RESOURCE CONSERVATION AND RECOVERY ACT

SUBTITLE C

HAZARDOUS WASTE MANAGEMENT

BACKGROUND DOCUMENT

ON

"DEGREE OF HAZARD"

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF SOLID WASTE

APRIL 1980

TABLE OF CONTENTS

I. INTRODUCTION

A. Purpose and Scope

Under the authority in Subtitle C of the Resource Conservation and Recovery Act of 1976, EPA is promulgating interim status standards for storage, treatment, and disposal of hazardous waste in landfills.

Draft regulations were proposed for public comment on December 18, 1978. Comments were received at public hearings and in writing. This document provides the rationale for the regulations and responds to the comments received.

This document is divided into four parts, followed by references and appendices. Part I, Introduction, describes the purpose and scope of this document, the legislative authority for the regulations, and key definitions used in their development. Part II, Need for Regulation, explains the basic public health and environmental problems which show the need for regulation in this area. Part III, Synopsis of the Proposed Regulation, summarizes the proposed regulations. Part IV, Analysis of Issues, comprises the bulk of this document. For each issue, it discusses the proposed regulation and its rationale, comments received and the Agency's response including any new information obtained, and the final regulatory language.

B. RCRA Mandate for the Regulation

Section 3004 of Subtitle C of the Resource Conservation and Recovery Act of 1976 (P.L. 94-580)(RCRA) required EPA to promulgate regulations establishing standards, applicable to owners and operators of hazardous waste treatment, storage, and disposal

facilities, as may be necessary to protect human health and the environment. Section 3004 further required that such standards include, requirements respecting (1) the location, design, construction, and operation of hazardous waste treatment, disposal or storage facilities, (2) records of hazardous wastes treated, stored, or disposed, and (3) reporting, monitoring, and inspection. Landfills are common means of disposing of hazardous wastes, and are therefore covered by Section 3004.

Section 3005(e) also provides a period of interim status for owners and operators of existing facilities for treatment, storage, and disposal of hazardous wastes. After the effective date of the regulations, treatment, storage, and disposal may not be carried out except in accordance with a permit issued under Section 3005. However, persons who have applied for a permit and who have notified EPA of their activities, shall be granted interim status and treated as though a permit had been issued. Interim status thus applies between the effective date of treatment, storage, and disposal regulations and the date on which a permit is issued to a particular owner or operator.

A complete rationale for establishing interim status standards and responses to the public comments on that subject are presented in the preamble to the Parts 264 and 265 regulations and in the background document entitled "General Issues Concerning Interim Status Standards."

This background document on interim status standards for landfills addresses the specific standards applicable to landfills during the time a facility is under interim status.

C. Definitions

Definitions pertinent to the landfill regulations are:

(1) "Active portion" means that portion of a facility where treatment, storage, or disposal operations are being or have been conducted after the effective date of Part 261 of this Chapter and which is not a closed portion. (See also "closed portion" and "inactive portion".)

(2) "Closed portion" means that portion of a facility which an owner or operator has closed in accordance with the approved facility closure plan and all applicable closure requirements. (See also "active portion" and "inactive portion".)

(3) "Constituent" or "hazardous waste constituent" means a constituent which caused the Administrator to list the hazardous waste in Part 261, Subpart D, of this Chapter, or a constituent listed in Table 1 of §261.24 of this Chapter.

(4) "Container" means any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled.

(5) "Disposal" means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

(6) "Disposal facility" means a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

(7) "Existing hazardous waste management facility" or "existing facility" means a facility which is in operation, or for which construction has commenced, on or before October 21, 1976. Construction has commenced if:

(1) The owner or operator has obtained all necessary Federal, State, and local preconstruction approvals or permits; and either

(2a) A continuous physical, on-site construction program has begun, or

(2b) The owner or operator has entered into contractual obligations -- which cannot be cancelled or modified without substantial loss -- for construction of the facility to be completed within a reasonable time.

(8) "Facility" means all contiguous land, and structures, other appurtenances, and improvements on the land, used for treating, storing, or disposing hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

(9) "Free liquids"* means liquids which readily separate from the solid portion of a waste under ambient temperature and pressure.

(10) "Ground water" means water below the land surface in a zone of saturation.

(11) "Hazardous waste" means a hazardous waste as defined in §261.3 of this Chapter.

(12) "Inactive portion" means that portion of a facility which is not operated after the effective date of Part 261 of this Chapter. (See also "active portion" and "closed portion".)

---

* Revised definition. See discussion in Part IV of this document.

(13) "Incompatible waste" means a hazardous waste which is unsuitable for:

(i) Placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or

(ii) Commingling with another waste or material under uncontrolled conditions because the commingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes, or gases, or flammable fumes or gases.

(See Part 265, Appendix V, of this Chapter for examples).

(14) "Individual generation site" means the contiguous site at or on which one or more hazardous wastes are generated. An individual generation site, such as a large manufacturing plant, may have one or more sources of hazardous waste but is considered a single or individual generation site if the site or property is contiguous.

(15) "Landfill"* means a disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a land treatment facility, a surface impoundment, or an injection well.

(16) "Landfill cell"* means a discrete volume of a hazardous waste landfill which uses a liner to provide isolation of wastes from adjacent cells or wastes. Examples of landfill cells are trenches and pits.

(17) "Leachate"* means any liquid, including any suspended components in the liquid, that has percolated through or drained from hazardous waste.

---

* Revised definition. See discussion in Part IV of this document.

(18) "Liner"* means a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment, landfill, or landfill cell, which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate.

(19) "Operator" means the person responsible for the overall operation of a facility.

(20) "Owner" means the person who owns a facility or part of a facility.

(21) "Partial closure" means the closure of a discrete part of a facility in accordance with the applicable closure requirements of Parts 264 or 265 of this Chapter. For example, partial closure may include the closure of a trench, a unit operation, a landfill cell, or a pit, while other parts of the same facility continue in operation or will be placed in operation in the future.

(12) "Run-off"* means any rainwater, leachate, or other liquid that drains over land from any part of a facility.

(23) "Run-on"** means any rainwater, leachate, or other liquid that drains over land onto any part of a facility.

(24) "Solid waste" means a solid waste as defined in §261.2 of this Chapter.

II. NEED TO REGULATE

A. Potential for Environmental Damage

EPA files contain many examples of environmental damage from improper land disposal of hazardous waste. Although damage to

---

* Revised definition. See discussion in Part IV of this document.
** New definition. See discussion in Part IV of this document.

ground water is the most common occurrence, improper land disposal has resulted in surface water and air pollution as well. The following discussion describes reported incidents involving the contamination of all these media as well as public health damage that has occurred.

An EPA ground water report, entitled "The Prevalence of Subsurface Migration of Hazardous Chemical Substances At Selected Industrial Waste Disposal Sites,"[1] investigated the likelihood of ground water contamination at hazardous waste land disposal sites. In this study, ground waters at 50 land disposal sites which received large quantities of industrial waste were sampled and analyzed. The sites selected were all located East of the Mississippi River, were representative of typical industrial land disposal facilities, and were situated in a wide variety of geologic environments. No previous contamination of ground water with hazardous substances had been reported at these facilities before sampling, and waste disposal had been in progress for a minimum of 3 years. At 43 of the 50 sites migration of one or more hazardous constituents was detected in the ground water. Twelve potentially hazardous inorganic constituents were detected in ground waters above background concentrations. The five most frequently occurring were selenium, barium, cyanide, copper, and nickel in that order. Organic substances that were identified in ground waters included PCBs, chlorinated phenols, benzene and derivitives, and organic solvents.

At 26 sites, potentially hazardous inorganic constituents in the ground water from one or more of the monitoring wells exceeded the EPA drinking water limits. Of the potentially hazardous

substances, selenium most frequently exceeded drinking water limits, followed by arsenic, chromium, and lead.

Conclusions drawn from the study are:

1. Ground-water contamination at industrial land disposal sites is a common occurrence.
2. Hazardous substances from industrial waste land disposal sites are capable of migrating into and with ground water.
3. Few hydrogeologic environments are suitable for land disposal of hazardous waste without some risk of ground-water contamination.
4. Continued development of programs for monitoring industrial waste land disposal sites is necessary to determine impact on ground-water quality.
5. Many old industrial waste disposal sites, both active and abandoned, are located in geologic environments where ground water is particularly susceptible to contamination.
6. Many waste disposal sites are located where the underlying aquifer system can discharge hazardous substances to a surface-water body.

B. Actual Damage Incidents

Numerous incidents of damage which resulted from improper land disposal are contained within EPA files. Some of those documented damage cases which support the need for these regulations are summarized below.

1. Ground Water Contamination

- A landfill in Jackson Township, New Jersey was closed after it had contaminated approximately 100 drinking water wells. Analysis of water samples showed the presence of chloroform, methylene chloride, benzene, toluene, trichloroethylene, ethylbenzene and acetone. Residents claim that premature deaths, kidney malfunctions, kidney removals, recurrent rashes, infections and other health related problems are due to the contaminated water supplies.[2]
- An industrial landfill in South Brunswick, New Jersey has been identified as the source of contamination of a number of residential wells adjacent to the facility. Significant levels of chloroform, toluene, xylene, trichloroethane and trichloroethylene have been found in well water.[3]
- A New Hanover County, North Carolina landfill which has accepted municipal and industrial wastes since 1972 has contaminated an underlying aquifer and several domestic wells to the extent that the water is hazardous for human consumption and other uses. Chemicals found in the residential wells at levels sufficient to adversely affect human health and the environment include tetrachloroethylene, benzene, vinyl chloride, trichloroethylene and 1,2-dichloroethane, all carcinogens, as well as methylene chloride and lead. In addition the presence of chlorides, dichlorophenol, chlorobenzene, iron, manganese, phenol and zinc, have rendered the water unfit for human consumption due to extreme bad taste or odor.[4]

- A company which engages in the distillation, recovery and disposal of industrial solvents in Southington, Connecticut has, through its improper handling, storage and disposal of hazardous wastes, contaminated the groundwater causing the closure of three of the city's six wells. Chemicals found in the wells at levels which may adversely affect human health include: tetrachloroethylene, chloroform, trichloroethylene, 1,1,1,-trichloroethane, dichloroethane and carbon tetrachloride. In addition, soils and crops in the vicinity show very high levels of lead, reportedly from open burning of wastes at the site.[5]
- Chemical wastes in barrels were buried in two Plainfield, Connecticut gravel pits which resulted in groundwater contamination. The owner of the site was fined $25,000 and is paying for site cleanup, estimated at $750,000.[6]
- Wastes from a chemical company in Canton, Connecticut were disposed of in a dump between 1969 and 1972. Solvent type chemicals including carbon tetrachloride, methyl ethyl ketone, trichloroethylene and chloroform have contaminated eleven Canton wells. The estimated costs of extending water lines from nearby communities range from $145,000 to $379,000. The present owner of the dump has been ordered to clean up the site.[7]
- Tannery waste disposed of in the Saco, Maine town dump resultd in the contamination of private drinking water wells with chromium, iron and manganese.[8]

- Illegal dumping of chemical wastes in Rehobeth, Massachusetts resulted in the contamination of private wells and threatened a reservior. Among the chemicals identified were toluene, trichloroethylene and ethyl acetate. The site was cleaned up by the State at a cost of $125,000.[9]
- Chemicals dumped into a gravel pit near Lunenburg, Massachusetts has resulted in the contamination of both deep and shallow wells. Among the chemicals identified are benzene and toluene.[10]
- Disposal of benzene, toluene, dichloroethylene, and other organics by an organic chemcial manufacturer in Acton, Massachusetts led to the loss of 45 percent of the municipal water supply. The company has agreed to pay for cleanup.[11]
- Seventeen private wells adjacent to a landfill at Exeter, New Hampshire were found to be contaminated with phenols, one of which was 750 times drinking water standards. The town has approved a $200,000 bond issue to supply public water to the area.[12]
- The Bristol, Rhode Island landfill has three illegal dump sites of chemical wastes. Toluene and trichloroethylene have been found at the site. The adjacent marshland and at least eleven wells have been contaminated by the site.[13]
- A Cumberland, Rhode Island landfill has been implicated in the closing of four municipal wells which became contaminated by tetrachloroethylene and 1,1,1,-trichloroethane.[14]
- A Deptford Township, New Jersey landfill which accepted chemical wastes resulted in the contamination of well water with cyanides and phenols at levels twice the recommended drinking water standards. In addition, fires have been

reported at the site and workers have complained of skin and eye irritation as well as nausea.[15]

- Local residents began complaining in 1975 about water contamination in the area of a South Brunswick, New Jersey landfill. The site had accepted all types of chemical wastes, and significant amounts of organic chemicals were detected in six nearby wells. The State ordered the site closed; however, damage to the aquifer is estimated at $300,000.[16]
- The 102nd Street landfill in Niagara Falls, New York was utilizd for the disposal of hazardous wastes from the 1940's to 1972. Lindane and tetrachlorobenzene and phenol have been found to have migrated from the disposal site. The estimated cost to clean the site is $16,500,000.[17]
- The "S" area landfill in Niagara Falls, New York was utilized for the disposal of hazardous wastes between 1947 and 1975. Tetrachloroethylene and benzene hexachloride are migrating from the site and are entering the public drinking water supply. Remedial measures to clean this site are estimated at $50,000,000.[18]
- In mid 1979, a mixture of waste oil and organic chemicals were found to be pouring from an abandoned mine shaft into the Susquehanna River at Pittston, Pennsylvania. The river is used for recreational purposes and for downstream drinking water supplies. To date approximately $500,000 has been expended on the site and $850,000 is needed for site assessment and emergency containment. It is estimated that $10,000,000 will be needed to fully remedy the problem.[19]

- A landfill in Lehigh County, Pennsylvania which received industrial wastes contaminated a well which supplied water to about 50 homes. Excessive levels of phenols, ethyl actate and trichloroethylene were present in the well water.[20]
- Rainwater and groundwater percolating through a landfill in Wilmington, Delaware produced a leachate containing high concentrations of iron, chlorides, ammonia, heavy metals and dissolved organics. The leachate migrated from the site and into the deeper Potomac aquifer used extensively in New Castle County for a water supply. At a cost of over $1,000,000 the County has installed wells to intercept contaminated groundwater in order to prevent the contamination of the public water supply wells.[21]
- Investigation of a landfill in Hillsborough County, Florida showed volatile organic groundwater contamination of six wells, three of which were for private residences and two wells which served as community water supplies. Pending a long term solution, the County Health Department has instituted a bottled-water distribution program.[22]
- A landfill in New Hanover County, North Carolina which received industrial wastes has been shown to have contaminated 17 private wells in the vicinity. Approximately twenty additional private wells are in danger of becoming contaminated. The County is providing drinking water to residents with affected wells and plans are proceeding to provide a permanent outside water supply to the area. Court action is also proceeding against the State, County and operators of the landfill.[23]

- Leachate from a landfill accepting industrial waste near Aurora, Illinois has contaminated nine wells. Owners of the wells were forced to hook-up to the city of North Aurora's water lines.[24]
- An industrial landfill near Elkart, Indiana is the suspected source of contamination of six private wells with chromium at levels over 100 times the EPA drinking water standards. The problem was "remedied" by digging deeper wells. A recent USGS study is evaluating the extent of groundwater contamination.[25]
- In 1973, high levels of trichloroethylene (TCE) were found in the well of a private residence near Oscoda, Michigan. Over the following five years, seven other private residential wells and an industrial well became contaminated. The suspected source is the open dumping of TCE on the site of a nearby auto parts plant. Public water has been supplied to the residents at a cost of $140,000.[26]
- Two illegal dumpsites in Oakland County, Michigan have been named as the source of PCB's, toxic solvents and other chemicals found in local wells in August 1979. Approximately 2000 drums were dumped at the sites 12 to 14 years ago. The cost to remove the drums from the site is estimated at $500,000.[27]
- Extremely high levels of PCB's in fish have resulted in an advisory against consuming fish from 129 miles of the Sheboygan, Mullet, and Onion Rivers in the State of Wisconsin. One suspected source of the chemical is the Tecumseh Products Company, which used wastes containing 10,000 parts per million PCB's as fill in the Sheboygan River floodplain.

Remedial measures have been.initiated by the Wisconsin Department of Natural Resources.[28]

- Instead of properly disposing of some drums containing unidentified residues, a disposal company dropped them at a dump locatd in Cabazon, California. A heavy rain unearthed the drums, which gave off poisonous gases and contaminated the water.[29]
- An old gravel quarry near Spokane, Washington was used to disposing aluminum processing wastes until closed by a county order. The shallow perched water table has been contaminated by chlorides. The county has issued an order directing remedial actions at the site. The owner has agreed to do additional groundwater monitoring and to evaluate alternative remedial measures.[30]
- Water that had been used to wash RDX (a high explosive) out of shells leached from a dump in Kitsap County, Washington and contaminated groundwater. The U.S. Navy spent $150,000 on a monitoring program; final costs might reach $1,000,000.[31]
- Grasshopper bait, a pesticide containing arsenic trioxide, was being buried on a farm near Perham, Minnesota between 1934 and 1936. In 1972, 36 years later, a well was drilled near the burial site to supply water for employees in a newly built office facility. Eleven of the thirteen employees of the facility became ill from arsenic poisoning. Two required hospitalization and treatment. One lost the use of his legs for about six months due to severe neuropathy. Analysis of the well water revealed arsenic levels of 21,000 ppb.

(The USPHS drinking water standard is 50 ppb). The area of disposal was located twenty feet from the well. Estimated costs for solving the problem range form $2500 to $25,000.[32]

- A landfill near Montague, Michigan began operations in the 1950s and continued until 1970. A variety of materials were buried at the site including brine softening sludge, hexachlorocyclopentadiene, asbestos, and flyash. Approximately 400,000 cubic yards of wastes were disposed and the ground water has been contaminated as a result of improper operations.[33]
- A disposal site in Salt Lake City received waste tars and acidic bitumens from the 1920s until 1957. The volume of waste received is at least 37,000 cubic yards. Ground water contamination by oil and grease has been detected both up gradient and downgradient from the site due to ground water mounding at the site.[33]
- A landfill in Egg Harbor Township, New Jersey, has been the depository of large quantities of organic and inorganic industrial wastes. In 1973, this landfill was ordered by the State not to accept any more industrial wastes since laboratory analysis of samples from nearby observation wells established the existence of a ground water pollution problem involving several chemical contaminants. Lead concentrations in the observation wells have been analyzed up to 18 ppm. (The U.S. Public Health Service mandatory drinking water standard for lead is 0.05 ppm.) A municipal water supply well field, situated within 0.6 miles (1 kilometer) of the area of contamination, has not been affected; however, it is being regularly monitored because of the obvious threat.[34]

- A disposal site in Hardeman County, Tennessee received pesticide wastes from 1964 to 1972. Compounds disposed include endrin, dieldrin, aldrin, heptachlor, and isodrin. Evidence of water contamination was discovered as early as 1967. Several private wells have been abandoned. Total costs to clean up the area are estimated at nearly $6,000,000.[35]
- In 1974 in Dover Township, New Jersey a total of 148 private wells were condemned because they contained hazardous organic chemicals. Sources of the contaminants include the Township landfill and an illegal chemical waste dump on which hundreds of thousands of gallons of petrochemical wastes had been stored and dumped.[35]
- A creosoting company near Minneapolis operated a disposal site between 1917 and 1972. In the 1930's a tar-like taste was detected in municipal and private wells which were abandoned for deeper ground water. In 1973, phenolic compounds were detected in the deeper municipal wells. At least $20,000,000 will be required to clean up the ground water.[35]
- A variety of drummed chemical wastes were buried in the Hyde Park (N.Y.) Dump between 1953 and 1975. This site replaced the Love Canal Dump when that site closed. Toxic materials have been found in monitoring wells near the site.[35]
- A chemical manufacturing company has been dumping arsenic-containing wastes since 1953 at the LaBounty Dump Site along the Cedar River in South Charles City, Iowa. This chemical fill covers approximately 8.5 acres and contains an estimated 27,000,000 cubic feet of chemical sludge. In addition to various forms of arsenic, the site also contains phenols,

orthonitroalinine, nitrobenzene, etc. The situation poses a serious threat because the underlying fractioned limestone bedrock is where 70 percent of Iowa residents obtain their drinking and irrigation water. At one point toxic chemicals from LaBounty were found in the drinking water at Waterloo, 50 miles downstream on the Cedar River. In December 1977, the company was ordered by the Iowa Department of Environmental Quality to close its shop and cease dumping at LaBounty. The estimated cost of removal of these toxic wastes is about $20,000,000.[36]

2. Surface Water Contamination

° Between 1940 and 1970, the PCB-contaminated waste oil was dumped on land close to the Housatonic River at Pittsfield, Massachusetts. Surface water runoff has resulted in very high PCB levels in the river.[37]

° Approximately 1,000 gallons of petroleum based cleaning fluids were dumped at a landfill in Haywood County, North Carolina in 1974 and leaked into a tributary of Homing Creek. Cattle died after drinking from the polluted water.[38]

° Leachate from a company's toxic chemical dump near Sheffield, Illinois has been charged by the Illinois Attorney General's office with causing a major fish kill in a lake near Sheffield.[39]

° Powdered pesticides, including DDT, toxaphene, lindane and Alpha and Beta Benzene Hexachloride, killed several hundred fish in a Southeast Austin pond. The pesticides had been dumped in paper bags into an Austin, Texas landfill. Bulldozers constructing a baseball field unearthed the chemicals, and rain washed them into the pond. In August, 1979

construction in the park ceased while officials removed the contaminated soil.[40]

- Until approximately June 1970, Beech Creek, Waynesboro, Tennessee, was considered pure enough to be a source of drinking water. At that time, waste polychlorinated biphenyls (PCBs) from a nearby plant began to be deposited in the Waynesboro city dump site. Dumping continued until April 1972. Apparently the waste, upon being off-loaded at the dump, was pushed into a spring branch that rose under the dump and then emptied into Beech Creek. Shortly after depositing of such wastes began, an oil substance appeared in the Beech Creek waters. Dead fish, crawfish, and waterdogs were found, other wildlife which used the creek were also affected (e.g., two raccoons were found dead). Beech Creek had been used for watering stock, fishing, drinking water, and recreation for decades. Presently, the creek seems to be affected for at least 10 miles (16 kilometers) from its source and the pollution is moving steadily downstream to the Tennessee River. Health officials have advised that the creek should be fenced off to prevent cattle from drinking the water.[33]
- A number of disposal sites near Pickens, S.C. have received PCB-contaminated equipment, capacitors, and transformers. PCBs have been found in the waters near these sites. Approximately $2,000,000 will be needed to clean up the area.[35]

3. Ground and Surface Water Contamination

- Leachate from a Morristown, Tennessee dump containing municipal refuse, DDT, DDE, DDD and dieldrin polluted nearby wells and odors emanated from a leachate-polluted stream. TVA produced a final closing plan which included a two foot final cover and plastic covering of the pesticide disposal area.[43]
- Between 1971 and 1973 a chemical company near St. Louis, Michigan disposed of wastes containing at least 161,400 pounds of PBB's into a Gratiot County landfill. Significant traces of PBB's and various levels of other contaminants are presently being found in ground and surface water in and around the landfill site. A slurry wall trench system to contain the wastes is being developed.[42]
- A chemical company buried tons of brine, asbestos, fly ash and deadly pesticides on its factory site near Montague, Michigan. Included in this were as many as 20,000 drums that were leaking wastes resulting from the manufacture of the pesticide precurser C-56. In 1979, State offices discovered the highest levels of dioxin ever measured in Michigan. Chemicals from the landfill have leached into the groundwater, contaminating private wells and into White Lake which flows into Lake Michigan less than a mile away. The chemical company has agreed to install a purge well system to intercept contaminated water before it reaches White Lake. Cleanup estimates range from $15,000,000 to $300,000,000.[43]

- Since 1948, a company at Jacksonville, Arkansas manufactured chlorophenoxy herbicides including 2,4-D and 2,4,5-T. Chemical wastes, such as dioxin and chlorinated hydrocarbon insecticides, are buried at eight locations. Traces of dioxin were discovered in the sediment of a nearby creek and a downstream bayou; both of which have been quarantined by the state health department. Soil contamination has been documented. The cost to cleanup the site may exceed $4,000,000.[44]
- A petroleum processor in Baton Rouge, Louisiana has dumped hazardous wastes into a waste disposal site. Heavy rains transported the chemicals to an adjacent 550 acres of farmland which damaged vegetation and killed 160 cattle. Cleanup costs are expected to be substantial.[45]
- The Stringfellow Class I Disposal Site operated near Glen Avon, California from 1957 to 1972. During that time 32,000,000 gallons of waste were received containing sulfuric, nitric, and hydrochloric acids, zinc, lead, mercury, and chromium. Toxic contaminants have been transmitted to the ground and surface waters and air pollution from the evaporation sprayers has been suspected.[35]
- In May 1974, three dead cattle were discovered on a power company's recently acquired farm property near Bryan, Illinois, and pathological examination established that the cattle had died of cyanide poisoning. Further investigation revealed that the approximately 5-acre area, which is a part of a large property set aside for a nuclear power plant, had been for several years a repository of large quantities of toxic

industrial wastes. The former owner of the property used it to dispose of industrial waste his hauling company collected. The power company hired a consultant to study the environmental damage on the property and to recommend clean-up procedures. The subsequent study documented extensive harm to wildlife and vegetation. Nearby soils and surface and ground waters were heavily contaminated with cyanide and chromium. It is not yet known when farm crops can safely be harvested on the affected property again.[35]

4. Major Public Health Damage Caused By Chemicals Migrating from Disposal Site

° An old landfill on Neville Island, Pennsylvania which had received municipal refuse and miscellaneous industrial wastes was being made into a public park when site development was indefinitely stopped in the spring of 1979 after complaints of a high rate of health problems among workers. A field investigation of chemicals uncovered at the park included benzene, phenols, cyanide, mercury, coal tar residues and parathion.[47]

° The most highly publicized contamination incident by toxic chemicals occurred at the Love Canal industrial waste site in Niagara Falls, New York. Chemical wastes were disposed of at the site for approximately 25 years, until about 1953. Only of late have problems at the site become known to the public. Eighty-two chemicals, 11 of which are suspected or known carcinogens, were found on the surface and leaking into the basements of homes that were constructed in the area. Two hundred thirty-nine families in the immediate area

were evacuated, and their homes were purchased by the State government; in February 1979, about 100 more families -- those with pregnant women or children under two years of age living within a 20 square block area around the canal -- were urged to relocate. The report of the New York State Health Commissioner, which appeared in August of 1978, cited "growing evidence of ...subacute and chronic health hazards as well as spontaneous abortions and congenital malformations." A subsequent State Health Department study, released in February 1979, showed a higher than expected frequency of miscarriages, birth defects, and low birth weights.

Between $3 and 4 billion in lawsuits have been filed by victims seeking compensation for health and property damage. An additional $8,000,000 from the State and EPA is being used to contain the wastes on-site in an effort to minimize or eliminate additional damage. The site was declared a Federal disaster area, making this the first time that Federal disaster relief funds were made available for a man-made disaster.[46]

5. Explosions and Fires

° Used chemical drums were dumped in a Carrollton, Kentucky landfill and later retrieved by a man for use as garbage cans. When using a torch to cut the tops off the drums, the chemicals inside exploded. The flying debris severed the foot of a 5 year old boy.[48]

° In Chester, Pennsylvania, a chemical fire at an industrial disposal site resulted in the hospitalization of firemen overcome by toxic fumes. Volatile organics including methacrylic acid and a variety of aromatic hydrocarbons were

identified at the site. In addition, a water sampling program revealed concentrations of chromium, copper, nickel and lead substantially in excess of drinking water standards. The minimum cost to clean up the site is estimated at $1,250,000.[49]

- A combination of aluminum dust, magnesium chips and concentrated phosphorus ignited while being compacted at a landfill near Everett, Washington in 1974. Firemen applied water, which worsened the situation; two firemen were subsequently thrown from a front end loader, but escaped injury. Firefighters extinguished the surface fire but the fire burned underground until it expended its fuel.[50]
- Two sites in Gary, Indiana operated by the same firm in the mid-1970's accepted general industrial hazardous waste including plating wastes, solvents, acids and cyanide. Both sites were scenes of explosions and fires. The cause of one of the fires has been established as the result of mixing acid solvents. The owner has abandoned both sites and the extent of contamination of the soil and ground and surface water has not yet been determined. At least $6,000,000 will be required to clean up the two sites.[35]
- In October 1975 an equipment operator at a disposal site in Cook County, Illinois, struck a drum filled with ethyl acetate. The man died three days later as a result of second and third degree burns.[36]
- A load of empty pesticide containers was delivered to a disposal site in Fresno County, California. Unknown to the site operator, several full drums of an acetone/methanol mixture

were included in the load. When the load was compacted by a bulldozer, the barreled waste ignited, engulfing the bulldozer in flames. The operator escaped unharmed, but the machine was seriously damaged. In the ensuing fire pesticide wastes were dispersed.[36]

- At a dump in Contra Costa County, California, a large number of drums containing solvents were deposited in a landfill. In the immediate area were leaky containers of concentrated mineral acids and several bags containing beryllium wastes in dust form. The operators failed to cover the waste at the end of the day. The acids reacted with the solvents during the night, ignited them and started a large chemical fire. There was possible dispersion of beryllium dust into the environment. Inhalation, injestion or contact with the beryllium dust by personnel could have led to serious health consequences.[36]

- A disposal site in central California accepted a load of solid dichromate salts and dumped it in a pit along with pesticide formulations and empty pesticide containers. For several days thereafter, small fires erupted in the pit due to the oxidation of the pesticide formulations by the dichromate. Fortunately, the site personnel were able to extinguish these fires before they burned out of control. There were no injuries, or property or equipment damage.[36]

6. Toxic Fumes Resulting from Mixing of Incompatable Wastes

- In Los Angeles County, a tank truck emptied several thousand gallons of cyanide waste onto refuse at a sanitary landfill. Another truck subsequently deposited several thousand gallons of acid waste at the same location. Reaction between the acid and the cyanide evolved large amounts of toxic hydrogen cyanide gas. A potential disaster was averted when a local chlorine dealer was called to oxidize the cyanide with chlorine solution.[36]

- At a sanitary landfill near Dundalk, Maryland, a 2,000-gallon liquid industrial waste load containing iron sulfide, sodium sulfide, sodium carbonate and sodium thiosulfate, along with smaller quantities of organic compounds, was discharged into a depression atop a earthcovered area of the fill. When it reached eight to ten feet below the point of discharge, the liquid started to bubble and fume blue smoke. The smoke cloud quickly engulfed the truck driver and disabled him. Several nearby workers rushed to his aid and were also disabled. During the clean-up operation, one of the county firefighters also collapsed. All six of the injured were hospitalized and treated for hydrogen sulfide poisoning. The generation of hydrogen sulfide was probably due to the incompatibility of the waste with some of the landfill materials since the pH of the waste was measured to be 13 before it left the plant. It may also have been caused by the instability of the waste.[36]

- In July 1978 a truck driver died as a result of unloading chemicals at a Louisiana disposal site. At least 16,000,000 gallons of material contaminated with sulfur compounds, alkyl chloride, and sulfuric acid have been accepted at the site. A minimum of $17,000,000 will be required to clean up the site.[36]

7. Explosive or Hazardous Gases Migrate from Landfill

- Volatilization of hexachlorobenzene (HCB) from landfilled wastes as well as from direct emissions into the air from industrial plants in Darrow, Louisiana resulted in the settlement of HCB on pastures. This led to the bioaccumulation of HCB in the tissues of grazing cattle. Evidence of widespread contamination resulted in a quarantine of livestock produced over a 100 square mile area.[51]
- In the spring of 1975, residents near the Lees Lane landfill in Louisville, Kentucky experienced flash fires around water heaters and unusual gas odors in their homes. The landfill has received municipal and industrial wastes, including vinyl chloride wastes, for a number of years. Methane gas was being generated in explosive levels in the landfill and migrating into nearby homes resulting in seven families being evacuated. Studies are now underway to determine the most appropriate way to control the gas migration. A gas recovery system is being considered.[34]

8. Formation of Water Soluble Toxic Substances from Ruptured Drums

° In Riverside County, California, several drums of phosphorus oxychloride, phosphorus thiochloride and thionyl chloride were improperly dropped off at a dump. Later during a flood, the drums were unearthed, ruptured, and washed downstream. They released hydrogen chloride gas and contaminated the water.[36]

9. Wind Dispersal of Hazardous Waste

° Since 1867, asbestos product manufacturers have accumulated nearly 2 million cubic yards of assorted industrial wastes in open piles in a small Pennsylvania town. The original generator of the wastes went out of business in 1962. Since then, two other companies have been responsible for enlarging the spoils piles. The atmosphere around the piles contains asbestos fibers, as a result of wind erosion. An air monitoring program, conducted by the U.S. Environmental Protection Agency in October 1973, indicatead ambient background levels of asbestos to be 6 ng/m^3. An asbestos level of 9.6 ng/m^3 was found at a playground near the largest waste pile. Values obtained near active disposal piles range from 114 to 1,745 ng/m^3. A high pH level in a nearby stream has resulted from the piles. The State has ordered and gotten compliance for closing the site. The ongoing (as of October 1979) closure plan includes halting additions to the piles, stablizing the piles, reducing erosion and runoff by planting vegetation on the piles, and fencing them off. The State is confident that the piles now present no human health hazard.[52]

- A similar asbestos waste pile exists at Hyde Park, Vermont. The pile was approximately 400 feet high, approximately 2600 feet long, and approximately 1000 feet wide as of September 1973. At that time the site contained 20 million metric tons of tailings. The site had been in use for 15 years at that time. Percentages of chrysotile asbestos in samples of debris from the tailings pile ranged from 12.7 to 21.1. Ambient concentrations (away from the site) ranged from 3 to 13,600 ng/m^3; average concentration was about 1300 ng/m^3. Windblown emissions from the tailings pile averaged 500 ng/m^3. In this case emissions from mining, milling, and roadways probably contributed significantly to ambient concentrations.[52]

III. SYNOPSIS OF PROPOSED REGULATIONS

The proposed regulations for landfills were specified in Section 250.45-2 of the proposed hazardous waste regulations published in Federal Register on December 18, 1978 (43 FR 58946-59028). The landfill regulations were divided into the following sub-sections:

a) Site selection

b) Construction and operation

c) Closure, and

d) Post-closure care.

In addition, certain requirements applicable to all facilities, such as waste analysis and recordkeeping and reporting were specified in General Facility Standards, §250.43 and in §250.45, of the proposed regulations.

Those portions of the above landfill standards applicable during interim status were proposed in §250.40, "Purpose, Scope, and Applicability."

The content of the proposed full set of landfill regulations is summarized below. It is followed by a summary of the portions of those standards which were proposed as applicable during interim status. Then a synopsis is presented of those portions of the General Facility Standards proposed as applicable to landfill disposal during interim status which are now addressed in the landfill interim status standards. Finally, additions to the interim status standards are listed, with a brief explanation of the rationale for these additions.

A. Summary of Proposed Regulations

1) Site Selection

The proposed regulations specified that:

- o The landfill not be in direct contact with navigable water.
- o The bottom of the landfill liner be at least five feet above the historical high water table.
- o The landfill be at least 500 feet from a functioning public or private water supply or livestock supply.

Variances to the second and third of these requirements were allowed based on demonstration by a permit applicant to the Regional Administrator that water contact or contamination could otherwise be prevented, and that a ground-water monitoring system was in place and was being maintained.

2) Construction and Operation

Requirements included:

- o Minimization of erosion, landslides, and slumping.
- o Compatibility of the liner with all waste to be landfilled.
- o Recording the exact location of each hazardous waste and the dimensions and contents of each cell with respect to permanently surveyed bench marks.
- o Disposing of incompatible wastes in separate landfill cells.
- o Surrounding each container of liquid waste by an amount of sorbent material capable of absorbing all of the liquid contents of the container.
- o Prohibition of ignitable, volatile, and reactive waste from being placed in a landfill unless it could be demonstrated that airborne contaminants would not exceed certain levels and the structural integrity of the impoundment containment system would not be damaged through heat generation, fires, or explosions.

- o Prohibition on placing bulk liquids, semi-solids, and sludges in a landfill unless the waste is evaporated and/or stabilized or treated in the landfill to reduce its liquid content or increase its solids content so that a nonflowing consistency is achieved to eliminate the presence of free liquids.

- o Diversion structures to prevent surface run-off from entering the facility unless the owner/operator can show that run-off would not enter the facility.

- o Collecting and treating surface water which has been in contact with the active portions of the landfill, or disposing of the run-off as a hazardous waste unless it is found not to be hazardous per the Subpart A criteria, or discharging in accordance with NPDES requirements.

- o Installation of a gas collection system where gases are generated in a landfill, unless it can be demonstrated that there would be no fire or explosion potential.

- o Minimum requirements for daily cover (six inches), unless otherwise justified by the owner/operator.

- o Required containment system design, including:

  - specification regarding natural in-place soils

  - two alternative designs, specifying:

    - number and placement of liners

    - soil liner thicknesses and permeabilities

    - use of a leachate collection and removal system

    - minimum thicknesses, permeability, and lifetime of artificial liners

    - limitations on soil types acceptable for use in the impoundment

  - installation of a leachate collection system.

Variances to several of these requirements were allowed if the permit applicant could demonstrate equivalent performance of alternate designs to the Regional Administrator.

- o Requirement for ground-water and leachate monitoring systems.

- o Specifications for the design of a leachate collection and removal system.

- o Requirements for removal of leachate from a leachate collection system.

- o Specification of maximum permeability for soil underlying a landfill liner system.

3) Closure

The proposed regulations required:

- o Placing a final cover over the landfill consisting of:

  - at least 15 centimeters (6 inches) of clay soil with a permeability of less than or equal to 1 x 10-7 cm/sec, underlying:

  - 45 centimeters (18 inches) of soil capable of supporting indigenous vegetation, of which

  - the top 6-inches must be topsoil.

A variance was provided allowing different soil thicknesses and permeabilities if it could be demonstrated that equivalent performance would be achieved.

- o Where trees or other deep rooted vegetation is to be planted on the completed landfill, the final cover must consist of at least 3-feet of soil overlying the 6-inch clay soil cap, unless it could be demonstrated that such vegetation would not penetrate the 6-inch clay cap.

- o The final grade of the cover must not exceed 33 percent. Where final grades exceed 10 percent, horizontal terraces were required sufficient to withstand a 24-hour, 25-year storm. (Spacing of the terraces was also specified.)

- o Alternative grades and terracing were permitted if it could be demonstrated that pooling and erosion would be prevented.

4) Post-closure Care

The regulations required the following during the post-closure period of 20 years:

- o Maintenance of the soil integrity, slope, and vegetative cover of the final cover and all diversion and drainage structures.
- o Maintenance of the ground-water and leachate monitoring systems.
- o Maintenance of surveyed bench marks.
- o Maintenance of any gas collection and control systems.
- o Restricting access to the landfill.

A variance to these requirements permitted the owner/operator to demonstrate that certain of these requirements could be discontinued before the end of the post-closure period.

- o The post-closure requirements also prohibited construction of buildings for habitation over any landfill where radioactive waste had been disposed.

B. Summary of Proposed Interim Status Standards

The proposed interim status standards for landfills included the following parts of the above standards:

1) Operating Requirements

- o Recording the exact location of each hazardous waste and the dimensions and contents of each cell with respect to permanently surveyed bench marks.
- o Disposing of incompatible wastes in separate landfill cells.
- o Surrounding each container of liquid waste by an amount of sorbent material capable of absorbing all of the liquid contents of the container.

2) Closure (All of the closure requirements listed above.)

3) Post-Closure Care (All of the post-closure care requirements listed above.)

4) Applicable General Facility Standards

In addition to the above requirements the proposed interim status standards included certain waste analysis, recordkeeping, and reporting requirements which were applicable to all facilities. These requirements were listed under the heading of Manifest System, Recordkeeping, and Reporting requirements in the proposed regulations and interim status standards, but have now in part been incorporated into the interim status standards for landfills. Additional manifest, recordkeeping, and reporting requirements applicable to all facilities described separately in Subpart E of the final Interim Status Standards.

The proposed waste analysis, recordkeeping and reporting requirements included:

- Waste analysis to determine the hazardous constituents and properties of the waste prior to initial disposal; verification of certain properties of each shipment of waste received; and periodic comprehensive analysis of waste if there were indications of changes in composition;
- Recordkeeping and reporting to include an operating log, a record of the quantity and description of each waste received, locations where each waste was treated or disposed and the methods and dates of treatment or disposal, the results of the waste analysis performed, monitoring data, reports of visual inspections, and records of incidents requiring initiation of a contingency plan.

C. Additional Standards to be Included for Interim Status

Finally, there were certain requirements proposed in the full regulations for landfills, but not in the proposed interim status standards, which the Agency feels should be added to the interim status requirements.

The rationale the Agency has used in selecting those standards to be applicable during interim status is described in the preamble to the Parts 264 and 265 regulations and the background document entitled "General Issues Concerning Interim Status Standards." Since the interim status standards apply prior to the time a permit application is acted upon, the applicable standards have generally been limited to those which would not involve interpretation or prior approval by the permitting official, involve large capital expenditures, or require more than six months for compliance. As they have been reformulated, the requirements for ignitable, reactive, and incompatible wastes now come within these criteria.

However, these criteria were only guidelines in developing the interim status standards, and exceptions have been made for requirements of unusual importance where the benefits to be gained from early implementation were judged to substantially outweigh the disadvantages. The Agency believes that the regulations listed below meet this standard for reasons which are outlined in the detailed discussions of the individual regulations:

- Restrictions on placing bulk or containerized liquids or wastes containing free liquids in landfills
- Collection and management of surface water run-off from active portions of the landfill

Also, the following requirements, which were not part of the proposed full set of standards or the proposed interim status standards for landfills, have been added to the current interim status standards:

- Control of wind disperal of hazardous waste,
- Special requirements for empty containers.

The rationale for these additional standards is explained in the applicable sections of Part IV of this background document. Except for allowing an additional 12 months to meet the requirements for control of run-on, run-off, and disposal of liquid wastes or wastes containing free liquids, the Agency believes that these requirements meet the general criteria for interim status standards.

IV. DISCUSSION OF THE COMMENTS

ISSUE: DEFINITION OF LANDFILL

A. Proposed Definition

"Hazardous Waste Landfill" means an area in which hazardous waste is disposed of in accordance with the requirements of §250.45-2.

B. Comments Received

Several commenters noted that "hazardous waste landfill" and "sanitary landfill" are defined. However, within the regulations "landfill", which is not defined, is the most commonly used designation. They point out that this could lead to confusion since the requirements for the two types of landfills are substantially different.

C. Analysis of and Response to Comments

EPA agrees that "landfill" is the most common term used throughout the regulations. Since these regulations are entirely concerned with the proper management of hazardous waste, EPA has

decided to define only the term "landfill" in terms of disposal of hazardous waste, for the purpose of these regulations. This clarifies that "landfill" always refers to a hazardous waste landfill and enables use of the abbreviated terminology in the text of the regulation. Any time the term "sanitary landfill" is meant, it is not abbreviated to "landfill."

In addition, the definition of the term landfill" has been modified. Rather than referring to the landfill standards to define the term, the revised definition defines it as a hazardous waste disposal facility which is not a land treatment facility, a surface impoundment, or injection well.

D. Revised Definition

"Landfill" means a disposal facility or part of a facility where hazardous waste is placed in or on land which is not a land treatment facility, a surface impoundment, or injection well.

ISSUE: DEFINITION OF CELL

A. Proposed Definition

As proposed, "cell" means a portion of waste in a landfill which is isolated horizontally and vertically from other portions of waste in the landfill by means of a soil barrier which meets criteria specified in Section 250.45-2(b)(14).

B. Comments on Proposed Definition

1) Some commenters felt the regulations should define landfill cells and subcells. Two similar definitions for each of these were proposed:

- "Landfill cell" means the discrete volume of land excavated and lined and intended for long-term storage and isolation of hazardous solid waste.

- "Landfill cell" means the discrete volume of land prepared and intended for long-term storage and isolation of hazardous solid waste.
- "Landfill subcell" means a discrete volume within the landfill cell dike to provide segregation of incompatible hazardous waste.
- "Landfill subcell" means discrete volume within the landfill cell to provide segregation of incompatible hazardous waste.

2) Rather than address the whole landfill facility, it was suggested that the regulations for closure, post-closure care, and financing be specifically tailored to fit the individual characteristics of each part of the site (cell) in terms of engineering and financial arrangements. Thus, all references in the regulations under Part 250 to landfills should be changed to landfill cells unless the word landfill refers to facility. This would "better reflect actual technology in use today at disposal facilities," and would "conform to the permit concept of individual landfill cell permit requirements and closure procedures."

3) There are other suitable materials in addition to soil that can be used for a barrier in the definition of "cell."

4) "Landfill" (integral to this definition) was not defined.

C. Analysis of and Response to Comments

The term "cell" was defined in the proposed regulation for use with the section dealing with the disposal of incompatible wastes in separate cells. Commenters apparently suggested adding subcells because of the emphasis they placed on cells as discrete

entities which could be separately closed and covered by separate financial arrangements. The final regulation incorporates such a concept of cells as discrete entities and as a volume providing isolation of incompatible wastes. Under this approach, the concept of a subcell is unnecessary, because a subcell would meet the definition of cell.

As suggested by the comments, the reference to "a portion of waste in a landfill" was replaced by "the discrete volume of a landfill..." This makes the cell a part of the disposal facility rather than a volume of waste and helps in addressing individual cells in the regulatory and permit framework. It may be appropriate to apply different engineering and financial arrangements for the closure and post-closure care (also the design and operation) of the separate cells in those instances where a landfill cell is essentially a "mini-landfill." This, however, is restricted to those instances where such individual treatment does not interfere with the ability of the landfill owner or operator or EPA or State permit-writer/inspector to design, operate, maintain, or monitor the whole facility, and where the individual cells or group of cells are large enough that it makes sense to address them separately (e.g., to close out portions of the facility). In the regulations, we have not addressed this issue explicitly (i.e., how to close, etc. an individual cell), but the concept of a "closed portion" and the flexibility of the closure and financial responsibility arrangements allows this approach. For example, separate permits may be issued for separate portions of a facility where the site is so large that two totally different hydrogeological regions are encountered, two totally different types of hazardous

wastes are being disposed of, one portion is operating for a period of time then closed out and another part opened, etc.

We agree there are other suitable materials in addition to soil that can be used as a barrier in a cell. Therefore, the term "soil barrier" has been deleted and only "isolation" with use of a liner is required.

D. Revised Definition

"Landfill cell" means the discrete volume of a landfill which uses a liner to provide isolation of waste from adjacent cells or waste.

ISSUE: DEFINITION OF LINER

A. Proposed Definition

"Liner" means a layer of emplaced materials beneath a surface impoundment or landfill which serves to restrict the escape of waste or its constituents from the impoundment or landfill.

B. Comment on the Proposed Definition

1) It is not clear whether requirements using this term would result in the appropriate barrier on the sides as well as the bottom and in some cases the top of the impoundments and landfills. A liner may encapsulate an entire disposal cell.

2) The definition of liner should be broadened by specifying that it includes not only emplaced materials, but naturally occurring materials which may be found beneath a surface impoundment or landfill.

3) Liner should be defined to include emplaced materials inside storage tanks and containers.

C. Analysis and Response to Comments

EPA concurs with the comments received on the proposed definition of liner. After review of the comments and the proposed definition, the sole use of the term "beneath" may not convey placement of a liner on the bottom and sides of the facility, which was originally intended. Obviously this is necessary in order to adequately restrict not only downward but also lateral escape of waste, waste constituents, or leachate from the landfill or surface impoundment.

The omission of natural or naturally occuring in-place materials from the definition was an over sight by EPA. This is evident by the fact that requirements throughout the proposed land disposal regulations specify that liners be constructed of natural soil material or man-made (artifical) materials. The revised definition is further broadened by defining liner as "a continuous layer of natural or man-made materials...", thus eliminating any confusion about liner material having to be in-place to be "natural." In other words a liner can be a layer of any material which functions to restrict the escape of wastes, waste constituents, or leachate. The Agency decided to refer to liners inside storage tanks and containers by the term "inner liner." A discussion of this term may be found in the background document for §260, General Definitions.

D. Revised Definition

"Liner" means a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment, landfill, or landfill cell, which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate.

ISSUE: DEFINITION OF LEACHATE

A. Proposed Definition

"Leachate" means the liquid that has percolated through or drained from hazardous waste or other man emplaced materials and contains soluble, partially soluble, or miscible components removed from such waste.

B. Comments on Proposed Definition

1) The word "miscible" should be changed to "immiscible".

2) The word "contains" should be changed to "which may contain", because liquids which percolate through waste may not always pick up components of the waste.

C. Analysis of and Response to Comments

The Agency agrees that the word "immiscible", rather than "miscible", is the correct word to use when referring to the insoluble components contained in a liquid. However, the wording of the revised definition does not use either term because leachate may contain both immiscible (insoluble) and miscible (soluble) components. Therefore, to simplify the definition, it has been revised to "..., including any suspended components in the liquid..."

To clear up any confusion concerning the use of the word "contains" in the proposed definition, it is not used in the revised wording of the definition. The Agency believes that leachate results when any liquid drains from or percolates through hazardous waste and that the leachate includes any suspended components in the liquid.

D. Revised Definition

"Leachate" means any liquid, including any suspended components in the liquid, that has percolated through or drained from hazardous waste.

ISSUE: DEFINITIONS OF COVER MATERIAL AND FINAL COVER

A. Proposed Definitions

1) "Cover material" means soil or other material that is used to cover hazardous waste.

2) "Final Cover" means cover material that is applied upon closure of a landfill and is permanently exposed on the surface.

B. Comments on Proposed Definition

No comments were received on these definitions.

C. Final Definition

The Agency believes that it is essentially obvious what the meaning of these terms are, they take no special or unusual meaning in the regulation that is not conveyed by the words themselves without any definition. Therefore, they are not defined in the final regulation.

ISSUE: SURFACE WATER RUN-ON CONTROL

A. Definition

The proposed regulations did not define or use the term "run-on." Rather, the term "run-off" was used to refer both to water running onto a facility from outside the facility, and to water running off the facility. Since these two types of run-off are treated differently in these regulations, the Agency decided that it would be clearer if it adopted different terms for them.

Thus, "run-on" is defined to mean "any rainwater, leachate, or other liquid that drains over land onto any part of facility." Further discussion of the term "run-on" is included in the discussion of the term "run-off."

B. Proposed Regulation

The regulations proposed for general status, although not for interim status, required that run-on (as the term is currently defined) be diverted away from the active portion of a landfill by diversion structures capable of handling a 24-hour, 25-year storm unless the owner or operator could demonstrate to the permit writer that the local topography would prevent run-on from entering the facility (§§250.43(b) and 250.45-2(b)(7)). The purpose of this standard was to minimize the amount of liquids entering the landfill facility. Run-on controls prevent (1) erosion, which may damage the physical structure of the landfill, (2) the surface discharge of wastes in solution or suspension, and (3) the downward percolation of run-on through wastes, creating leachate. Control is accomplished by constructing diversion structures to prevent surface water run-on from entering the active portion of the landfill facility.

Precipitation can create large amounts of surface water runoff which can enter or even flood a landfill. Landfills which are below surrounding grade are particularly vulnerable since they can serve as sinks for the collection of rainfall or snowmelt run-on. This water may damage the physical structure of a landfill through erosion or carry away wastes in solution or suspension. Sufficient water may collect to allow overflow (run-off) of hazardous wastes or hazardous waste constituents to surface

water. Futhermore, any water which is allowed on the surface of a landfill may percolate downward through wastes creating leachate and contributing to the static head within the site. To avoid these potential environmental threats, every effort should be made to minimize run-on into landfills. This may be achieved by the construction of dikes or drainage ditches capable of diverting run-on from landfill. The diversion capacity of control structures should be based on a prediction of maximum storm frequency for the active life of the facility.

C. Discussion of Comments

See page 49 for a list of summarized comments received on the standard.

Comment was received that the proposed regulation implied that all run-on would have to be diverted from the landfill, and that the regulations should specify the capacity of the diversion structure in terms of the useful life of the landfill.

The Agency believes that the main area of concern for protection of human health and the environment is the active portion of the landfill, not the landfill facility as a whole (as may have been suggested by the language of the proposed regulation). It is at active portions that run-on is most likely (1) to seep into the exposed waste, contributing to the formation of leachate, or (2) to erode wastes, or constituents of them, carrying them away in run-off. The Agency requires in these regulations that all surface water run-on be diverted from active portions. Diversion of run-on may be accomplished by locating the active portion in areas where the topography naturally prevents run-on

to the active portions of the landfill, or by sloping or contouring the land, building ditches and culverts, or building dikes. The capacity of diversion structures should be determined by the owner or operator considering site topography, size of drainage area, and size of the active portions.

Comments were received suggesting that the proposed standards be modified to allow the owner or operator the flexibility to either divert surface water run-on or collect and treat all of the surface run-off, as long as Clean Water Act effluent limitations were complied with. The Agency disagrees. EPA believes that such a standard allows the unnecessary infiltration of water into the landfill.

The Agency has determined that diversion of run-on is appropriate for inclusion in the interim status standards. Run-on control is for active portions only. The Agency expects that run-on diversion structures, where needed because of topography, will most likely be earthen dikes or berms, or ditches, which can be erected with earth moving equipment commonly found at landfills. These structures can be temporary, and can move with the active portions as material is added to the landfill. Such structures can be designed and maintained adequately during interim status without case-by-case review by permitting officials.

A 12 month delay is allowed for compliance with this requirement so that operators will have the adequate time to make any necessary topographic and hydrologic determinations and complete construction.

D. Final Regulatory Language

See the following section on surface water run-off control.

ISSUE: SURFACE WATER RUN-OFF CONTROL

A. Definition

The proposed regulations defined run-off to mean "that portion of precipitation that drains over land as surface flow." No comments were received on the definition itself. However, the proposed general regulations and these regulations specify different requirements for run-off from the active portion of the facility, and for what is now called "run-on" -- liquid flowing over land toward the facility. Thus the Agency has chosen a different term for the latter.

In addition, the Agency's concern with run-on and run-off extended to more than precipitation, and included leachate and other liquids that may flow over the surface, either from or onto a facility.

Since run-off usually has been in contact with waste or leachate seeps from active portions, and since run-off sometimes is collected via a leachate collection system, it is usually contaminated. Thus, it is usually impossible to differentiate between rainwater run-off and leachate run-off at the active portion of a landfill. Because of this, the proposed definition of "run-off" has been revised to "any rainwater, leachate, or other liquid that drains over land...". This change clarifies that more than just precipitation must be collected.

B. Proposed Regulation

The regulations proposed for general status, although not for interim status, required that run-off that has been in contact with active portions of the facility must be collected and treated

or disposed of as a hazardous waste unless it was analyzed and found not to be a hazardous waste, or unless it was collected and discharged under an NPDES permit (§250.45-2(a)(8)). In addition, the structures to accomplish this were required to be able to handle the run-off expected from a 24-hour 25-year storm (§250.43(c)). The objective of these requirements was to reduce the potential for off-site migration of contaminated run-off to land or to waters of the United States. There have been a number of damage incidents caused by mismanaged or uncontrolled contaminated run-off from landfills. Several of these incidents are briefly described above. These damage cases indicate that run-off from active portions of hazardous waste landfills can cause serious adverse impacts to land and surface waters. In contaminating streams, run-off from landfills frequently results in fishkills and destruction of other aquatic life. During the period 1963-1974, forty-seven separate fishkills caused by run-off from waste disposal were recorded by EPA. Based on this evidence, EPA believes that it is imperative that run-off from active portions of hazardous waste landfills be controlled.

C. Comments on the Proposed Regulation

Commenters made the following points:

- Should add a statement to provide stilling basins for suspended solids.
- Change the rainfall even to a 24-hour, 10-year storm so that it will be consistent with NPDES.
- The regulation is too vague as to alternatives to confinement of surface water run-off. Suggest allowing run-off to be:

(1) deep welled in accordance with a UIC permit.

(2) placed in a permitted surface impoundment, and

(3) landfarmed at a permitted site.

° The proposed landfill standards should have allowed lawful discharges to POTW's.

° The proposed regulations improperly eliminated deepwell disposal or ocean dumping.

° Landfills which accept only containerized wastes should be exempt from any surface run-off requirements.

° Standards should be modified to permit the owner or operator the election of either to divert surface run-off or collect and treat surface run-off as long as the effluent limitations are compiled with.

° Language in standards and background document lead to the belief that all surface run-off would have to be collected.

D. Response to Comments

A number of comments were received concerning the requirements for diversion and collection capacity for run-off from active portions of a facility. The Agency believes that the 24-hour, 25-year storm is a general minimum for adequate protection of human health and the environment. Some minimum is needed to ensure a reasonable level of protection; the 25-year storm is not an unreasonably burdensome capacity to achieve, and anything less than 25 years would likely occur during facility operation or before the facility is closed according to all applicable closure regulations. However, because the quantity of run-off which can be produced at any one site is dependent on the site specific situation, including amount of precipitation, site topography, location of the active portions, etc., no general requirements specifying a collection or diversion capacity can be established

as a national standard for the final interim status standards.

Comments suggested a requirement that stilling basins should be provided for suspended solids. It is EPA's position that the owner or operator should have flexibility in determining which type of treatment and/or discharge scheme is to be used for the collected run-off. It is incumbent upon the owner and operator to provide the necessary compliance of the chosen scheme with any applicable regulations promulgated by the Agency. EPA's concern is for the protection of human health and the environment. Therefore the owner or operator should be free to choose how the collected surface water run-off will be dealt with such that any applicable EPA requirements will not be violated. EPA also acknowledges the concern of the comment that the proposed regulation did not allow for the alternatives of deep well injection, placement in a surface impoundment, or land treatment of collected run-off. As stated previously, the owner or operator should have the flexibility of determining the fate of the collected water run-off within a framework of the requirements of any applicable Federal environmental regulations. The final Interim Status Standards allow this flexibility.

Comment was received that the proposed landfill standards should have allowed lawful discharges to a publicly-owned treatment works. It is important to note that the Clean Water Act and its associatd regulations have the authority for regulating such discharges. The proposed regulations did not limit the authority of the Clean Water Act. Rather, the proposed regulations were intended to provide documentation of the possibility of a interface with any Clean Water Act provisions.

Another comment stated that the proposed landfill regulations improperly eliminated deep well disposal or ocean dumping. The authority for these options more properly falls under authorities of the Safe Drinking Water Act and Marine Protection, Research, and Sanctuaries Act, respectively. Therefore, the proposed landfill regulations did not address these methods.

One commenter said that landfills which accept only containerized hazardous waste should be exempt from any surface waste run-off requirements. The Agency does not agree with this comment. Hazardous liquid and solid wastes which are containerized and disposed of in a landfill have a substantial potential for leakage. Leakage can result through mishandling and mismanagement of drums or containers during storage and transportation; or by inadvertant use of a container which is incompatable or inappropriate for use with the waste it will contain; or by use of a new or recycled container which is defective; or through final placement within the landfill. Such leakage will contaminate run-off from the active face of the landfill, leading to as great a potential for damage to human health and the environment via off-site migration as run-off from active portions of landfills which accept non-containerized wastes. Based on the evidence presented above, EPA believes that it is imperative that run-off from active portions of hazardous waste landfills be controlled during the interim status period. Even though such a requirement may not, in entire, meet the general interim status criteria, the documented magnitude and serious nature of the problems which have resulted from uncontrolled surface water run-off and the relatively

simple and inexpensive methods that are able to be implemented without interaction with a permit officical, justify that this regulation be included in the landfill requirements during interim status.

Run-off control is accomplished by (1) minimizing run-off and (2) collecting and managing run-off from active portions. Run-off is minimized by (1) preventing run-onn, (2) minimizing the size of the active portion, and (3) preventing disposal of liquid wastes in the landfill.

There are two basic types of landfill operations: trench method and area fill method. Using an area fill method it is good practice at the beginning of each operating day to construct a depression, pit, or shallow trench at the base of the active face of the landfill large enough to collect the amount of surface water run-off or leachate expected to be produced at the active face. In this manner any contaminated surface water is collected, and during the day or at the end of the day the soil from the construction of the depression, pit, or shallow trench, or other absorptive material, can be used to absorb the collected liquid. The resulting mixture can then be added to the active portion.

If the method of operation is a trench, then the run-off from the active face is contained within the trench. Managing the contaminatad liquids which have collected in the trench during an operating day can be done in a variety of ways. For example, if a leachate collection and removal system is not present, in-place mixing with absorptive material can be done, or the liquid can be removed and treated by absorption or solidification and placed

back in the fill. The liquid can also be removed from the trench and stored, treated, and then disposed of or discharged. If a leachate collection, removal and management system is present and operating properly, all contaminated liquid (run-off, leachate) will usually be collected, removed and managed as leachate from the trench. However, when landfills using either the trench or area methods become large and substantially above grade, both run-off and leachate seeps, which often occur on the outer slopes of the fill need to be collected. Run-off which does emerge from active portions may be collected by ditches, berms, and culverts which direct it (sometimes by sump pump) to surface impoundments, basins, tanks, or treatment facilities. These collection devices may consist of temporary structures around active portions.

Once collected, a number of options exist for treating and disposing of run-off. These are the same options which exist for managing liquid wastes and leachate and include deep well injection, land treatment, treatment in surface impoundments (evaporation, aeration, chemical treatment, etc.) dewatering or mixing with an absorbent material and disposal in the landfill, percolation through a filtering or attenuation medium (e.g., charcoal, clay, soil, sand), or discharge to a sewer or other treatment facility.

The proposed landfill standards required that if surface water came into contact with the active portions of a facility, it was to be collected and managed as a hazardous waste unless it was analyzed and found not to be hazardous.

The Agency received essentially no objections to the proposed requirement that run-off from active portions of landfills be collected and treated in some fashion. Most of the comments on the proposed standards concerned the capacity of the collection or treatment systems or the final disposition of the run-off that the proposed regulations required. These comments have been discussed previously in this background document. The current regulation does not limit the method of treatment of run-off.

The regulation requires run-off from active portions to be collected. The collected run-off is a solid waste from an industrial activity (the operation of the landfill) and the owner or operator must determine whether it is a hazardous waste in accordance with Section 262.11 of this Chapter. If the collected run-off is a hazardous waste it must be managed as a hazardous waste. Even if it is not a hazardous waste, good management practices may still require some degree of treatment or use of other techniques as previously discussed, although such practices are not required by these regulations. A 12 month delay for compliance with these regulations is given so that existing facilities may construct new run-off systems or upgrade existing systems, including those for run-off treatment and disposal. If collectead run-off is discharged to waters of the United States, owners or operators of facilitis must have or apply for an NPDES permit under the Clean Water Act.

I. Final Regulatory Language

§265.302

(a) Run-on must be diverted away from the active portions of a landfill.

(b) Run-off from active portions of a landfill must be collected. [Comment: If the collected run-off is a hazardous waste under Part 261 of this chapter, it must be managed as a hazardous waste in accordance with all applicable requirements of Parts 262, 263 and 265 of this chapter.

If the collected run-off is discharged through a point source to waters of the United States, it is subject to requirements of Section 402 of the Clean Water Act, as amended.]

(c) The date for compliance with paragraph (a) and (b) of this Section is 12 months after the effective date of this Part.

ISSUE: WIND DISPERSAL

A requirement of the owner or operator of a hazardous waste landfill to manage the landfill so that wind dispersal of the hazardous waste is controlled was not proposed for inclusion in either the interim or general standards. However, at public meetings following the publication of the proposed regulations, the fact was brought to light that piles are sometimes used for storing and disposing of wastes, some of which may be hazardous. Subpart L (Waste Piles) grew out of these comments, and also includes a requirement for controlling wind dispersal.

Dispersal of landfilled hazardous wastes by wind is not often a problem. The Agency's major concern in requiring the control of wind dispersal is large waste piles which constitute disposal and thus come under the landfill regulations. The Agency is aware of at least two cases in which wind dispersal from piles of asbestos wastes created a health hazard. The example of the Pennsylvania asbestos waste piles graphically demonstrates the need for control of blowing wastes from piles. An air monitoring

program, conducted by EPA in October 1973, indicated ambient background levels of asbestos, a known carcinogen, to be 6 ng/m^3 was found at a playground near the largest waste pile. It therefore seems prudent to require that, where landfilled hazardous waste is subject to wind dispersal, the landfill be managed so that wind dispersal is controlled. Appropriate methods may vary from waste to waste, and the Agency believes that the owner or operator of the facility is best able to develop an adequate, cost-effective technique to meet this requirement. The Agency believes that this requirement should typically not require major capital expenditures, does not require any case-by-case determination by the Regional Administrator, and can be accomplished within six months. It is therefore appropriate for inclusion in the interim status standards. Since it was not proposed, it is being promulgated interim final, and the Agency solicits comments on it.

Interim Final Regulatory Language

§265.302

(d) The owner or operator of a landfill containing hazardous waste which is subject to dispersal by wind must cover or otherwise manage the landfill so that wind dispersal of hazardous waste is controlled.

ISSUE: WASTE ANALYSIS

The proposed regulations included in §250.43(f-h), waste analysis requirements, apply to all treatment, storage and disposal facilities, including landfills. The waste analysis requirements included: determination of the hazardous constituents and properties of each waste shipment received, and periodic comprehensive analysis of waste if there were indications of changes in composition.

The reasoning behind the proposed waste analysis requirement is discussed in the background document on waste analysis. In brief, the purpose was to ensure that a facility owner and operator had sufficient current information to manage the waste without endangering human health and the environment.

Comments on the proposed waste analysis requirements are discussed in the background document on waste analysis. As a result of those comments the Agency restructured the waste analysis requirements. The final interim status regulations for waste analysis require each owner or operator to develop a waste analysis plan which proposes the analysis which is necessary to comply with the regulations (see §265.13). This provides flexibility for the owner and operator. The Agency has also included in the regulations for some types of facilities additional waste analysis requirements beyond those in the general section. However, for landfills the Agency does not believe that any additional requirements are necessary. As a comment in the landfill regulation mentions, the general waste analysis regulation requires owners and operators to:

- Determine whether the waste has the characteristics of ignitability or reactivity in order to comply with the restrictions on these wastes in §265.312 and §265.17(b)
- Conduct sufficient analysis of the waste to comply with the waste compatibility requirements of §265.313 and §265.17(b)

The comment also refers to §265.73, which requires the owner or operator to record the results from any waste analysis in the operating record.

ISSUE: SURVEYING AND RECORDKEEPING

A. Proposed Regulation and Rationale

The proposed standards required the owner or operator of a hazardous waste landfill to record the exact location of each hazardous waste and the dimensions of each landfill cell, along with its contents, with respect to permanently surveyed bench marks.

The objective of this regulation was to ensure the availability of information that would be useful especially in emergencies and other contingencies and also in landfill operation, closure, and damage assessment. Securing this information appeared to be a relatively easy task. With the dimensions and bench marks determined for a particular landfill, a simple grid system could be utilized to record exact locations and contents of cells.

Permanent records containing the exact location and the contents of each landfill and each landfill cell will provide a means for tracking down sources of contamination in case of any damage incident resulting from the landfill operation. Knowing the exact location, and contents of each landfill cell will help the owner or operator determine the hazardous waste responsible for any detected ground water, surface water, or air contamination. The potential for further damage and methods of correction may also be more readily identified.

Information on the exact location and contents of each landfill cell are also useful in post-closure care activities. For example differential settlement of surface caps or changes in leachate quality could be traced to particular wastes. In addition,

as new technologies develop to neutralize or degrade wastes, they may be applied in-situ to certain landfilled wastes. Such treatment may enable the reduction in or termination of long-term maintenance when the disposed wastes are shown to be no longer hazardous.

Permanent records for location and contents of landfill cells would also ensure that incompatible wastes have minimal chance of coming in contact with each other. They would also reduce the chance of filled and covered cells being structurally disturbed from subsequent inadvertent landfilling in the immediate area of those cells.

Recording the exact location and contents for a landfill could aid in resource recovery efforts for a particular hazardous waste should it become economically feasible to excavate and reuse that waste.

B. Comments on the Proposed Regulation

° This standard requires recording the exact location of each hazardous waste and the dimensions of each cell with respect to permanently surveyed bench marks. It appears that it would be nearly impossible and also unnecessary to record the exact location of each hazardous waste. It is sufficient to know the contents of each cell and the exact location of each cell.

° Landfills that receive only one type of waste whose composition does not vary significantly should be exempted from the requirement to record where different batches are placed.

° Include in the regulation that these requirements do not apply retroactively to existing landfills.

as new technologies develop to neutralize or degrade wastes, they may be applied in-situ to certain landfilled wastes. Such treatment may enable the reduction in or termination of long-term maintenance when the disposed wastes are shown to be no longer hazardous.

Permanent records for location and contents of landfill cells would also ensure that incompatible wastes have minimal chance of coming in contact with each other. They would also reduce the chance of filled and covered cells being structurally disturbed from subsequent inadvertent landfilling in the immediate area of those cells.

Recording the exact location and contents for a landfill could aid in resource recovery efforts for a particular hazardous waste should it become economically feasible to excavate and reuse that waste.

B. Comments on the Proposed Regulation

- This standard requires recording the exact location of each hazardous waste and the dimensions of each cell with respect to permanently surveyed bench marks. It appears that it would be nearly impossible and also unnecessary to record the exact location of each hazardous waste. It is sufficient to know the contents of each cell and the exact location of each cell.
- Landfills that receive only one type of waste whose composition does not vary significantly should be exempted from the requirement to record where different batches are placed.
- Include in the regulation that these requirements do not apply retroactively to existing landfills.

- There are other methods of operating landfills than by placing wastes in cells. For example, wastes may be blended with soils so that there are not isolated "cell" sections of landfills. These regulations should permit such operations.
- In order to facilitate waste material inventories for each landfill, a cross-referencing of the landfilled materials with appropriate manifest numbers should be required.

C. Response to the Comments

After carefully considering comments to this standard, the Agency believes that identifying the specific location of each cell can be accomplished adequately by use of a three-dimensional grid system. However, recording the exact location of each waste within a cell would be an unreasonable and unnecessary task. Identifying "exact locations" would be extremely time consuming and technically difficult. Furthermore, over time, internal subsidence and/or shifting can be expected within a landfill, causing changes in "exact location." General locations will be adquate to facilitate remedial action, in-situ treatment, and resource recovery efforts, and to ensure that incompatible wastes do not come in contact with one another, and should not be unduly burdensome. For most circumstances at multi-waste landfills, the Agency believes that 3 meters accuracy should be sufficient for use with a grid system. However, the size of the units of the grid would generally be a function of the number of waste types and amounts and number of locations of each waste type at a facility.

In addition, EPA did not intend that the owner or operator of a landfill should record and report the location of each batch of waste disposed. The recording and reporting of the location

of each waste type is all that is necessary.

It would obviously be difficult or impossible, unless adequate records exist, for existing facilities to record and report the location of waste types disposed prior to the effective date of these regulations, and this is not required. The Agency suggests, however, as a good management practice, that owners and operators record approximate waste or cell locations when such information is readily available.

EPA recognizes that there are other methods of operating a hazardous waste landfill than by placing wastes in cells as the term is commonly perceived, i.e., "isolated cell" sections of landfills. For this reason and in order to write regulations on a national scale which apply to a wide variety of operational techniques, EPA defined "cell" to mean "the discrete volume of a hazardous waste landfill which uses a liner to provide isolation of waste from adjacent cells or waste. Defined in this manner, the term "cell"

can mean a separate isolated "cell" within a large landfill or it could mean the entire landfill trench, etc. as long as it provides containment (isolation) both horizontally and vertically.

The comment suggesting cross referencing landfilled materials with their appropriate manifest numbers, is now reflected in §265.73. Thus, this suggestion has been incorporated into the regulation.

D. Final Regulatory Language

§265.309

The owner or operator of a landfill must maintain the following items in the operating record required in §265.73:

(a) On a map, the exact location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks; and

(b) The contents of each cell and the approximate location of each hazardous waste type within each cell.

ISSUE: CLOSURE OF A LANDFILL

A. Proposed Regulation and Rationale

The proposed regulation specified three types of closure requirements:

1. Final Cover

The proposed standard required the owner or operator of a hazardous waste landfill to place a final cover over the entire landfill at the time of closure. The cover had to consist of a top layer of 45 cm (18 in) of soil capable of supporting vegetation (the top 15 cm (6 in) must be topsoil and a lower layer consisting of at least 15 cm (6 in) of soil with a permeability less than or

equal to 1 x 10^{-7} cm/sec. A note was provided stating that the owner or operator could use soils of different thicknesses and permeabilities as long as he could show that they would provide equivalent control and protection of human health and the environment.

2. Final Grade

The proposed regulation required that the final grade of the final cover must not exceed 33 percent. It also required that where final grades exceed 10 percent, horizontal terraces be constructed with sufficient width and height to withstand a 24-hour, 25-year storm at every 10 feet of rise in elevation when the slope is greter than 20 percent. A note following the standard allowed the owner or operator to have a final grade of different construction or slope if he could show that water would not pool on the final cover and the erosion would be minimized.

3. Deep Rooted Vegetation

The proposed standard required that final cover must consist of a soil layer of 15 centimeters (6 inches) underlying at least 1 meter (3 feet) of soil capable of supporting indigenous vegetation if trees or other deep rooted vegetation are to be planted on the completed landfill. A note following the standard allowed less soil in the upper layer of cover if the owner or operator could show that the roots of the vegetation would not penetrate the underlying 6 inch clay-type soil.

The major objectives of the cover requirement were to prevent (to the extent practicable) infiltration of moisture into the landfill, to control escape of harmful gases and vapors from the landfill, prevent erosion of wastes or contaminated soils or the cover itself, to restore the land to a more useful condition for future productive use. Minimizing moisture infiltration is necessary to prevent build-up of a hyrdaulic head in the landfill that would contribute to leaching of contaminants to the ground water. (See discussion in this document on bulk liquids.)

Clay was specified for the initial or bottom soil layer primarily because of characteristics which make it suitable for preventing moisture infiltration and containing gases and vapors. Table 1 summarizes the results of a study which compared different soils for use as landfill cover material.(54) The results show that clay was rated highly for these two objectives.

However, clay was not rated so highly in supporting vegetation. Also, clay does not perform well in minimizing moisture or containing gases if cracks extend through the cover. The study noted that this occurs when clay dries out. Consequently, the regulations specified that the clay be overlain with a layer of soil capable of supporting indigenous vegetation. This layer would also serve to help maintain moisture so that the clay would not dry out.

A permeability of 1×10^{-7} cm/sec was selected for the clay, based in part on a Corps of Engineers study, Design and Construction of Cover Materials for Solid and Hazardous Waste.(55) In reviewing the information from this study the Agency concluded that a permeability of 1×10^{-7} cm/sec provided reasonably effective control

TABLE 1

SUITABILITY OF VARIOUS SOIL TYPES FOR USE AS LANDFILL COVER MATERIAL[1] (54)

Function	Soil Type					
	Clean Gravel	Clayey-Silty Gravel	Clean Sand	Clayey-Silty Sand	Silt	Clay
Prevents rodents from burrowing or tunneling	G	F-G	G	P	P	P
Keeps flies from emerging	P	F	P	G	G	E[2]
Minimizes moisture entering landfill	P	P-F	P	G-E	G-E	E[2]
Minimizes gas venting through cover	P	P-F	P	G-E	G-E	E[2]
Provides pleasing appearance and control of blowing paper	E	E	E	E	E	E
Supports vegetation	P	G	P-F	E	G-E	F-G
Vents decomposition gas[3]	E	P	G	P	P	P

[1]E, Excellent; G, good; F, fair; P, poor.
[2]Except when cracks extend through cover.
[3]Only if well drained.

of moisture infiltration. Furthermore, less permeable soils are much more difficult to find, and could require extensive hauling. In view of the need to make the regulations practical, the Agency felt that cover materials should be relatively widely available. Furthermore, combined with other cover requirements such as grading to prevent pooling of water on the cover, the Agency believed that a practical moisture control would be obtained. The cover depth of six inches of clay was determined to be the minimum thickness required to provide the desired functions.

Grading of final cover is important in order to promote run-off and minimize infiltration and erosion. The general topographic contours of the completed landfill surface should be controlled by carefully locating waste cells. The final cover should then be compacted and graded to inhibit the ponding of water on the landfill surface because any standing water will allow greater quantities of moisture to infiltrate the cap.

The maximum slope of 33 percent was based on a review of various literature on erosion and discussion with experts. This information suggested that control of erosion on any greater slope would be extremely difficult. The terracing requirements were based on a similar analysis, particularly regarding erosion control in agriculture.

The requirement of a minimum of 3-feet of soil if trees or other deep rooted vegetation are planted is based on recommendations in EPA's guidelines for "Sanitary Landfill Design and Operation."(54) The purpose of the additional cover is to prevent penetration of the clay cap by roots.

B. Comments on the Proposed Regulation

1. Final Cover

° This standard will result in grossly ineffective long term containment in landfills. A 15 centimeter (6 inch) final cover is totally inadequate for isolating hazardous waste from the environment. (Many commenters suggested a minimum of 2-feet of clay cover.)

° Other strategies for minimizing infiltration, other than a final cover, are not clearly emphasized in the regulation. These strategies are establishment of a dense, vegetative cover and the promotion of surface run-off.

° This standard should permit flexibility of closure techniques depending on the planned subsequent use of the site. For example, an industrial plant site may have good and valid reasons for a surface which will not support any vegetation. Furthermore, to require support for "indigenous" vegetation is not necessary since any ground cover which is suitable to the purpose of preventing erosion, should be acceptable.

° Change permeability requirement to less than or equal to 1×10^{-6} cm/sec, rather than 1×10^{-7} cm/sec. (No rationale)

° Change note to read: A final cover using different materials, thicknesses, and permeability may be used.

° The requirement for 6 inches of top soil is unnecessarily restrictive in some situations. Denuding other areas to reestablish vegetation over the disposal facility is counterproductive.

2. Final Grade

° The 10 percent slope limitation should be raised to 15 percent before requiring terracing, since 15 percent slopes are manageable without additional measures.

° A minimum slope should be required to assure run-off and offset differential settlement within the landfill. Two recommendations are: one percent, the other three percent.

° The note which follows (c)(3) provides for flexibility in design and, also, is the only requirement which prohibits cover designs which allow ponding on the surface of the landfill. This should be made part of the regulation.

- Requiring horizontal terraces on grades greater than 10 percent is overkill. A grade of 10 percent is quite gentle in itself. A terrace each 50' to 100' between slopes of 20 to 30 percent is almost as much as one slope can stand.

3. Deep Rooted Vegetation

- This standard allows ineffective long-term containment in secure landfills. Deep rooted vegetation on closed landfills will seriously impair the waste containment capabilities of a landfill.

- Tall growing vegetation species are likely to have deep roots as well. It is suggested that they also be included in this standard or a new standard written to limit their growth.

- There is no rational basis for prohibiting tree roots from penetrating the soil layer where products from the particular species are not used for human consumption.

C. Response to the Comments

A number of comments on the three parts of the closure standards requested that the regulation provide greater flexibility in designing final cover for a landfill. For example, it was pointed out that different combinations of cover materials, thicknesses, and permeabilities could achieve equivalent results. In addition, valid objections were raised to some of the specified requirements. For example, a multitude of comments were received concerning the ineffectiveness of the proposed 6-inch clay cover thickness. A variety of other thicknesses were recommended. Similar objections were received to some of the requirements for final grade, particularly regarding terracing.

The Agency feels that these commenters have made valid points. However, the proposed regulation contained notes which would have provided the flexibility to use alternative designs, achieving

equivalent control. These alternatives appeared to have been largely overlooked. However, they did not totally address some of the comments which objected to the basic level of control specified, such as six inches of clay cover.

After carefully considering the comments received and reanalyzing the issue as a whole, the Agency has decided to change the approach to the regulations for partial and final landfill closure. The revised approach will provide significantly greater flexibility to owners and operators in designing a final cover. The specific limits proposed would probably not be appropriate for all situations. The conditions at each site should weigh more heavily than perhaps the proposed regulation would have allowed in determining an appropriate cover requirement. The final regulations provide this flexibility, by requiring that certain objectives be addressed in developing a closure plan and designing a final cover. The specified objectives are: (1) control of pollutant migration from the facility via ground water, surface water, and air, (2) control of surface water infiltration, including prevention of ponding, and (3) prevention of erosion. The overriding objective for any closure plan is the adequate control of pollutant migration from the facility. Within this purpose, control of surface water infiltration and prevention of erosion are those objectives which if addressed, specific to the case intended, and implemented and managed properly will result in a successful application of the closure plan, within an acceptable degree of confidence.

In an effort to inform the owner and operator what detailed

information the Agency believes is necessary to adequately define the degree of control necessary for proper closure at any landfill site, the regulation lists a minimum set of technical factors which must be considered in addressing the above control objectives. There are six listed factors; two are concerned with the waste disposed of at the site, three are concerned with the site location, and one factor is concerned with characteristics of the final cover design.

The type and amount of hazardous waste and hazardous waste constituents in the landfill must be addressed along with their mobility and expected rate of migration. This gives the owner and operator, as well as the permitting official, an opportunity to evaluate a degree of hazard associated with the disposed waste. A factor concerned with site location, topography and surrounding land use, with respect to the potential effects of pollutant migration must also be addressed. The concern here is the proximity to usable ground water, surface water, and drinking water sources. Addressing and evaluating this factor, along with the others, will enable an evaluation of the present and future degree of risk, especially to human health, associated with the site. Climate, especially the amount, frequency, and pH of precipitation, is the second factor concerning site location which must be addressed. The amount and frequency of precipitation which may occur at a particular site will effect the degree of control of surface water infiltration and run-off, which may be necessary, and may effect the characteristics of the final cover. The third factor, concerning the actual site location, which needs to be addressed,

is the geological and soil profiles and surface and subsurface hydrology of the site. The more one knows of the hydrogeology of a site the more one can accurately make determinations and sound predictions of the long-term risks or lack of risk a hazardous waste disposal site will present to human health and the environment. The final factor which is required to be addressed in the development of a closure plan is the cover design characteristics, which include cover materials, final surface contours, porosity and permeability, thickness, slope and length of run of slope, and type of vegetation. The function and design of a final cover is very important and should be a result of an evaluation and assessment of all the above factors. It is the cover function and design which will be the control feature for surface water infiltration and, for the most part, prevention of erosion. Therefore, the final cover plays an integral part in the long-term control of pollutant migration from the landfill facility. The cover design should take into account the number of layers of materials to be used and the indigenous vegetation. It should avoid or make allowances for deep rooted vegetation, and prevent water from pooling on the surface. Along with the above mentioned factors, the design will depend on the availability and characteristics of on-site or nearby soils. Depending upon the site-specific factors, the final cover design could simply be the placement, compaction, grading, sloping and vegetation of on-site soils, or could be a more complex design such as a combination of compacted clay or membrane liner placed over a graded and sloped base and covered by topsoil and vegetation.

The final regulation requires (in Subpart G) the approval, disapproval, or modification of the closure plan by the Regional Administrator, after opportunity for public comment. This process is necessary to assure that closure plans will achieve the objectives specified with an adequate degree of confidence. The Agency intends to provide guidance in the form of manuals, not only to permit writers but also to owners and operators, to assist them in developing and evaluating these closure plans. A similar approach is being taken for closure of surface impoundments and land treatment facilities.

Because it has been modified substantially, the regulation on landfill closure is being promulgated interim final and the Agency will consider additional comments on it. As previously mentioned, many comments on the proposed regulation severely criticized it for being too inflexible. The Agency believes that the present regulation responds to these comments by creating an extremely flexible system under which all pertinent characteristics of an individual facility can be considered in determining how it should be closed. Since the system leaves so much latitude for the creation of individual closure plans, those plans, as mentioned above, will need to be reviewed on a case-by-case basis by Regional Administrators to assure that the objectives of the regulations are achieved.

The Agency believes that the importance of proper closure justifies this interaction with the Regional Administrator during the interim status period. The closure and post-closure requirements are essential for protection of human health and the environment in the long-term (after post-closure care period). The importance of

proper closure and post-closure care, especially at hazardous waste landfills, is demonstrated by the numerous damage incidents which have occurred and have been documented. A number of these have been included in the background document for general closure and post-closure care (Subpart G) for interim status. All of these incidents have shown that unless certain precautions such as a stable and properly designed cover and future site use controls are taken, there is a high likelihood of future ground water, surface water, or air contamination or direct exposure of the public to hazardous waste.

D. Final Regulatory Language

§265.310 Closure and Post-Closure (Interim Final)

(a) The owner or operator must place a final cover over the landfill, and the closure plan under §265.112 must specify the function and design of the cover. In the post-closure plan under §265.118, the owner or operator must include the post-closure care requirements of paragraph (d) of this Section.

(b) In the closure and post-closure plans, the owner or operator must address the following objectives and indicate how they will be achieved:

(1) Control of pollutant migration from the facility via ground water, surface water, and air;

(2) Control of surface water infiltration, including prevention of pooling; and

(3) Prevention of erosion.

(c) The owner or operator must consider at least the following factors in addressing the closure and post-closure care objectives

of paragraph (b) of this Section:

(1) Type and amount of hazardous waste and hazardous waste constituents in the landfill;

(2) The mobility and the expected rate of migration of the hazardous waste and hazardous waste constituents;

(3) Site location, topography and surrounding land use, with respect to the potential effects of pollutant migration (e.g., proximity to ground water, surface water, and drinking water sources);

(4) Climate, including amount, frequency, and pH of precipitation;

(5) Characteristics of the cover including material, final surface contours, thickness, porosity and permeability, slope, length and run of slope, and type of vegetation on the cover; and

(6) Geological and soil profiles and surface and subsurface hydrology of the site.

ISSUE: POST CLOSURE CARE

A. Proposed Regulation and Rationale

The proposed standard required the owner and operator of a hazardous waste landfill, during the 20-year post-closure care period, to perform various site maintenance activities at the facility. The standard required the following activities:

- Maintain soil integrity, slope, and vegetative cover of the final cover and all diversion and drainage structures,
- Maintain and collect and analyze samples from the ground water and leachate monitoring systems,
- Maintain surveyed bench marks,

- When present, maintain and monitor the gas collection and control system, and,
- Restrict access to the landfill as appropriate for its post-closure use.

There was a note accompanying this standard which explained that the owner or operator could discontinue portions of post-closure care earlier than the 20-year period, if he or she could demonstrate to the Regional Administrator that such care is no longer necessary.

The proposed standard also required that no buildings for the purpose of habitation be built on hazardous waste landfills where radioactive waste have been disposed.

At hazardous waste landfills, where wastes are not removed during site closure, there remains a potential long-term threat to human health and the environment. During the active operation of a landfill, the interim status standards or the practices specified in a permit would substantially minimize the potential for escape of hazardous waste constituents. Some of these design and operating methods must also continue during post-closure for a number of years.

Soil integrity and slope and vegetative cover of the final cover must be maintained in order to minimize the infiltration of surface waters which would increase the likelihood of leaching of hazardous constituents to the ground water. Ground-water monitoring systems must also be maintained after closure to indicate any migration of contaminants to the ground water. This monitoring would enable detection and subsequent correction of a failure of a landfill containment system.

The maintenance of survey bench marks during the post-closure period would enable the location of specific wastes if it were to become necessary to remove or further isolate such waste or a portion of the landfill. This could occur if significant increases in waste constituents were found in samples analyzed from the ground water. Also, the record of the location of wastes in the landfill could be beneficial if it ever became desirable to remove a particular waste for reuse or recovery.

Where installed, gas collection and control systems must also be maintained during the post-closure period. The potential for gas generation in the landfill exists for long periods of time. Therefore the venting and control of such gases must be maintained during post-closure to reduce the risk of fires and explosions and to reduce the potential for air contamination.

Because of the presence of hazardous waste at landfills, EPA was of the opinion that site access must be restricted. However, the degree of restriction will be determined by the proposed post-closure use as approved by the Regional Administrator.

In the proposed regulations, the owner and operator of the landfill was given the opportunity to demonstrate that all or part of the post-closure care and maintenance for a particular site need not continue for the entire post-closure care period. The Agency feels that such an avenue for deviation must be available to provide flexibility in the regulation to deal with site specific-conditions.

The purpose of the restriction on buildings was to prevent radiation exposure to inhabitants of dwellings built on closed

landfills where radioactive waste had been disposed of as defined in Subpart A.

B. Comments on the Proposed Regulation

Comments received on the post-closure care requirements addressed the post-closure care time period and the associated variance discussed above. Similar comments were received in response to the general post-closure requirements in §250.43-7 of the proposed regulations. These comments and responses to them are addressed in the background document dealing with interim status standards for closure and post-closure. The final interim status regulations regarding the period of time during which post-closure care is required are addressed in the Subpart G standards.

The following comments were received on the restrictions on construction of buildings intended for habitation as proposed in §250.45-2(d)2:

- The use of land for the purpose of hazardous waste disposal should be recognized as being incompatible with any futurre use of that property involving continued contact by humans and the regulations should effect this concern.
- Any kind of disturbance of the ground surface over a hazardous waste landfill will reduce the infiltration resistance of the cover.
- This standard is inconsistent with the standards in 250.46-4(b)(2) and 250.46-3(c)(2) which deal with phosphate and uranium wastes.

C. Response to the Comments

No comments on the technical post-closure care requirements specific to landfills were received. Although some comments were received concerned with the General Facility post-closure care requirements and concerned specifically with the post-closure care requirements for surface impoundments, and because some of these comments could apply to landfill post-closure care as well, the Agency has determined that certain revisions are necessary.

Maintaining a leachate monitoring system during the post-closure period at a hazardous waste land disposal facility has been deleted from this requirement. The state-of-the-art technology for monitoring leachate in the unsaturated zone of a landfill is unreliable (see Surface Impoundment Background document for more detailed discussion.) Therefore, no requirements for leachate monitoring have been included in the final regulations.

On the other hand, a requirement has been added to the post-closure standards to maintain and monitor a leachate collection and removal system if there is one present in the landfill and to remove and treat or dispose of any leachate collected in the system during the post-closure period. The potential for the generation of leachate within the landfill will continue long after the site is closed. The Agency believes that in order for the liner system to achieve maximum control of hazardous waste constituents, leachate must be removed as it is generated within the landfill. Also, a knowledge of the quantity and quality of leachate generated will give the owner or operator and other interested parties a good indication of the degree of waste degradation within the landfill,

thus enabling decisions to be made concerning need for continued post-closure care.

Regarding the issue of construction of buildings, the Agency agrees that the restrictions regarding radioactive waste overlap those described for uranium and phosphate waste. Since these two waste streams were the basis for the regulations, the restrictions are expected to be placed in the regulations dealing with disposal of uranium and phosphate mining and processing waste, and have been dropped from the regulations for landfills. EPA expects to promulgate requirements for such wastes in its Phase II regulations.

The Agency also agrees with the comments stating that maintaining the integrity of the final cover, along with other structural components of the landfill system is necessary to minimize or prevent migration of waste constituents from within the landfill. The need to have reliable ground-water monitoring data to enable one to assess the quality of the ground water beneath and in the proximity of the facility is also important for any future judgements to be made concerning the safety of the site.

The Agency does not believe that it is necessary to ban any future use of the site which may involve the property to be in contact with humans. However, the Agency does believe that it is necessary to restrict the activities on or in close proximity to the facility which may potentially reduce the control capabilities of the facility or the capabilities of the monitoring system which are used to determine the safety of the site and its impact on human health and the environment. The final regulation (§265.117(c)) requires the Regional Administrator to approve any such activities under specified criteria.

D. Final Regulatory Language

§265.311(d)

In addition to the requirements of §265.117, during the post-closure period the owner or operator of the hazardous waste landfill must:

1) Maintain the function and integrity of the final cover as specified in the approved closure plan;

2) Maintain and monitor the leachate collection, removal, and treatment system (if there is one present in the landfill) to prevent excess accumulation of leachate in the system; [Comment: If the collected leachate is a hazardous waste under Part 261 of this Chapter, it must be managed as a hazardous waste in accordance with all applicable requirements of Parts 262, 263, 265 of this Chapter. If the collected leachate is discharged through a point source to waters of the United States, it is subject to the requirements of Section 402 of the Clean Water Act, as amended.]

3) Maintain and monitor the gas collection and control system (if there is one present in the landfill) to control the vertical and horizontal escape of gases;

4) Protect and maintain surveyed bench marks; and

5) Restrict access to the landfill as appropriate for its post-closure use.

ISSUE: IGNITABLE AND REACTIVE WASTE

A. Proposed Regulation and Rationale

The proposed standard prohibited disposal of ignitable and reactive wastes in a hazardous waste landfill unless certain conditions specified in a variance were met. The variance required that it be demonstrated that airborne contaminants would not exceed a specified concentration, and that there would be no damage to the structural integrity of the facility from heat, fires or explosions.

This regulation was not included in the proposed interim status regulations. However, after further analysis, the Agency has

concluded that the requirement meets the criteria established by the Agency for interm status standards. It is widely recognized and accepted good operation procedure to minimize the potential for intense heat generation, fires, or explosions during and after landfill disposal of ignitable or reactive wastes. Such restrictions would not require a substantial capital cost or interaction with the Regional Administrator, by the owner or operator, to adequately implement.

The objective of the proposed regulation was to prevent damages to public health and the environment which could result from fires or explosions in a landfill facility. Placing ignitable or reactive wastes in a landfill presents at least three potential problems.

One problem is the concentration of the air through volatilization, since most ignitable and some reactive waste have relatively high vapor pressures.

A second problem is that ignitable and reactive wastes can explode or burn, injuring the personnel at the facility and releasing toxic fumes into the air that can reach surrounding populations and cause personal and property damage.

The third problem is that fires, or explosions caused by ignitable and reactive wastes can damage the structural integrity of the landfill and cause rupturing of a cell or liner with subsequent leaks of hazardous wastes into the ground water or surface water. For example, many synthetic liners could be melted by a fire, and almost any liner could be ruptured by an explosion of sufficient strength.

Several of the damage cases listed in Part II of this document are the result of land disposal of ignitable and reactive wastes. In some of these cases ignition was caused by mixing of incompatible wastes which generated extreme heat. In others ignition occurred from contact of machinery with containers of reactive or ignitable waste.

In the proposed regulations the Agency stopped short of a complete ban on placing ignitable and reactive wastes in landfills by providing a variance in a note to the regulation. The variance would have allowed placing these wastes in landfills as long as the permit applicant could provide assurance that the types of potential damages mentioned above would not occur i.e., excessive volatilization and damages from fires or explosions. The purpose of the variance was to provide flexibility to facility owners and operators as long as the

practice could be carried out with minimal potential for damages to public health and the environment.

B. Comments on the Proposed Regulation

The restriction on ignitable, reactive, and volative wastes in the proposed regulations went beyond landfill disposal. A general restriction on placement of such wastes in landfills, surface impoundments, basins, and land treatment facilities was included in §250.45(c) of the proposed regulations. Standards for surface impoundments under §250.45-2, basins under §250.45-4, and land treatment facilities under §250.45-5 also contained such a restriction.

Those comments received which were directed specifically toward restrictions on ignitable and reactive wastes in landfills are as follows:

- Banning the disposal of ignitable waste in hazardous waste landfills is unreasonable. Effective landfill operation can dispose of such waste in a way which eliminates the principal hazards associated with the waste, e.g., by blending with landfill soil. Operators should not be denied this option.

- Banning the disposal of all reactive wastes in hazardous waste landfills is unreasonable. For example certain monomers such as methyl methacrylate may be classified as reactive because they are autopolymerizable. Some of these materials slowly convert to the polymer and in essence become non-hazardous after landfilling. The disposer should be allowed to landfill these materials without treatment.

- Many wastes which according to the criteria will be classified as ignitable or reactive are appropriately disposed of in a secure landfill. A list of such could be developed, so as not to unduly impede such practices.

C. Response to the Comments

Relevant to the discussion of the comments above is the fact that the Agency, in response to comments on the note in §250.45(c)

dealing with volatility, has found it necessary to defer any requirements relative to controls on volatiles. Similarly, the note in 250.45(c) regarding concentration of airborne contaminants was inappropriate under the circumstances and has been deleted. The reader is referred to the preamble sections on "Volatile Wastes" and "Ignitable, Reactive, and Incompatible Wastes" for further discussions of these issues.

Several comments suggesting that the "ban" was unreasonable seemed to have overlooked the note to the standard which allowed a variance to the prohibition if certain conditions were met. One of these conditions, regarding concentration of airborne contaminants has been removed, as explained above. The other condition was that the owner or operator demonstrate that the structural integrity of the land disposal facility would not be damaged.

Comment was received suggesting that incorporation of such wastes into the soil is in itself an effective way of rendering these wastes non-ignitable, and should be allowed in the regulation. The Agency, for the most part, agrees that there are effective methods which will eliminate the characteristic of ignitability or reactivity accociated with a hazardous waste. Thus, mixing the waste with soil or other materials before or immediately after the waste is placed in to the landfill is allowed if the resulting mixture is neither ignitable nor reactive. The resulting "treated" waste must meet the general requirement for handling ignitable, reactive, and incompatible wastes (see §265.17(b)).

A commenter suggested that certain wastes may become non-reactive sometime after landfilling, and that their placement in a landfill should be allowed. The Agency does not concur with this suggestion. The major potential danger associated with ignitable and reactive wastes is their uncontrolled disposal within the landfill. Thus, the fact that they may lose their reactive property over time after landfilling would not eliminate this hazard. Thus, the Agency maintains that some treatment of all reactive wastes before or immediately after placement in the landfill is necessary.

Comment was received which suggested that instead of a general variance to this regulation a specific list of ignitable and reactive wastes which can be disposed of safely in a landfill should be developed. The Agency does not believe that it is possible to develop such a list at this time. It is possible that certain ignitable and reactive wastes would not present a problem when finally placed in a landfill and covered. However, there is a serious question of handling these wastes during the disposal operation. The Agency feels that it may be possible on a case by case basis to develop special handling requirements for these wastes that would allow their safe disposal in a landfill. However, these special conditions would have to be defined in the permitting process, and thus cannot be accomodated in the interim status standards. In developing the full regulations for land disposal the Agency will consider whether such a variance should be included.

D. Final Regulatory Language

§265.312

Ignitable and reactive waste must not be placed in a landfill, unless the waste is treated, rendered, or mixed before or immediately

after placement in the landfill so that (1) the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under §§261.21 or 261.23 of this Chapter, and (2) §265.17(b) is complied with.

ISSUE: INCOMPATIBLE WASTES

A. Proposed Regulation and Rationale

The proposed standard required the owner or operator of a hazardous waste landfill to dispose of incompatible waste, whether containerized or non-containerized, in separate landfill cells. This regulation was not included in the proposed interim status standards. However, after further examination, the Agency decided that this regulation meets the criteria for interim status standards established by the Agency.

Incompatible wastes are wastes which react when they come in contact with another waste to create a more acutely dangerous situation than that posed by the wastes individually. This can occur when incompatible wastes contact each other during handling at a facility, during disposal, or after disposal.

When incompatible wastes come in contact with one another they can generate: (1) heat or pressure, fire, explosion or violent reaction; (2) produce toxic mists, fumes, dusts, or gases; (3) produce flammable fumes and gases; (4) damage the structural integrity of the device or facility containing the waste, (5) or through like means threaten human health and the environment.

These reactions can cause injury or death of workers, members of the public, wildlife, and domestic animals. They can also cause

property and equipment damage, destroy facility containment systems and contaminate air, water, and land.

The lack of accurate information about the wastes, and the often indiscriminate handling and disposal of the wastes, contribute to the high risk of contact of potentially incompatible substances at hazardous waste landfills. This is supported by the many incidents that have already occurred, several of which are documented in Part II of this document. In each of the cases listed, incidents occurred during normal handling and disposal operations and were the result of either lack of accurate information about the waste or indiscriminate mixing and disposal practices. The reactions were caused by waste mixing, improper handling of ignitable or unstable waste, or other improper disposal and resulted in toxic gas dust emissions, fires, water contamination, injury or death, and equipment damage.

To prevent these incidents it is necessary for persons handling and disposing wastes which may be incompatible to know the contents of the waste, its incompatible characteristics, and with which wastes it is incompatible. The basic control method is to segregate incompatible wastes so that mixing does not occur.

The California Department of Health restricts disposal of incompatible wastes in order to insure that they will not come into contact with one another. California's guidelines for handling of hazardous waste list incompatible wastes according to the potential consequences of their intermingling.[53] Disposal standards require separation of these materials at storage and disposal sites. The Texas Water Quality Board has similar regulations for control of incompatible wastes.

B. Comments on the Proposed Regulation

The restriction on incompatible wastes in the proposed regulations went beyond landfill disposal. A general restriction on placement of such wastes in landfills, surface impoundments, basins, and land treatment facilities was included in §250.45(c) of the proposed regulations. Standards for surface impoundments under §250.45-3 basins under §250.45-4 and land treatment under §250.45-5 also contained such a restriction.

Those comments received which were directed specifically toward landfills are as follows:

- Support for the concept of separate cells for incompatible wastes. Additional specifications for separation of incompatible wastes are needed to reduce the likelihood that hazardous situations might arise. "Incompatible wastes, separated by six to twelve inches of soil, might easily come into contact with each other after a short period of time." Therefore, separation by eight feet of soil is suggested, since "this distance leaves adequate room for trucks to manuever when emplacing the hazardous waste and reduces the probability that incompatible waste will combine."

- The degree of segregation and isolation should be keyed to the physical and chemical properties of the wastes. Further, the separating material around certain wastes should be tailored to match properties; for example, "heavy metal waste surounded by lime-bearing waste materials would work fine".

C. Response to the Comments

It was suggested that incompatible wastes be separated by eight feet of soil, and that the degree of separation should be keyed to the chemical and physical properties of the wastes. The Agency does not believe that such requirements are necessary because the proposed regulation requires that incompatible wastes must be disposed of in separate landfill cells. The definition of a landfill "cell" specifies that each cell is to "use a liner to provide

isolation of wastes from adjacent cells or wastes". "Liner" is defined as a continuous layer of natural or man-made materials, beneath or on the sides of a surface impoundment, landfill or landfill cell, which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents, or leachate.

The thickness of such barriers or liner systems is not specified in the regulation because thickness alone does not assure separation. Other factors, such as liner permeability and porosity, and liner compatibility with the waste, are even more important. The requirement for separation is met by designing cell liner systems of sufficient thickness, permeability, compatibility etc., based on waste characteristics, to ensure isolation.

For these reasons EPA feels that to specify an eight foot separation or base degree of separation on physical and chemical properties is unnecessary and would not provide for any more protection than what is proposed. Comments received on other sections of the proposed regulation indicate that potentially incompatible wastes can be premixed or treated before or during disposal so that they are no longer incompatible. Therefore, the final regulation has been revised to allow the placement of incompatible wastes in the same cell, if they meet the general requirements for handling incompatible wastes in §265.17(b).

The Agency is considering adding a fifth class of incompatible waste to the four mentioned above to these regulations. It would declare incompatible those wastes which would solubilize or otherwise mobilize another hazardous waste or hazardous waste constituent, thus increasing the likelihood that the mobilized waste or constituent

would be leached onto the groundwater. Because the potential scope of this concept is so broad the Agency currently believes that it would be most practicable to implement such a regulation by listing only specified waste combinations as being incompatible. Those currently under consideration are:

(1) PCBs and organic solvents,

(2) Organic pesticides and organic solvents, and

(3) Metal-containing wastes and acids.

The first material in each of these pairs can be substantially mobilized by the second, but may be relatively immobile in its absence. It therefore seems prudent to dispose of such pairs in separate landfill cells, land treatment areas, or impoundments. The Agency requests comment on this concept of incompatibility, on these and other possible pairs of wastes which might be listed as incompatible under this standard, and on circumstances under which these wastes can safely be commingled in land disposal facilities. (See the preamble for General Requirements for Ignitable, Reactive or Incompatible Wastes for further discussions concerning incompatible wastes)

D. Final Regulatory Language

§265.313

Incompatible wastes or incompatible wastes and materials,(see Appendix V for examples) must not be places in the same landfill cell, unless §265.17(b) is complied with.

ISSUE: DISPOSAL OF BULK LIQUIDS

A. Proposed Regulation and Rationale

The proposed standard specified that the owner or operator of a hazardous waste landfill could not directly dispose of bulk

liquids, semi-solids, or sludges in the landfill. However, if the owner or operator pretreated and/or stabilized such liquid wastes before landfilling or treated and/or stabilized the liquid in the landfill in a manner which reduced its liquid content or increased its solids content so that it reached a non flowing consistancy, the owner or operator could dispose of bulk liquids, semi-solids, or sludges in a hazardous waste landfill.

The purpose of the proposed regulation is to reduce the presence of free liquids in a landfill. Free liquids could migrate through a landfill, possibly mobilizing (solubilizing) other toxic substances in the process. This leachate has the potential of migrating from the landfill and contaminating ground water. Free liquids also contribute to hydraulic head (hydrostatic pressure) which in turn, contributes to the potential for the leachate to migrate through the containment system. This phenomenon is explained by Darcy's Law which describes the movement of liquids through porous media. According to the law, an increase in the hydraulic head, causes an increase in the velocity of a liquid through a material, assuming all other parameters are held constant. Thus, the disposal of bulk liquids, (or semi-solids and sludges containing free liquids) in hazardous waste landfills would supply both the fluid for leachate formation and increase the hydraulic head which is the driving force to cause leachate to pass through a liner system. This would increase the rate of movement of hazardous contaminants from the landfill.

As the damage cases outlined above indicate, many cases of ground and surface water contamination have been caused by the migration of industrial wastes from landfills. The damage cases suggest that this is probably the most serious form of pollution created by landfills. EPA believes that its regulations restricting the landfilling of bulk liquids and wastes containing free liquids will substantially reduce this type of pollution during interim status. Because of its importance in reducing this major source of pollution, and because EPA believes that this restriction can be implemented during interim status without the intervention of permitting officials, EPA has included restrictions on landfilling bulk liquids and wastes containing free liquids in the interim status standards.

B. The Definition of "Free Liquids"

There were no definitions for "liquids", "bulk liquids", "free liquids", "semi-solid", flowable", or "non-flowable" in the proposed regulations. The Agency received a number of comments on this subject:

° The terms bulk liquids, semi-solids and sludges are not defined in these regulations for proper interpretation of this section. The Agency has indicated that its concern is to limit the liquid content of the waste and prevent overload of the leachate collection and removal system. There are hazardous wastes that could be classified as semi-solids or sludges which have minimal liquid content and can be safely contained in the landfill specified in the regulations. It is recommended that the terms bulk liquid, semi-solids and sludges be properly defined for these regulations and this subpart be rewritten to

allow the disposal of semi-solids and sludges with minimal liquid content in a secure landfill.

- Within this standard, EPA is concerned with the liquid nature of the waste. This concern does not justify the inclusion of semi-solids and sludges within this prohibition, especially semi-solids and sludges which are not water soluble.
- Finite parameters defining what is meant by modification and/or treatment to a non-flowing consistency are needed.

These comments all imply the same basic concern about this standard, i.e., the need to include a degree of specificity in order to help in the interpretation and implementation of this standard. The comments recommend that this can be done by defining the term "liquid", "semi-solids" and "sludges" or defining a specific percentage of solids which must be attained prior to landfilling.

The Agency agrees with these comments but found it extremely difficult to provide specific definitions of these terms that are workable and broadly applicable. One problem is the wide variation among waste types. For example, a "sludge" or "semi-solid" of one type containing 20 percent solids may have very different flow, free liquids, and other characteristics than another sludge of the same solids content. Thus, to apply a limiting definition to such waste based on percent solids would not necessarily achieve the objective of the regulation (i.e., may be too restrictive or not restrictive enough), and would limit the flexibility necessary for proper implementation of the regulation.

The terms "non-flowing" and "non-flowing consistency" also do not necessarily reflect the objective of the regulation. Even very

dry materials such as dry sand or other granular materials can "flow" and this could lead to improper interpretation of the intent of the regulation. Thus, achieving a non-flowing consistency is not the intended objective. The objective is the elimination of the presence of free liquids and thereby reduction of the potential for producing leachate and increasing contaminant migration.

"Sludge" has been defined in RCRA basically as any solid, semi-solid, or liquid waste resulting from pollution control facilities. Obviously, this definition is inadequate for the purposes of this section of the regulations. Any attempt to redefine this term could unnecessarily lead to confusion and potential conflict with RCRA.

Furthermore, bulk liquids are readily and indisputably identifiable. Bulk liquids are large quantities (e.g., tanker truck loads) of liquids or fluids -- substances that exist as a continuum characterized by low resistance to flow and the tendency to assume the shape of its container.

The Agency believes that the real concern here is liquids within a waste which are free to migrate out of the waste and into the landfill, much as bulk liquids can. EPA has therefore decided to use the term "free liquids", defined as "liquids which readily separate from the solid portion of a waste under ambient temperature and pressure." This term and meaning best reflect the use to which this term is put, which is to distinguish when a waste contains liquids which will readily flow from the waste in a landfill to produce leachate. For sludges or semi-solids which are not obviously liquids, the following test may be used to determine if they contain "free liquids." Place a one to five kilogram (2.2 to 11.0 lbs.)

sample of waste on a level or slightly sloping plate of glass or other similarly flat and smooth solid material for at least five minutes. If a liquid phase separation is observed, the waste contains "free liquids." The test must be performed at temperatures above freezing. EPA feels this test provides a practical way to test sludges and semi-solids and helps clarify the meaning of free liquids until a more rigorous test is devised.

The test is intended to simulate, in a simple way, the behavior of semi-solid wastes placed on the surface of a landfill. If liquids can be observed as a separate phase draining over an impermeable substrate from the base of a small sample of the waste, such liquids can also be expected to drain from the waste itself when it is placed on the surface of the landfill, and will be free to migrate into the landfill much as liquid wastes would. The fact that liquids cannot be observed to migrate from a small sample after a few minutes does not, of course, assure that they will not migrate from a larger sample, or after a longer period of time, or when the waste is compressed by wastes placed over it. This test thus represents a rough minimum for the containment of free liquids. The Agency expects to study the problem of free liquids further and to attempt to devise tests which more accurately reflect the conditions of waste within a landfill.

The Agency intends that the definition and suggested test be a working guide to identifying free liquids until a more formal test is devised. It clearly is not rigorous, but will provide a practical way of achieving the objective of this regulation. The Agency believes that the definition of free liquids adequately specified

the extent of pretreatment necessary for waste liquids, semi-solids, and wet sludge prior to disposal.

EPA has selected this test after consideration of a number of alternatives. A major flaw in the test procedure is that is does not account for pressures which will be encountered in a landfill, which will tend to squeeze liquids from the absorbent mass. An anology is liquids which readily flow from a saturated sponge when the sponge is compressed. The Agency is currently evaluating other test procedures and will provide guidance if another test procedure is determined to be a better indicator of the performance in a landfill. One area of investigation was current State regulations. Information was obtained from 32 States and four of these States use formal or informal definitions for liquids. This information is presented in Appendix A.

C. Other Comments Received

- EPA should not prohibit disposal of bulk liquids in properly designed landfills which meet the high degree of security required by the proposed landfill standards. Furthermore, so long as the overall performance standards are met, the Agency should not be concerned with specific internal operating procedures. Also, placing bulk liquids in a landfill should be environmentally acceptable since landfills have tighter design requirements than surface impoundments. The prohibition of disposal of bulk liquids, semi-solids and sludges should be deleted.

- Utilizing municipal refuse or other organic materials as a sorbent for liquid hazardous waste will not provide long term stabilization of hazardous waste. Organic materials will degrade and subsequently liberate the hazardous constituents.
- Standard should clarify that injection, discharge, or disposal of liquids into a well or pit located in a landfill containing municipal refuse meets the requirements of eliminating the presence of free liquids prior to final disposal. It has been our experience that the garbage acts as an absorbant for liquids, and the practice has the advantage of conserving space by filling existing voids in the landfill. Also, the words "prior to" should be changed to "after" or "upon" to allow the practice of in-situ absorption of liquids and municipal waste.
- Where the degree of risk is low, we do not believe it should be EPA policy to ban all liquid disposal in landfills, specifically if it can be demonstrated that health and environmental protection will not be compromised. Landfills can benefit from compaction if liquids are applied in proper quantities.
- The regulations should categorically ban all liquids from being landfilled. The regulations should eliminate the landfilling of liquids that are either capable of being incinerated or are treatable.

- We are afraid that through EPA's encouragement the use of "fixation" techniques may be widely adopted, even though the process can result in a solid waste disposal cost increase of ten to one-hundred fold without a real need or concern regarding the cost-benefit relationship. Many wastes after "fixation" are now being safely disposed of at non-hazardous waste landfill facilities at a lower cost than the amount charges at hazardous waste landfills.
- This provision would require pretreating dried sludge prior to landfilling. Also this standard would preclude the use of sludge pipelines, the most economical method of transportation in some instances.
- Within this standard, EPA is concerned with the liquid nature of the waste. This concern does not justify the inclusion of semi-solids and sludges within this prohibition, especially semi-solids and sludges which are not wate soluble. The arbitrary nature of the restriction on disposing of semi-solids or sludges in landfills is evident by the fact that solid wastes which are soluble are permitted to be disposed of in landfills under the proposed regulations.

D. Response to the Comments

The Agency received many comments suggesting that all liquids be banned from landfills. These commenters believed that liquids should be incinerated or treated by alternative methods, not landfilled. EPA believes that an across-the-board ban of any liquid waste disposal in a landfill is not a practical alternative at the present time.

The suggestion that the Agency require that all liquid waste be either incinerated or treated rather than landfilled has been rejected. Liquid wastes are a large portion of total hazardous waste . To eliminate a major disposal method for liquid waste and to require that a large percentage of this waste be incinerated or treated would far exceed the existing capacity of incinerators and treatment facilities. Some wastes, particularly sludges, may not be amenable to incineration or other treatment. The environmental impacts of incinerating liquid wastes cannot simply be assumed, without study, to be less than pretreatment and disposal in a landfill. However,
the Agency believes that requiring liquids, semi-solids and sludges to be incinerated in the interim status standards would be impractical.

Also, the Agency believes that there are conditions under which liquids in landfills can be tolerated. The conditions are use of a secure liner of low permeability, and continuous operation of an effective leachate collection and removal system over a long period of time. Under this scheme the leachate is removed from the landfill continuously to prevent build-up of a hydraulic head, and the low liner permeability and low head result in a very slow (insignificant) rate of migration through the liner. The leachate must be either treated and discharged under NPDES permit, recycled back to the facility, or treated, disposed, or stored as a hazardous waste. Over time, leaching potential of the waste may be reduced and the contents of the landfill may present less of an environmental problem. The landfill, in essence, may become a treatment system. In order for the Agency to approve this type of landfill operation, the nature of the waste, the liner, and leachate collection system

would need to be carefully evaluated.

Another reason advanced in the comments for deleting the standard is that landfills have tighter design requirements than surface impoundments (which are used for liquids). Even if this were a correct interpretation, it would not be relevant to the interim status standards, which deal with existing facilities that frequently do not meet the proposed EPA requirements. The commenter has also perhaps misinterpreted the objectives of the containment designs for landfills and surface impoundments. The liner in most surface impoundments is designed for a discrete time period (e.g., for storage or treatment) following which the waste (or at least any liquids) are to be removed. The proposed landfill designs were based on long-term containment, but assuming that free liquids would minimized. If free liquids remained in a landfill indefinitely, the proposed designs may not be effective.

Comment was received concerning the issue of municipal waste used for absorbing liquids within the landfill. Some comments suggested that EPA should further clarify and encourage their use; other comments recommended that this approach be discouraged. The latter comments stated that mixing with municipal waste or other organic material will not provide long-term stabilization.

EPA believes that mixing liquid hazardous waste with biodegradable municipal waste is not a desirable means of reducing free liquids within the landfill. Such a practice would require that muncipal wastes be placed in hazardous landfills with the result that volumes of hazardous landfill space will be taken up by non-hazardous municipal waste. More importantly, as commenters stated, it is probable that

when the municipal waste degrades, the hazardous waste would be released. EPA is aware of no data showing that this approach will prevent ultimate release of free liquids from a landfill. Until data area available to show that such a practice will effectively eliminate free liquids on a long term basis the Agency cannot support this option in the regulation.

Commenters also suggested that the practice of mixing liquid hazardous waste with municipal waste could take place in sanitary landfills which are not designed and constructed for disposal of hazardous wastes. This approach is not practical under the regulations even if it were assumed that it would adequately protect the environment. The Act requires that hazardous wastes must be managed in permitted hazardous waste management facilities. If they are permitted, they would have to meet the criteria for a hazardous waste landfill.

Since a significant portion of all bulk liquids are landfilled, this partial prohibition will have major impact on the disposal industry. However, the Agency believes that a large number of options are available to handle the waste load in addition to the placement in a lined facility with leachate collection. These options are: incineration, dewatering before landfilling, chemically fixing or solidifying, resource recovery, on-site mixing with sorbents, well injection, treatment to render the waste non-hazardous, and surface impoundments. While no single processing or disposal option can handle the additional waste load, each option will receive some of these wastes and the total impact will be minimal. However, in the short term there will be difficulties as the generators attempt to match the available options to a particular

waste stream. Therefore the Agency is promulgating this standard as interim final and is requesting comment on this issue. The Agency will take all comments concerning this standard under consideration during this interim final period to determine final Agency policy and regulatory language for disposal of bulk liquids. For this reason, this portion of the regulations will not go into effect until twelve months after the effective date of the interim status regulation.

We also received comments recommending that we delete the prohibition or restriction on disposal of bulk liquids, semi-solids and sludges. One reason that was given was that the prohibition was unnecessary in properly designed landfills which meet the high degree of security required in the proposed regulations. EPA is in limited agreement with this comment. The regulations allow bulk liquids to be placed in landfills with a liner physically and chemically resistant to the liquids added and with a continuously operated leachate collection and removal system with sufficient capacity to accomodate all the leachate produced. In landfilling bulk liquids, the owner or operator should consider the moisture regime for the specific site. The various sources of free liquids including precipitation, groundwater infiltration, and the amount of bulk liquids to be added must be balanced against the ability of the leachate collection and removal system to remove the liquids, evapotranspiration, and surface run-off.

A commenter suggested that performance standards would make operating standards such as this one unnecessary, but did not suggest which "performance" standards would in themselves be

sufficient. The Agency disagrees that performance standards are sufficient by themselves. Environmental performance of a landfill is much more difficult to measure than performance of an effluent treatment process or air pollution control device. Sampling a stack or an effluent discharge gives immediate performance feedback.[56] Sampling of ground water provides relatively slow feedback because of the time required for contaminants to reach ground water. Thus, the Agency feels that it is necessary to specify both operating and design criteria that will minimize the potential for waste migration.

We received comments suggesting that in-situ treatment (absorption) of liquid wastes be allowed i.e., mixing liquids with wastes already in the landfill. The Agency feels that it is preferable for free liquids to be eliminated before wastes are placed in a landfill. This provides greater assurance that the liquid will be fully absorbed. However, the uncertainty of in-situ absorption can be tolerated when the landfill has a functioning liner and leachate collection and removal system.

Some commenters were concerned that this standard would necessitate pretreating dried sludges before landfilling. This is a misinterpretation of the standards. The objective of this standard is to minimize free liquids in landfills. Wastes, such as dried sludges, which have no free liquids do not require further treatment prior to landfilling.

The EPA also sees no reason why this standard would preclude the use of sludge pipelines. As long as liquids, semi-solids and sludges are pretreated prior to disposal to minimize free liquids, or the wastes are placed in a lined landfill with leachate collection

at on-site facilities. Appendix A gives more detail on individual State requirements.

C. Final Regulatory Language

§265.314 Special Requirements for liquid waste (Interim Final)

(a) Bulk or non-containerized liquid waste or waste having free liquids must not be placed in a landfill, unless:

(1) The landfill has a liner which is chemically and physically resistant to the added liquid, and a functioning leachate collection and removal system with a capacity sufficient to remove all leachate produced; or

(2) Before disposal, the liquid waste or waste containing free liquids is treated or stabilized, chemically or physically (e.g., by mixing with an absorbent solid), so that free liquids are no longer present.

(b) (Discussed below)

(c) The requirements of this Section are effective 12 months after the effective date of this Part.

ISSUE: CONTAINERIZED LIQUIDS

A. Proposed Regulation and Rationale

The proposed standard required the owner or operator of a hazardous waste landfill to surround each container of liquid hazardous waste with an amount of sorbent inert material capable of absorbing all of the liquid contents in the container.

The primary purpose of the proposed regulation was to control the presence of free liquids in a landfill that would result from ruptured or leaking containers. The problems inherent with "free liquids" in landfills have been discussed above. The sorbent material to hold the liquid waste could reduce leachate production.

However, the proposed option also has significant drawbacks. One is that the ability of the sorbent material to absorb the liquids is not certain. Thus, some liquid could escape, particularly if the sorbent is poorly placed. The seepage of appreciable amounts of liquid waste or leachate may also cause a rise in the water table and the development of a groundwater mound. As the mound increases in size, the unsaturated zone becomes progressively thinner and thus the opporunity for natural attenuation is reduced. Sorbent material would tend to retain liquid waste lost from ruptured containers and reduce the formation of this groundwater mound and the subsequent reduction in natural attentuation.

B. Comments on the Proposed Regulation

- o This standard only allows for the external use of inert sorbent material surrounding a container of liquid hazardous waste. It is recommended the Agency provide for the placement of the sorbent material inside the waste container for economics of operation.

- o Suggest the word "inert" be deleted from this requirement. There are materials that could be used for sorbents which are not inert but should be completely acceptable in a hazardous waste landfill, e.g., surrounding material could be a compatible solid hazardous waste.

- o This stipulation would appear to mandate much larger volumes of space than necessary.

- o In this paragraph the Agency has failed to detail or define what is meant by "sorbent," "inert" or "surrounded by."

- o It is recommended that EPA delete this paragraph from the regulations because:

  - So long as the performance standards are met, the Agency should not be concerned with specific internal operating procedures; especially in regard to individual containers.

  - It is not necessary in landfills with restricted permeability.

  - The landfill requirements specify acceptable liner materials, the type and amounts of cover materials, and frequency with which active portions must be covered. There is no need for requiring containers to be surrounded by sorbent materials.

- o Problems from toxic chemicals mobilized by liquids have occurred in landfills across the country. The practice of liquid disposal on land must be halted. Delete this standard and insert the following: Liquids of any kind shall not be buried in a landfill cell.

- o This regulation would increase the likelihood of liquid wastes escaping from secure landfills. Several things may happen as the containers lose their integrity.

C. Response to the Comments

Commenters suggested that the proposed regulation only allowed external use of sorbent material and recommended that it be allowable to place the sorbent in the container prior to landfilling. This is a misunderstanding of the regulation since the Agency has never intended to discourage this type of disposal operation. The liquid waste must be mixed with sorbent material to eliminate free liquids before the filled container can be landfilled. There is no prohibition against landfilling containers which do not contain free liquids.

It was recommended that "inert" be removed as a requirement since there are sorbents which are not inert and these materials could be acceptable in a landfill. The Agency agrees with this comment and has removed the requirement. There are very few, if any, materials which are physically, chemically, and/or biologically inert. This requirement could result in unnecessary burdens on the owner/operator in order to locate and prove that a particular sorbent is "inert".

Commenters stated that the requirements to surround containers with sorbent material would mandate large volumes of landfill space be used for the sorbent material and that this was not necessary. The Agency agrees with the comment in that additional landfill volume would be required. However, this comment is no longer valid since the landfilling of containerized liquid waste will not be allowed.

Commenters noted that the Agency failed to define "sorbent," "inert" and "surrounded by." These terms do not appear in the interim status regulation. Rather the regulation has focused on eliminating "free liquids" which has been defined earlier in this document.

The Agency received many comments which argued against any type of restriction on landfilling containerized liquid because they felt that this was an internal operating procedure which would be acceptable because of the requirements for liner materials, amount of cover, and other performance standards. The Agency also received comments suggesting a complete ban on landfilling containers of liquid waste because they felt that the containers would eventually leak resulting in an unstable "honeycombed" landfill structure. The landfill could then collapse with damage being done to the final cover.

The Agency agrees with the latter comments and has prohibited the practice of landfilling containerized liquids. Similar bans have been or will be enacted in at least eleven states (see Appendix A). The Agency can perceive no positive difference between adding bulk liquids and the landfilling of containerized liquids but does recognize the potential for additional negative impacts. Virtually all containers will eventually leak and cause additional free liquids to be present in the landfill. The negative impacts of free liquids have been discussed earlier. The additional problem with containerized liquids is that it is not possible to predict when the liquid will be released and how the release will effect the landfill's ability to restrict the movement of hazardous waste into the environment. While EPA recognizes that the subsidence of the landfill cover can be easily repaired, the unpredictability of when the subsidence would

occur would result in an extended time for post closure care. Therefore, EPA believes that eliminating containerized liquid waste from the landfills will provide a long term benefit for the operator. EPA intends to eliminate the type of landfill which is constructed almost entirely of 55-gallon drums filled with liquids or materials containing "free liquids". These facilities provide the potential to release hazardous constituents for decades. This prohibition does not apply to drums filled with solid materials which do not contain "free liquids". Further, the ban does not apply to small containers, such as paint cans or ampules because the small containers should not contain enough volume of liquid to produce a significant increase in the hydraulic head in the landfill nor would significant voids be created in the landfill when liquids are released and the containers degrade.

Another important exception to the ban on landfilling containerized liquids is the case when the container serves a function other than storage, disposal or transportation. Examples of this exception are batteries and capacitors. These types of containers are not likely to contribute substantial volumes of liquid to most landfills and the difficulty of opening and emptying appears to outweigh the small benefit gained. Because of the concern for creating voids in the landfill, empty containers may not be landfilled unless they are crushed flat, shredded, or in some manner substantially reduced in volume. In many landfills this will be accomplished by using the bulldozers or other heavy equipment at the site. At least six States encourage similar handling procedures for empty containers (see Appendix A). Care should be taken to ensure that each container is crushed; it is not acceptable to have the equipment

attempt to crush several layers of containers at one time.

Since a significant portion of all liquid waste is landfilled in containers, the prohibition will have major impact on the disposal industry. However, the Agency believes that a large number of options are available to handle the waste load. These options are the same as those for bulk liquids wastes except that facilities for storage of containers will be more readily available than for bulk liquids. While no single processing or disposal option can handle the additional waste load, each option will receive some of these wastes and the total impact will be minimal. However, in the short term there will be difficulties as the generators attempt to match the available options to a particular waste stream. Therefore, the Agency will promulgate this standard as interim final and is requesting comment of the issue. The Agency will take any and all comments concerning this standard under consideration during this interim final period to determine final Agency policy and regulatory language for disposal of containerized liquids. For this reason, compliance with this portion of the regulation will not be required until twelve months after the effective date of the interim status regulation.

Comments received in support of the proposed regulation expressed the opinion that fewer problems would result from burial of containers and subsequent settlement problems than would result from emptying the containers and mixing with sorbent. Problems cited include spills and greater exposure to workers. EPA believes that the burial of containers presents a long-term problem that other available options do not have and for this reason the Agency has decided to ban the landfilling of containerized liquid waste.

Containerized volatile liquids will present special handling problems because of the ban on landfilling containers. These wastes, by their nature, should not be exposed to the atmosphere. Extreme care must be used in handling these wastes in order to protect the workers. EPA intends to address the problems associated with volatile liquids in future regulations. In lieu of more specific guidance, we offer the following list of materials and types of materials which are likely to yield hazardous emissions due to volatility.

- Spent halogenated solvents and halogenated solvent recovery sludges from degreasing operations
- Mercury bearing sludges from brine treatment and mercury bearing brine purification muds from the mercury cell process in chlorine production
- Polyvinyl chloride sludge from the manufacture of polyvinyl chloride
- Bottom stream from quench column in acrylonitrile production
- Bottom stream from wastewater stripper in production of acrylonitrile
- Solid waste discharge from ion exchange column in production of acrylonitrile
- Waste stream from purification of HCN in production of acrylonitrile
- Waste stream (column bottoms) from acetonitrile purification in production of acrylonitrile
- Heavy ends from distillation of ethylene dichloride in ethylene dichloride production

- Heavy ends from the production of glycerine from allyl chloride
- Vacuum still bottoms from the production of maleic anhydride
- Heavy ends from distillation of vinyl chloride in production of vinyl chloride from ethylene dichloride

D. Revised Regulatory Language

§265.214 Special Requirements for liquid wastes (Interim Final)

(a) (does not apply)

(b) A container holding liquid waste or waste containing free liquids must not be placed in a landfill, unless:

(1) The container is designed to hold liquid waste or waste containing free liquids for a use other than storage, such as a battery or capacitor; or

(2) The container is very small, such as an ampule.

(c) The date for compliance with this Section is 12 months after the effective date of this Part.

§265.315 Special requirements for containers (Interim Final)

(a) An empty container must be crushed flat, shredded, or similarly reduced in volume before it is buried beneath the surface of a landfill.

(b) The date for compliance with this Section is 12 months after the effective date of this Part.

e: Protection Agency, The Prevalence of Sub-
ti. of Hazardous Chemical Substances at Selected
ste Land Disposal Sites, EPA/530/SW-634, Oct. 1977.

hreats Caused by Hazardous Material Sites,
il and Special Materials Control Division,
.C., February, 1980, p. 6.

24. Ibid, p. 116

25. Ibid, p. 120-121

26. Ibid, p. 126

27. Ibid, p. 126

28. Ibid, p. 135

29. Ibid, p. 160

30. Ibid, p. 168

31. Ibid, p. 171

32. Hazardous Waste Disposal Damage Reports, U.S. Environmental Protection Agency, EPA/530/SW-151, June 1975.

33. U.S. Environmental Protection Agency, Office of Solid Waste Management Programs, Disposal Of Hazardous Wastes; Report to Congress, Environmental Protection Publication SW-115. Washington, U.S. Government Printing Office, 1974. 110 p.

34. Office of Solid Waste Management Programs, SW-131s. Unpublished data.

35. U.S. Environmental Protection Agency. Summary of Hazardous Waste Damage Cases, Unpublished Document, 1979.

36. U.S. Environmental Protection Agency, Internal Damage Assessment Files, Unpublished reports.

37. Damages and Threats Caused by Hazardous Material Sites, U.S.E.P.A., Oil and Special Materials Control Division, Washington, D.C., February, 1980, p. 49.

38. Ibid, p. 107

39. Ibid, p. 116-117

40. Ibid, p. 144

41. Ibid, p. 113-114

42. Ibid, p. 124

43. Ibid, p. 125

44. Ibid, p. 137

45. Ibid, p. 139-140

46. Environmental Protection: Hazardous Wastes Issue Brief Number IB79088, Mason, Robert J., The Library of Congress, Congressional Research Service, Sept. 5, 1979, p. 2.

47. Damages and Threats Caused by Hazardous Material Sites, U.S.E.P.A., Oil and Special Materials Control Division, Washington, D.C., February, 1980, p. 9-10.

48. Warning Toxic Waste, A Courier-Journal Special Report, "The Danger is Seeping From Under Society's Rug", Jim Adams & Jim Detjen, The Courier Journal, Louisville, Kentucky, 1979.

49. Damages and Threats Caused by Hazardous Material Sites, U.S.E.P.A., Oil and Special Materials Control Division, Washington, D.C., February, 1980, p. 11-12.

50. Ibid, p. 170

51. Ibid, p. 29-30

52. Evaluation of Emission Control Criteria for Hazardous Waste Management Facilities, Final Report, EPA Contract No. 68-01-4645 April, 1978, p.p. 464-469.

53. State of California, State Water Resources Control Board, "Waste Discharge Requirements for Non-Sewerable Waste Disposal to Land, Disposal Site Design and Operation Information."

54. U.S. Environmental Protection Agency, Sanitary landfill Design and Operation. SW-65ts, 1972m p. 14.

55. U.S. Environmental Protection Agency, Design and Construction of Covers for Solid Waste Landfills, EPA - 600/2-79-165, August 1979.

56. U.S. Environmental Protection Agency, Potential for Capacity Creation in the Hazardous Waste Management Service Industry, PB-257187, August 1976.

Appendix A
State Regulatory Programs for Liquid Hazardous Wastes

EPA has reviewed the current State laws, regulations, and guidelines on hazardous wastes and contacted State regulatory officials. Information from 34 State hazardous waste programs have been evaluated.

While many State programs recognize the need for extraordinary controls for disposal of liquids, few have attempted to define liquids or similar terms. Only Rhode Island has adopted a formal definition (any waste that expresses as separable liquid by weight thirty percent (30%) or more of the waste when exposed to a vacuum of 3/4 atmosphere for thirty (30) minutes). Other States (Connecticut, Illinois, and South Carolina) have less formal definitions which include characteristics such as "pumpable" and "flowable". The majorit of the States report that they will not attempt to structure a definition but will adopt the definition supplied by EPA. The conventional definitions for these terms is attached.

The problems inherent with the disposal of bulk liquids in landfills are in some manner controlled by 19 States. The following States restrict the disposal of bulk liquids in landfills; Alabama, Arkansas, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Oregon, Rhode Island, South Carolina, Tennessee, Texas, and Wisconsin.

Thirteen States exercise control over the disposal of drummed liquids. The types of control include an outright ban, "strongly discouraging" the practice, and allowing such disposal only at a very limited number of sites. The States with these controls are: Alabama, Georgia, Illinois, Indiana, Iowa, Kansas, Maryland,

Mississippi, Missouri, Oklahoma, Oregon, Rhode Island, South Carolina, and Texas.

There are six States where empty containers are crushed prior to landfilling. The crushing may be required or it may be done by custom. The States are: Kansas, Kentucky, Louisiana, South Carolina, Texas, and Wisconsin.

Seven other States have adopted controls similar to the procedures proposed in December 1978. The procedures call for triple rinsing or handling the empty containers as a hazardous waste. These States are: Georgia, Illinois, Iowa, Michigan, Minnesota, Oklahoma, and Utah.

An additional eight States exercise other controls. These range from not allowing the containers at landfills to requiring separate burial. The eight States are: Arkansas, Connecticut, Indiana, Massachusetts, Mississippi, Rhode Island, Tennessee, and Washington.

Summaries of the information on the various State programs is attached.

Dictionary Definitons:

These conventional definitions distinguish between gas, liquid, and solid, and between liquid and fluid.

liquid[1] - adj.- readily flowing; fluid.

- n.- a substance that, unlike a solid, flows readily but unlike a gas, does not tend to expand indefinitely.

liquid refers to a substance that flows readily and assumes the form of its container but retains its independent volume (water that is neithor ice nor steam is a liquid); fluid applies to any substance that flows (all liquids, gases, and viscous substances are fluids).

fluid[1] - adj. - that can flow; not solid; able to move and change shape without separating when under pressure.

- n. - any substance that can flow; liquid or gas.

viscous[1]- adj.- in physics, having viscosity.

viscosity[1]- n.- in physics: (a) the internal fluid resistance of a substance, caused by molecular attraction, which makes it resist a tendency to flow; (b) the property of a solid yielding steadily before a constant stress.

fluid[2] - n. - substances that exist as a continuum characterized by low resistance to flow and the tendency to assume the shape of its container.

1 - Webster's New World Dictionary of the American Language, College Edition, The World Publishing Company, 1968.

2 - The American Heritage Dictionary of the English Language,

CURRENT STATE PRACTICES AND REGULATORY POLICIES FOR HAZARDOUS WASTE LIQUIDS

Areas of Interest	Arkansas	Connecticut	Florida	Georgia	Illinois
Current status of state regulations for ground disposal of hazardous waste liquors (on-site and off-site).	No regulations - maybe by 6/80, follow RCRA.	No regulations. Some guidelines. Regulations may be available in 6-9 months.	No regulations. Legislation should be passed in 1980. Most liquid waste (62%) discharged to sewers.	No regulations - will deviate from RCRA in not allowing ground disposal of HWL in drums.	Regulations in place 4/1/80, for off-site. Fee system for industry to landfill.
Existence of disincentives (formal and informal) for ground disposal of hazardous waste liquid.	Formal permit system will be used.	Siting bill is being considered.	Formal permit system will be drafted following RCRA.	Informal policy of recycling or sent out of state.	Formal permit system.
State definitions of hazardous waste liquids.	Will follow RCRA, degree of hazard based on LD_{50}.	Liquid-pumpable, flowable; sludge-plastic, flowable, non-pumpable. Will follow RCRA.	None, will follow RCRA.	None, will follow RCRA.	If it doesn't move, it's a solid. Will follow RCRA when final.
Current practices regarding ground disposal of hazardous waste liquids.	Land disposal currently prohibited.	Not allowed except for bulk metal sludges in cells at 11-12 approved municipal sites.	Hazardous waste survey (mostly liquid) 62% to sewers, 32% bulk on-site, 1% landfill, 3% private hauler, 2% other.	Plan to require a mixture of bulk HWL. No drums. Currently most HL are sent out of state.	Landfills are authorized based on local geology. Flammable liquids must be drummed. Drum: bulk = 2:3. Drums disposed in lined trenches.
Type of records maintained on amounts and identification of hazardous waste liquids.	All hazardous waste recorded but no distinction between solids and liquids.	Not yet applicable. Currently making a survey.	No records are maintained.	Industrial facility reports; no manifests, yet.	Manifest system on computer.
Known accidents or incidents related to land disposal of hazardous waste liquids.	None.	Not known.	Fish kill possibly due to leaching.	Unauthorized disposal of pesticide drums led to fire and hospitalization of three firemen.	Minor fire at landfill in 1978.
Current procedures for handling empty drums at landfills	Presently prohibited. Intend to have a fee system to discourage use.	Not Allowed.	None.	Pesticide drums may be rinsed and recycled. Others may be reconditioned or disposed as hazardous waste.	Triple rinsed and recycled or disposed as hazardous waste.

Areas of Interest	Indiana	Iowa	Kansas	Kentucky	Louisiana
Current status of state regulations for ground disposal of hazardous waste liquors (on-site and off-site).	No regulations. May be available by 7/81. Present practices based on 1974 Hazardous Waste Act.	No regulations - will be final 30 days after RCRA is published.	Temporary regulations, will eventually conform to RCRA	No regulations. Use EPA guidelines. Mostly off-site.	Regulations in effect as of 8/1/79. Follow RCRA.
Existence of disincentives (formal and informal) for ground disposal of hazardous waste liquid.	Permit system for on- and off-site.	Formal permit system will be adopted. Special waste authorization papers currently required.	None, other than on-site permit system requiring pond liners, soil tests for percolation, etc.	Site approval by state and local government. Local tax is being proposed.	Fee system (per ton) is being drafted.
State definitions of hazardous waste liquids.	"Any liquid waste is hazardous," use RCRA in state statute.	"Industrial waste" currently in use.	None, will follow RCRA.	None, will follow RCRA.	Follows RCRA.
Current practices regarding ground disposal of hazardous waste liquids.	Most BWL is treated, or drummed for shipment out of state. Some bulk liquids landfilled with pretreatment or mixing.	Currently case by case review and permit system. Drums disposed in separate areas of landfill.	Only one state permitted facility (evap. lagoons and land burial). Bulk: Drummed > 2:1	No permitted landfills for liquid hazardous waste. Off- and on-site subject to same permit system and treatment of liquids.	Landfilling permitted; criteria for liners and wells. Encapsulation and burial and deep well injection are primary methods. Drum: bulk >1:1. On- and off-site monitoring.
Type of records maintained on amounts and identification of hazardous waste liquids.	Only monthly reports on source and amount from shipping papers.	Authorization papers.	Manifest system.	Yes, 1977 survey of hazwd by class, off/on site, where and how disposed.	Manifest system and quarterly reports.
Known accidents or incidents related to land disposal of hazardous waste liquids.	Two cases of fire and equipment loss due to illegal (careless) dumping.	None.	None.	Not known.	Illegal dumping in pond - loss of life.
Current procedures for handling empty drums at landfills.	Not allowed.	Open drums are triple rinsed prior to reuse or disposal as hazardous waste.	May be stored on-site 90 days prior to disposal at one state site. Directly buried or openly crushed and landfilled.	Triple rinsed and recycled or crushed and buried.	Opened, triple rinsed and reused, or crushed and buried or burned.

Areas of Interest	Maryland	Massachusetts	Michigan	Minnesota	Mississippi
Current status of state regulations for ground disposal of hazardous waste liquors (on-site and off-site).	Same as RCRA. Promulgated at same time.	In preparation. Will follow RCRA. Available 5-6 months.	Regulations in effect. Use permit system. Also state PCB law.	No regulations, but HWL disposal in landfill is not allowed.	In preparation. Available about mid-80. Will follow RCRA.
Existence of disincentives (formal and informal) for ground disposal of hazardous waste liquid.	Formal permit system.	When regulations go into effect, will probably contain clause for local board of health approval of new sites.	Formal permit system.	Formal permit system for on-site, no off-site allowed. (Currently one on-site permit.)	Formal permit system will follow RCRA.
State definitions of hazardous waste liquids.	Follows RCRA.	Follows RCRA.	Currently being rewritten, will follow RCRA.	None, will follow RCRA.	Follows RCRA.
Current practices regarding ground disposal of hazardous waste liquids.	Heavy metals must be removed, acids and alkalis must be neutralized prior to ground disposal. No drummed liquids disposed.	Not allowed.	Mostly bulk waste haulers licensed and permitted. Most HWL shipped out of state. Fee system for disposal relative to degree of treatment.	Hazardous waste liquids are not permitted to be disposed off-site; one on-site permit for land disposal. Mostly shipped out of state.	Drummed and bulk, on- and off-site, case-by-case review, no record of volume produced and disposed. Drums landfilled are ≤ 10% of total HWL.
Type of records maintained on amounts and identification of hazardous waste liquids.	Manifest system.	Not applicable.	Records only for liquid industrial wastes.	Shipping papers.	None.
Known accidents or incidents related to land disposal of hazardous waste liquids.	One accident prior to program.	Several well contaminations.	Not known.	None.	None.
Current procedures for handling empty drums at landfills.	Not known.	Not allowed.	Triple rinsing and recycling, or commercially reclaimed or burned.	Treated as hazardous waste, cleaned and reconditioned, or used for one type of waste exclusively.	Buried separately.

Areas of Interest	New Jersey	New Mexico	North Carolina	Oklahoma	Rhode Island
Current status of state regulations for ground disposal of hazardous waste liquors (on-site and off-site).	Ground disposal of HWL not allowed.	Regulations use EPA's definitions. Permits for off-site only.	Regulations exist, follow RCRA. HWL disposed at permitted sites.	1976 law; 1977 regulations for landfills, lagoons, and wells, off- and on-site.	Have regulations - do not follow RCRA. Cover 15 of 17 types of hazardous wastes disposed in secured landfill.
Existence of disincentives (formal and informal) for ground disposal of hazardous waste liquid.	Formal permit system since 1978.	Formal permit system.	Formal permit system, waste screening procedure.	Formal permit system; discourages landfilling of drums.	Formal permit system. High public awareness.
State definitions of hazardous waste liquids.	None, will follows RCRA.	None, will follow RCRA.	None, will follow RCRA.	Use term "controlled industrial waste."	Use 17 categories - 2 highest are not allowed in landfills based on LD_{50}, LC_{50}, flash points, etc.
Current practices regarding ground disposal of hazardous waste liquids.	Minor amount goes to landfill, mostly incinerated or treated. If hazardous waste is not disposed via a water resource it is considered a solid.	On-site, no approval required; bulk HWL in ponds probably most common method. Off-site - shipping out of state.	Permitted landfills, no breakdown on drum vs bulk, survey on 7 SIC codes available. On-site dumping, currently not monitored.	Permits primarily for on-site wells (1 billion lbs. in 1978). 10-15% of total is drummed, mostly landfilled, on- and off-site.	Bulk and drummed HWL disposed under permits. Drummed HWL not allowed in landfill without absorbent material.
Type of records maintained on amounts and identification of hazardous waste liquids.	Manifest system.	Manifest system being implemented.	None.	Manifest system being computer programmed.	Manifest system.
Known accidents or incidents related to land disposal of hazardous waste liquids.	None, but lost five people at incinerator explosion.	Pesticide fire on truck. Fireman without breathing apparatus was killed.	Not known.	Permitted landfill mixed incompatible liquids, NO_x gas formed. No one hurt.	Fire due to illegal handling; "midnight dumping."
Current procedures for handling empty drums at landfills.	Reconditioned and reused or decontaminated by incineration then landfilled or sold for scrap.	Not known.	Large number of commercial recyclers, incineration and surface disposal not monitored.	Triple rinsed and recycled or disposed, or reclaimed.	Treated as hazardous waste (no rinsing required).

Areas of Interest	South Carolina	Tennessee	Texas	Washington	Wisconsin	Utah
Current status of state regulations for ground disposal of hazardous waste liquors (on-site and off-site).	Regulations approved March 1980. Now gearing up to regulate, inspect, etc. On- and off-sites can be approved for HWL.	No regulations but may have by end of year. Emergency law in effect. No landfill disposal allowed.	Have regulations. Follows RCRA. Land disposal allowed at permitted sites.	Proposed regulations on Governor's desk for signature. Disposal allowed under permitted conditions.	Regulations pending. Awaiting final RCRA definitions. 3 approved HWL sites in operation.	No regulations yet. Using EPA guidelines and all decisions on a case-by-case basis.
Existence of disincentives (formal and informal) for ground disposal of hazardous waste liquid.	Formal permit system. Informal policy of allowing landfill as last means of disposal.	Formal permit system for water quality. Others in draft form.	Off-site disposal sites must post security bonds, no drums may be landfilled.	Formal permit system.	Law and penalties similar to RCRA. Enforced on case by case basis.	Draft interim authorization, case by case review, 1 year old program
State definitions of hazardous waste liquids.	"Flowable" will follow RCRA. Sludge is 20% solid.	None, will follow RCRA.	Follows RCRA.	"Extremely hazardous" and "dangerous."	Follows RCRA.	None, "solid waste" follows EPA guidelines.
Current practices regarding ground disposal of hazardous waste liquids.	Liquid must be treated so not flowable, or dissolved with liquid that keeps it from being harmful. Bulk = 75%, drummed = 25%. One secure landfill takes direct disposal of drums.	No landfills for hazardous waste currently allowed in state.	Either placed in injection wells or premixed with soil or clay prior to landfill or landfarm. Landfill operators decide if HWL are adequately treated.	No state approved sites, yet. Currently treat, store, or send out of state. On-site ponding and incineration allowed but not deep well injection.	Case by case review, off-site directed to 1 of 3 state permitted disposal sites, or shipped out of state. On-site certification required.	About 50 permitted landfills plus 150 currently not permitted, take bulk and drummed HWL. Relative amounts unknown. Landfills required to be self-contained.
Type of records maintained on amounts and identification of hazardous waste liquids.	Planning to computerize data.	Only by SIC code.	Manifest system on computer.	Manifest system.	Case files.	No on-site records; voluntary manifest system for off-site.
Known accidents or incidents related to land disposal of hazardous waste liquids.	Not known.	Illegal drum at landfill exploded, injured machine operator.	None.	Explosions of powders in landfill 4 years ago.	None.	Fire which couldn't be traced.
Current procedures for handling empty drums at landfills.	Triple rinsed and recycled or crushed, or incinerated.	Not allowed.	Usually crushed and landfilled.	Not allowed.	Recycled or crushed and disposed.	Rinsed and recycled or reclaimed.

SUMMARY OF STATE DRUMMED LIQUID LANDFILL DIS

State	Hazardous Waste Regulation	Drummed Liquid Landfill Disp
Alabama	Cradle-to-grave regulation to become effective October, 1980.	The State strongly discoura prior fixation. In October be mandatory. The State do industry.
California	Cradle-to-grave.	The State allows for the di quantities of drummed liqui feels that prohibiting drumm cost burdens on the industr
Missouri	Cradle-to-grave regulation to become effective July, 1980.	The State strongly discoura prior fixation and, in July State feels that this prohi practice in-plant and end-o waste landfill space.
Oregon	Cradle-to-grave.	The State prohibits the dis must be emptied and placed ation. Industries in the S portation but the State has
Colorado	No authorizing legislation; however, landfills are regulated.	All liquids are bulk dispos tamination, worker exposure
New York	Hazardous waste facilities are regulated; a manifest system is forthcoming.	A very little amount of dru liquids are treated/recover
Ohio	State is in the process of formulating hazardous waste policy.	No information available.

State	Hazardous Waste Regulation	Drummed Liquid Landfill Disp
Pennsylvania	Cradle-to-grave	The State allows the disposa and the voids grouted. Hist problems with landfills in v
Texas	Cradle-to-grave	The State requires that all to landfilling. At on-site leakage problems have been e