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RCRA PERSONNEL TRAINING GUIDANCE MANUAL

FOR OWNERS OR OPERATORS OF HAZARDOUS WASTE MANAGEMENT FACILITIES

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CHAPTER 1

INTRODUCTION

1.1 WHAT IS RCRA?

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA, the Act). The stated objectives of RCRA are to promote the protection of human health and the environment and to conserve valuable material and energy resources. Subtitle C of RCRA specifically concerns the management of hazardous waste.

The following elements are the key to the Federal hazardous waste management regulatory program under RCRA:

- definition of hazardous waste
- a manifest system to track hazardous waste from its generation to its final disposal
- standards for generators and transporters of hazardous waste
- permit requirements for facilities that treat, store, or dispose of hazardous waste
- requirements for state hazardous waste programs

On May 19, 1980, regulations promulgated under RCRA require that owners or operators of hazardous waste management facilities train their personnel. This manual has been prepared specifically to provide guidance concerning these personnel training requirements.

1.2 PURPOSE OF THIS MANUAL

Regulations promulgated under RCRA on May 19, 1980, require owners or operators of hazardous waste management facilities to train their personnel. Specifically, 40 CFR 265.16 states:

"Facility personnel must successfully complete a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures the facility's compliance with the requirements of this Part..."

"This program must be directed by a person trained in hazardous waste management procedures and must include instruction which teaches facility personnel hazardous waste management procedures (including contingency plan implementation) relevant to the positions in which they are employed. At a minimum, the training program must be designed to ensure that facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures, emergency equipment, and emergency systems, including where applicable:

(i) Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment;

(ii) Key parameters for automatic waste feed cutoff systems;

(iii) Communications or alarm systems;

(iv) Response to fires or explosions;

(v) Response to groundwater contamination incidents; and

(vi) Shutdown of operations."

This training must be completed either within six (6) months of the effective date of the regulations, i.e., six (6) months from November 19, 1980, or six (6) months after the date of employment or assignment to a facility or to a new position at a facility, whichever is later.

The regulations state explicitly that facility personnel must be trained and that the training must be correlated to job classification. The regulations do not provide criteria for acceptable training programs.

The intent of this manual is the provision of guidance to owners or operators or other facility personnel concerning the design and implementation of personnel training progams. Information is provided concerning training in general and specific recommendations are made concerning training modules appropriate to training in hazardous waste management. Recommendations are also provided concerning training module content. In all cases the intent has been to recognize sufficient flexibility in approach that cost-effective programs can be implemented.

1.3 SCOPE AND ORGANIZATION OF THE MANUAL

For some types of activities exist nt at hazardous waste management facilities, personnel training is required under the Occupational Safety and Health Act. In the development of this manual these types of training have been recognized; however, personnel training which is required under RCRA has been interpreted as going beyond that designed to protect workers and extending into the area of community protection as well.

This manual has been prepared to provide guidance to an audience consisting of owners or operators of hazardous waste management facilities and also regulatory personnel responsible for facility permitting. It was not considered appropriate to the scope of this manual to identify minimum acceptable educational backgrounds and qualifications for facility personnel. Rather, information is provided in subsequent sections concerning general training strategies and program design, types of training, training modules pertinent to hazardous waste management, suggested training module elements, and sources of information. The correlation of training to job description is also addressed.

Chapter 2 provides a discussion of pertinent elements of the RCRA regulations and contains suggestions for additional sources of informa-

tion. Chapter 3 discusses personnel training and the design and implementation of training programs in general. Fundamental issues pertinent to hazardous waste management facility personnel training are considered in Chapter 4. Chapter 5 presents detailed recommendations concerning training modules and training module elements and sources of information are provided in Chapter 6.

1.4 WHERE ARE YOU NOW?

Training program design and implementation in accordance with the regulations requires an evaluation of the following items:

- Are high level management personnel aware of the personnel training requirements under RCRA?
- Have priorities been established?
- What is the status of existing personnel training?
- Has the required training been administered?
- Are the required records being kept?

Information concerning RCRA regulations can be found in the Federal Register (May 19, 1980) and updates. Appendices A and B present addresses and phone numbers for state hazardous waste management personnel and the USEPA regional division offices. Also EPA is preparing a series of technical manuals for various facility operations and regulatory activities. These are listed in Appendix C.

CHAPTER 2

LEARNING ABOUT RCRA

2.1 GENERAL

Regulations concerning personnel training under RCRA can be found in 40 CFR 264 and 40 CFR 265. The RCRA permit program is discussed in 40 CFR 122 and 40 CFR 124. Key elements of the Act are discussed below.

2.2 INSPECTIONS

Section 3007 of RCRA pertains to inspections. The following is taken direct from Section 3007:

> "...any person who generates, stores, treats, transports, disposes of, or otherwise handles hazardous wastes shall, upon request of any officer or employee of the Environmental Protection Agency, duly designated by the Administrator, or upon request of any duly designated officer or employee of a state having an authorized hazardous waste program, furnish or permit such person at all reasonable times to have access to, and to copy all records relating to such wastes..."

The USEPA is currently preparing two manuals containing information on facility inspection (see Appendix C.)

2.3 COMPLIANCE ORDERS, CIVIL AND CRIMINAL PENALTIES

Section 3008 of RCRA contains sections pertinent to Federal enforcement. Provisions are specified for compliance orders and violations. Civil penalties may be incurred of up to $25,000 for each day of non-compliance. Criminal penalties are defined for activities which include transport of a hazardous waste to an unpermited facility; management of a hazardous waste at an unpermited facility; and making false statements and representations.

2.4 WHERE TO GET HELP

Appendices A and B present information on addresses and phone numbers for state and Federal hazadous waste management regulatory personnel.

2.5 OTHER SOURCES OF INFORMATION

Chapter 6 of this manual presents information on existing training materials and training programs.

CHAPTER 3

PERSONNEL AND TRAINING

3.1 TRAINING

3.1.1 Overview

This chapter provides information on many fundamental aspects and components of effective training program design and implementation. One methodology in particular, the instructional system development approach (ISD) developed by the Department of Defense, is discussed in detail to provide a basic vocabulary and foundation upon which owners or operators and other interested parties could build specific training programs designed to meet specific personnel training needs.

Clearly, training needs must be correlated to manpower requirements and accompanying job descriptions. In Chapters 4 and 5, information is provided to assist the owner or operator in establishing this correlation and in identifying specific program elements. While it was not considered appropriate to the development of this manual to establish educational requirements and qualifications for facility personnel, owners or operators are encouraged to identify and incorporate minimum personnel qualifications for various job descriptions to ensure successful completion of training objectives and safe and effective facility operation. Also, while there are no federal requirements for personnel certification and licensing and educational levels, owners or operators are advised that some states have proposed or enacted hazardous waste management laws and regulations incorporating these requirements.

3.1.2 Training Strategies

The sources of much of the material in sections 3.1.2 through 3.1.5 are the Instructional System Development (ISD) training manuals developed for the Department of Defense. The ultimate purpose of ISD is to produce a properly trained person; that is, a person who can do the job for which he was trained. This means that in order to design and carry out effective training it is necessary to define the job in detail. The ISD process begins with specific questions about the job.

Some of the details which must be identified in order to develop adequate training are:

a. What kinds of people will be doing this job? How many will be doing the job? Where will they be located?

b. What major duties does the job include?

c. What tasks make up the job?

d. Exactly how is each task accomplished? What work elements make up the task? In what order must these be performed?

e. Under what conditions must each task be performed? What tools, equipment, or other facilities are required to perform each task?

f. What cues cause a worker or job holder, in the job situation, to perform a particular task in a particular manner? (How does he know when to start a task, when to perform each element that makes up the task, and when the task is completed?)

g. To what standard of proficiency must each task be performed?

3.1.3 Training Criteria

Requirements for personnel training originate from a number of sources:

a. Introduction of new equipment and processes.

b. New laws.

c. Realignment and/or consolidation of jobs.

d. Quality control reports indicating a training need that is not being adequately met.

While training needs can and will arise from any and all of these sources, the first step in the ISD process is to identify the discrepancy that exists between whatever training is being given at the present time and the training that must be given to satisfy the manpower need. Discovery of this discrepancy begins by asking the question: Does anyone do the job now? If the answer is "yes," then does a training program exist now for this job?

If the answer to both questions is yes, an evaluation of the existing course can be made to insure that it meets the requirements. If the answer is "no" to either of the above questions (that is, if no one does the job now or no training programs for the job exist), a discrepancy is found. In the first case, where no one does the job now, the job undoubtedly is just being created because of some new or modified system or equipment. A discrepancy is certain to exist between the ability of existing courses to effectively and efficiently train personnel, and the training requirements of an as yet undefined new job. In the second case, where there is no existing training program, there is an obvious discrepancy. Therefore, the correct place to begin in the ISD process is to analyze the job to determine exactly what the job holder must do when he does the job right. This is the foundation for all sound training programs. If this step is

not done and done well, there will be no basis for development of effective, efficient instruction.

3.1.4 Basic Concepts

It is essential that those involved in ISD define such terms as job, duty, task, and element in the same way. Since one of the purposes of analyzing jobs is to provide information for developing instruction, there must be clear communication between those analyzing the job and those who use the job analyst's findings as a basis for developing instruction. Figure 3-1 illustrates the relationship between the several layers of a job breakdown.

The duties and tasks performed by a single worker constitute his job. If identical duties and tasks are performed by several individuals, they all hold the same job. The job is the basic unit used in carrying out the personnel actions of hiring, training, and assignment.

A duty is one of the major subdivisions of work performed by one individual. A job is made up of one or more duties.

The following are some of the characteristics of duties:

a. A duty is one of the job holder's main functions. It sometimes may be a particular job holder's total job.

b. A duty is a grouping of closely related tasks.

c. Duty requirements often are the basis for initial assignment to a job, for determining the qualifications required to perform in the job, or for determining requirements for post-assignment training.

Duties can usually be defined by asking a supervisor what he thinks are the 5 or 6 most critical factors of a job or what he would demand of a person being considered for a job. In the case of a clerk/typist, for

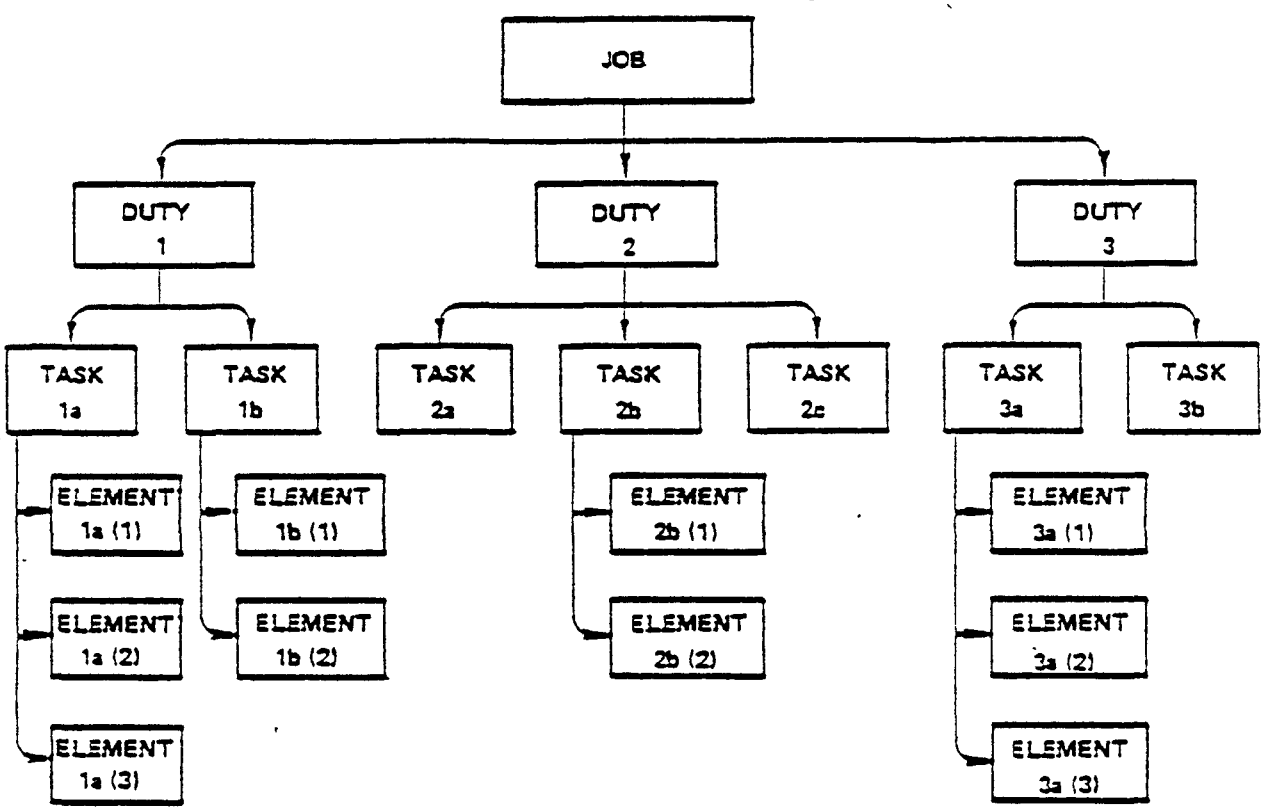

FIG. 3-1. INTERRELATIONSHIPS OF JOB, DUTIES, TASKS, AND ELEMENTS

example, he may say, "(1) Ability to operate equipment, (2) ability to route correspondence, (3) ability to maintain files, and (4) ability to prepare correspondence." The job of clerk/typist, even after exhaustive analysis, probably will be found to consist of four duties, i.e., OPERATING equipment, MAINTAINING files, ROUTING correspondence, and PREPARING correspondence.

Job analysis actually is accomplished at the task level. Duties are actually clusters of tasks, the performance of which constitute the duties. Job analysis goes much deeper into job activity description at the task level than it does with the more general duty statements. A task is the lowest level of behavior in a job that describes the performance of a meaningful function in the job under consideration. Examination of the job at the task level allows the job to be described in sufficient detail to serve as the basis for a complete instructional system.

Task statements must be constructed carefully to assure that the final analysis yields usable job performance data. The following are characteristics of tasks and task statements:

a. A task statement is a statement of a highly specific action.

b. A task has a definite beginning and end.

c. Tasks are performed in relatively short periods of time, i.e., seconds, minutes, or hours, but rarely, if ever, days, weeks, months, or years. Although no definite time limit can be set, the longer the period of time between the beginning and the completion of the activity, the greater the probability that the activity is a generality or goal rather than a task.

d. Tasks must be observable in that by observing the performance of the job holder or the results of his efforts a definite determination can be made that the task has been performed.

e. A task must be measurable; that is, in the real world, a technically proficient individual can observe the performance of the task or the product produced by the task and be able to conclude that the task has or has not been properly performed.

f. Each task is independent of other actions. Each task statement must describe a finite and independent part of the job. Tasks are not components of a procedure. In the eyes of a job holder, a task is performed for its own sake in the job situation. A task is either performed or not performed by any one job holder. The job holder is never responsible for only part of a task.

An element is the smallest "package" of behavior that has practical meaning to the instructional designers. By "has practical meaning," is meant that further subdivision of the element would be unnecessary since the instructional designers fully understand the element without further subdivision. To be useful as a basis for developing instruction, step-by-step direction and guidance are required as to how the task is performed. The work activities that make up this step-by-step direction and guidance are the elements that make up the task.

By way of an example, the following demonstrates these definitions:

JOB - Material Handler.

DUTY - Off-Load vehicles using a drum handler.

TASK - Perform before operation maintenance on the drum handler.

ELEMENT - 1. check oil, fuel, and coolant levels.

2. Visually inspect engine compartment for evidence of leakage or damage.

3. Check tires for excessive wear, damage and correct pressure.

4. etc.

3.1.5 Training Response and Feedback

An ideally developed training program is of no use if it does not accomplish its designed purpose. It is vital that feedback be provided to tell the trainers whether or not the program is working. This takes place through internal and external evaluation.

3.1.5.1 Internal Evaluation. The primary purpose of internal evaluation is to determine whether the instructional development effort has accomplished what was intended. Through the analysis of test results , whether written, oral, or performance, the effectiveness of the instruction is determined. If the student can do what he was taught, the instruction was successful. This does not necessarily point out whether the method used was the most effective and efficient.

3.1.5.2 External Evaluation. The primary purpose for conducting external evaluation is to find out whether students who successfully complete training can do, to the established standards, the job for which they were trained. A second purpose of external evaluation is to insure that the job is still the same as when it was job analyzed.

External evaluation is different from internal evaluation in two major ways. First, while internal evaluation is conducted before and during the actual instruction, external evaluation is conducted after the

students have completed the instruction and have been assigned to the job. Second, internal evaluation is concerned with whether the learning objectives are mastered by the students.

The results of a properly planned and carried out external evaluation will result in either,

1. Assurance that students who complete the course will be able to do the job to the level of their training, or
2. Data that indicate that students are not able to do the job to the planned standard, and on which of the job tasks they are failing.

In planning the external evaluation, one of the first concerns is the question of who will provide data. In general, data will come from five sources:

1. Baseline data gathered before development of instruction was started.
2. Graduates being evaluated. These are graduates who are now working on the job for which the instruction provided training.
3. Supervisors of the graduates listed above.
4. An evaluation team made up from the corporate hierarchy.
5. Records of students' performance during the instruction.

In addition to the above, it is advisable to check out some of the graduates who are now assigned to other jobs. Why were they assigned to other jobs? Were they first asigned to the job for which they were trained, and then reassigned to a different job because they could not do the first one?

By making comparisons between the baseline data and data gathered from the other four sources, it is possible to obtain at least partial answers to questions like the following:

1. Do a greater percentage of graduates of the current instruction show satisfactory performance on the tasks than graduates of older courses or training methods?
2. Do graduates of the current instruction require less on-the-job training than graduates of other courses or training methods?

From the graduates who are now working on the job, get answers to such questions as:

1. How well are you able to perform the job?
2. How much and what kind of training have you received since you arrived on the job?
3. How well did the instruction prepare you for the job?
4. What portions of the instruction were relevant to your job?
5. What portions of the instruction were irrelevant to your job?
6. In your job, how often do you use the skills taught?
7. In your job, what tasks have given you the most difficulty?
8. In your job, for which tasks do you feel the least adequately prepared?
9. In your job, which tasks do you think you perform the best?
10. What parts of the instruction do you think could be changed to better prepare students for the job?

From the supervisors of graduates who are now working on the job, get answers to such questions as:

1. How well are the graduates able to perform on the job?

2. How do these graduates compare to those who received no training or were trained by an alternate method?
3. How much and what kind of training have the graduates received since arriving on the job?
4. In what areas were the graduates the most adequately prepared?
5. In what areas were the graduates inadequately prepared?
6. What suggestions would you make for improving the training program?
7. Has the graduate had accidents or been reprimanded for misuse or improper operation of equipment?
8. Has the graduate been warned or commended for unusually good or bad performances?
9. Has the graduate been recommended for promotion?

From the evaluation team, get answers to such questions as:

1. How well did graduates score on the job performance measures?
2. Which tasks did they fail?
3. What is the relationship between the tasks and the actual job requirements?
4. Were performance tests properly administered and scored?
5. Does the firm perform the job in accordance with regulations or approved doctrine?
6. How well does the supervisor know the job?
7. What other factors should be considered in making revision decisions?

It is not advisable to contact a graduate or the graduate's supervisor until the graduate has been on the job for at least 30 days. This is because it probably will take that long for the graduate to get some feel

of how well the instruction prepared him for the job, and exactly what the real job is all about. Also, it probably would take that long for the supervisor to get a clear picture of how well the new graduate can perform.

On the other hand, it is recommended that no longer than three months elapse before contacting the graduate and his supervisor. After that period, the graduate will be hard pressed to remember details of the instruction. He likely will have a difficult time making realistic judgements about how well it prepared him for the job. Also, the supervisor likely will have difficulty in recalling intervening training and the graduate's initial capabilities.

Once all of this information has been gathered, an accurate appraisal of the effectiveness of the training can be made, changes can be implemented, and the training cycle started again.

3.1.6 Instructor Skill Level

3.1.6.1 Lecture and Discussion Courses. Generally speaking, an instructor for a lecture and/or discussion type program should be an acknowledged expert in the field or highly qualified, at a minimum, since answers to questions that could arise during the class may require a backlog of considerable experience and expertise.

3.1.6.2 On-The-Job Training. For performance type training programs, the instructor should be a supervisor who is skilled in the current methods of performing the task. The supervisor is recommended since he is the one who must ultimately make the determination of whether or not the trainee has mastered the skills necessary to perform those tasks called for in his job description.

3.1.7 Approximation to the Job

Realism is vital for any training. If the training is unrealistic, the value received from the training diminishes.

It is vital that the trainer be cognizant of the site functions and equipment. He must structure his training so that it parallels as realistically as possible, the actual job. The training should approximate "real-world" activities as much as possible.

On-the-job training is a special case since it is performed at the site, using actual equipment, under actual job conditions, and with close supervision.

3.1.8 Adaption to Trainee Difference

To be effective, any training program must be geared to the level of the class. This can be accomplished by several methods.

The obvious method is to screen the personnel records of the class participants. This allows the instructor to determine the educational level of the class. It also enables him to determine how much knowledge the trainees should have by the amount of time they have been working and by their position within the firm.

Another method that is widely used is pre-testing. Prior to class startup, an examination is administrated to the trainees. The pre-test results should allow the instructor to determine the knowledge level of the trainees; consequently the presentation can be tailored to correspond to specific needs.

Tests administered during the course (Internal evaluation) allow the instructor to determine whether or not the instruction is being retained.

Observation of the students during training will show the instructor if the students are paying attention. If the instruction is at too high or too low a level for them, or if it is confusing, the students will become bored and will be inattentive.

3.1.9 Cost

Costs for training will vary greatly dependent upon the type of training being given, the location of the training, the length of training, and the number of personnel to be trained. Certain generalizations can be made concerning costs, however.

In all training programs, certain fixed costs exist. These are:

a. The salary of the trainer.

b. The salaries of the trainees and the corresponding loss of productivity during the training period.

c. Direct expenses associated with the training program.

In on-site training, several costs are minimized. The facilities belong to the firm, thus they are "free." The student travel is minimized; hence, student expenses are negligible.

In off-site training, student travel and living expenses must be added to the normal wages and loss of productivity. These make off-site training more expensive unless personnel from many sites can be trained at one time, thereby eliminating repetitive iterations of the program and the resulting costs of the trainer. Prior to contracting for a course to be given many times at different locations, a cost analysis should be conducted to determine if a one course program might not be less expensive.

On-the-job training is a special case. A supervisor's time is taken up in the preparation, conduct, and supervision of the training for the

trainee. The supervisor's span of control during this type of training is extremely limited - usually to no more than two trainees. A benefit is gained, however, in that the trainees will have some productivity during their training.

Programmed instruction is relatively expensive to develop compared to other types of training, but once it is developed, it is the least expensive form of training to provide for any quantity of trainees and it is the easiest to administer.

3.2 TRAINING METHODS AND EVALUATION

3.2.1 Lecture

This is normally the least desired method of instruction. It has the greatest output of information but usually has the least retention by the students. The instructor is normally an expert in his field who, unless he has a "feel" for the group, can easily talk above or below the level of the group. In a lecture class, there is little chance for exchange between the student and instructor, especially with large classes. In an "informational-type class," the lecture is an ideal vehicle since it allows the maximum amount of information to be disseminated in a minimum amount of time. The formal lecture also lends itself to introductory classes where the student, under proper supervision in later classes, will have an opportunity to reinforce his learning through actual performance of the tasks that were taught in the lecture.

3.2.2 Discussion

The discussion, or conference, is an excellent learning vehicle when used properly. Although less information can be taught than in a lecture,

the student comprehension and retention is usually greater. There are two types of discussions - structered and unstructured.

Structured. The instructor is normally an expert, or is at least highly-qualified, in the subject to be covered. He begins the class using specific guidelines for the items to be discussed. He teaches an item and then allows the student to question or discuss the item. Once the instructor is assured that the students comprehend the item, he proceeds to the next item. At all times, the instructor maintains control of the class and guides the discussion.

Unstructured. An unstructured discussion is often beneficial as a "brain storming" session. It does not lend itself to the dissemination of a large amount of material. It is best used as a problem-solving tool where an item can be brought up and discussed with the entire class. In this instance, a minimum is said by the instructor or leader and the students actually conduct the class and discuss the subject. The instructor merely guides and maintains order.

3.2.3 On-The-Job Training (OJT)

OJT is a planned training program designed to qualify or upgrade trainees through self-study and supervised instruction, to perform a given job while actually working on the job. The training is conducted in the actual work situation generally by designated supervisors who also work in support of the organization.

The OJT supervisor should be carefully selected as one who has the knowledge and experience to conduct the training and evaluate the job

performance. He is normally the best qualified person available. He maintains the OJT records and selects, trains, and counsels the students. He also selects the tasks for each trainee, instructs, motivates, and evaluates the trainees.

Properly conducted OJT requires comprehensive planning, careful scheduling, timely implementation, capable direction, skillful apolication, and expert evaluation. It should be used only when the necessary supervisory manpower resources are available.

OJT is used most effectively where tasks are complex and can be learned faster or to a higher proficiency level with hands-on experience. Such programs can be particularly effective for persons newly hired or for persons reassigned to an area that has systems that are new to them. Another major advantage is that most programs permit the trainee to make a positive contribution to the job while they are being trained to perform more advanced tasks.

3.2.4 Case Study

Case studies are an excellent vehicle for either teaching or evaluating the lesson comprehension. A properly prepared case study will consist of several parts which may be actual or fictional.

Scenario. In this portion, all necessary background information is given to the student. This may consist of an oral or written presentation or both. Visual aids may also be used to further develop the scenario. It is vitally important that the student be given all necessary information. Extraneous material may be given if one of the desired results is that ths student be able to differentiate between necessary and unnecessary information. For maximum benefit to be

derived, it is necessary both that the student have ample time to absorb the material and that he understands it.

Problem. At this point, the student is either given the problem in writing or is told what he is expected to do. Dependent upon the level of expertise in the group, the problem difficulty and definition should be geared to the class-ranging from simple to complex.

Student Solution. The critical factor at this juncture is to allow sufficient time for the student to work out his solution. If insufficient time is allowed, the student will tend toward frustration and will not derive the maximum benefit of the exercise. If too much time is allowed, once the student arrives at this solution, he will be idle, he may become bored, and valuable training time will be lost. Depending on the objective of the exercise, the solution may be an individual effort or it may be a group effort.

Solution Discussion. Here the student or the group presents the solution that was determined. The solution is discussed by the class and the instructor. At this point, construction criticism may be offered. The instructor should point out the adequacies or discrepancies of the solution.

Actual Solution. If the case study is actual, the real solution should be presented. If it is fictional, the recommended solution should be given. Obviously, all actual cases are not going to have perfect solutions, the student benefits from being shown what was done as opposed to what should have done.

Discussion. Ample time should be allotted to thoroughly discuss the solution. Any differences between student solutions and

recommended solutions should be pointed out and explained as to why the recommended solution was chosen unless the student solution is obviously better. In that case, it should be explained why the student solution is better.

3.2.5 Simulation and Games

Simulation is best used in the testing of contingency plans. It is best utilized by following most of the steps used in the case study.

Scenario. The situation is explained fully just as though it were an actual operation.

Problem. The class is told that a problem exists. They are to remedy the problem using the existing contingency plans. At this time, they should be informed of any simulations and items that, although called for in the plan, are not available.

Student Solution. Using the steps of the contingency plan, the class should attempt to remedy the problem. If they are unable to do so, any deviations should be noted.

Solution Discussion. A more proper term for this activity is performance critique. A critical review of all activities should be conducted. Deviations from the master plan should be thoroughly discussed and a determination made of why the deviation was necessary. Wherever student mistakes, rather than plan failure, occurred, the mistakes should be discussed, explained as to why it was a mistake, and when possible, the consequences of the mistake detailed.

Remedial Action. Simulation, in essence, is a rehearsal. As such, it should be used to improve performance. When plan short-

comings are shown, the plan should be critically reviewed and revised as necessary.

General. Simulation, or gaming, is one of the most efficient methods for learning. The person does what was taught. This "doing" reinforces the skills that have been taught from the manager and trainer and it requires, extensive planning and supervision. Therefore, it is not always practical to use as a sole teaching vehicle. For facilities it is most appropriate to contingency plan training and emergency response.

3.2.6 Programmed Instruction (PI)

PI is designed to be used without an instructor being present. PI may include printed materials, audio or audio/visual delivery systems, relatively small training kits of tools and items to be assembled, repaired, or operated, and any other compact, transportable items. Also, the course may be designed to make use of facilities and equipment known to be available to the students.

While an instructor is not required at the student's location, assistance from the instructor should be available within a reasonable period of time. PI generally is intended for individual use and can be used by the individual on his own time; however, PI can also be used by two or more individuals meeting together and holding discussions and critiques for their mutual benefit.

PI is a very difficult teaching media to develop. It must be thorough, accurate, and interesting. If it is none of these, the student rapidly perceives its lack of usefullness. The PI must also contain a feedback mechanism to the student so that he can determine his progress. PI is best utilized to teach routine, non-complex items.

Trainer. On many occasions, the supervisor will be the trainer or will assist the trainer since he is the single person most knowledgeable of the job to be trained. He is also the one who normally has the closest relationship to the persons under him.

All of these roles are in addition to his inherent responsibilities of being the trainee's supervisor. He has a vested interest in assuring himself that his personnel receive adequate training. He is also the one who will normally supervise OJT programs for those under him.

3.3.3 Types of Training

Entry Behavior. Entry behavior includes the skills, information, and attitudes that an individual possesses at the time he comes for instruction. An instructional program assumes that students who begin instruction will already have certain skills, knowledge, and attitudes. The primary purpose of this effort is to establish exactly what these entry level behaviors are. One goal of efficient, effective instruction is to base new learning on what the students already have, and to avoid having them waste time on objectives they have already mastered.

Since the entry behaviors of individuals may vary greatly, it is not always practical to start instruction at the point that matches the behaviors of all prospective students. This means some individuals should either be rejected or given remedial lessons. Usually, the entry level is set at a point where most prospective employees will have the prerequisite skills, knowledge, and attributes.

The assumptions made about student entry behavior were based on familiarity with the general level of skills, knowledge, and attitude of

3.3 MANAGEMENT RESPONSIBILITY

3.3.1 Organizational Accountability

In the design and implementation of a personnel training program for a specific facility, it is highly desirable that input be provided from the appropriate health and safety personnel accountable to the organization for worker and community protection. The effectiveness of these individuals in training activities can be hampered through lines of communication and position in the chain of command which conflict with health and safety accountability. Consequently, it is recommended that health and safety directors removed from the line of command from operational considerations, be held accountable for training.

3.3.2 The Role of the Supervisor

The supervisor has a multi-faceted role in the training cycle.

Designer. He must have input to training program design. He is the most knowledgeable of what tasks are to be performed by the trainees. Usually, he has either written, or has had input into the writing of the various job descriptions for the people under him. He should have considerable input into the design, since he alone knows what he will expect from the trained personnel as far as job performance is concerned.

Scheduler and Coordinator. Since the personnel work for him, the supervisor is the logical person to schedule and coordinate the effects of the trainer and trainees. Even if the organization is large enough to have a separate training section, all efforts must be coordinated with him to insure that the trainees are at the right place at the right time.

personnel hired for the particular job and on external systems requirements. These external requirements are statements of minimum entry behaviors usually established by the personnel section. These requirements exclude from all or certain courses of instruction individuals who do not meet minimum industry or specific-assignment requirements. Some of these external requirements are as follows:

a. Administrative requirements which involve personnel compliance with regulatory requirements, e.g., a person may be known to be a habitual safety offender; thus, he may be undesirable for hire and/or training in a particularly hazardous environment.

b. Physical requirements which include specific skills and general fitness which may include age, height, color perception, vision, etc.

c. Academic requirements which include educational or aptitude considerations, specific courses, academic degrees, foreign language fluency, etc.

Orientiation. Any new employee should be allotted an orientation period. This, as practicable as possible, should be a formalized procedure so that management will be assured that all required information will be imparted to the newly hired person.

A thorough program should include, but not be limited to:

a. Administrative briefing: Work hours, sick leave, vacation, pay procedures, chain-of-command, personnel procedures, etc.

b. Operational briefing: What the firm does.

c. Job briefing: What his specific job will be, who his supervisor will be, where he will be working, etc.

d. Safety briefing: The general safety plan for the organization.

e. Training program: Specifically, what training he will be given to prepare him for his job.

Retraining and Corrective Actions. Training programs should be continually subjected to evaluation in an effort to assure that they are effective. Many times, evaluation will point out a need for retraining or some other corrective action. Some of the things that would point out this need include:

a. New or revised processes and/or equipment.

b. New or revised regulatory requirements.

c. Poor safety habits demonstrated through accidents or near accidents.

d. Employee suggestions or requests.

e. Organizational ineffectiveness and inefficiencies.

Obviously, the corrective action will vary from instance to instance. Generally, the action should attempt to cure the problem rather than to temporarily stop it.

Use of On-the-Job Training. When used properly, OJT is an effective teaching tool. The normal person retains the most knowledge and skill when he actually does the job. He retains the least when he sees or hears about it. During an OJT program, the person is productive; however, his productivity must be weighted against the loss of productivity of the trainer, usually a supervisor. OJT is the best method to teach a job that is performance oriented, lengthly and/or complex, and will be repetitive in nature. It can only be

effective if an OJT program is designed, adhered to, and implemented and directed by supervisory personnel who can devote the required time to the effort since the OJT program will require a considerable amount of close supervision.

New Hire Training. A training program should be implemented for all new hires. After a thorough job analysis, a program should be instituted for new personnel. This program should include an orientation program and a specific training program which will include a blend of classroom and OJT. The course should be designed to produce a knowledgeable, effective, safety-minded employee who can work with a minimum of supervision. Obviously, this is not an instantaneous product, but must be developed over varying lengths of time.

3.3.4 Need Under RCRA for Environmental Awareness

In the training cycle, many peripheral areas should be addressed. Although the areas may not specifically pertain to the trainee, these areas reflect a philosophy of management concerning the potential impact of hazardous materials. Many of the subjects go beyond the boundaries of the facility and worker protection. Some of these areas are listed below. Many will be site specific and will not be elaborated on.

- Accountability to the community
- Inspections
- Incident reporting
- Medical Surveillance
- Symptom recognition
- Accident investigation and analysis for cause
- Review of potential high hazard conditions and situations
- Program checklists

CHAPTER 4

ASSIGNING TRAINING

4.1 BASIC ISSUES

In the development of this manual, several fundamental questions were considered including:

- What types of training are needed?
- Who should be trained?
- What material should be recommended for inclusion?
- What levels of training are necessary?
- How should training be administered?
- How can proficiency be demonstrated?

4.1.1 What Types of Training Are Needed?

From the standpoint of training of hazardous waste management personnel, two types of activities can be distinguished as follows:

1. Routine day-to-day hazardous waste handling, storage, treatment, and disposal operations.
2. Emergency response activities in accordance with the specific site contingency plan.

Personnel training is necessary in each of these areas.

4.1.2 Who Should Be Trained?

As regards routine day-to-day hazardous waste management operations, training should be administered to all responsible on-site supervisory personnel and to all persons handling, storing, treating and disposing of hazardous waste. It is recommended that off-site personnel, especially those impacting on planning and site design and operational procedures, participate as well in the training programs.

Emergency response training should be conducted in accordance with the specific site contingency plan. Consequently, everyone having a role in the contingency plan should be trained in his or her specific duties per the contingency plan. It is anticipated that some minimum level of training in emergency response procedures should be administered to all persons who will be on site. In many cases this training will be limited to evacuation procedures. Some individuals, however, must necessarily be trained in specific activities, e.g., reporting of the event to the proper individuals and departments and implementation of mitigative measures, depending on the type and extent of emergency.

4.1.3 What Types of Material Should be Recommended for Inclusion in Training Programs?

As stated previously, training will correlate with job descriptions. Consequently, an individual's position and specific duties will dictate those areas in which training should be administered.

The following training modules have been identified and are discussed in subsequent sections of this manual.

- Training for Personnel Safety
  - Chemistry of Hazardous Materials and Wastes
  - Health Effects
  - Selection and Use of Personnel Protective Clothing and Equipment
- Release Prevention and Response
  - Contingency Planning
  - Emergency Response
- Decontamination Procedures
- Facility Operation and Maintenance

- Hign Hazard Operations
- Maintaining Documentation

4.1.4 What Levels of Training Are Necessary?

Clearly, a training program which would provide the same level of instruction to all on-site personnel is neither workable nor desirable. For a given hazardous waste management facility, a relatively small number of individuals will be in supervisory and decision-making positions with a degree of authority and responsibility which warrants broad training in all aspects of hazardous waste management pertinent to their facility. This broad training must necessarily encompass all of the six areas presented in Section 4.1.3 with the provision that the facility operation and maintenance module could be limited to only those hazardous waste management operations utilized at the individual's specific facility. The level of instruction which these management personnel receive should be reasonably comprehensive and should constitute a relatively detailed overview of all pertinent aspects of hazardous waste management. Other personnel, having more limited spheres of activity, responsibility and authority, could be trained at a level less comprehensive than that applicable to management personnel. Furthermore, depending on the specific position, training in one or more areas might not be necessary.

As an example of applying this correspondence, Figure 4-1 depicts correlations utilizing twelve (12) various job titles. Clearly, job titles may exist which are different from those exhibited in Figure 4-1. Thus, there will be some need for intepretation. The distinction between the need for broad versus limited training is linked to the degree to which the position is a managment level position.

	Training For Personnel Safety	Release Prevention and Response	Decontamination Procedures	Facility Operation and Maintenance	High Hazard Operations	Maintaining Documentation
Site Manager	B	B	B	B	B	B
Chief Chemist	B	B	B	B	B	B
Safety Officer	B	B	B	B	B	B
Supervisor - Foreman	B	B	B	B	B	B
Laboratory Technician	L	L	L	L	L	
Equipment Operator-Waste Handler	L	L	L	L	L	
Treatment Plant Operator	L	L	L	L	L	
Record Keeper		L				B
Maintenance Staff		L	L	L	L	
Driver		L	L			
Clerical Staff		L				
Security Guard		L	L			

B - Broad Instruction
L - Limited Instruction

FIG. 4-1 . JOB CLASSIFICATIONS AND CORRESPONDING TRAINING RECOMMENDATIONS

4.1.5 How Should Training be Implemented?

Three (3) types of complementary training implementation mechanisms can be distinguished as follows:

- formal training, e.g., attendance and participation in a short course or University course on hazardous waste management principles; relatively long term training, i.e., two (2) weeks or more at one time.
- informal training, e.g., weekly on-site safety meeting, seminars, etc.; relatively short term training, i.e., a few hours to a few days at one time.
- on-the-job (OJT) training.

While all of the above mechanisms have desirable features, none is recommended as a self sufficient vehicle for personnel training for all job classifications and levels of training. Chapter 3 provides information on the various advantages and disadvantages of instruction versus OJT training. Any requirement that all requisite personnel training be administered totally through classroom techniques would constitute an unreasonable and unnecessary economic burden and disruption of facility operations. Furthermore, an essential element of personnel training is the inclusion of a variety of site-specific aspects concerning specific facility hazards. It is difficult, if not imposssible, to provide this type of material in a formal presentation which is necessarily general. Site-specific material is best handled through informal training sessions and OJT administered by competent instructors who have some familiarity with the site. Consequently, it is anticipated that owners and operators will elect to incorporate selected aspects of each of the above training mechanisms into their personnel training program.

As stated previously, the intent is to recognize flexibility in training program design and implementation. Smaller companies might prefer, for economic reasons, to send their personnel to a private or university training program. On the other hand, larger companies might prefer to develop and administer the training program to their personnel. In either case, training could be administered by trained supervisory personnel or by outside instructors, in accordance with the regulations.

4.1.6 How is Proficiency to be Demonstrated?

Demonstrations of proficiency can be correlated to acceptable performance in written and oral examinations and acceptable job performance. Oral examinations are a powerful evaluation tool and are recommended where feasible. In large groups written examinations can provide valuable information concerning comprehension levels which have been attained. The trainee should be given various realistic scenarios and his or her responses should be evaluated in the context of the training which has been administered. It is recommended that quantitative evaluation techniques, i.e., performance in written and oral examinations, be utilized togther with careful observation of on-the-job performance to provide a measure of the proficiency which the trainee has attained as a result of the training program and that this information be used to modify the training, if necessary. Tests scores, oral examination results, and job performance observations should be kept as part of the training records.

4.2 RELATED ISSUES

The period during which facility personnel training needs are being assessed and programs are being designed is an excellent opportunity to consider many facility specific factors and operational procedures from

the standpoint of worker and community protection. These include:

- Company standards
- Overview of company operations
- Waste characteristics and sources
- Utilization of waste data sheets
- Identification of needs for safe handling and management of each waste
- Development and utilization of safe job procedures
- Identification of specific personnel handling each waste
- Development of training correlated to needs and job duties
- Training for hazard awareness

CHAPTER 5

TRAINING PROGRAM ELEMENTS

5.1 INTRODUCTION

This chapter presents recommended program elements for training programs appropriate to personnel engaged in hazardous waste management operations. Suggested elements have been developed for those training modules identified in Chapter 4. For each training module, the following types of information are presented;

- information concerning the intent of the training module
- recommended program elements
- suggested contents for each program element
- recommendations concerning overall approach, use of demonstrations, audiovisual aids, etc.

Also this manual incorporates the philosophy that two levels of training are appropriate:

- broad training appropriate to management/supervisory level personnel
- limited training appropriate to personnel in relatively less responsible positions

The intent of all of the training programs should be the provision of knowledge and "hands-on" experience through workshops, demonstrations, and on-the-job training which will enable all levels of personnel to perform their duties in a manner which protects human health and the environment.

Management level personnel need broad training in all aspects of hazardous waste management to provide the necessary background and perspective for decision making activities which can impact both the operation and condition of the facility and the health and welfare of the surrounding community. Employees need site-specific training pertinent to the performance of their more limited activities.

It is emphasized that the intent of this manual is to provide flexibility in training program implementation. It is anticipated that many useful instructional aids will be developed in the future to meet the need for the types of training identified in this manual. Instructors are encouraged to revise their programs and incorporate new and useful instructional materials as necessary to strive to improve the quality and effectiveness of their training programs.

5.2 TRAINING FOR PERSONNEL SAFETY

5.2.1 Chemistry of Hazardous Materials and Wastes

5.2.1.1 Broad Training

5.2.1.1.1 Introduction. This section provides information concerning those program elements which constitute the chemistry portion of an upper management level training program. The intent of the chemistry presentation should be the provision of a sufficient amount of hazardous materials and waste chemistry and "hands-on" experience to enable the trainee to:

- recognize potential chemical hazards.
- comprehend the chemical aspects of the materials presented in subsequent sections, especially toxicology and health effects; personal safety and selection and use of protective clothing and

equipment; operational aspects of handling, storage, treatment, and disposal of hazardous wastes; contingency plan training, and labeling, placarding and record keeping.

- obtain and utilize additional information from available chemical data resources.

The broad training chemistry module should contain the following program elements:

- basic concepts of the chemistry of hazardous materials and wastes
- classification of hazardous materials based on the correlation of hazard to physical and chemical properties
- physical and chemical properties for general hazard classes
- chemical aspects of handling, storage, treatment and disposal of hazardous wastes
- acquisition and utilization of chemical data

In the following sections, suggested approaches and content for each of these elements are provided. It is emphasized that use of demonstrations and provision of opportunities for actual hands-on participation are encouraged.

5.2.1.1.2 Basic Concepts of the Chemistry of Hazardous Materials and Wastes. A material is typically referred to as hazardous if it is toxic and/or reactive. Consequently, hazardous materials are those which:

- contain materials which are toxic
- contain materials which can react under various environmental conditions to yield large amounts of energy (e.g., heat and/or light) in a relatively short time
- contain materials which can react under various environmental conditions to yield materials which are toxic.

There is a distinction between a hazardous material and a hazard. The latter requires both the material and exposure to the material. Also exposure is necessarily related to two additional concepts, viz, contact and dose or the level of the material to which humans and/or the environment are exposed.

The section on toxicology and health effects will be specifically devoted to materials which are toxic. Consequently, apart from a presentation of the more general chemical aspects of toxic materials, the section on chemistry should be devoted to reactive materials. Basic concepts of chemical reactions pertinent to hazardous materials and wastes should be presented including:

- thermodynamic aspects of chemical reactions (endothermic, exothermic reactions)
- the concept of reaction rate
- factors which affect reaction rates:
  - nature of the material
  - physical state
  - surface area
  - concentrations of the reactants
  - activation energy
  - temperature
  - catalysts
- the concept of chemical equilibrium

5.2.1.1.3 Classification of Hazardous Materials and Wastes. Several methods of classification for both hazardous materials and hazardous wastes have been devised. At a minimum, the trainee should be given information concerning the following "systems":

- RCRA hazardous waste classification (3001)
- United Nation and DOT (Department of Transportation) hazardous materials classifications

In 1973, the DOT amended its system to establish a consistency with a system proposed by the United Nations which had been adopted by several foreign governments. The United Nations system is shown in the following:

Hazard Class No.	Description
1	Explosives
2	Gases: Compressed, liquified, or dissolved under pressure
3	Flammable liquids
4	Flammable solids; substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases
5	Oxidizing substances, organic peroxides
6	Poisonous (toxic) and infectious substances
7	Radioactive substances
8	Corrosives
9	Miscellaneous dangerous substances

The following presents the DOT system with corresponding UN hazard number:

DOT CLASSIFICATION OF HAZARDOUS MATERIALS

Hazard Class No.	Description
1	Class A, B and C explosives
2	Nonflammable and flammable compressed gases
3	Flammable liquids
4	Flammable solids, spontaneously combustible substances, and water reactive substances
5	Oxidizing materials, including organic peroxides
6	Class A and B poisons, irritants, and etiologic (disease causing) materials

7 Radioactive materials

8 Corrosive materials (acids, alkaline liquids, and certain corrosive liquids and solids)

9 Miscellaneous hazardous materials not covered by any of the other classes

- National Fire Protection Association (NFPA) 704M System. The NFPA has developed a system, also known as the 704M system, which is presented in their Fire Protection Guide on Hazardous Materials. This system identifies hazardous materials by a color-coded numeric system showing, on a diamond shaped diagram with four sections, the degree of hazard with respect to health, flammability and chemical reactivity. Degree of hazard is represented by numbers which range from 0 (no hazard) to 4 (maximum hazard). The colors red, blue and yellow are used for fire hazard rating, health hazard rating, and chemical reactivity hazard rating, respectively. Three additional symbols can be used in the lower quadrant: a radiation hazard symbol, ⋕ denoting that water should not be used in fire-fighting, and OXY to denote an oxidant.

- Generic classification based on hazard

Flammable and Ignitable materials and wastes

5.2.1.1.4 Physical and Chemical Properties for Generic Hazard Classes.

Flammable and Ignitable Materials and Wastes. Following a general presentation of the chemistry of combustion, the trainee should be taught the fundamental physical and chemical properties which define the flammability hazard, specifically:

- flash point
- fire point
- auto-ignition point
- upper and lower explosive limits
- vapor density
- ignition sources
- flammability classification systems (RCRA, DOT, NFPA)

Sources of data should be presented including chemical data sheets and handbooks. Several opportunities for demonstrations exist. Key concepts to be demonstrated include upper and lower explosive limits and the relationship of vapor density to hazard with ground level ignition sources. The analytical procedure for determining ignitability per the RCRA regulations should be taught and demonstrated. Information should be provided concerning the flammable limits of common gases and flash points of common solvents.

Explosive Materials and Wastes. The distinction between explosives and combustion reactions should be illustrated along with fundamental concepts of explosion reactions including:

- concepts of detonation and deflagration
- bleve (Boiling Liquid Expanding Vapor Explosion)
- information on classes of chemicals with potentially explosive hazards, for example:
    - nitrogen compounds
    - organic peroxides

Toxic Materials and Wastes. While the major component of information transfer for toxic materials and wastes will be provided in the section on toxicology and health effects, it is important that the trainee receive a limited amount of instruction in the chemical aspects of toxic

substances. Consequently, the broad training chemistry module should include training on the chemical properties of the following classes of toxic substances:

- heavy metals
- organic solvents
- pesticides
- toxic gases

Corrosive Materials and Wastes. The trainee should be taught the following general concepts:

- definition of corrosive under RCRA
- pH, acidity, alkalinity
- measurement of pH, acidity, alkalinity, corrosion
- acid and base strength
- neutralization
- buffer systems

Demonstrations of all of the above are encouraged. Also, it should be pointed out that many corrosive materials present other potential hazards, e.g. many organic acids are flammable, sulfuric acid is vigorously water reactive, picric acid and peracetic acid are explosive, etc.

Reactive Materials and Wastes

- Definition of reactive waste per RCRA regulations
- Classes of reactive materials - within each class the trainee should be given information concerning chemical properties, reaction products, and associated hazards
- Water Reactive

  alkali metals - most reactive of metals. React vigorously with water (consequently, water is not an effective fire

fighting tool). Water reaction can liberate flammable gases: $Na + 2\ H_2O \rightarrow NaOH + H_2$ (gas)

hydrides - formed when hydrogen combines with metals. Very reactive with water and can ignite and explode since often the heat given off is sufficient to ignite the hydrogen gas liberated.

organometallic compounds

- Air Reactive

  pyrophoric materials - common examples and properties, e.g. white phosphorus

- Oxidizing and Reducing Agents

  concepts of oxidation and reduction

  common oxidizing and reducing agents

  general properties of oxidizing and reducing agents

5.2.1.1.5 Chemical Aspects of Handling, Storage, Treatment, and Disposal of Hazardous Waste. The intent of this portion of the broad training chemistry module should be the provision of a chemical foundation for subsequent material to be presented in the facility operation and maintenance module. Topics which would be covered include:

- development and utilization of chemical waste data sheets
- chemical aspects of personal safety
- concept of chemical incompatability
- chemical aspects of landfilling operations

  chemical waste segregation

  choice of cover material

- chemical aspects of land application operations

  fate of chemicals in soil systems and groundwater

- chemical aspects of incineration operations
- environmental monitoring - sample collection, labeling, preservation, and analysis procedures
    - air
    - surface water
    - groundwater

5.2.1.1.6 Acquisition and Utilization of Chemical Data. The trainee should be made aware of existing sources of chemical data and should be instructed in procedures for obtaining and using these data. Available data resources include both hard copy reference sources and computer retrieval systems. Specific sources of information are:

- those reference texts listed in Chapter 6
- Chemical Transportation Emergency Center (CHEMTREC)
- EPA Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS)
- National Library of Medicine Databases CHEMLINE (Chemical Dictionary)
- Bibliographic Retrieval Services Databases CA CONDENSATES
- Chemical Manufacturer's Data Sheets

5.2.1.2. Limited Training

Personnel requiring limited training in chemistry should receive a program of instruction combined with on-the-job training enabling them to:

- recognize potential chemical hazards
- report chemical hazards to the proper on-site personnel
- understand chemical aspects of their specific job including handling of hazardous wastes, use of safe job procedures, etc.

It is recognized that an attempt to present too much information or training which is unnecessarily advanced will not aid the employee and may in fact reduce his or her ability to perform. Consequently, only those essential less technical elements of chemistry which will assist in meeting the above stated objectives should be provided. Furthermore, the contents of limited training programs will vary due to site specific aspects. Types of information appropriate to limited training include:

- essential elements of behavior of flammable materials
  - temperature
  - vapor density
  - types and availability of ignition sources
- essential elements of behavior of corrosive materials
  - handling precautions
- essential elements of behavior of reactive materials
  - temperature
  - shock sensitivity
  - exposure to air, water
- recognition of flammable, corrosive, and reactive materials

5.2.2 Effects on Humans (Toxicology)

5.2.2.1 Broad Training

5.2.2.1.1 Introduction. The intent of the broad training toxicology module is the provision of an overview in toxicology and health effects which will enable the trainee to:

- recognize potential health hazards to on-site personnel and the surrounding community.
- comprehend the toxicological and health effects of the materials presented in subsequent modules.

- understand and appreciate some well-known effects of exposure to hazardous materials and the corresponding need for preventive measures and protective clothing and equipment
- understand the natural protective measures the body has
- develop an awareness of potential long range adverse effects, e.g. cancer, birth defects, and damage to successive generations.
- utilize the information of this module together with that imparted in other modules and obtained from additional information sources to take steps to minimize potential health hazards resulting from hazardous waste management operations at the specific facility
- obtain and utilize additional toxicological and health effects information.

The broad training toxicology and health effects training module should contain the following elements:

- basic concepts of toxicology
- information concerning the fate of chemicals in biological systems (pharmacokinetics).
- carcinogenicity, mutagenicity, teratogenicity
- toxicity testing.
- health effects aspects of exposure to frequently encountered hazardous materials and wastes.
- acquisition and utilization of additional toxicological and health effects information.

In the following sections, a discussion of each of these elements is presented and lists of those topics which should be covered in the broad training toxicology training module are provided.

5.2.2.1.2 Basic Concepts of Toxicology

- definition of health hazard
- principles of risk assessment
- dose-response concepts
    - inter- and intra- species variability
    - bioassays
    - shape of the dose response curve
    - linearization of dose response data
    - use of ED_{50} and LD_{50}
    - examples of LD_{50}s of common compounds
- effect of exposure period - slow and fast poisons
    - delayed toxicity
    - acute, subchronic, and chronic toxicity
- interactive effects
    - additive toxicity
    - synergism
    - antagonism

5.2.2.3. Fate of Chemicals in Biological Systems (Pharmacokinetics)

- Absorption
    - concept of effective dose
    - routes of absorption
        - oral (mouth, stomach, intestine)
        - inhalation
        - percutaneous
    - mechanisms of absorption
        - diffusion
        - filtration
        - active transport

factors influencing absorption

lipid solubility - partition coefficient

degree of ionization - polarity

molecular size and shape

particle size - inhalation

condition of skin - skin contact

- Distribution

biological barriers

bioconcentration

- Metabolism

concepts of bioactivation and bioinactivation

mechanisms for biotransformation

oxidation

reduction

hydrolysis

conjugation

factors affecting metabolism

dose related factors

organism related factors

environmental factors

- Excretion

modes of excretion

feces

urine

exhaled air

sweat

milk

hair and nail growth

importance of polarity-function of liver and kidneys

Examples of the fate of well-known chemicals in biological systems should be provided, e.g., alcohol, chlorinated hydrocarbon solvents, heavy metals, pesticides.

5.2.2.1.4 Carcinogenicity, Mutagenicity, Teratogenicity

- basic definitions
- correlation of carcinogenicity to mutagenicity
- examples of known human carcinogens, teratogens
- elementary aspects of mechanisms of carcinogenicity, mutagenicity, teratogenicity

5.2.2.1.5 Toxicity Testing

- selection and use of animal models
- design of acute, subchronic, and chronic toxicity tests
- design of tests for carcinogenicity, mutagenicity, teratogenicity

  epidemiology

  long-term animal tests

  short-term tests
- interpretation of toxicity testing data
- costs

5.2.2.1.6 Health Effects Aspects of Exposure to Frequently Encountered Hazardous Materials and Wastes. This section should provide a presentation of basic material to the trainee on the impact of exposure to a variety of common hazardous materials and wastes. Emphasis should be placed on the symptoms, effects, and applicable therapeutric measures for

those selected materials and wastes. The list of materials discussed should include the following:

- toxic vapors
  - CO
  - H_2S
  - HCN
- heavy metals
  - cadmium
  - lead
  - mercury
- chlorinated hydrocarbon solvents
- pesticides, insecticides, rodenticides
  - chlorinated hydrocarbons
  - organophosphorus
  - carbamate

Liberal use of slides and audiovisuals depicting exposed individuals, organ damage and other effects is encouraged. The intent of this section should be to impress upon the trainee the impact of hazardous exposure to these materials so that this respect can be communicated to other on-site personnel and to provide information which will aid in health effects recognition and hazard mitigation.

5.2.2.1.7 Acquisition and Utilization of Additional Toxicological and Health Effects Information. The trainee should be made aware of existing resources on toxicology and health effects including:

- those referenced texts listed in Chapter 6
- National Library of Medicine Databases

MEDLINE and BACKFILES

TOXLINE and TOXBACK

- Bibliographical Retreival Services Databases

  BIOSIS

  MEDOC

5.2.2.2 Limited Training. As with the limited chemistry training module it is important that the material selected for incorporation into a limited toxicology and health effects training module not be unnecessarily complex and inclusive. The intent of the limited toxicology and health effects training module should be provision of sufficient knowledge and experience to enable the trainee to:

- recognize potential health hazards
- report potential health hazards to the proper on-site personnel
- comprehend the health effects related aspects of his or her specific position with respect to training in operational procedures, personal safety and selection and use of personal protective clothing and equipment, and contingency plan training

Site specific factors will dictate the final choice of material to be incorporated into the limited toxicology and health effects training module. Topics appropriate for incorporation include the following:

- types of exposure to commonly handled hazardous wastes - need for protection, if any
- health related aspects of safe job procedures
- potential impacts of commonly handled hazardous waste on human health - what could happen if safe job procedures were not followed

- need to be alert to odors, emissions, leaks, etc. and to report these to the proper on-site authority

Use of audiovisuals, slides, and other instructional aids depicting impacts on health is encouraged.

5.2.3 Personal Safety - Selection and Use of Personal and Protective Clothing and Equipment

5.2.3.1 Introduction. The purpose of this module is to set forth a training program for both managers and employees. The guidelines enclosed are appropriate to a minimum program and should be expanded by the managers to include pertinent site specific items. The general topics discussed are:

- A method to establish criteria for the selection of protective equipment.
- Establishing a training program for supervisory personnel.
- Establishing a Respiratory Protection program.
- A recommended training program for employees who will be required to wear protective equipment.
- Standard safety precautions to be observed.

5.2.3.2 Establishing Criteria for the Selection of Protective Equipment. The development of data sheets on each waste product that is routinely received can save time and provide valuable information concerning the product. One item that should be included on the data sheet is the designation of protective equipment required for the protection of personnel who would come in contact with the product, e.g., laboratory personnel, equipment operators, security personnel.

One method for doing this is to categorize the levels of protective equipment with an alphanumeric code, i.e., letters for one item and numbers

for the other. Respiratory devices should be National Institute for Occupational Safety and Health (NIOSH) approved items and should be selected by the guidelines presented in American National Standards Institute (ANSI Z 88.2-1969).

A simplified version of this method is presented below:

PROTECTIVE CLOTHING	RESPIRATORY PROTECTION
A - Total encapsulation suit	1 - Self-contained breathing apparatus
B - Rubberized rain gear	2 - Gas mask with organic vapor canister
C - Disposal coveralls	3 - Half mask respirator with dust cartidge
D - Normal working clothing	4 - Disposable dust respirator

With a system such as this, the data sheet could be annotated with the applicable code for each level of operation. The equipment operator could readily determine the degree of protection needed. For example, the data sheet could show that for this particular product, the equipment operator needed C-2. The operator knows that he or she must be wearing disposal coveralls and a gas mask with an organic vapor cartidge. As the potential for exposure decreases, obviously the levels of protection could be decreased.

5.2.3.3 Establishing a Training Program for Supervisory Personnel. Supervisors who are required to both use and to supervise workers using protective equipment should undergo a comprehensive training program. At a minimum, the program for site managers and supervisory personnel should include:

I. Protective clothing

a. Types of protective clothing and uses.

1. Corrosive materials. A two-piece suit or one piece coverall of a rubberized or vinyl fabric should provide adequate protection for normal exposures. Other items that might be required include protection for the face (goggles, shield, hood), gloves, and foot protection (boots, overshoes, shoe covers). It is impossible to make specific recommendations because of the varying characteristics of the compounds classified as "corrosive." The various manufacturers have developed lists of what their product can protect against.

2. Flammable. Clothing available for handling flammables varies from fire resistant clothing made of Nomex to aluminized fire entry suits. Again, specific recommendations are impossible because of the varying characteristics and because the actual use at a specific site is unknown.

3. Toxic. After determining the potential for personal contamination and the type of contaminant available, selection of protective clothing can be made. Clothing is available in all styles from total incapsulating suits, coveralls, two piece suits, to aprons. Other items of protective clothing available include hoods, gloves, and boots. Fabrics used for this type of clothing are normally impermeable to air and impervious to liquids.

b. Inspection procedures to determine serviceability prior to using, and periodic inspections thereafter.

c. How to put on the clothing to ensure maximum protection.

d. How to remove the clothing to preclude personal contamination.

e. How to decontaminate and maintain the clothing.

f Limitations for each type of clothing used at the facility

II. Respiratory protective devices

a. Types of respiratory protective devices and uses:

1. Oxygen deficient environments - An atmosphere containing 19.5 percent or less of oxygen by volume. ANSI Z88.2-1969 requires the use of a Self-Contained Breathing Apparatus (SCBA), or a type A hose mask with blower, or a combination air line respirator with an auxiliary self-contained air supply.

2. Immediately dangerous to life or health (IDLH) - Conditions that pose an immediate threat to life or health or exposure to an environment that could have adverse delayed effects such as radioactive materials. This is divided into several categories--gas and vapor contaminants, particulate contaminants, and a combination of gas, vapor, and particulate contaminants:

- Gas and vapor contaminants - SCBA, type A hose mask with blower, gas mask (for escape only), self rescue mouthpiece respirator with an auxiliary self-contained air supply.
- Particulate contaminants. Same as for gas and vapor contaminants.
- Gas, vapor and particulate contaminants. SCBA, type A or AE hose mask with blower, air purifying, full facepiece respirator with chemical canister and appropriate filter (gas mask with filter), self rescue mouthpiece respirator (for escape only), or a combination air line respirator (type C or CE) with an auxiliary selfcontained air supply.

3. Not immediately dangerous to life or health (NIDLH) -

Those conditions that are not severe enough to warrant a classification of IDLH, but do present a health hazard and require the use of respiratory protective devices. These conditions are divided into the same categories as the IDLH.

- Gas and vapor contaminants; Air line respirator, hose mask with blower, or air-purifying, half-mask or mouthpiece respirator with chemical cartridge.
- Particulate contaminants. Air line respirator, hose mask without blower, air line abrasive blasting respirator, or air purifying, half mask or mouthpiece respirator with filter pad or cartridge.
- Gas, vapor and particulate contaminants. Air line respirator, hose mask without blower, or air purifying, half mask or mouthpiece respirator with chemical cartridge and appropriate filter.

4. The above categories are in compliance with ANSI Z 88.2-1969. This standard should be changed in the near future to reflect state-of-the-art developments in breathing devices. Many of the items listed above will not, in all probability, be accepted any longer. When the new ANSI Z88.2 is published, changes in the devices listed in the categories above will have to be made.

b. Inspection procedures to determine serviceability prior to using.

c. How to properly fit the facepiece.

d. How to leak test the respiratory protective device.

e. How to recognize the end of service life.

f. How to decontaminate, disinfect, and maintain the device.

g. Limitations for each type of device used at the facility.

5.2.3.4 Establishing a Respiratory Protection Program. The employer who requires his employees to wear respiratory protective devices is required to do several things. The most important of these are that he shall:

I. Obtain only National Institute for Occupational Safety and Health (NIOSH) approved devices. These are items that have been tested and approved in accordance with 30 CFR Part 11.

II. Establish a Respiratory Protection Program in accordance with 29 CFR Part 1910.134 (b). The requirements for a minimally acceptable program are:

a. Written standard operating procedures covering the selection and use of respirators.

b. Selection based upon hazards that the worker will be exposed to.

c. These users must be instructed and trained in the proper use of respirators and their limitations.

d. Respirators should be permanently assigned to workers for their exclusive use.

e. Respirators should be cleaned and disinfected on a regular basis.

f. Resirators shall be stored in a convenient, clean and sanitary location.

g. Respirators used routinely shall be inspected and repaired, if necessary, during cleaning. Emergency use equipment shall be inspected monthly and after each use.

h. Surveillance of the work area conditions shall be accomplished as necessary and an evaluation of the employee exposure and stress shall be maintained.

i. Regular inspection and evaluation procedures shall be implemented to insure the continued effectiveness of the program.

j. A medical evaluation of employees is mandatory prior to their using protective equipment to insure that they are physically capable of performing the work while wearing protective equipment. A periodic medical review should also be established.

k. Only approved or accepted respiratory protective devices shall be used.

5.2.3.5 Recommended Training Program for Employees Who Will be Required to Wear Protective Equipment. 29 CFR Part 1910.134 (b)(3) places the responsibility for proper training on the use of respirators directly on the employer. Unless the employee thoroughly understands the reasons for the use of respiratory protective devices, understands the instructions on proper use and maintenance of the respiratory protective devices, the devices will not be used or they may not work properly. Minimum training by the employer should include:

- Instruction in the nature of the hazard and information as to what may happen if the respirator is not used.
- Explanations of why engineering or process oriented controls are not feasible to reduce or eliminate the need for the respirators.
- Explanations of why this is the proper respirator for the particular purpose.
- Discussion of the respirator's capabilities and limitations.

- Classroom and field training to recognize and cope with emergency situations.
- Training to include recognition of the end of the service life of the cartridge, canister or filter.
- Periodic refresher training in actual use of the respirator.

In addition to the above training program, each employee should be instructed in the proper method of fitting the respirator and leak testing it.

- Fitting instructions vary from respirator to respirator. The only correct method is to follow the manufacturer's instructions that are provided with the respirator.
- Each time the wearer puts a respirator on, a positive and negative pressure test should be conducted to insure a proper fit.
  1. Positive pressure test. Close the exhalation valve and exhale gently into the facepiece. A slight positive pressure should build up inside the facepiece without any outward leakage of air at the seal.
  2. Negative pressure test. Close the inhalation valve(s) and inhale gently. The facepiece should collapse against the face. Hold the breath for 10 seconds. If the facepiece remains collapsed against the face and no inward leakage of air occurs, the fit of the respirator is satisfactory.
- Each time a new respirator is issued, the wearer should wear the respirator in a test environment to demonstrate the effectiveness of the respirator. Either a qualitative test using isoamyl acetate vapors or an irritant smoke or a quantitative test using sodium chloride or dioctyl phythalate (DOP) is acceptable.

Either method is acceptable; however, the quantitative test actually establishes a protection factor for that individual respirator. This method is useful in that it is an objective measurement rather than a subjective decision of the wearer.

The use of protective clothing also requires training. The following subjects will be included in the training program:

- Why the particular type of clothing was chosen and what protection it will offer.
- The proper method of wearing the clothing so that maximum protection will be afforded.
- The proper method of undressing so that the possibility of personal contamination can be precluded.
- The proper method of decontamination and maintenance of the clothing.
- Each manufacturer normally includes these instructions with the clothing and it will vary from brand to brand.

5.2.3.6 Standard Safety Precautions to be Observed. A good safety sense should be second nature to employees who handle hazardous materials and wastes. The major areas that should be continuously emphasized by the employer are:

- Glasses with temple pieces cannot be worn with a full face piece respiratory protective device. A good seal is impossible to achieve.
- Contact lenses cannot be worn with respirators. They are forbidden by OSHA.
- Any facial hair that could preclude a good face-to-mask seal shall not be allowed. This includes beards, sideburns and long mustaches that extend outward.

- Personnel with facial features that might preclude a good face-to-mask seal should not be assigned duties that would require their wearing a respirator. These features include sunken temples or cheeks, an abnormally large nose, or a malformed face.
- Personnel with respiratory problems should not be assigned duties requiring a respirator.
- Personnel should be screened for claustrophobic tendencies when they are wearing protective equipment.
- Personnel should be advised of the heat buildup while wearing protective equipment. They should be made aware of the symptoms of heat exhaustion, heat stroke, heart attack, and pulmonary collapse. They should receive training in first aid for each of these.
- Personnel should be trained in the use of life lines and the "buddy" system for use in confined spaces and "Immediately Dangerous to Life or Health" environments.
- Periodic training should be conducted which will require the employee to properly use the available protective equipment.
- Personnel performing duties requiring the use of protective equipment should be entered in a medical surveillance program and should receive, as a minimum, an annual physical checkup.

5.3 RELEASE PREVENTION AND RESPONSE

5.3.1 Broad Training

5.3.1.1 Introduction. Regulations developed in accordance with RCRA Section 3004 specifically state that, at a minimum, the training

program must be designed to insure that facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures, emergency equipment, and emergency systems..." (Personnel Training Section 264.16 (a)(3)). Regulations have also been promulgated concerning required on-hand emergency equipment, communication systems, required aisle space, testing and inspection of equipment, and special handling procedures for ignitable and reactive waste. Regulations concerning the content of acceptable contingency plans, duties of the emergency coordinator, and emergency procedures are found in Subpart D-Contingency Plan and Emergency Procedures (Section 264.50-Section 264.56). A contingency plan must be prepared for each facility and made available to the proper authorities identified in the regulations. Facility personnel must be trained in accordance with their role in the contingency plan.

It is appropriate that all management level personnel receive a comprehensive contingency plan training package designed to do the following:

- provide general information concerning types of emergency equipment and communication devices required in accordance with the regulations.
- provide general information concerning development and execution of acceptable contingency plans; selection, deployment, and operation of emergency plan and communication equipment; and design and administration of acceptable site-specific contingency plant training programs.

The broad training contingency plan training module should contain the following elements:

- Regulatory Aspects
- Planning for emergencies
- Preparation of an Acceptable Contingency Plan
- Relation to the SPCC Plan
- Emergency equipment
- Duties of the Facility Emergency Coordinator

Additional information concerning suggested topics to be included in each of these elements and approches to release prevention and response training, are presented in the following sections.

5.3.1.2 Regulatory Aspects of Contingency Plan Training. Instruction should be provided on the following specific regulations:

Subpart C - Preparedness and Prevention

Subpart D - Contingency Plan and Emergency Procedures

5.3.1.3 Planning for Emergencies - Preparation of an Acceptable Contingency Plan. Planning is a vital function entrusted to management. This is where potential problem areas are identified and corrected. Areas to address in the initial development stages of the site should include:

- A good road network that allows for rapid evacuation of personnel and equipment and provides rapid access and deployment of emergency response vehicles and personnel.
- Special handling procedures and areas for ignitable and/or reactive wastes, to include designation of specific smoking areas.
- Development of a Contingency Plan that will prevent or minimize human health and environmental damage in the event of an accident. The existing SPCC Plan can be incorporated into the facility Contingency Plan. Specific areas to address in the development of the Contingency Plan include:

- Methods of implementing the plan.
- Coordination and liaison with local police and fire departments, hospitals, clean-up contractors, and state and local emergency response teams. This should include visits to the site by these agencies and briefings to them by site personnel covering site layout, materials handled, working areas, road network, and designated evacuation routes.
- Designation of the Facility Emergency Coordinator.
- A listing of all emergency equipment at the site, its location, a description of it, and its capabilities.
- An evacuation plan which outlines evacuation routes, both primary routes, and alternate routes, and the signal to be used to begin evacuation.
- The development of a training program for the familiarization of employees with emergency procedures, emergency equipment and emergency systems.
- Specific steps to be taken when a determination is made that a facility with a required groundwater monitoring system is affecting the groundwater.
- Distribution of the Contingency Plan - the facility, the Regional Administrator, all pre-arranged emergency response groups.

5.3.1.4 Emergency Equipment

One of the most important items of emergency equipment is communications equipment. This may be radio, telephone, or an audible alarm, e.g. siren, klaxon, etc. Suggested areas of training include:

- types of equipment available at the site and how to use them.

- locations of equipment.
- emergency telephone numbers to be used to summon external assistance - local police and fire departments, ambulance, spill clean-up contractors.
- alarm codes - if a horn is used one blast means one thing; two blasts means something else.
- how to maintain the equipment and frequency of serviceability checks.

Other types of equipment that may be required at the sites include fire fighting equipment, decontamination equipment and spill control and clean-up equipment. Areas for training on these items include:

- types of fires (chemical, electrical, paper)
- methods of fighting each type of fire
- extinguishing agents (water, foam dry chemical, etc.)
- locations of equipment
- how to inspect, maintain and use each item
- what decontaminants are to be used for the materials involved, what quantities of decontaminants would be required, and how to prepare them (if applicable)
- personal protection required for responding personnel

5.3.1.5 Duties of the Facility Emergency Coordinator. The Facility Emergency Coordinator is a person designated in the Contingency Plan as being the person responsible for coordinating all emergency response measures at the facility. Although duties may vary from facility to facility, certain duties will recurr. These include:

- The emergency coordinator must have familiarity with the site, its layout, operations, and contingency plan.

- The emergency coordinator must have the authority to commit resources.
- The emergency coordinator activates internal alarms to alert facility personnel of an actual or impending emergency.
- The emergency coordinator notifies external emergency response forces when their assistance is required.
- The emergency coordinator provides immediate information of discharged materials and assessment of the possible hazards to human health and the environment outside the facility and transmittal of the assessment to the appropriate authorities.
- The emergency coordinator must take all reasonable measures to insure that the affected area does not spread to other areas.
- If the facility shuts down, the emergency coordinator must maintain surveillance on other areas to insure that they are not affected by pressure buildup in pipes, leaks, gas generation in other areas, etc.
- After the emergency is over, the emergency coordinator must provide for clean-up, treatment and disposal of affected materials and insure that no hazardous waste is discharged.
- prior to resuming operations, the emergency coordinator must submit all required reports to the appropriate authorities within the specified time.

5.3.2 Limited Training

Each employee should be trained in his or her specific role per the facility contingency plan. In addition, training should be provided in the following areas:

- First aid - it is recommended that all facility personnel, with the possible exception of clerical staff, complete a program of instruction in first aid; any of the readily available programs offered by the Red Cross, YMCA, or other competent organizations would be most satisfactory.
- personnel should be instructed in the locations of first aid stations, showers, communication systems, and fire fighting equipment and instructed in the operation of equipment as necessary.
- personnel should be instructed in evacuation procedures and incident reporting mechanisms to be followed in the case of an emergency.

Finally, it is recommended that all facility personnel engage in simulated training for those potential emergencies having the highest probability depending upon the type of facility and type of wastes managed. This will give management valuable feedback on the effectiveness of the training and any need for remedial training.

5.4 DECONTAMINATION PROCEDURES

5.4.1 Personal Hygiene

It is of vital importance that the necessity of good personal hygiene be stressed to all employees of hazardous waste management facilities. Personal hygiene is a key factor in reducing the incidence of personal injury caused by contamination of hazardous materials. Some of the major items that should be stressed in a training program are listed below.

5.4.1.1 Shaving. Persons who are required to wear respiratory protection, either on a routine or emergency basis, should be clean shaven.

A beard or large "mutton-chop" sideburns could interfere with the sealing capability of a respiratory protective device. A large extending mustache (handle-bar type) could also prevent the facepiece from sealing. Even a beard stubble could prevent a seal.

5.4.1.2 Long Hair. Long hair can also prevent facepieces from sealing properly unless it is pulled back from the face. If hair is observed inside the facepiece, the person does not have an effective seal.

5.4.1.3 Glasses. Normal glasses cannot be worn with a full facepiece respiratory protective device. The temple pieces would preclude a good seal of the respirator. Personnel who must wear full facepiece respirators and who require corrective lenses should be provided with spectacles that can be mounted inside the facepiece. Most respiratory protective device manufacturers have spectacle mounting kits for their facepieces.

5.4.1.4 Contact Lenses. The wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed. This applies to both "hard" and "soft" lenses.

5.4.1.5 Clothing. It should always be emphasized during training sessions that street clothing cannot be worn in the operational areas. Personnel should be taught that they change from street clothing to work clothing prior to going to an operational area. Once they leave the operational area, they should go through a decontamination process which culminates in showering and re-dressing in their street clothing. This will preclude the possibility of contamination leaving the site on work clothing.

5.4.1.6 Lunchrooms and Smoking Areas. Personnel must be taught that for their own safety, directives pertaining to eating and smoking areas

must be adhered to. Again, this is in an effort to control the spread of contamination. At a minimum, personnel should be taught to thoroughly wash with soap and water before eating, drinking or smoking. If the potential for contamination is sufficiently high, they may be required to go through complete decontamination before performing these functions.

Personnel should follow the same procedures listed in 5.4.1.6 above before going to the toilet facilities. This precludes genitalia contamination. They should be taught to use only the facilities provided. Under no circumstances should they be allowed to use the landfill or other operational areas as a toilet facility.

Personnel should be instructed always to inform their supervisor of any illness that could either interfere with their job performance or could mask symptoms caused by materials in the facility. Of vital importance are respiratory illnesses and skin disorders since these could interfere or preclude wearing of protective equipment.

5.4.2 Location of Lunchrooms

Employees should be taught that lunchrooms are specifically designated areas. Under no circumstances should employees be allowed to eat or smoke in any operational areas. Prior to eating or smoking, personnel should go through decontamination procedures. At a minimum, this should include a thorough cleaning of the hands with soap and water. Eating and smoking areas should be kept clean and free of all contaminating substances. Eating tables should not be used as beds and feet should not be rested on chairs or tables.

5.4.3 Laundry

Laundry facilities should be available to decontaminate and launder

work clothing that has been worn. If one of the duties of the trainee is to operate the laundry, he should become thoroughly familiar with the procedures for decontaminating the clothing, inspecting it for serviceability, storing it, and issuing it.

5.4.4 Personnel Decontamination

Prior to leaving the site, personnel should go through a decontamination procedure. This is an element that should be emphasized throughout the training program. Although facilities and procedures will vary from site to site, certain general characteristics can be taught. In the following material, guidelines are provided based to a degree on conservative assumptions concerning the seriousness of the contamination.

5.4.4.1 Change House. A sample lay-out is presented in Figure 5-1. It is not necessary that it be as elaborate as shown. It should be capable of providing the necessary function of decontamination.

5.4.4.1.1 Dressing Area. The location where personnel change from street clothing to work clothing.

5.4.4.1.2 Protective Clothing Storage and Issue. The location where all clean work clothing and stored and issued from.

5.4.4.2 Decontamination Procedures. After completing work, personnel return to the change house.

a. If they are wearing impermeable clothing, they step under the deluge shower and flush their clothing with water.

b. Next is the boot wash. Here, they scrub their rubber boots with either a decontaminant or soap and water to remove chemicals and mud.

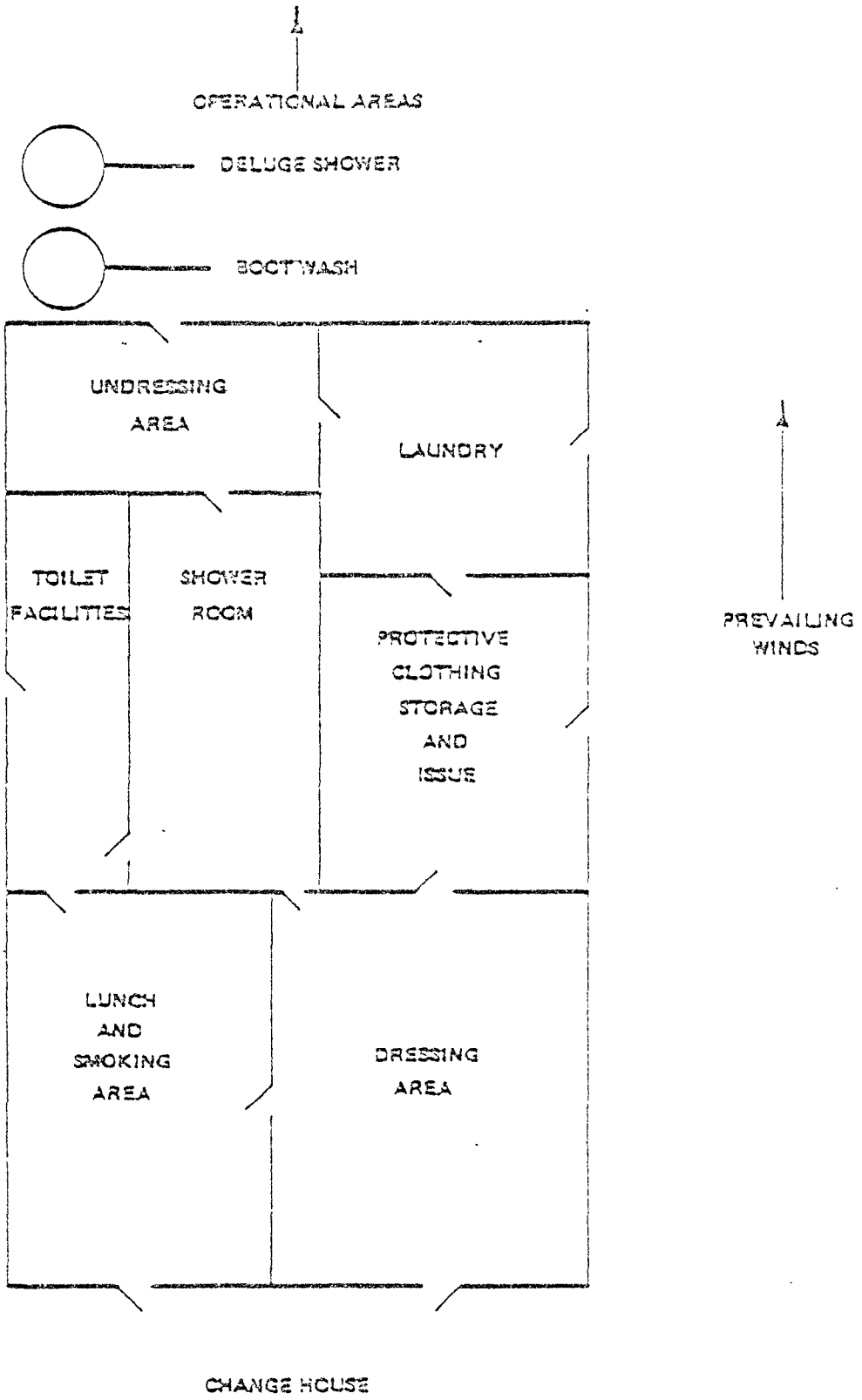

FIG. 5-1 . SAMPLE LAYOUT - PERSONNEL DECONTAMINATION FACILITIES

c. After the boot wash, they proceed to the undressing area where they remove all clothing and place in marked containers. Generally, they undress removing the most heavily contaminated items first, i.e. boots and gloves. Next, the suit comes off, then the undergarments, the respiratory protective device is the last item to be removed.

d. Prior to removing the mask, the person takes a deep breath, holds it, removes the mask, steps under the shower, and flushes the top portion of the body before he resumes breathing.

e. A complete shower is taken using soap and water.

f. The person then proceeds to the dressing room where he dresses in clean work clothing or street clothes if it is the end of his shift.

Once personnel decontamination is completed, laundry personnel gather the protective equipment taken off in the undressing area, sort it, decontaminate and launder it, inspect it, and store it for reissue. It must be emphasized that the equipment taken from the undressing area is contaminated, so laundry personnel must wear protective equipment while handling it until it is decontaminated.

All waste waters generated during decontamination and laundering should be considered to be contaminated and treated as such until proven otherwise.

5.4.5 Waste Specific Procedures

5.4.5.1 Toxic Wastes. Personnel decontamination after handling toxic wastes should follow the procedures listed in 5.4.4.2 above.

5.4.5.2 Radioactive Wastes. Personnel decontamination after handling radioactive wastes will follow the procedures listed in 5.4.4.2 above with the following additions:

a. Personal dosimetry must be accomplished to determine the dose, if any, received.

b. Radiation dose-rate meters must be used prior to redressing to insure the adequacy of decontamination.

5.4.5.3 Infectious Wastes. Personnel decontamination after handling infectious wastes should follow the procedures listed in 5.4.4.2 above for chemical contaminants with the following addition.

Dependent on the type of infectious waste, normal clothing decontamination and laundering may not suffice. Sterilization may be required.

5.4.5.4 Carcinogenic and Mutagenic Wastes. Personnel decontamination after handling these wastes should follow the procedures listed in 5.4.4.2 above for chemical contamination.

5.4.6 Spill Cleanup Procedures

Personnel should be thoroughly trained on all aspects of the Site Contingency Plan and should be allowed to practice their specific areas of responsibility. This area lends itself to case studies and especially to simulation. This should not be a once a year drill. Personnel roles should be continually re-emphasized until their reaction to a spill becomes a reflex action.

5.4.7 Decontamination Treatment Capability and Capacity

Personnel should be traned to know the capabilities and capacities of decontamination facilities at the site. These capabilities and capacities

should never have to be exceeded under any contingency for the specific site.

5.5 FACILITY OPERATION AND MAINTENANCE

5.5.1 Introduction

This section presents information concerning facility operational and maintenance aspects which might be pertinent for inclusion into the training program for a particular facility. Given the variability within the industry of process types and corresponding equipment many of the following may be inappropriate for a specific site. Here the intent is to provide the owner or operator or any other individual, charged with design of a specific training program with a comprehensive listing of training elements which should be evaluated from the standpoint of potential inclusion. In the case of this module, as with others, it is recommended that managers receive broad training while operations staff are trained in accordance with the particular job description and duties. Appendix C presents a list of technical manuals which the USEPA is preparing which can be utilized for additional information.

5.5.2 Process Description

Training should be provided concerning:

- Process Function
- Relationship to other facility units

This training is best done in a modular approach with ample use of diagrams and other visual aids.

5.5.3 Waste Acceptance Procedures

Items to be evaluated include:

- Gate operation
- Acceptance Area
- Weighing, measuring and sampling
- Laboratory procedures and quality control
- Initiation and use of waste data sheets
- Unloading at process area

5.5.4 Process Operation and Controls

Items to be evaluated include:

- Routine Operation
- Startup - reason
  - frequency
  - action
  - special conditions
- Normal Operation
  - controls
  - maintenance
- Partial Shutdown
- Normal Shutdown
- Emergency Shutdown
- Alternate Operation
- Emergency Operation
- Description of Controls
- Recommended Settings
- Reference to Schematic Diagrams and Manufacturers' Manuals
- Fail Safe Features

- Operating Problems and Solutions
    - Problem Index
    - Description
    - Problem
    - Indicators
    - Inspection
    - Corrective Measures
- Laboratory Process Controls
    - What Facts and Why
    - Interpretation of Results
    - Sampling
    - Flow Controls
    - Analysis
    - Monitoring
    - Standards Used (TLV, MCL, etc.)
    - Documentation

5.5.5 Maintenance

For all equipment the following elements should be considered:

- Schedules
- Manufacturers' Recommendations
- Special Tools and Equipment
- Housekeeping Schedule
- Spill Cleanup Procedures
- Lubrication
- Removing Equipment From Service
- Power and Water Failures
- Care of Structures

- Driving Equipment
- Electric Motors
- Gasoline Engines
- Variable Speed Drives
- Couplings
- Shear Pins
- Pumps
- Valve and Valve Repairs
- Monitoring Equipment
- Repair of Contaminated Equipment
- Equipment Decontamination

5.5.6 Equipment Safety

The following elements should be incorporated. OSHA training requirements are in effect here as well.

5.5.6.1 Electrical Equipment. Although there are no specific requirements developed by the Occupational Safety and Health Administration for the Waste Management Industry, certain inferences can be made relative to training concerning electrical equipment.

- Employees should be trained to know the location of lock-out mechanisms for electrical equipment. They should know how and when to operate them.
- Employees should be trained to recognize electrical hazards such as improper or unsafe wiring, ungrounded circuits, inoperable overload protective devices, and warning markers.
- Employees should be trained to use only acceptable and/or certified portable electric tools and should be taught to

recognize when their use may be hazardous, e.g., in an explosive atmosphere.

- Employees should be trained to practice good electrical safety procedures such as not using metal objects near energized electrical equipment, not bypassing safety devices such as lockouts, fuses, circuit breakers, and shut down of nearby electrical equipment when a spill of flammables occurs.

5.5.6.2 Mechanical Equipment. Employees, as part of their safety training, should be taught the proper usage and maintenance of mechanical equipment.

- All hand tools have general safety precautions associated with them, e.g. always cut away from the body, never remove installed safety guards. These precautions, along with the proper method of using tools, should be emphasized in any training program.
- Equipment operating permits may be required to restrict the use of certain equipment to personnel who have been specifically trained in its operation.
- Preventive maintenance of all equipment that is used at the site should be stressed in any training program. Properly maintained equipment is less likely to fail than equipment which is poorly maintained.
- Fixed mechanical equipment normally has built-in safety guards. Employees should be trained to use them and other associated safety equipment such as eye protection, gloves, aprons, etc.

5.5.6.3 Explosion and Fire Hazards. Flammable materials and explosive mixtures are items that may be routinely received by some waste

management facilities. A thorough training program should be implemented to minimize the risks associated with these products. The program should include the following:

- Information on materials that are received and procedures to recognize and identify flammable and explosive wastes.
- Procedures that have been implemented to preclude the possible formation of flammable and/or explosive mixtures by accidentally combining different waste products.
- Classification of Fires:
  - a. Class A fires are fires in ordinary combustible materials such as wood, cloth, or paper.
  - b. Class B fires are defined as fires in flammable petroleum products or other flammable liquids or greases.
  - c. Class C fires are fires involving energized electrical equipment where the electrical nonconductivity of the extinguishing agent is of importance.
  - d. Class D fires are fires in combustible metals such as potassium, sodium, and magnesium.
- Personnel should be thoroughly trained in the types, location, and usage of the various fire extinguishing methods, equipment and plans available at the site.
- Personnel should be thoroughly familiar with the Site Contingency Plan on fire fighting techniques, evacuation procedures, and emergency communications.
- It should be continually emphasized throughout the training cycle that "Smoking Areas" have been designated and smoking is allowed only in those areas.

- Employees should be trained concerning the methods used at the site to control matches, lighters, and other ignition sources.

5.5.6.4 Materials Handling. Site personnel should be made familiar with the provisions of 29 Code of Federal Regulation Subpart N, paragraphs 1910.176-1910.190 dealing with materials handling and storage. These paragraphs cover all aspects of materials handling and storage. Only those portions applicable to the site need be taught.

5.5.6.5 Tank Hazards. Confined spaces entry is an area requiring a great deal of training. A confined space is any area with limited access and egress which allows or can allow the accumulation of hazardous contaminants or allows an oxygen deficient atmosphere to exist. These areas present unique problems because of the mobility of the workmen to enter and exit easily, particularly in emergencies. Communication problems may exist because of the physical separation of the workers. A training program would be established which will insure that the trainees fully comprehend the safety measures which are to be taken. These safety measures include the following:

- The vessel should be thoroughly cleaned and ventilated.
- Connecting pipelines should be disconnected.
- All power driven devices such as agitators must be locked out at positive disconnect switches.
- Air samples should be taken to prove absence of flammable vapors, and also in some cases, of toxic or noxious materials.
- Air samples should be taken to prove presence of a normal amount of oxygen.

- A tank entry permit should be used and be signed by operating and maintenance supervision verifying that above steps have been satisfactorily complied with, and posted at the vessel site.
- Men to enter vessel and safety observers should be equipped with life belts and ropes. (Belts should be the type fitting high under the armpits for ease in lifting, not around the waist. Handcuff types are preferred as alternates by some, opposed by others.)
- Appropriate respiratory protective devices should be provided. This should be a device that provides a respirable atmosphere such as an airline or a self-contained breathing apparatus. If applicable, appropriate protective clothing should be provided.
- A safety observer should be present at the entrance to the vessel. He should be equipped with a self-contained breathing apparatus and appropriate clothing.
- Life line signals should be established prior to entry so that the worker and the safety man can communicate by tugging on the rope.
- An additional man should be in the immediate vicinity to assist the safety observer if needed.
- Rope or chain ladders with rigid rungs of wood or metal may be used for vessel entry where straight ladders cannot be used. However, lowering of a man into a vessel without facilities for him to come out by himself should be avoided.
- A man should not be allowed to go into a vessel through an opening which requires him to "squeeze through". He cannot be

removed quickly enough in emergency conditions. A 22-in. manhole should be standard. Small men can enter as small an opening as 13 in.

- All of the above procedures should be emphasized in a comprehensive training program. Employees should be required to display their competance prior to being issued an entry permit.

5.5.6.6 Buddy System. Operational personnel should be trained to always use a "buddy system" in potentially hazardous operations. The "buddy" is not to go into the area. He should function as a safety observer prepared to assist in the event of an emergency. He should be provided with the capability to communicate with the worker and the operational control area. If protective equipment is required by the operator, the safety observer should be equipped with the same equipment or better.

5.5.6.7 Recommended Safety Equipment. Specific recommendations on equipment are not practical since equipment is going to vary from site to site. The general guideline to be followed is that personnel must be trained to properly use and maintain safety equipment and to be familiar with limitations of the safety equipment.

5.6 HIGH HAZARD OPERATIONS

For some facilities, operations may exist which have the potential to cause extremely serious irreversible damage to human health and the environment in the event of an operational malfunction. Facility owners or operators should examine each facility carefully to determine the existence of these high hazard operations. Special training should then be provided to all management personnel and the appropriate operations personnel. This training should incorporate the following elements:

- Contingency Awareness
- Need for Systematic Planning
- Analysis of Probable and Possible Failures
- Hazard Hunts
- Failsafe Operation
- Simulated Emergencies
- Automatic Controls
- Emergency Alarm Signals and Codes
- Special Contingency Instructions
- Degree of Emergency

5.7 MAINTAINING DOCUMENTATION

The appropriate facility personnel should be instructed in the following elements of reporting and record keeping:

- Use of the Manifest System
- Labeling and Placarding
- Incident Reporting
- Developing and Maintaining Training Records

  Job Titles and Classification

  Job Duties and Descriptions

  Personnel Names

  Personnel Training Records
- Contingency Plan Records

  Plan

  Amendments

Information concerning each of the above can be found in the regulations (Federal Register, May 19, 1980.)

CHAPTER 6

SOURCES OF INFORMATION

6.1 INTRODUCTION

This chapter presents information concerning instructional materials and programs which were available at the time the training manual was being prepared (January, 1980). The information presented was obtained using catalog searches and conversations with knowledgeable professionals. The types of instructional materials surveyed include textbooks, reference works, pamphlets, chemical data sheets, slide packages, films, and short courses.

At this time, surprisingly little material is available concerning the handling of hazardous wastes per se. However, given the degree of concern which is currently being expressed by all members of the scientific and engineering community, it is anticipated that much additional information will be available in the near future. Also, there is, at this time, quite a bit of information concerning hazardous materials management which is believed to be applicable and appropriate for incorporation into a properly designed hazardous waste management program. On this subject, it is also anticipated that there are many private industrial training programs which are currently provided to personnel handling hazardous materials and which would be appropriate, given modifications, to personnel handling hazardous wastes. Many of these programs have been and are being developed in accordance with Spill Prevention, Control, and Countermeasure (SPCC) Plan regulations for oil and hazardous substances under Section 311 of the Clean Water Act.

In the sections which follow, information is presented concerning material believed to be of potential use in the development of training programs for personnel associated with hazardous waste management facilities. This material ranges from general information concerning waste disposal to very specific chemical and toxicological data for selected hazardous materials. Information is also provided concerning computerized data bases and emergency response information centers.

6.2 TEXTBOOKS AND REFERENCE MATERIALS

The following sections present information concerning textbooks and reference materials of potential use in training programs. Many of these textbooks provide information which is of a general or background nature. Also included are reference titles for health effects and environmental data on many specific chemicals, and documents on contingency planning and emergency response and regulations.

6.2.1 General Information Sources

Hazardous Waste Disposal

1. Toxic and Hazardous Waste Disposal, Four Volumes, R.B. Pojasek (ed.), Ann Arbor Science Publishers, Inc., 1979 and 1980, viii + 407 pages, x + 259 pages, viii + 205, and x + 313.

   These four volumes contain several papers written by various authorities and present much information suitable for review and consideration in development of the broad training operational module especially from the standpoint of pretreatment operations for landfills. Information is provided on other technologies as well, including incineration and land farming, and on the RCRA regulatory program.

2. Recommended Methods of Reduction, Neutralization, Recovery, or Disposal of Hazardous Waste, Sixteen Volumes, R.S. Ottinger, et al, U.S. Department of Commerce, National Technical Information Service, PB-224 580 through 595, 1973, approximately 3700 pages in total.

The sixteen volumes are entitled:

a. summary report

b. toxicologic summary

c. disposal process descriptions - ultimate disposal, incineration, and pyrolysis processes

d. disposal process descriptions - geological and miscellaneous waste treatment process

e. national disposal site candidate waste stream constituent profile reports - pesticides and cyanide compounds

f. national disposal site candidate waste stream constituent profile reports - mercury, arsenic, chromium, and cadmium compounds

g. national disposal site candidate waste stream constituent profile reports - propellants, explosives, and warfare material

h. national disposal site candidate waste stream constituent profile reports - miscellaneous inorganic and organic compounds.

i. national disposal site candidate waste stream constituent profile reports - radioactive materials

j. industrial and municipal disposal candidate waste stream constituent profile reports - organic compounds

k. industrial and municipal disposal candidate waste stream constituent profile reports - organic compounds (continued)

l. industrial and municipal disposal candidate waste stream constituent profile reports - inorganic compounds

m. industrial and municipal disposal candidate waste stream constituent profile reports - inorganic compounds (continued)

n. summary of waste origins, forms and quantities

o. research and development plans

p. references

This set contains a large amount of information, applicable given some updating, to the operational, chemistry, and toxicology and health effects training modules.

3. Other sources are identified in the operations manuals for landfills, land application systems, incinerators, etc.

Safety

1. Techniques of Safety Management, 2nd Edition, D. Peterson, McGraw-Hill Book Company, 1973, xii - 314 pages.

According to the author, this book was written to provide descriptions of new safety techniques, weaknesses in the safety profession and directions for future efforts. It is not a comprehensive reference book. The major areas addressed within the framework discussed above include: safety concepts and general maturation of the field; management's role and accountability; criteria and measurement of safety performance at various levels; means of motivating employees, supervisors and

tional Safety and Health, DHEW (NIOSH) Publication No. 77-206, 1977, 50 pages.

This pamphlet contains an elementary presentation of information on the nature of cancer, carcinogens, OSHA protocols for recognition of carcinogens, protection from exposure to carcinogens and in-plant safety procedures. Also provided is information on carcinogens regulated to the date of this publication. This pamphlet is appropriate for use as a source to the toxicology and health effects and personal safety-selection and use of personal protective clothing and equipment modules.

7. The OSHA Compliance Manual, D. Peterson, McGraw Hill Book Company, 1979, x + 241 pages.

The author states in the preface that the intent of this book is to help those who have been given the responsibility of preparing an organization to meet the rigorous standards imposed by the Occupational Safety and Healt Act. Many of the techniques discussed in the manual are appropriate to RCRA considerations as well. Chapters are provided on a general introduction, becoming familiar with OSHA, recordkeeping requirements, OSHA standards, reading the Federal Register, finding your physical violations, finding your administrative violations, beginning corrective action, keeping in compliance, documenting, and before OSHA and beyond it - back to safety management. Several useful appendices are provided as well containing information on training requirements under OSHA, inspections, protective equipment, toxic substances and other topics pertinent to safety management under OSHA.

Chemistry and Toxicology of Hazardous Materials

1. Chemistry of Hazardous Materials, E. Meyer, Prentice-Hall, Inc., 1977, xiv + 370 pages.

The author presents a basic introduction to the chemistry of hazardous materials. General information is provided through chapters on matter and energy, subdivisions of matter, and principles of chemical reactions. Other chapters present material on the chemistry of corrosive materials, water-reactive materials, toxic materials, oxidizing and reducing agents, chemical explosives, and radioactive materials. Additional information is provided on the chemistry of some common elements, organic compounds, and plastics, resins, and fibers. Appendices present information on first aid and treatments for poisons and a safety chart for common solvents. This text presents a large amount of pertinent information and is a good source for both the broad training and limited chemistry modules.

2. Hazardous Materials, L. Schieler and D. Pauze, Van Nostrand Reinhold Company, 1976, v + 249 pages.

This text presents thirty-seven (37) study units in ten (10) areas viz, basic sciences, combustion, gases, combustible materials, explosive materials, reactive materials, corrosive materials, toxic materials, radioactive materials, and unifying principles (official regulations for handling hazardous materials). While the approach is fairly elementary, a large amount of useful information is provided. Review questions at the end of each unit are presented and can be used to reinforce the learning

management on safety; and various safety techniques. It should be noted that this second edition has been revised to include the impact of the Occupational Safety and Health Act (OSHA).

2. Safety and Accident Prevention in Chemical Operations, H.H. Fawcett and W. S. Wood, John Wiley and Sons, Inc., 1965, xiv - 617 pages.

This test is composed of 31 papers by experts (predominantly industrial) in their fields. The contents provide a treatise on safety in the chemical industry and, as such, the scope is quite broad. Specific topics include: various overviews of safety; sites, plants and processes and their respective relationships to safety; the medical profession and safety; education and training; protective equipment materials and maintenance; measurement of efficacy; disaster planning; and projections for the future.

3. Guide for Safety in the Chemical Laboratory, 2nd Edition, Manufacturing Chemists Association, Van Nostrand Reinnold Company, 1972, vi - 505 pages.

This book is described as a "reference and practical guide." As such it provides the background for the development of a laboratory health and safety program. In twenty-nine chapters it discusses fundamentals of safety; various dangerous chemicals and situations; fire-fighting, storage, etc; emergency planning; first aid; accident investigations. The appendices provide discussions of hazardous reactions, charts for waste disposal procedures as well as a partial listing of sources from which additional relevant literature is available.

4. Guidelines to the Handling of Hazardous Materials, D. J. Benrendson, Sources of Safety, Inc., 1976, 56 pages.

The manual is paperbound and pocketsized - 9" x 4". It provides general information on the handling and transport of hazardous materials, followed by detailed discussions of definitions and classes of hazardous materials including identification (placarding). Other chapters address in detail labeling requirments, commodity list of dangerous articles; loading requirements; shipping papers, way bills and manifests; and the driving and parking rules for the transportation of hazardous materials. Included also at the back are lists of telephone numbers of relevant sources of information and assistance, governmental agencies as well as space for the inclusion of addional pertinent telephone numbers.

5. Working Safely with Flammable and Combustible Liquids, U. S. Department of Health, Education and Welfare, National Institute for Occupational Safety and Health, DHEW (NIOSH) Publication No 78-206, 1978, iii - 29 pages.

This pamphlet provides information on understanding liquid fires, fire prevention and protection, personal protection, and waste disposal. The presentation is elementary and the material appropriate for use in various training modules especially chemistry, contingency plan training, personal safety-selection and use of personal protective clothing and equipment.

6. Carcinogens - Working with Carcinogens, U. S. Department of Health, Education, and Welfare; National Institute for Occupa-

experience. This text is a good source of information for both the broad training and limited chemistry modules.

3. Flammable Hazardous Materials, 2nd Edition, J. H. Meidl, Glencoe Publishing Co., Inc., 1973, ix + 313 pages.

As the title indicates, this text is dedicated to one type of hazardous materials, viz, flammable hazardous materials. While the emphasis is on flammable properties, information is presented on other hazards associated with specific flammable materials. Chapters are provided on the chemistry of fire, properties of all flammable liquids, flammable liquids, flammable liquids in bulk, pressurized gases, liquefied gases, cryogenics, flammable solids, combustible metals, plastics, and oxidizing agents. This text contains much material on flammable materials appropriate for both a general presentation and for use as a detailed reference source. It provides a source of information for both the broad training and limited chemistry modules.

4. Explosive and Toxic Hazardous Materials, J. H. Meidl, Glencoe Publishing Co., Inc., 1970, xvii + 381 pages.

Chapters are provided on ammonium nitrate, explosives, unstable materials, rocket propellants and exotic fuels, water reactive materials, toxic materials - class B poisons, pesticides and class A poisons, corrosives, toxic combustion products, and radioactive materials. Appendices present additional information on class A, B, and C poisons, corrosive liquids, radioactive materials, the American table of distance for storage of explosives, organic peroxides, and selected toxic thres-

hold limits. This text is a good refrence source and source of information for material to be presented in both the broad training and limited chemistry and toxicology modules.

5. Principles of Fire Protection Chemistry, R. L. Tuve, National Fire Protection Association, NFPA No. TXT-2, 1976, xvii + 255 pages and Instructions Manual to Accompany Principles of Fire Protection Chemistry, NFPA No. TXT-2A, 1976, vii + 40 pages.

Chapters are provided on the basic "stuff" of our world, the language of science, the chemical world and some of its reactions, the relationship of fire and the physical world, heat and its effects, properties of solids important to the fire sciences, common flammable and combustible liquids and gases, basic facts about flames and fire extinguishment, fire classifications and water to foam agents, and gas to "halon" extinguishing agents. Appendices are provided on conversion factors, temperature conversion tables, and a table of hazardous materials and chemical index (taken from Fire Officer's Guide to Emergency Action by C. W. Banme NFPA, 1974). While the text is geared to fire fighters, it contains much material appropriate to the comprehensive and limited modules on chemistry and contingency plan training.

6. Essentials of Toxicology, 2nd Edition, T. A. Loomis, Lea & Febiger, 1976, vii + 233 pages.

This text provides chapters on introduction and scope, numbers in toxicology, biologic factors that influence toxicity, chemical factors that influence toxicity, influence of route of

administration on toxicity, genetic factors that influence toxicity, classification of harmful effects of chemicals, normal toxic effects of chemicals, abnormal response to chemicals, the basis of selective toxicity, the basis of antidotal therapy, principles of biological tests for toxicity and toxicologic testing methods. It is a good source for the broad training toxicology and health effects module and could be used as a reference in preparation of a limited toxicology and health effects module.

7. Introduction to General Toxicology, E. J. Ariens, A.M. Simmons, J. Offermeier, Academic Press, 1976, vii + 230 pages.

Subsequent to the introduction, chapters are provided on the different fields of toxicology, the toxicological action, classification of toxic effects, dose-effect relation and time effect relation, risk-determining factors when handling dangerous substances, interaction between substances in toxicology, detection of hazardous exposure, and general principles in the treatment of intoxication. A bibliography is also included. This text is a good source for the broad training toxicology and health effects module and contains information suitable for use in preparation of a limited toxicology and health effects module.

8. Patty's Industrial Hygiene and Toxicology, Volume I, General Principles, Third Revised Edition, G.D. Clayton and F. E. Clayton (eds), John Wiley & Sons, xviii + 1466 pages.

This text presents chapters written by various authorities on industrial hygiene; retrospect and prospect; legislation and legislative trends; industrial hygiene records and reports; the industrial hygiene survey and personnel; epidemiology; the mode of entry and action of toxic materials; the pulmonary effects of inhaled inorganic dust; occupational dermatoses; physiological effects of abnormal atmospheric premises; industrial noise and conservation of hearing; nonionizing radiation; ionizing radiation; lighting for seeing; air pollution; agricultural hazards; odor measurement and control; industrial engineering controls; air pollution controls; heat stress: its effects, measurement and control; respiratory protective devices; ergonomics; potential exposures in industry - their recognition and control; quality control; calibration; industrial sanitation; and fire and explosion hazards of combustible gases, vapors, and dusts. This source contains material suitable for inclusion in the broad training and limited toxicology and health effects module and the personal safety-selection and use of personal protective clothing and equipment module.

9. Patty: Industrial Hygiene and Toxicology, Volume II, Toxicology, Second Revised Edition, D. D. Irish and D. W. Fassett (eds), 1966, xxxi - 2377 pages.

Chapters were written by various authorities and cover the following areas: halogens; alkaline materials; arsenic, phosphorus, selenium, sulfur, and tellurium; inorganic compounds of oxygen, nitrogen, and carbon; industrial lead poisoning; the

metals (excluding lead); the aliphatic (open chain, acyclic) hydrocarbons; the alicyclic hydrocarbons; the aromatic hydrocarbons, halogenated hydrocarbons; I aliphatic; halogenated hydrocarbons: II cyclic; phenols and phenolic compounds: alcohols; glycols; derivation of glycols; epoxy compounds; ethers; ketones; organic acids, anhydrides, lactones, acid, halides, and amides, thiocids; esters; organic phosphates; aldehydes and acetals; cyanides and nitriles; aliphatic and alicyclic amines; aliphatic nitro compounds, nitrates, nitrites; aromatic nitro and amino compounds; heterocyclic and miscellaneous nitrogen compounds; and potential exposures in industry: their recognition and control. This source is mainly a reference source applicable to the toxicology and health effects modules. It contains information pertinent both to a discussion of the effects of classes of chemicals, and the effects of specific chemicals.

6.2.2 Chemical and Toxicological Data Reference Sources

The following texts are useful reference sources which contain data on the chemical, physical, and toxicological properties of hazardous materials. Trainees should be made aware of their existence and the types of information which they contain.

1. Handbook of Chemistry and Physics, The Chemical Rubber Co., published annually, approximately 2400 pages.

   This reference source is divided into six (6) major sections on mathematical tables, the elements and inorganic compounds, organic compounds, general chemical, general physical constants and miscellaneous.

2. Handbook of Environmental Data on Organic Chemicals, Karel Verschueren, Van Nostrand Reinnold Company, 1977, vi + 659.

Environmental data are presented for over one thousand organic chemicals. Specific types of data included are physical and chemical data, air pollution data, water pollution data, and data on biological effects on microorganisms, plants, animals, and man. Specific topics for which information is reported, if available, are as follows: physical and chemical data - formula, physical appearance, molecular weight, melting point, boiling point, vapor pressures for different temperatures, vapor density, saturation concentrations in air for different temperatures, total heat of combustion, lower heat of combustion, maximum solubilities in water at different temperatures, and specific gravity; air pollution data-conversion factors, threshold limit values, protection measures, odor threshold values, atmospheric reactions, natural and manmade sources, maximum emission concentrations and emission limits, control methods sampling and analysis; water pollution data - biodegradation, oxidation, impact on biodegradation processes, reduction of amenities (taste, odor, color), water quality, natural and manmade sources, wastewater treatment, sampling and analysis of biological effects data - bacteria, algae, plants, protozoa, worms, arthropoda, molusks, insects, fish, mammals, and man.

3. The Condensed Chemical Dictionary, Ninth Edition, G. G. Hawley, Van Nostrand Reinnold Company, 1977, xiii + 957 pages.

In the introduction the author states that this text is "not a dictionary in the usual sense of an assemblage of brief definitions but rather a compendium of technical data and descriptive information...". Information if available, is provided concerning chemical name, synonyms, formula, properties, source or occurrence, derivation, grades, containers, hazard, uses, and shipping regulations. General entries are also included covering many chemical concepts and important terms.

4. Dangerous Properties of Industrial Materials, Fifth Edition, N. Irving Sax, Van Nostrand Reinhold Company, 1979, xi - 1118 pages.

In addition to a large section which provides information on properties of specific chemicals, chapters written by various authorities are included on the historical perspective, industrial air contaminant control; industrial noise: effects and control; air pollution control requirements for industrial, commercial, and public facilities; radiation hazards; large radiation sources applications and safeguards, health hazards of solid waste treatment; industrial fire protection; industrial and environmental cancer risks; toxicology; chemical substance legislation; an industrial response to chronic health hazards, labeling and identification of hazardous materials. The section on specific chemicals presents information on names, formulas, physical properties, hazard analysis and countermeasures. Each chemical is rated per a toxic hazard rating code having the following categories: unknown, no toxicity (none), slight toxi-

city (low), moderate toxicity (mod), severe toxicity (high). Also provided are a bibliography and an addendum of very newly listed carcinogens, neoplastigens.

5. Registry of Toxic Effects of Chemical Substances, R. J. Lewis and R. L. Tatken (eds), U. S. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health, 1979, xxxii + 1363 pages.

This reference source provided the following types of information, if available: primary name, chemical abstracts service (CAS) registry number, molecular weight, molecular formula, synonyms, skin and eye irritation data, toxicity data, cited reference, aquatic toxicity ratings, reviews, standards and regulations, criteria documents, and status.

6. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data. The International Technical Information Institute, 1977, xiii + 591 pages.

Data on 702 chemical substances are provided. Types of information provided include synonyms, uses, properties, flammability, toxicity, handling and storage, emergency treatment measures, spills and leakage, disposal and waste treatment.

7. Hazardous and Toxic Effects of Industrial Chemicals, M. Sittig, Noyes Data Corporatives, 1979, xiv + 450 pages.

This reference source provides data on 236 compounds and classes of compounds. Types of information presented include description of the chemical synonyms, potential occupational exposures, permissible exposure limits, route of entry, harmful

effects, medical surveillance, special tests, personal protective methods, references, and bibliography.

8. Fire Protection Guide on Hazardous Materials, Seventh Edition, National Fire Protection Association, 1979, vii - 1302.

This source contains five (5) major sections as follows: flash point index of trade name liquids; fire hazard properties of flammable liquids, gases, and volatile solids; hazardous chemical data; manual of hazardous chemical reactions; and a recommended system for the identification of the fire hazards of materials. Flash points are provided for more than 8,000 trade name products listed alphabetically by trade name. Fire hazard properties are provided for more than 1,300 flammable substances. The hazardous chemicals data section provides information on fire, explosion, and toxicity hazards for approximately 416 chemicals; and the manual of hazardous chemical reactions includes information on 3,650 mixtures of two or more chemicals reported to be potentially dangerous in combination.

9. Hazardous Materials Handbook, J. H. Meidl, Glencoe Publishing Co., 1972, ix - 350 pages.

This reference presents major sections on firefighting procedures for various types of hazardous materials, explosive hazards, water and air reactivity, hazardous mixtures, toxicity hazards, and a tabulation of hazardous materials and selected characteristics. Also included are a glossary of terms and a bibliography. The tabulation of hazardous materials characteristics provides the NFPA 704 M identification, the DOT classifi-

cation and information on firefighting procedures, explosive hazards, water and air reactivity, mixture hazards and toxicity hazards keyed to the other major sections.

10. Material Safety Data Sheets, Materials Information Services, General Electric Company, 1979.

These sheets provide information on approximately 50 inorganic compounds and 1200 organic compounds and are updated periodically with new additions. Types of information covered include material name and other designations; manufacturer; ingredients and hazards; physical data; fire and explosion data; reactivity data; health hazard information; spill, leak and disposal procedures; special protection information; and special precautions and comments.

6.2.3 Contingency Plan Training

1. Highly Hazardous Materials Spills and Emergency Planning, J. E. Zajic and W. A. Himmelman, Marcel Dekker, Inc., 1978 x + 225 pages.

This text is primarily devoted to spills of hazardous materials and as such contains pertinent information on spill containment and treatment techniques and contingency planning. The presentation is general and elementary.

2. Introduction to Fire Science, Second Edition, L. S. Bush and J. H. McLaughlin, Gencoe Publishing Company, 1979, xii + 370 pages.

This text contains good information on firefighting equipment , extinguishing agents, tactics, and strategy appropriate to incorporation in broad training and limited contiungency plan training modules.

3. First Aid and Emergency Rescue, L. W. Erven, Glencoe Publishing Company, 1970, xvi + 408 pages.

Chapters are provided on paramedical personnel and procedures; psychological first aid; anatomy and physiology of the human body; emergency treatment; shock and other complications; respiration and resuscitation; hemorrhage and wounds; bandaging and transportation; internal medical disorders; injuries to bones, joints, and muscles; injuries from heat and cold; poisons and drugs; gases, chemicals and diseases; emergency childbirth; other common emergencies; glossary of medical terms; rescue skills and techniques; rescue tools and equipment, respiratory protection; rescue incidents and problems; water rescue techniques; wildnerness rescue techniques; and radiation problems and hazards. This text contains information useful to development of the personal safety-selection and use of personal protective clothing and equipment and contingency plan training modules (although it is emphasized that emergency rescue techniques are best left to experts in this field).

4. Emergency Action Guide for Selected Hazardous Materials, U. S. Department of Transportation, National Highway Traffic Safety Administration and Materials Transportation Bureau, 1978, vii + 87 pages.

This reference provides information on potential fire, explosion, and health hazards; immediate action necessary in the event of a spill; immediate follow-up action; additional follow-up action; water pollution control; and evacuation areas for 43

chemicals and classes of chemicals. It is a good reference for any facility having potential spills of these materials.

6.2.4 Legislation and Regulations

1. Resource Conservation and Recovery Act of 1976, P.L. 94-580 and associated regulations.
2. Clean Water Act of 1977, P.L. 95-217, and associated regulations.
3. Clean Air Act of 1977, P.L. 95-11 and associated regulations.
4. Hazardous Materials Transportation Act of 1975, P.L.93-633, and associated regulations.
5. Occupational Safety and Health Act of 1970, P.L. 91-596, and associated regulations.
6. Toxic Substances Control Act of 1976, P. L. 94-469, and associated regulations.
7. Environmental Law Handbook, Government Institutes, Inc., revised regularly.

   This handbook presents a discussion of the various environmental laws and contains a complete text of these laws in appendices. Also included are discussions of environmental law fundamentals. The most recent edition (Fifth Edition, May 1978) contains chapters on the National Environmental Policy Act; water pollution control legislation; air pollution control; land use and major issues in the control of industrial development; federal regulation of pesticides, toxic substances, noise, and solid waste and resource recovery.

6.3 AUDIO VISUAL AIDS

An examination of audio visual aids available at the time of preparation of this manual did not reveal any audio visual material offering assistance in other than highly specialized topics; e.g., movies and slide packages marketed by the National Fire Prevention Association. The NFPA currently has films and other audio-visual material available on a variety of fire-related topics; e.g., on the use of fire extinguishers, improper handling of flammable liquids, BLEVE (boiling liquid expanding vapor explosion), etc. Slide packages and films are also available from many protective clothing and equiment vendors; e.g., MSA, Scott, 3M. Other films are available from the USEPA dealing with specialized topics such as "Health Hazards of Pesticides." Labelmaster offers a slide series on labeling and placarding of hazardous materials and the USEPA has a slide package on the RCRA regulations offered through the National Audio Visual Center. Addresses are provided in Section 6.6.

6.4 COURSES

6.4.1 University Programs

At the time of preparation of this manual no University courses were found in hazardous waste management. The search was admittedly not exhaustive but did include examinations of the curricula offered by many leading educational institutions. While no courses were found "in-place," it was determined that several universities have courses in hazardous waste management in the planning stages and will be offering these courses in the near future. The U.S. Environmental Protection Agency recently awarded grants to three universities viz, Georgia Institute of Technology, University of Minnesota, and California State University of Long Beach, to sup-

port development of courses in hazardous waste management and it is anticipated that courses in hazardous wste management will soon be offered by many other institutions.

6.4.2 Short Courses

Several courses in hazardous waste management are currently being offered. These courses typically run from two (2) days to one week and cover a variety of topics. It is anticipated that given the appropriate modifications in program content, short courses can be utilized to accomplish many, if not all, of the broad training objectives, apart from site specific considerations. Institutions and groups currently offering professional development courses in the area of hazardous waste management include the following:

1. Vanderbilt University

   a. National Hazardous Materials Training Course: A one-week seminar designed to provide a clearer understanding of the effects of hazardous materials on the environment and human health; to increase the participants' ability to manage hazardous materials effectively and safely in normal operations and in spills and other emergencies and to comply with federal and state laws; to increase participants' knowledge of the multidisciplinary aspects of hazardous materials control, including state-of-the-art updates in chemistry, toxicology, laws and regulations, engineering, transportation, protective equipment and disposal.

   b. Hazardous Waste Management; Uncontrolled Waste Site Workshop: A one-week seminar designed to provide an under-

standing of the Resource Conservation and Recovery Act and new technologies for hazardous waste disposal. Subjects covered include RCRA definition of hazardous wastes, chemistry and toxicology of hazardous wastes, requirements for generators of hazardous wastes, standards for transporters of hazardous wastes and for owners and operators of hazardous waste management facilities, regulatory control, notification requirements for hazardous waste management activities, federal and state authorization and permits, secure hazardous waste landfills, incineration technology, deepwell disposal, detoxification and stabilization of hazardous wastes, waste exchange programs, management of hazardous waste spills and releases, liability, and hazardous waste disposal workshop.

c. Hazardous Waste Management: A three-day seminar covering chemistry of hazardous materials and wastes, legal aspects of hazardous waste management, toxicology of hazardous materials and wastes, treatment of hazardous effluents, disposal options, impacts of hazardous wastes on the environment.

d. Industrial Toxicology and Occupational Control of Hazardous Materials: A one-week seminar covering industrial toxicology, toxicology of hazardous industrial materials, radioactive materials, occupationally related diseases, industrial hygiene-monitoring and safety engineering, control of occupational hazards-chemistry, occupational

safety and health regulations, and hazardous wastes and industrial effluents.

e. Toxic Substance Control: A one-week seminar designed to provide an understanding of the Toxic Substance Control Act (TSCA) and its impact on industry. Subjects include toxic and hazardous substances, TSCA-development content, requiremnts, implementation, rules and regulations, pre-manufacturing notification, scientific and technial aspects, substantial risk reporting, risk analysis, business effects, compliance planning.

2. University of Wisconsin:

Hazardous Waste Management Practices: A one-week course emphasizing the application of available technology for managing the disposal of hazardous wastes. Subjects include overview of management needs and regulations, public participation in hazardous waste management decisions, hazardous waste characterization, transporation, waste characterization modification, hazardous waste disposal site selection and evaluation and hazardous waste disposal site design, operation and monitoring.

3. George Washington University:

Hazardous Waste Management: A three-day seminar designed for technical and management personnel concerned with the management of hazardous wastes. Sections included in the course cover pertinent state and federal regulations and anticipated regulatory directions, chemical and toxicological principles of

hazardous materials and wastes, and the state-of-the-art hazardous waste management techniques. Emphasis is placed on waste characterization, generation, transport, storage, treatment, and disposal. The topics employ case studies and problem sessions.

4. New Jersey Institute of Technology:

   National Conference on Hazardous and Toxic Wastes Management: A three-day conference, to identify the problems and solutions associated with the management of hazardous and toxic wastes, integrated, cost-effective ways of identifying and controlling hazardous and toxic wastes, and the toxic substances compliance requirements.

5. J. T. Baker Chemical Company, Phillipsburg, NJ:

   a. The Hazardous Chemical Safety Seminar and Workshop: A two-day seminar covering the understanding and safe handling, transportation, storage, labeling and usage of hazardous chemicals and improving the chemical control program. Subjects include hazard analysis, fundamentals of hazardous chemical safety, flammable liquids and solids, flammable materials workshop, corrosive chemicals, eye and face protection and shielding, corrosive chemicals workshop, insidious hazards, toxic chemicals, chemical storage, sources of information, chemical waste disposal, cryogenic liquids and compressed gases, the safety audit-labeling, first aid, responses to emergency situations, decontamination, emergency equipment.

b. Management and Disposal of Hazardous and Chemical Wastes: A two-day course on the management and disposal of hazardous and chemical wastes. Subjects include history of the industry, RCRA overview, in-house waste management, hazardous materials regulations, generator and transporter standards, permit requirements, standards for treatment, storage and disposal facilities, storage and classification, resource recovery, special disposal problems --asbestos, PCB's, highly reactive materials, disposal technologies.

6. The Center for Energy and Environmental Management, Fairfax, VA:

a. Strategic Planning for Disposal of Solid Wastes: A two-day course covering the technical and administrative provisions of the Resource Conservation and Recovery Act (RCRA) of 1976. Subjects include Resources Conservation and Recovery Act, RCRA Sec. 3001 - Defining hazardous waste, RCRA Sec. 1008/3004, liability, planning for disposal of waste, strategies, action planning.

b. EPA's Regulation of New Chemical Substances: A one-day course covering the provisions of the Toxic Substance Control Act (TSCA) of 1976. Subjects include the Toxic Substance Control Act of 1976, TSCA Sec. 5, corporate liability, small group workshops, action planning.

c. EPA Testing Requirements under TSCA and RCRA: A one-day course defining and analyzing the requirements of Sec. 3001 of RCRA and Sections 4 and 5 of TSCA. Subjects include testing under TSCA and RCRA, TSCA Section testing standards, TSCA Section 4 testing rule, RCRA Sec. 3001 - defining hazardous wastes.

7. Lion Technology Inc.; Dover, NH:

Hazardous/Toxic Waste Disposal: A two-day seminar covering management, storage, packaging, shipment, transporting, and disposal of hazardous wastes. Subjects include RCRA, corporate and personal liability, transporation regulations, disposal methods and technical options, regulatory and common sense reponsibilities, vocabulary of regulatory definitions, impact throughout the company, and good management practices and procedures.

8. Gastek Corporation, Gasten, PA:

Hazardous Chemical Safety Management: A four-day course covering subjects such as risk analysis, hazardous chemical control, chemical information, toxicology, industrial hygiene-biomonitoring, protective equipment, crisis management, and extremely hazardous chemicals.

9. McGraw-Hill Seminar Center, New York, NY:

Hazardous Wastes Management: A two-day seminar covering subjects such as growing scope of the problem, the federal and state regulatory climate, environmental considerations, sludges, packaging, transport, disposal, facilities operation, siting considerations, and energy recovery potentials.

10. Chemical Manufacturers Association:

Disposal of Hazardous Wastes: A two-day seminar. Subjects include siting, control of landfills, leachate control and recovery, alternative methods for disposal, ocean incineration, regulations, and off-site contract disposal.

New courses are appearing quite regularly, and it is anticipted that by the time this manual appears many other courses in hazardous waste management will be available.

6.5 COMPUTERIZED DATA BASES AND EMERGENCY RESPONSE CENTERS

6.5.1 Computerized Data Bases

1. U. S. Environmental Protection Agency

Oil and Hazardous Materials - Technical Assistance Data System (OHM-TADS), U. S. Environmental Protection Agency, Oil and Special Materials Control Division, Office of Water Program Operations, Washington, D.C.

The Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS) is designed to include all information pertinent to spill response efforts related to any material designated as an oil or hazardous material. As such, it includes a wide variety of physical, chemical, biological, toxicological, and commercial data. However, the greatest emphasis is placed on the deleterious effects these materials may have on water quality.

The investigative effort required to compile the data files involved no original research. Consequently, the completed files comprise a compendium of information available in open literature., Further, the data gaps represent a fairly accurate listing of current research needs.

Sources of information include articles in journals, books, papers presented at various symposia, compendiums, governmental reports, and basic reference texts.

Data are entered in a form that requires some technical background for maximum benefit. It is assumed that the user is familiar with chemical symbols and common chemical-biological terms.

2. National Library of Medicine

MEDLINE contains approximately 600,000 references to biomedical journal articles published in the current and two preceding years. An English abstract, if published with the article, is frequently included. The articles are from 3,000 journals published in the U.S. and 70 foreign countries; MEDLINE also includes a limited number of chapters and articles from selected monoigraphs. Coverage of previous periods (back to 2966) is provided by backfiles that total some 2,500,000 references.

MEDLINE can also be used to update a search periodically. The search formulation is stored in the computer and each month, when new references are added to the data base, the search is processed automatically and the results mailed from NLM.

TOXLINE (Toxicology Information Online) is a collection of 650,000 references from the last five years on published human and animal toxicity studies, effects of environmental chemicals and pollutants, and adverse drug reactions. Older material (400,000 references) is in TOXBACK. Almost all references in TOXLINE have abstracts or indexing terms and most chemical compounds mentioned in TOXLINE are further identified with Chemical Abstracts Service Registry Numbers. The references are from

five major published secondary sources and five special literature collections maintained by other organizations.

CHEMLINE (Chemical Dictionary Online) is a file of 900,000 names for chemical substances, representing 450,000 unique compounds. CHEMLINE, created by NLM in collaboration with Chemical Abstracts Service (CAS), contains such information as CAS Registry Numbers, molecular formulas, preferred chemical nomenclature, and generic trivial names. The file may be searched by any of these elements and also by nomenclature fragments and ring structure information making chemical structure searches possible.

RTECS (Registry of Toxic Effects of Chemical Substances, formerly the Toxic Substances List) is an annual compilation prepared by the National Institute for Occupational Safety and Health. RTECS contains acute toxicity data for approximately 36,000 substances. For some compounds there are also threshold limit values, recommended standards in air, and aquatic toxicity data.

3. Bibliographic Retrieval Services

MEDLARS

The MEDLARS (Medical Literature Analysis and Retrieval System) database, produced by the National Library of Medicine, contains citations from over 3,000 English and major foreign language journals in all the basic and clinical biomedical sciences.

All citations from the printed INDEX MEDICUS, INTERNATIONAL NURSING INDEX, and INDEX TO DENTAL LITERATURE are included in this comprehensive database, which now totals in excess of 2 million citations.

BIOSIS PREVIEWS

The BIOSIS PREVIEWS database, produced by the BioSciences Information Service, provides comprehensive coverage of the world's biological and life sciences literature, including such broad areas as anatomy, bacteriology, biochemistry, cell biology, genetics, immunology, microbioogy, nutrition, pathology, physiology, pharmacology, toxicology, taxonomy, virology, and zoology.

The file includes all citations from the printed volumes of BIOLOGICAL ABSTRACTS and BIORESEARCH INDEX totallling 240,000 new references each year.

CHEMICAL ABSTRACTS CONDENSATES

The CHEMICAL ABSTRACTS CONDENSATES (CA CONDENSATES) database, produced by Chemical Abstracts Services, contains citations to the world's literature in chemistry, including biochemistry, organic and macromolecular chemistry, analytical and physical chemistry, applied chemistry, and chemical engineering.

CA CONDENSATES includes all those references from the printed volumes of CHEMICAL ABSTRACTS, providing users with over 300,000 new references annually.

NTIS

The NTIS database, produced by the National Technical Information Service (NTIS), contains references to all unrestricted U. S. Government-sponsored research and technical reports issued in the broad areas of physical and biological science and technology, business and social science.

The NTIS database includes all citations from the printed volumes of GOVERNMENT REPORTS ANNOUNCEMENTS, as well as reports from the AEC, departments of Defense and Commerce, HUD, EPA, National Bureau of Standards, DOC, etc.

POLLUTION ABSTRACTS

The Pollution Abstracts database, published by Data Courier, Inc., Louisville, Kentucky, contains more than 40,000 citations with abstracts from both published and unpublished worldwide pollution and environmental information.

The file dates back to 1970 and is updated bimonthly with more than 1,000 new references.

6.5.2 Emergency Response Centers

CHEMTREC stands for Chemical Transportation Emergency Center, a public service of the Chemical Manufacturers' Association at its offices in Washington, D.C.

CHEMTREC provides immediate advice for those at the scene of emergencies, then promptly contacts the shipper of the chemicals involved for more detailed assistance and appropriate follow-up.

CHEMTREC operates around the clock - 24 hours a day, seven days a week - to receive direct-dial, toll-free calls from any point in the continental United States through a wide area telephone service (WATS) number, 800-424-9300 (483-7616 for calls originating within the District of Columbia; 202-483-7616 for calls originating outside the continental U.S.).

Shippers, including CMA members and non-members are notified through pre-established phone contacts providing 24-hour accessibility, via information operators, or through cooperation of fire and police services.

As circumstances warrant, the National Transportation Safety Board or appropriate offices of other agencies may be notified.

CHEMTREC's capabilities have been recognized by the Department of Transportation, and a close and continuing relationship is maintained between CHEMTREC and the Department.

6.6 PUBLISHERS' ADDRESSES

Academic Press, Inc.
111 Fifth Avenue
New York, NY 10003 1-212-741-6800

American Chemical Society (ACS)
1155 Sixteenth Street, N.W.
Washington, D.C. 10036 1-202-872-4600

Ann Arbor Science Publishers, Inc.
P. O. Box 1425
Ann Arbor, MI 48106 1-313-761-5010

CRC Press, Inc.

2255 Palm Beach Lakes Boulevard

West Palm Beach, FL 33409 1-3050994-0555

General Electric Company

Growth Services

120 Erie Boulevard

Department 20

Schenectady, NY 12305 1-518-385-2211 Research Development Center and Main Plant

Glencoe Publishing Co., Inc.

17227 Ventura Boulevard

Encino, CA 91316 1-213-990-3080

Government Institutes, Inc.

4733 Bethesda Avenue, N.W.

Bethesda, MD 20014 1-301-656-1090

The International Technical Information Institute

Toranomon-Tachikawa Bldg., 6-5 1 Chome

Nichi-Shimbashi, Minato-ku

Tokyo, Japan

Labelmaster

7525 North Wolcott Ave.

Chicago, IL 60626 1-312-973-5100

Lea & Febiger

600 S. Washington Square

Philadelphia, PA 19106 1-215-922-1330

National Audiovisual Center

Government Services Administration

Washington, DC 20409 1-301-763-1896

Marcel Dekker, Inc.

270 Madison Avenue

New York, N.Y. 10016 1-212-889-9595

McGraw-Hill Book Company

1221 Avenue of the Americas

New York, NY 10020 1-212-997-1221

National Fire Protection Association (NFPA)

470 Atlantic Avenue

Boston, MA 02210 1-617-482-8755

National Institute for Occupational Safety and Health (NIOSH)

Division of Technical Services

Cincinnati, OH 45226 1-513-684-8302

Noyes Data Corporation

Mill Rd. at Grand Avenue

Park Ridge, NJ 07656 1-201-391-8484

NTIS

U.S. Department of Commerce

National Technical Information Service

425 13th Street, N.W., Room 620

Washington, DC 20004 1-202-724-3374 (director) 1-202-557-4600 (general information)

National Library of Meicine

8600 Rockville Pike

Bethesda, MD 20014 1-301-496-4000

Prentice Hall

Englewood Cliffs, NJ 07632 1-201-592-2000 (General Office) 1-201-592-5260 (Learning Systems)

Sources of Safety, Inc.

8303 East Kenyon Drive

Denver, CO 80237 1-303-771-1219

U.S. Department of Transportation

National Highway Traffic Safety Administration

Emergency Medical Servics Branch

400 Seventh Street S.W.

Washington, D.C. 20590 1-202-426-1828 (General Information)

Van Nostrand Reinhold Company

135 West 50th St

New York, NY 10020 1-212-265-8700

John Wiley and Sons, Inc.

1 Wiley Drive

Somerset, NJ 08873 1-201-469-4400

APPENDIX A

STATE/TERRITORY SOLID WASTE MANAGEMENT AGENCIES

APPENDIX A

STATE/TERRITORY SOLID WASTE MANAGEMENT AGENCIES

Alabama

Director
Division of Solid Waste
and Vector Control
State Department of Public Health
State Office Building
Montgomery, Alabama 36130
(205) 832-6728

Alaska

Solid Waste Program Coordinator
Dept. of Environmental Conservation
State of Alaska
Pouch O
Juneau, Alaska 99801
(907) 586-6721

American Samoa

Department of Public Works
Government of American Samoa
Pago Pago, American Samoa
Overseas Operator (Commercial Call)

Arizona

Division of Sanitation
Environmental Health Services
Arizona State Dept. of Health
411 No. 24th St.
Phoenix, Arizona 85008
(602) 255-1160

Arkansas

Chief
Solid Waste Control Board
Arkansas Department of Pollution
Control and Ecology
P.O. Box 9583
8001 National Drive
Little Rock, Arkansas 72219
(501) 371-1701

California

Department of Public Health
714-44 P. St.
Sacramento, California 95814
(912) 445-4171

Colorado

State Department of Health
Division of Radiation and
Hazardous Waste
4210 East Eleventh Avenue
Denver, Colorado 80220
(303) 320-8333

Connecticut

Solid Waste Management Unit
Department of Environmental
Protection
State of Connecticut
122 Washington Street
Hartford, Connecticut 06106
(203) 566-3672

Delaware

Chief, Solid Waste Section
Delaware Dept. of Natural Resources
and Environmental Control
Edward Tatnall Building
Dover, Delaware 19901
(302) 678-4781

District of Columbia

Director
Department of Environmental
Services
415 12th Street, N.W.
Washington, D.C. 20004
(202) 727-5748

Florida

Dept. of Environmental Regulations
2600 Blair Stone Rd.
Twin Towers Bldg.
Tallahassee, Florida 32301
(904) 488-8163

Georgia

Chief, Land Protection Branch
Environmental Protection Division
270 Washington St., S.W.
Atlanta, Georgia 30334
(404) 656-2833

Guam

Administrator, Guam, EPA
P.O. Box 2999
Agana, Guam 96910
Overseas Operator (Commercial Call)

Hawaii

Director, State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801
(808) 548-2811 Ext. 521

Idaho

Chief
Solid Waste Management Section
Environmental Services Division
Idaho Dept. of Health and Welfare
Boise, Idaho 83720
(208) 384-2287

Illinois

Illinois Environmental Protection Agency
Illinois Pollution Control Board
2200 Churchill Road
Springfield, Illinois 62706
(217) 782-6760

Indiana

Chief, Solid Waste Section
Division of Sanitary Engineering
Indiana State Board of Health
1330 West Michigan Street
Indianapolis, Indiana 46206
(317) 633-0176

Iowa

Director
Air and Land Quality Division
Department of Environmental Quality
900 East Grand St.
Des Moines, Iowa 50319
(515) 281-8692

Kansas

Kansas Department of Health and Environment
Division of Environment
Building 740
Forbes Air Force Base
Topeka, Kansas 66620
(913) 862-9360

Kentucky

Division of Hazardous Material and Waste Management
Department of Natural Resources and Environmental Protection
U.S. 60 Pinehill Plaza
Frankfort, Kentucky 40601
(502) 564-6716

Louisiana

Department of Health and Human Resources
Office of Health Services and Environmental Quality
P.O. Box 60630
New Orleans, Louisiana 70160
(504) 568-5137

Maine

Chief
Bureau of Land Quality Control
Division of Solid Waste Management
Department of Environmental Protection
State House
Augusta, Maine 04333
(207) 289-2111

Maryland

Water Resources Administration
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland 21401
(301) 269-3846

Massachusetts

Water Resources Commission
Bureau of Solid Wastes
State Office Bldg. Government Center
100 Cambridge St.
Boston, Massachusetts 02202
(617) 727-4293

Michigan

Chief, Resource Recovery Division
Environmental Protection Branch
Department of Natural Resources
P.O. Box 30028
Lansing, Michigan 48909
(517) 323-1315

Minnesota

Director
Minnesota Pollution Control Agency
Division of Solid Waste
1935 West County Road, B-2
Roseville, Minnesota 55113
(612) 296-7315

Mississippi

Director
Division of Solid Waste Management
and Vector Control
Mississippi State Board of Health
P.O. Box 1700
Jackson, Mississippi 39205
(601) 982-6317

Missouri

Director, Solid Waste Management
Program
Department of Natural Resources
2010 Missouri Blvd.
Jefferson City, Missouri 65101
(314) 751-3241
(mailing address)
P.O. Box 1368
State Office Building
Jefferson City, Missouri 65101

Montana

Chief
Solid Waste Management Bureau
Montana State Department of Health
and Environmental Sciences
1400 11th Avenue, Suite A
Helena, Montana 59601
(406) 449-2821

Nebraska

Chief
Solid Waste Division
Department of Environmental Control
301 Centennial Mall
Box 94877
Lincoln, Nebraska 68509
(402) 471-2186

Nevada

Division of Environmental Protection
201 South Falls Street
Room 221
Carson City, Nevada 89710
(702) 885-4670

New Hampshire

Bureau of Solid Waste
Department of Health and Welfare
Hazen Drive
Concord, New Hampshire 03301
(603) 271-4611

New Jersey

Department of Environmental Protection
P.O. Box 2807
Trenton, New Jersey 08625
(609) 292-7645

New Mexico

Director, Health and Environment
P.O. Box 968, Crown Building
Santa Fe, New Mexico 87503
(505) 827-5271

New York

Director, Div. of Solid Waste Mgmt.
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233
(518) 457-6603

North Carolina

Department of Human Resources
Division of Solid Wastes and
Vector Control
306 N. Wilmington St.
Bath Bldg.
Raleigh, North Carolina 27611
(919) 733-2178

North Dakota

Director
Division of Solid Waste Mgmt.
State Department of Health
1200 Missouri Avenue
Bismarck, North Dakota 58505
(701) 224-2382

North Mariana Islands

Chief, Dept. of Health Services
Office of High Commission
Trust Territory of the Pacific
Islands
Saipan, Marianas 96950
Overseas Operator (Commercial Call)

Ohio

Ohio Environmental Protection Agency
361 E. Broad Street
Columbus, Ohio 43215
(614) 466-7220

Oklahoma

Chief
Industrial and Solid Waste Service
State Department of Health
10th and Stonewall Streets
Box 53551
Oklahoma City, Oklahoma 73152
(405) 271-5338

Oregon

Director, Solid Waste Mgmt. Division
Oregon State Department of
Environmental Quality
P.O. Box 1760
Portland, Oregon 92707
(503) 229-5696

Pennsylvania

Director
Division of Solid Waste Management
Dept. of Environmental Resources
P.O. Box 2063
Harrisburg, Pennsylvania 17120
(717) 787-7381

Puerto Rico

Environmental Quality Board
Office of the Governor
Box 11488
Santurce, Puerto Rico 00910
(809) 725-5140 Ext. 226

Rhode Island

Chief, Division of Solid Waste Mgmt.
Department of Environmental Management
204 Cannon Building
Davis Street
Providence, Rhode Island 02908
(401) 277-2808

South Carolina

South Carolina Board of Health
and Environmental Control
2600 Bull Street
Columbia, South Carolina 29201
(803) 758-5681

South Dakota

Division of Solid Waste and Air Quality
South Dakota Dept. of Health
120 East Capitol St.
Pierre, South Dakota 57501
(605) 773-3329

Tennessee

Division of Solid Waste Management
Bureau of Environmental Health Sciences
Tennessee Department of Public Health
301 Seventh Avenue, North
Nashville, Tennessee 37219
(615) 741-3424

Texas

Texas Department of Health
Division of Solid Waste Management
1100 West 49th Street
Austin, Texas 78756
(512) 458-7271

Utah

Chief
Bureau of Solid Waste Management
Dept. of Health
Division of Environmental Health
150 W. North Temple
P.O. Box 2500
Salt Lake City, Utah 84110
(801) 533-6163

Vermont

Air and Solid Waste Programs
Agency of Environmental Conservation
State Office Building
Montpelier, Vermont 05602
(802) 828-3395

Virgin Islands

Assistant Director
Division of Utilities & Sanitation
Department of Public Works
Government of the Virgin Islands
Charlotte Amalie
St. Thomas, Virgin Islands 00801
(809) 774-7970

Virginia

Department of Health
Bureau of Solid and Hazardous
Waste Management
James Madison Building
109 Governor Street
Richmond, Virginia 23219
(804) 786-5271

Washington

Division Chief
Solid Waste & Resource Recovery
Division
Department of Ecology
Olympia, Washington 98503
(206) 753-6883

West Virginia

Director, Solid Waste Program
State Department of Health
1800 Washington Street, E.
Charleston, West Virginia 25305
(304) 348-2987

Wisconsin

Department of Natural Resources
Bureau of Solid Waste Management
P.O. Box 7921
Madison, Wisconsin 53705
(608) 266-2111

Wyoming

Solid Waste Program Supervisor
Wyoming Dept. of Environmental Quality
Hathaway Building
Cheyenne, Wyoming 82002
(307) 777-7752

APPENDIX B

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGIONAL OFFICES

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REGIONAL OFFICES

Information from the Regional Office of the EPA can be obtained either from the Regional Administrator, the Director of the Air and Hazardous Materials Division or the Solid Waste Management Representative in each region. General information on the Federal Hazardous Waste Management Program can be obtained from the Director, Hazardous Waste Management Division (AW-465), Environmental Protection Agency, Washington, D.C. 20560. Telephone number: 202/755-9185.

Regional Offices	Addresses	Telephone Contact
Region I Maine, New Hampshire, Vermont, Conn., Mass., Rhode Island	Regional Administrator Room 2203 John F. Kennedy Federal Bldg. Boston, MA 02203	Chief, Solid Waste Prgm. Air & Haz. Mtls. Division 617/223-5186
Region II New York, New Jersey, Puerto Rico	Administrator 26 Federal Plaza New York, NY 10007	Chief, Solid Waste Mgmt. Branch, Water Division 212/264-2513
Region III Pa., Md., Va., W. Va., D.C., Delaware	Administrator 6th & Walnut Streets Philadelphia, PA 19106	Solid Waste Mgmt. Rep. Air & Haz. Mtls. Div. 215/597-0980
Region IV Ala., Miss., Ga., N.C., S.C., Tenn., Ky., Fla.	Administrator 345 Courtland Street, NE Atlanta, GA 30308	Head, Solid Waste Mgmt. Section, Air & Hazardous Mtls. Branch 404/881-3454
Region V Minn., Wis., Ill., Ind., Ohio, Michigan	Administrator 230 South Dearborn St. Chicago, IL 60604	Chief, Solid Waste Branch Air & Haz. Mtls. Division 312/353-2197

Regional Offices	Addresses	Telephone Contact
Region VI Tex., Arkansas, N.M., La., Oklahoma	Administrator 1201 Elm Street First International Bdg. Dallas, TX 75270	Chief, Haz. Waste Mgmt. Sec. Air & Haz. Mtls. Division 214/767-2730
Region VII Kansas, Nebraska, Missouri, Iowa	Administrator 324 East 11th Street Kansas City, MO 64106	Chief, Waste Mgmt. Section Air & Haz. Mtls. Div. 816/374-3307
Region VIII Col., Utah, N.D., S.D., Montana, Wyoming	Administrator 1860 Lincoln Street Denver, CO 80295	Chief, Waste Mgmt. Branch Air & Hazardous Mtls. Div. 303/837-2221
Region IX California, Arizona, Nevada, Hawaii	Administrator 215 Fremont Street San Francisco, CA 94105	Chief, Solid Waste Mgmt. Sec. Haz. Mtls. Branch 415/556-3352
Region X Oregon, Washington, Idaho, Alaska	Administrator 1200 6th Avenue Seattle, WA 98101	Chief, Solid Waste Prgm. Air & Haz. Mtls. Division 206/442-1260 or 1253

APPENDIX C

TECHNICAL ASSISTANCE MANUALS BEING PREPARED BY THE USEPA

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TECHNICAL ASSISTANCE MANUALS BEING PREPARED BY THE USEPA

1. Application Guidance Manual for State Authorization.
2. The Closure and Post Closure Guidance Document.
3. Guidance Manual for Investigations of Hazardous Waste Disposal Sites.
4. Hazardous Waste Data Management System.
5. Procedures Manaul for RCRA Permit Review.
6. Personnel Training Manual for Owners/Operators of Hazardous Waste Management Facilities.
7. The RCRA Inspection Manual.
8. Regulation Information Program Workbook.
9. Resource Conservation and Recovery Act Case Proceedings Manual.
10. Safety Manual for Hazardous Waste Site Investigations.
11. Permit Writers' Guidance Manual: Landfarms
12. Permit Writers' Guidance Manual: Landfills
13. Permit Writers' Guidance Manual: Surface Impoundments.
14. Permit Writers' Guidance Manual: Containers
15. Permit Writers' Guidance Manual: Piles.
16. Permit Writers' Guidance Manual: Physical, Chemical, and Biological Treatment
17. Permit Writers' Guidance Manual: Tanks.
18. Permit Writers' Guidance Manual: Thermal Treatment.
19. Permit Writers' Guidance Manual: Incineration.
20. Permit Writers' Guidance Manual: Site Selection.
21. Permit Writers' Guidance Manual: Air Monitoring

22. Technical Resource Document: Guidance Manual for Closure for Hazardous Waste Surface Impoundments.

23. Technical Resource Document: Guide to the Disposal of Chemically Stabilized and Solidified Wastes.

24. Technical Resource Document: Hydrologic Simulation of Solid Waste Disposal Sites.

25. Technical Resource Document: Landfill and Surface Impoundment Performance Evaluation Manual.

26. Technical Resource Document: Manual for Evaluating Cover for Hazardous Waste.

27. Technical Resource Document: Hazardous Waste Leachate Management Manual.

28. Technical Resource Document: Lining of Waste Impoundment and Disposal Facilities.

29. Technical Resource Document: Landfill Treatment Manual.

30. Technical Resource Document: Air and Groundwater Monitoring Model.

31. Technical Resource Document: Incineration.

32. Technical Resource Document: Waste Analysis Trial Tests and Incompatibility.

33. Technical Resource Document: Closure

34. Technical Resource Document: Inspections (3004).

35. Technical Resource Document: Incinerator Burns Data.

36. Technical Resource Document: Risk Assessment.

37. Technical Resource Document: Site Operation and Management.

38. Waste Exchange Seminar Program.

39. Regional Guidance Manual on Selected Interim Status Requirements.

40. Test Methods for the Evaluation of Solid Wastes.

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