulations and directed disposal operations for such materials in the United States and abroad.

While directing activities of 15 army bomb squads located in Greece, Italy, Turkey, and Germany, he was in charge of mission assignments, financial planning, training, and inspection of operations involving nuclear weapons disposal and detection and dismantling of terrorist bombs. He was principal advisor to the Commanding General, U. S. Army Europe, for these activities and directed a special program countering explosive devices of the Baader-Meinhoff terrorist organization.

Mr. Adams acted as army staff executive agent for the security of chemical weapons storage testing and training sites. In this regard, he developed and published the first comprehensive army procedures for site protection including chemical accident and incident control, emergency reaction force deployment, and personnel screening and evaluation. He assessed the adequacy of local security programs at chemical installations and served as advisor to the army staff on development of bomb squad procedures for chemical weapons.

During his army career, Mr. Adams administered and instructed programs for the security of radioactive isotopes and hazardous chemicals during storage, transit, and dismantling. He created and directed units to escort hazardous and radioactive materials and was responsible for developing army policies and procedures regarding the control of chemical accidents. He developed and published the first comprehensive army directive prescribing security procedures for the protection of chemical sites against a terrorist threat.

As part of his work on army security programs, Mr. Adams screened and evaluated security personnel, wrote security procedures, controlled chemical accidents and incidents, and handled emergency reaction force procedures. As studies officer, he conducted long-range studies for equipment, training, and organizational requirements for handling hazardous and radioactive materials.

As army radiation protection officer, Mr. Adams organized and directed a special unit to escort chemical ammunition from the manufacturing plant to storage depots. The safety program he developed resulted in an accident-free record for the two years he was in the unit.

He has served as director of a military school and has taught techniques for dismantling terrorist bombs, military ordnance, and nuclear weapons. Most civilian bomb squads are trained at this school. During his tenure, the school he directed was honored for its contributions to law enforcement and public safety by a resolution of the Mississippi legislature.

RICHARD C. BENSON
Technos, Inc.

EDUCATION:

B.S., Geophysics
Graduate Studies in Ocean Engineering
Registered Geologist GA #312
A.I.P.G. Prof. Geologist #3686

EXPERIENCE:

Mr. Benson is the senior executive and chief scientist for Technos Inc. He founded the company in 1972 to provide state-of-the-art consulting services within the field of the earth sciences. He possesses a broad background in many of the earth sciences and is considered an authority in engineering geology and Karst problems. His development of the hazardous Karst model used by Technos was a major breakthrough in dealing with subsidence in Karst areas. He has evaluated numerous geotechnical problem sites including landslides, dams, sinkhole collapses, and subsidence. In addition, his experience covers a wide range of geohydrologic problems including landfills, saltwater intrusion, and aquifer exploration and assessment, as well as extensive hazardous material site assessments. Such work has been carried out for chemical manufacturers, mining operations, municipal governments, and Federal agencies, including the Army Corps of Engineers, USDA Soil Conservation Service, and Bureau of Land Management, and USGS Water Resources Division.

Under his guidance Technos has achieved numerous technical breakthroughs in the application of new approaches for assessing geohydrologic and engineering geologic problems. Many of these methodologies are unique to the firm. Mr. Benson is author or co-author of 16 technical papers and a member of numerous professional societies.

DAVID A. BUECKER
Ecology and Environment, Inc.

Region IX, FIT Member
Environmental Health Specialist
Toxic and Hazardous Materials Specialist
Industrial Health Specialist
Safety and Risk Analyst

EDUCATION:

M.S., Public Health, University of North Carolina, 1978
Additional graduate courses, Environmental Engineering, State University of New York at Buffalo, 1980
B.S., Biology, Florida State University, 1975

EXPERIENCE:

Mr. Buecker of E & E's San Francisco office has experience in hazard and risk analysis and in the design of comprehensive environmental health programs. He has performed industrial hygiene investigations for methylene chloride and for methane gas. He has investigated the public and occupational aspects of coal gasification. His training and experience include the handling of toxic and hazardous substances. He has provided expert testimony and has given public presentations concerning his projects.

He designed an occupational health program for an industrial complex in Santa Cruz, Bolivia. The program required the identification of potential industrial health and safety hazards and the development of organizational structure, equipment, and personnel requirements for its industrial hygiene and occupational medicine components.

He conducted E & E's investigation of methane gas generation from a sanitary landfill, the operator of which was applying for a facility extension permit in Garfield Heights, Ohio. The project required Mr. Buecker to determine and clarify qualitative and quantitative differences in the composition of landfill and natural gas, gas migration patterns through compacted solid wastes, gas formation processes, environmental parameters affecting gas generation, and analytical testing methodologies. He performed an on-site survey and evaluated gas samples. He provided expert testimony at an administrative hearing before the Ohio Environmental Review Board concerning the generation of gas at the landfill.

He prepared a risk analysis of the movement of hazardous materials by rail, including accident probability and severity analysis, failure mode analysis, demographic profiling, and determination of potential liability. He has investigated asbestos exposure and use in community schools and has recommended corrective action. He has researched the causes of byssinosis in textile workers through the use of pulmonary function testing and laboratory bioassays.

STEVE CALDWELL
U.S. Environmental Protection Agency

EDUCATION:

B.A., History and Geography, Valparaiso University, 1969
Graduate work in Geography, University of Arizona
Research at the University of Arizona Dendrochronology Laboratory

EXPERIENCE:

Mr. Caldwell's experience includes:

- Drafting of notification (Section 3010) guidelines under RCRA
- Developing a damage assessment program to support RCRA regulations
- Developing enforcement suppport in imminent hazard cases
- Developing the Guidance Manual for the Investigation of Hazardous Waste Disposal Sites
- Managing the project to develop guidance for setting priorities and the development of the form for use in a data management system

SPECIAL EXPERIENCE:

Mr. Caldwell taught for three years at the International Christian University in Tokyo, Japan.

PAUL F. CLAY
Ecology and Environment, Inc.

Region I, Assistant
FIT Leader

EDUCATION:

M.S., Chemistry, University of New Hampshire at Durham, 1973
B.A., Zoology, cum laude, University of New Hampshire at Durham, 1969

EXPERIENCE:

Mr. Clay is E & E's Assistant Team Leader for its Region I (Boston) team for the Field Investigation of Uncontrolled Hazardous Waste Sites. He has developed an inventory of hazardous waste cleanup contractors in Region I, including information on their licensing and equipment capabilities. He also developed a list of well-boring contractors for possible use in groundwater monitoring at hazardous waste sites. He is presently involved in developing standard operating procedures for collection of environmental and hazardous waste samples.

Mr. Clay has attended courses concerning the field monitoring and analysis of hazardous materials both in Buffalo and in Cincinnati at the EPA's National Training Center. He is familiar with field and laboratory analytical techniques and sampling methods for hazardous waste sites. He has served as the designated training officer for the Region I field investigation team.

As an environmental administrator for the city of Haverhill, Massachusetts, he interfaced with local, state, and federal government agencies and with the community. He was also involved with the solid and hazardous waste disposal problems of the Boston area. He reviewed existing solid waste facilities in New York and New England and provided input for the proposed siting of a solid waste disposal facility in Haverhill. He reviewed environmental impact statements pertaining to wetlands and the Massachusetts State Wetlands Protection Act. He wrote a watershed/wetlands zoning ordinance that was subsequently adopted by the city council. His responsibilities also included budget administration, personnel supervision, and the holding of public hearings pertaining to environmental quality.

SPECIAL EXPERIENCE:

<u>Gas Chromatography/Infrared Spectrophotometry</u>

Paul Clay was the recipient of a National Science Foundation grant to obtain a master's degree at the University of New Hampshire. His independent research involved the use of gas chromatography and infrared spectrophotometry to analyze human tissue fat for DDT residues.

<u>Teaching</u>

His experience includes 11 years of teaching chemistry at the secondary and community college levels.

Paul F. Clay (Cont.)

SPECIAL EXPERIENCE:

Gas Chromatography/Infrared Spectrophotometry

Paul Clay was the recipient of a National Science Foundation grant to obtain a master's degree at the University of New Hampshire. His independent research involved the use of gas chromatography and infrared spectrophotometry to analyze human tissue fat for DDT residues.

Teaching

His experience includes 11 years of teaching chemistry at the secondary and community college levels.

Paul F. Clay (Cont.)

EMPLOYMENT:

Ecology and Environment, Inc., Buffalo, New York, 1980-present
Danvers High School, Danvers, Massachusetts, Biology, Chemistry, and Ecology Teacher, 1969-1980
Northern Essex Community College, Haverhill, Massachusetts, Division of Continuing Education, Instructor of Chemistry, Anatomy, and Physiology, 1974-1980
City of Haverhill, Massachusetts, Member of Solid Waste Technical Committee, 1975-1978
City of Haverhill, Massachusetts, Member of Conservation Commission, 1973-1978
Massachusetts Department of Mental Health, Danvers State Hospital, Danvers, Massachusetts, Psychiatric Aide, 1966-1969

BIBLIOGRAPHY:

Paul F. Clay (Cont.)

PROJECTS AT E & E:

EPA-2, EP-980
See experience Summary.

LANGUAGE CAPABILITIES: GERMAN

Reading: Fair, semitechnical
Writing: Passable, nontechnical
Speaking: Fair

BID PROPOSALS AND REPORTS BIOGRAPHY HAS BEEN USED IN:

DAVID L. DAHLSTROM
Ecology and Environment, Inc.

Occupational/Environmental Health Specialist
Radiological Health and Safety Specialist
E & E Corporate Safety Director

EDUCATION:

M.S., Environmental Sciences and Engineering, Drexel University, 1978
B.S., Chemistry/Biology, University of Tennessee, 1973

EXPERIENCE:

Mr. Dahlstrom is E & E's corporate safety director. He has served as E & E's technical assistance team leader in Cincinnati for the Oil and Hazardous Substances Spill Prevention and Environmental Emergency Response Program for the United States Environmental Protection Agency.

He has been responsible for training EPA, Coast Guard, and E & E personnel about hazardous material incident mitigation and response, respiratory protection and protective clothing, field instrumentation and analysis, hazard assessment, and standard operating procedures concerning hazardous materials. As a member of E & E's health surveillance committee, he has provided input concerning general safety practices for personnel involved with hazardous waste sites and toxic material spills. He was extensively involved in the formulation of E & E's hazardous materials response program. He has also developed a technical plan for E & E's activities regarding the Toxic Substances Control Act and is experienced in applying the regulations stemming from the Occupational Safety and Health Act.

He has participated in numerous hazardous waste site investigations and emergency responses including on-site surveillance of a two-day fire involving hazardous materials in Denver, Colorado.

In previous assignments, he used acid containment principles in controlling low-grade thorium emissions which had reached a stream after leaking through a containment dike. He is experienced in handling inorganic chemical compounds including a wide range of solvents and hazardous dust, often containing radioisotopes.

SPECIAL EXPERIENCE:

Toxic and Hazardous Substances Management

Mr. Dahlstrom has worked on control and containment of oil and hazardous chemicals. He participated in the containment of an oil spill on the Tennessee River which threatened to affect municipal water supplies. He has studied the use of biological controls to degrade oil spills, specifically Acinebacter phosphadevorus, a microorganism capable of assimilating phosphates and oil which is superior to other microorganisms for oil cleanup because of its capability to digest a large number of carbon compounds. He studied the hazards and risks involved with an LNG terminal near Pascogoula, Mississippi.

While at W. R. Grace Chemicals, Mr. Dahlstrom also was involved with the planning for control and containment of a low-grade thorium compound which had reached a stream after leaking through a containment dike. He traced the dispersion of the thorium in the environment. He learned and applied the principles of acid containment and protection, particularly with hydrofluoric, hydrochloric, perchloric, and sulfuric acid. While in this position, he served as chairman of the Plant Communications Council.

Prior to his association with Grace, Mr. Dahlstrom worked for Cutter Laboratories in Chattanooga where his activities involved biological analysis of raw materials and finished products, clean room operations, and the biological seeding of intravenous solutions. He gained extensive experience in the control of hazardous microbiological materials, including yeasts, molds, and fungi. He was involved with the requalification by the United States Food and Drug Administration of a plant producing intravenous solutions.

During his graduate studies, Mr. Dahlstrom specialized in radiological health and safety and occupational/environmental health. In his master's dissertation, which contributed to the State Health Plan for Pennsylvania, he examined environmental and occupational factors as causes for lung cancers and other cancers in terms of industrial and community health.

Laboratory Analysis

Mr. Dahlstrom is proficient in analytical procedures using infrared spectroscopy, gas chromatography, ultraviolet adsorption, atomic adsorption, magnetic resonance, and emission spectroscopy and is experienced with the use of radioisotope survey and monitoring instruments and systems.

At Velsicol Chemical Corporation, where he worked as an analytical/quality control chemist, he was involved with the handling of many organic solvents, including benzene compounds, toluene, MBK, and MIBK.

ANTHONY A. FUSCALDO
Ecology and Environment, Inc.

Region III, Assistant FITL
Safety Officer

EDUCATION:

Ph.D., Microbiology, Indiana University, 1967
M.S., Virology, St. John's University, 1963
B.S., Biology, St. John's University, 1961
Special training in Biohazard and Injury Control, Minnesota School of Public Health; Cancer Research Safety, National Cancer Institute; Town Planning, West Chester State College

EXPERIENCE:

Dr. Fuscaldo joined E & E as assistant team leader for the Region III (Philadelphia) team for the Field Investigation of Uncontrolled Hazardous Waste Sites. His primary responsibilities have concerned health and safety including personnel training, decisions regarding procedure and equipment in the field, and input to standard operating procedures during field investigations. He is also responsible for coordinating safety procedures for subcontractor personnel and for directing Region III FIT field operations. This involves scheduling, planning, and supervision of operations from preliminary assessment of hazardous waste sites through the site visit and final report.

Prior to joining E & E he was employed at the Cancer Institute of Hahnemann Medical College as Director of the Electron Microscopy Laboratory. He headed the research laboratories for the Institute's Medical Oncology Division. He directed the Division of Tumor Biology for the Department of Medical Oncology and Hematology, with responsibility for the electron microscopy laboratories, the viral oncology laboratories, the tissue culture laboratories, the biochemistry laboratories, the biohazard laboratory suite, the instrumentation laboratory, the cytogenetic facilities, and the division library.

Because of his experience with biohazard laboratories at the Army Biological Laboratories at Fort Detrick, Maryland; radiological safety at Merrell-National Laboratories; carcinogenic safety at the Cancer Institute; and various National Institute of Health Safety symposia, he was appointed Carcinogenic and Biosafety Officer at Hahnemann Medical College and Hospital. In this capacity, he wrote "Hahnemann Institutional Life Safety Committee Standards for Laboratory Operations Involving Carcinogens" and instituted procedures to implement the regulations. He was appointed Chairman of the Institutional Biosafety Committee which is charged with monitoring recombinant DNA research and other biohazards within the medical school and hospital complex.

He edited the "Handbook of Laboratory Safety" for Academic Press, Inc. It covers all aspects of laboratory safety from psychological factors and medical surveillance; through physical and electrical safety; to laboratory techniques such as animal handling, radiation safety, biosafety, and carcinogenic and toxicological problems. He assisted in planning and teaching a course in environmental hazards of the laboratory at Hahnemann Medical College.

SPECIAL EXPERIENCE:

Cancer Research

As a principal investigator in the viral genetics branch of the Army's Virus Rickettsia Division at Fort Detrick, Maryland, Dr. Fuscaldo was responsible for overseeing the work of three research teams. He held administrative responsibilities for personnel, budget, technical planning, and reports.

In 1970, he was a member of a committee of five scientists lobbying for the conversion of Fort Detrick to a Cancer Research Center. His primary task was political liaison with federal and state officials. He maintained an active relationship with members of Congress and their staffs. He was also the public relations officer for the group. His efforts in this area resulted in favorable reports in newspapers such as the Washington Post, Washington Star, and Baltimore Sun; in national scientific publications such as Science and Nature; and on television including Metro Media TV and the ABC evening news. In 1972, Fort Detrick was converted to the Frederick Cancer Research Center.

He was the sole editor-consultant for the Cancergram entitled "Virus Studies in Humans and Other Primates," an information service provided to researchers by the Franklin Institute under contract from the International Cancer Research Data Bank (ICRDB) program of the National Cancer Institute. In addition, he has also acted as a consultant for the Cancergrams entitled "Antigens Associated with Cancer-Related Viruses" and "RNA Viruses Associated with Cancer" (excluding Studies in Avian and Primate Systems).

Viral Vaccine Research

At Merrell National Laboratories in Pennsylvania, his responsibilities included the development of testing procedures for vaccine purity and the development of new viral vaccine strains. The former responsibility involved the use of isotope dilution techniques, as well as developing new radioimmunoassay techniques. The latter responsibility included the writing of IND's for new virus vaccine strains. He was also the radiation safety officer for the Swiftwater plant. During his tenure, Atomic Energy Commission radiation inspections resulted in approved ratings.

RAYMOND D. HARBISON, PH.D.
Department of Pharmacology
and Biochemistry
Vanderbilt University
School of Medicine

Advisor for Health Surveillance Program and Training Programs, Oil and Hazardous Substances Spill Prevention and Emergency Response Program

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Dr. Harbison has worked as a consultant to E & E. During early phase of both the TAT and FIT, he served as a lecturer in toxicology and health, and safety aspects of handling hazardous and toxic wastes. He was the advisor and monitor of the health surveillance program which was developed for E & E TAT and FIT programs.

For E & E, Dr. Harbison has a 24-hour emergency toxicological service in case E & E personnel are exposed to chemicals. Dr. Harbison directs the National Hazardous Materials Training Course which is sponsored by the Toxic Substance Control Institute. The course was originally developed in conjunction with the EPA, and has been used to train EPA on-scene coordinators of hazardous materials spills and United States Coast Guard and Navy personnel.

Dr. Harbison's additional background and experience are summarized below:

- o Editorial Board, Teratogenicity, Mutagenicity, Carcinogenicity, 1979-present
- o Society of Toxicology Achievement Award, 1978
- o Scientific Program of National Center for Toxicological Research, 1977-1978
- o Professional Affairs Committee, American Society for Pharmacology and Experimental Therapeutics, 1977-present
- o National Institute on Drug Abuse--review of DAWN (Drug Abuse Warning Network), 1977-present
- o Editorial Board, Environmental Health Sciences, 1976-present
- o National Academy of Science, Advisory Center for Toxicology--revision of Toxicity Testing Procedures for Consumer Protection Agency, 1976-1977
- o National Institute on Drug Abuse Center Review Committee, 1975-1976

- National Institute on Drug Abuse, Clinical Behavioral Review Committee, 1974-1975
- Standing Policy Committee on Biomedical Sciences, Vanderbilt School of Medicine
- Consultant, Congressional Committee on Safety Assessment of Chemical Additives and Drugs, 1974-present
- Editorial Board, International Journal of Addictive Diseases, 1974-present
- Chairman, Technical Committee of the Society of Toxicology, 1975-1976
- Co-Chairman, Technical Committee of the Society of Toxicology, 1974-1975
- National Institute of Mental Health--Narcotic Addiction and Drug Abuse Review Committee, Biomedical-Pharmacology-Toxicology, 1971-1975
- Vanderbilt University School of Medicine, Associate Professor of Pharmacology and Biochemistry, 1977-present
- Vanderbilt School of Medicine, Assistant Professor of Pharmacology and Biochemistry, 1972-1976
- Director of Teratology Section, Laboratory of Environmental Health, Department of Medicine, School of Medicine, Tulane University, 1971-1972
- Tulane Medical School, Assistant Professor, Department of Pharmacology, 1971-1972
- Tulane Medical School, Instructor of Pharmacology, 1969-1970
- USPHS Trainee, University of Iowa, Department of Pharmacology, College of Medicine, Iowa City, Iowa, 1965-1969

ROBERT J. KING
Ecology and Environment, Inc.

Assistant National Project Manager for Training and Safety, Field Investigation
Public Health Specialist
Technical Advisor

EDUCATION:

M.P.H., University of Minnesota, 1972
United Nations Graduate Program on the Human Environment, 1972
B.M.E., University of Minnesota, 1968

EXPERIENCE:

Mr. King recently returned to E & E as the assistant national project manager for training and safety for E & E's contract with the United States Environmental Protection Agency for the Field Investigation of Uncontrolled Hazardous Waste Sites. In addition to his public health training and managerial experience, he has a long history of practical field experience with the oil, gas, and synthetic fuel industries.

Mr. King was responsible for environmental work on a $40-million technical support contract with the Department of Energy's (DOE's) Division of Fossil Fuel Processing coal conversion program. He acted as environmental advisor for coal conversion programs including the SRC I and SRC II coal liquefaction demonstration facilities in Kentucky and West Virginia. He also managed a number of coal conversion investigations entailing environmental studies for a coal gasification multi-test facility; environmental surveillance on the construction of a gasifier-in-industry program; and a peat gasification development program.

For the multi-test facility, Mr. King managed and participated in site feasibility studies, evaluated environmental regulations, and established design criteria for waste treatment process. For the coal gasification demonstration program, he evaluated requirements and compliance needs of the Resources Conservation and Recovery Act. For the gasifiers-in-industry program, he evaluated environmental permit requirements and monitored the construction of facilities for compliance. He participated in employee and public safety reviews for two competing processes for the coal liquefaction program.

In addition, he headed a team which evaluated the environmental and technical issues that could potentially constrain development of alternate fuel technologies. The issues included the siting of coal liquefaction facilities to meet the President's Executive Order and peat gasification program. In support of DOE Headquarters, he monitored the environmental work of other support contractors, process developers, ORNL and ORO.

Mr. King has worked as an air pollution/public health specialist and project engineer at E & E. He was assigned to environmental assessments of energy-related facilities and evaluation of OSHA requirements. He was responsible for characterization of all potential pollution sources, dissemination of these analyses to other members of the review team, and direction of the air pollution analyses of the atmospheric environment and proposed projects' impacts.

SPECIAL EXPERIENCE:

Alaska

As assistant project manager for E & E's Trans-Alaska Pipeline project, Mr. King assembled a five-report summary of procedures for environmental design considerations, the oil spill contingency plan, environmental compliance, fuel gas line construction, and the evaluation of oil spill incidents at Alyeska's Marine Terminal. These reports represented a compendium of extensive field experience and were written to serve as training guides and field manuals for future major arctic construction activities such as the approved ALCAN gas pipeline project.

He devised and conducted an oil spill demonstration program to evaluate Alyeska's readiness to execute its oil spill contingency plan. This program evaluated equipment allocation and readiness, personnel training, and the actual response to spill conditions which would be encountered in Alaska.

He also held responsibility for the design review of the Trans-Alaska Pipeline System's Valdez terminal. He managed E & E's field surveillance program. His responsibilities included the response to oil spills; improvement of fuel handling procedures; and evaluation of life support systems such as sewage plants, potable water supply facilities, incineration, and other waste disposal techniques.

In addition to field surveillance duties, Mr. King directed the development of the Alaska Pipeline Office Oil Spill Response Manual for the Department of the Interior. He prepared and conducted a training program for government representatives who will be on-scene coordinators in the event of pipeline-related spills. During startup of the TAPS, he was the lead environmentalist on the control and cleanup of four crude oil spills involving a sabotage incident, explosion of a pump station and leaks from valves.

Air

He has managed environmental projects dealing with ambient air monitoring, air pollution source compliance testing, solid and liquid waste management studies, and studies of leachate from landfills.

MARTIN S. MATHAMEL
Ecology and Environment, Inc.

Region V, FIT Member
Chemist

EDUCATION:

B.S., Chemistry, University of Michigan at Ann Arbor, 1971
Graduate courses, Chemistry, Loyola University, 1979; Eastern Michigan University at Ypsilanti, 1973

EXPERIENCE:

Mr. Mathamel joined E & E as a member of its Region V (Chicago) team for the Field Investigation of Uncontrolled Hazardous Waste Sites.

He previously supervised a computer-assisted forensic and industrial consulting laboratory in Illinois. His work included the use of gas and high-performance liquid chromatography, infrared and ultraviolet spectroscopy, microscopy, and wet chemistry. He has performed EPA stationary source and hydrocarbon compliance testing, as well as Occupational Safety and Health Act (OSHA) sampling. He has provided expert testimony in conjunction with his assignments.

Mr. Mathamel has conducted arson investigations and has analyzed fire accelerants in fire debris and has performed flashpoint and flammability testing. He has evaluated explosives and assisted in the preparation and presentation of a seminar entitled "Professional Techniques in Investigating Accidents."

In addition, he has applied instrumental and analytical laboratory procedures to air and water pollution, and to plastic and rubber analysis. In Illinois, he supervised a year-long ambient air sampling program with the EPA in conjunction with the University of Illinois.

JAMES B. MOORE
Ecology and Environment, Inc.

Region IV, FIT Member
Hydrologist

EDUCATION:

M.S. Candidate, Forest Resources/Forest Hydrology, University of Georgia
B.S., Biology, The Citadel, 1970

EXPERIENCE:

Mr. Moore joined E & E as a member of its Region IV (Atlanta) team for the Field Investigation of Hazardous Waste Sites.

Mr. Moore has 10 years' experience in hazardous waste management and environmental assessment, remote sensing, water quality research, and military administration and command. He has experience in Georgia as an ecologist and engineer on hazardous and residual waste management, flood insurance, and terrain analysis projects. He has used remote sensing data in environmental assessments of land use changes, water quality research, and non-point-source pollution control.

Mr. Moore developed hazardous waste management planning programs for the states of Tennessee and Alabama. He supervised a six-month survey of 400 industrial residual and hazardous waste generators, transporters, and disposers in the state of Alabama to determine best residual waste management plans for the state and private industry. In addition, he supervised an intensive effort to determine disposal methods at 17 army ammunition plants and depots.

SPECIAL EXPERIENCE:

Hydrology/Water Quality

Mr. Moore has assisted in base condition hydrologic analysis and hydraulic modeling for flood insurance studies for several cities and counties in Georgia. He supervised the preparation of environmental assessments for a beach nourishment project on the Gulf Coast, an industrial effluent pipeline route through an endangered species habitat, and a metropolitan water supply study.

As a graduate research assistant, Mr. Moore collected, collated, and analyzed water quality data from first experimental watersheds located in Piedmont physiographic region of Georgia. Implemented experimental procedures used in water quality, erosion, sedimentation, and non-point-source pollution control studies.

Land Use

Mr. Moore coordinated acquisition and analysis of data from remote-sensing satellites (LANDSAT) to determine the state-wide environmental and economic impacts of placing marginal, sub-marginal, and Soil Bank land into crop production. He used R-Index Method and specially developed land resource units to determine state-wide, non-point-source pollution caused by herbicide, insecticide, and fertilizer use.

BOYD N. POSSIN
Ecology and Environment, Inc.

Region V, FIT Member
Hydrogeologist

EDUCATION:

M.S., Geology, University of Wisconsin at Madison, 1973
M.S., Water Resources Management, University of Wisconsin at Madison, 1972
B.S., Earth Science Secondary Education, University of Wisconsin at Madison, 1970

PROFESSIONAL AFFILIATIONS:

Geological Society of America
American Water Resources Association
American Water Well Association

EXPERIENCE:

Mr. Possin is the assistant team leader and training officer for E & E's Region V (Chicago) office under the FIT contract. He has eight years of hydrogeological experience in the Great Lakes area and has conducted and managed a wide variety of environmental studies. With E & E, he has acquired field experience in the investigation of hazardous waste sites. He has completed onsite evaluations of soil and groundwater contamination in Minnesota and Ohio. In Michigan, he has determined the effects of a hazardous waste landfill on the Detroit River. In previous experience as a team leader on a contaminated waste processor project for the Corps of Engineers in Huntsville, Alabama, he developed waste handling and processing alternatives for pyrotechnics, explosives, and propellants.

As the manager of a regional office of an environmental consulting firm in Chicago, he was previously responsible for environmental monitoring, preparation of environmental impact statements and reports, and preparation of reports dealing with various aspects of flood control.

As a self-employed environmental consultant, he performed monitoring and feasibility studies for 27 Inland Lake Protection and Rehabilitation districts in Wisconsin. He also conducted studies of groundwater contamination from waste disposal operations.

As a researcher at the University of Wisconsin, he was responsible for designing and implementing a field program for developing the surface and groundwater hydrologic regimes of two lakes in Wisconsin.

In Pennsylvania, he participated in several types of hydrogeological consulting projects including the preparation of draft environmental report modules for sanitary landfills and spray irrigation sites. He also served as project manager for the preparation of the groundwater quality plan for the seven-county Philadelphia region as part of Pennsylvania's version of the 208 planning process.

JOHN R. TOTIN	Region VI, Assistant FIT Leader
Ecology and Environment, Inc.	Chemical Engineer

EDUCATION:

B.S., Chemistry, Boston College, 1957

EXPERIENCE:

Mr. Totin joined E & E as assistant team leader for the Region VI (Dallas) Field Investigation of Uncontrolled Hazardous Waste Sites which the company is performing for the United States Environmental Protection Agency. He previously served for 21 years with the United States Army, earning the rank of lieutenant colonel in the Chemical Corps. He has extensive experience in problem solving and planning and allocation of scarce resources to provide environmental protection from toxic chemical and radiological agents. He expedited and directed the massive movement and storage of chemicals; developed and monitored training exercises for the handling of toxic agents including substance identification, decontamination, and casualty management; and wrote contingency plans for both military operations and regional management of nuclear or chemical accidents within a four-state area. He is skilled in training and directing technical work groups, interpersonal communications, and budget planning and coordination. He also has prepared environmental impact assessments to support the use of simulated toxic chemical agents in training.

Mr. Totin has considerable expertise in coping with nuclear and chemical accidents, as well as in the study of technical analysis and computations related to protection of personnel and work environments from harmful dosages of radiation.

Mr. Totin has been a speaker at several National Governors Association conferences on landfill, hazardous waste, and resource conservation and recovery task forces. He has addressed special interest groups in the Chicago area and has participated in public hearings regarding toxic substances.