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Part III

Environmental Protection Agency

40 CFR Parts 257 and 258
Solid Waste Disposal Facility Criteria; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 257 and 258

[FRL-3227-7]

Solid Waste Disposal Facility Criteria

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency today is proposing revisions to the Criteria for Classification of Solid Waste Disposal Facilities and Practices set forth in 40 CFR Part 257. These revisions were developed in response to the 1984 Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act (RCRA). This proposed action would amend Part 257 by including information requirements for certain solid waste disposal facilities and by excluding municipal solid waste landfills (MSWLFs) from Part 257. In addition, this action would add a new Part 258, which spells out specific requirements for MSWLFs.

Amended Part 257 would establish notification and exposure information requirements for owners and operators of industrial solid waste disposal facilities and construction/demolition waste landfills. The new Part 258 sets forth revised minimum Criteria for MSWLFs, primarily in the form of performance standards, including location restrictions, facility design and operating criteria, ground-water monitoring requirements, corrective action requirements, financial assurance, and closure and post-closure care requirements.

EPA believes that the provisions in today's proposal are necessary for the protection of human health and the environment and take into account the practicable capability of owners and operators of municipal solid waste landfills. The Agency is requesting comment on the overall approach proposed and on specific components of the proposal.

Today's proposal also is intended to fulfill a portion of EPA's mandate under section 405(d) of the Clean Water Act (CWA) to promulgate regulations governing the use and disposal of sewage sludge. Under today's proposal, Part 258 would be co-promulgated under the authority of the CWA; this authority would apply to all municipal solid waste facilities in which sewage sludge is co-disposed with household wastes. A separate regulation for sludge monofills (landfills in which only sewage sludge is disposed of) is being prepared for future proposal under 40 CFR Part 503.

DATES: Comments on this proposed rule must be submitted on or before October 31, 1988.

Public hearings are scheduled as follows:

(1) October 13, 1988, 9:00 a.m. to 4:30 p.m., at the Sheraton National Hotel, 900 Orme Street, Arlington, VA. 22204, (703) 521-1900.

(2) October 18, 1988, 9:00 a.m. to 4:30 p.m., at the Sheraton Century Center Hotel, 2000 Century Boulevard, NE, Atlanta, Georgia. 30345-3377, (404) 325-0000.

(3) October 20, 1988, 9:00 a.m. to 4:30 p.m., at the Sheraton Anaheim, 1015 West Ball Rd., Anaheim, CA. 92802, (714) 778-1700

(4) October 25, 1988, 9:00 a.m. to 4:30 p.m., at the O'Hare Hilton Hotel, P.O. Box 66414, O'Hare International Airport, Chicago, Illinois. 60666 (312) 686-8000.

The meetings may be adjourned earlier if there are no remaining comments. Requests to present oral testimony should be received by EPA at least 10 days before each public meeting.

A block of rooms has been reserved at the above mentioned hotels for the convenience of individuals requiring lodging. Please make room reservations directly with the hotel and refer to the EPA hearings. The hearing registration will be at 8:00 a.m., with the hearings beginning at 9:00 a.m. and running until 4:30 p.m., unless concluded earlier. Anyone wishing to make a statement at the hearing must notify, in writing, Public Participation Officer, Office of Solid Waste (WH-562A), U.S. Environmental Protection Agency, 401 M Street, SW; Washington, DC 20460. Those wishing to make oral presentations must restrict them to 15 minutes and are encouraged to have written copies of their complete comments for inclusion in the official record.

The Agency is tentatively planning to coordinate these Subtitle D Criteria public meetings with the public meetings on EPA's Draft National Strategy for Municipal Waste which is expected to be issued in the near future. EPA will announce these meetings in a separate FR notice. For information on the strategy please see 53 FR 13316 (April 22, 1988).

ADDRESSES: Commentors must send an original and two copies of their comments to: RCRA Docket Information Center, (OS-305), U.S. Environmental Protection Agency Headquarters, 401 M Street, SW; Washington, DC 20460. Comments should include the docket number F-88-CMLP-FFFFF. The public docket is located at EPA Headquarters (sub-basement) and is available for viewing from 9:00 a.m. to 4:00 p.m., Monday through Friday, excluding Federal holidays. Appointments may be made by calling (202) 475-9327. Copies cost $.15/page.

FOR FURTHER INFORMATION CONTACT: For general information, contact the RCRA/CERCLA Hotline, Office of Solid Waste, U.S. Environmental Protection Agency, 401 M Street, SW; Washington, DC 20460, (800) 424-9346, toll-free, or (202) 382-3000, local in the Washington, DC metropolitan area.

I. Authority

These regulations are being proposed under the authority of sections 1008, 4004, and 4010 of the Resource Conservation and Recovery Act of 1976. Section 1008 directed EPA to publish guidelines for solid waste management, including criteria that define solid waste management practices that constitute open dumping and are prohibited under Subtitle D of RCRA. Section 4004 further required EPA to promulgate regulations containing criteria for determining which facilities are sanitary landfills and which are open dumps. In response, EPA promulgated the "Criteria for Classification of Solid Waste Disposal Facilities and Practices" (40 CFR Part 257) in 1979. Section 4010, added by the Hazardous and Solid Waste Amendments of 1984 (HSWA), directs EPA to revise those Criteria promulgated under sections 1008 and 4004 for facilities that may receive household hazardous waste (HHW) or small quantity generator (SQG) hazardous waste.

For municipal solid waste landfills in which sewage sludge is disposed of together with household wastes, the Part 258 regulations also are being proposed under the authority of section 405 (d) and (e) of the CWA. Section 405 regulates the use and disposal of sewage sludge generated by treatment works treating domestic sewage. Section 405 requires that EPA develop standards for sludge use and disposal, including: An identification of the major use and disposal practices, factors to be taken into account in determining applicable measures and practices for each use or disposal, and concentrations of pollutants that interfere with each use or disposal. When the CWA was amended in February 1987, additional requirements were added to section 405. Congress directed EPA to identify toxic pollutants that may be present in sewage sludge in concentrations that may adversely affect public health and the environment and to establish numerical limitations and management practices for each identified pollutant for each use of disposal option. The numerical limitations and management practices are to be adequate to protect public health and the environment from any reasonably anticipated adverse effects of each pollutant. Further, the amendments require that these section 405(d) sludge standards be implemented through National Pollutant Discharges Elimination System (NPDES) permits issued to publicly owned treatment works (POTWs) or other treatment works treating domestic sewage unless the standards have been included in a permit issued under RCRA Subtitle C; the Safe Drinking Water Act; the Marine Protection, Research and Sanctuaries Act; the Clean Air Act; or a State permit where the State program has been approved as ensuring compliance with section 405. In addition section 405(e) prohibits any person from disposing of sludge from a POTW or other treatment works treating domestic sewage except in accordance with the section 405(d) regulations.

II. Background

Subtitle D of RCRA establishes framework for Federal, State, and local government cooperation in controlling the management of nonhazardous solid waste. The Federal role in this arrangement is to establish the overall regulatory direction, to provide minimum standards for protecting human health and the environment, and to provide technical assistance to States for planning and developing environmentally sound waste management practices. The actual planning and direct implementation of solid waste programs under Subtitle D, however, remain State and local functions.

Section 405(d)–(f) of the CWA establishes a comprehensive framework for regulating the use and disposal of sewage sludge. Section 405(d) provides for the Federal promulgation of numerical limitations and management practices governing the use and disposal of sludge. Section 405(e) provides for Federal enforcement of these standards. Section 405(f) requires the implementation of these regulations through permits issued to POTWs under section 402 of the CWA, unless they have been included in a permit issued under Subtitle C of RCRA or other authority listed in that section. The permits are to be issued by EPA or by a State with a program that has been approved as ensuring compliance with section 405 of the CWA.

A. Current Subtitle D Criteria

Under the authority of sections 1008(a)(3) and 4004(a) of RCRA, EPA promulgated the "Criteria for Classification of Solid Waste Disposal Facilities and Practices" (40 CFR Part 257) on September 13, 1979. EPA issued minor modifications to these Criteria on September 23, 1981. These Subtitle D Criteria establish minimum national performance standards necessary to ensure that "no reasonable probability of adverse effects on health or the environment" will result from solid waste disposal facilities or practices. A facility or practice that meets the Criteria is classified as a "sanitary landfill"; a facility failing to satisfy any of the Criteria is considered an "open dump" for purposes of State solid waste management planning. State plans developed under the "Guidelines for Development and Implementation of State Solid Waste Management Plans" (40 CFR Part 256) must provide for closing or upgrading all existing "open dumps" within the State.

The existing Part 257 Criteria include general environmental performance standards addressing eight major topics: Floodplains (§ 257.3–1), endangered species (§ 257.3–2), surface water (§ 257.3–3), ground water (§ 257.3–4), land application (§ 257.3–5), disease (§ 257.3–6), air (§ 257.3–7), and safety (257.3–8). The following briefly summarizes these provisions.

Section 257.3–1 specifies that facilities or practices in floodplains shall not interfere with the floodplain or result in washout of solid waste so as to pose a hazard to human life, wildlife, or land or water resources. Section 257.3–2 prohibits solid waste disposal facilities and practices that cause or contribute to the taking of any endangered or threatened species or result in the destruction or adverse modification of the critical habitats of such species. The surface water provision, § 257.3–3, specifies that disposal facilities shall not cause a discharge of pollutants or dredged or fill material to waters of the United States that is in violation of section 402 or 404 of the CWA. Section 257.3–4 lays out the ground-water protection standards, which require that facilities and practices not exceed the Safe Drinking Water Act maximum contaminant levels (MCLs) in an underground drinking water source beyond the solid waste unit boundary or beyond an alternative boundary specified by the State.

Section 257.3–5 requires that a facility or practice meet certain restrictions with respect to the concentrations of cadmium and polychlorinated biphenyls (PCBs) contained in waste applied to land used for producing food chain crops. Section 257.3–6 specifies that waste disposal facilities and practices must institute appropriate disease vector controls, such as periodic application of cover material. In

addition, § 257.3–6 requires pathogen reduction processes for sewage sludges and septic tank pumpings applied to land.

The air criterion in § 257.3–7 prohibits open burning of solid waste (with certain exceptions) and specifies that the applicable requirements of the State Implementation Plans developed under section 110 of the Clean Air Act must be met. Finally, the safety provisions of § 257.3–8 require control of explosive gases, fires, bird hazards to aircraft, and public access to the facility.

Currently, EPA does not have the authority to enforce these existing Part 257 Criteria directly, except in situations involving the disposal or handling of POTW sludge. Federal enforcement of POTW sludge handling facilities is authorized under the CWA. The existing Criteria, as they apply to non-sludge-handling facilities, are enforced by the States through State regulatory programs or by citizens through the citizen suit provisions of section 7002 of RCRA.

B. Hazardous and Solid Waste Amendments of 1984

In 1984, Congress made significant modifications to Subtitle D of RCRA through the Hazardous and Solid Waste Amendments. As described below, the major modifications to Subtitle D include requirements that EPA complete a Subtitle D study and revise the Part 257 Criteria, and that States implement revised permitting programs.

1. Subtitle D Study and Report to Congress

HSWA added a new section 4010 to RCRA, which requires EPA to "conduct a study of the extent to which the guidelines and Criteria under this Act (other than guidelines and Criteria for facilities to which Subtitle C applies) which are applicable to solid waste management and disposal facilities * * * are adequate to protect human health and the environment from ground water contamination." This study is to include a detailed assessment of the adequacy of the Criteria regarding monitoring, prevention of contamination, and remedial action for protecting ground water and also is to identify "recommendation with respect to any additional enforcement authorities which the Administrator, in consultation with the Attorney General, deems necessary." EPA anticipates submitting a Report to Congress on the results of the study shortly.

2. Criteria Revisions

Section 4010 also required EPA to revise the Subtitle D Criteria by March 31, 1988, for facilities that may receive household hazardous waste or hazardous waste from small quantity generators. These revisions must be those necessary to protect human health and the environment, but, at a minimum, should require ground-water monitoring as necessary to detect contamination, establish location standards for new or existing facilities, and provide for corrective action, as appropriate. Section 4010 further states that EPA may take into account the "practicable capability" of facilities to implement the Criteria. Today's proposal represents the first phase of the Agency's promulgation of these mandated revisions.

3. Implementation and Enforcement

HSWA amended section 4005 of RCRA to require States to establish by November 8, 1987, a permit program or other system of prior approval to ensure that facilities that receive HHW or SQG hazardous waste are in compliance with the existing Part 257 Criteria. Within 18 months of promulgation of revised Criteria, each State must modify its permit program to ensure compliance with the revised Criteria. If the Administrator determines that a State has not adopted an adequate permit program, EPA may enforce the revised Criteria at facilities that may receive HHW or SQG waste.

C. Current Sewage Sludge Criteria

The existing Part 257 Criteria discussed above were co-promulgated under the joint authority of RCRA and section 405(d) of the CWA. The Part 257 regulations thus apply to all sludge land disposal practices, except distributing and marketing sludge. Because these regulations apply to sewage sludge, they are directly enforceable by EPA against any person found to be in violation of them.

In February 1987, Congress enacted the Water Quality Act of 1987, which amended portions of the CWA, including section 405. First, Congress expanded section 405(d) to impose new standard-setting requirements with associated deadlines. Second, Congress established new sludge permitting requirements in section 405(f) along with State program requirements. EPA currently is developing sludge regulations to be proposed under section 405(d) and published in 40 CFR Part 503. In addition, EPA already has published a proposed regulation in 40 CFR Part 501 that would implement the requirements of section 405(f) (53 FR 7642, March 9, 1988). The comment period for these latter regulations closed on May 9, 1988.

The Part 503 regulations, when promulgated, will address the incineration, ocean disposal, land application, and distribution and marketing of sludge. Lastly, and most relevant here, they also will regulate sludge monofills, which are landfills in which only sewage sludge is disposed of (i.e., no other type of solid waste is co-disposed of with the sewage sludge). Those regulations will not, however, contain regulations for the co-disposal of sewage sludge with household wastes. Regulations for the co-disposal of sewage sludge and household wastes, rather, are part of today's proposal. By this action, the Agency seeks to achieve consistency in its regulation under two legal authorities of a single disposal practice—the co-disposal of sewage sludge and other solid wastes in municipal solid waste landfills.

III. Nature and Scope of the Problem

To fulfill its responsibilities under HSWA, EPA has conducted a series of studies and analyses of solid waste characteristics, waste disposal practices, and environmental and public health impacts resulting from solid waste disposal. Preliminary results of these studies were summarized in the "Subtitle D Study Phase I Report," issued in October 1986 (Ref. 34). Final results, which form the basis for Agency decision making for this rule, are incorporated in EPA's Subtitle D report to Congress, which is expected to be issued shortly. The key studies pertinent to today's proposal are summarized below. Copies of the reports mentioned below are available for public review in the docket for this rulemaking.

A. EPA Studies of Solid Waste Management

1. Analysis of Solid Waste Characteristics

To analyze the characteristics of solid waste, EPA conducted numerous studies to determine the volume, characteristics, and management methods of wastes regulated under Subtitle D. These studies revealed that more than 11 billion tons of solid waste are generated each year, including 7.6 billion tons of industrial nonhazardous waste (which includes about 55.8 million tons of electric utility wastes), 2 to 3 billion tons of oil and gas waste (including both drilling wastes and produced wastes), more than 1.4 billion tons of mining waste, and nearly 160 million tons of municipal solid waste.

Several Subtitle D wastes currently are being addressed under separate Agency efforts and thus were not

examined in detail in EPA's Subtitle D study. In particular oil and gas wastes, utility wastes, and mining waste have been the subject of special studies conducted under section 8002 of RCRA and are being considered separately for rulemaking. In addition, the Agency currently is closely evaluating, in a separate effort, the characteristics and management practices for municipal waste combustion ash. Thus, the following discussion focuses on the characteristics of municipal solid waste, household hazardous waste, and small quantity generator hazardous waste, which are the primary waste streams addressed by today's proposal, as well as industrial solid waste.

In 1986, EPA sponsored a study entitled "Characterization of Municipal Solid Waste in the United States, 1960 to 2000" (Ref. 16). This study examined the quantity and composition of municipal solid wastes and forecast the characteristics of municipal solid wastes in the U.S. through the end of the century. The study found that, on average, more than 50 percent of municipal solid waste comprises paper, paperboard, and yard wastes; nearly 40 percent is metals, food wastes, and plastics; and the remaining 10 percent is wood, rubber, leather, textiles, and miscellaneous inorganics. Waste composition was found to be highly site-dependent and influenced significantly by climate, season, and socioeconomic factors. The study determined that approximately 150 million tons of municipal solid waste were generated in 1984 (of which more than 126 million tons were landfilled) and that the waste volume was expected to increase significantly by the end of the century. EPA recently completed an update to this study entitled, "Characterization of Municipal Solid Waste in the United States, 1960–2000 (Update 1988)" (Ref. 17). This update estimated that 158 million tons of municipal solid waste were generated in 1986.

In October 1986, EPA published "A Survey of Household Hazardous Wastes and Related Collection Programs," which analyzed the existing information on characteristics of HHW and reviewed HHW collection programs (Ref. 30). This study indicated that common discarded household products, such as household cleaners, automotive products, paint thinners, and pesticides, may contain hazardous wastes that are either listed under Subtitle C or exhibit one or more hazardous characteristics. Household wastes, including HHW, currently are exempt from regulation under Subtitle C of RCRA.

A third study, "Summary of Data on Industrial Nonhazardous Waste Disposal Practices," compiled available data on industrial solid waste characteristics and land disposal practices in 22 major manufacturing industries (Ref. 29). This study estimated that roughly 390 million metric tons of industrial nonhazardous waste are generated by these industries each year, that 35 percent of these wastes are managed on site, and that 75 percent of these wastes are generated by four industries: Iron and steel, electric power generation, industrial inorganic chemicals, and plastics and resins. Additional information on industrial nonhazardous waste quantities was provided by the Industrial Facility Screening Survey (Ref. 35), which estimated that approximately 7.6 billion tons of industrial nonhazardous wastes are generated each year. The survey is described in more detail below.

In 1985, EPA also conducted the "National Small Quantity Generator Survey," which characterized SQG waste volumes and disposal practices (Ref. 14). (For purposes of this study, SQGs were defined as those operations yielding less than 1,000 kilograms of hazardous waste per month.) This survey indicated that SQGs annually produce 940,000 metric tons of hazardous waste, consisting largely of lead-acid batteries, solvents, and strongly acidic or alkaline wastes. Furthermore, the survey found that solid waste disposal facilities, including MSWLFs, are the second most frequent destination for SQG hazardous waste shipped off site. EPA estimates that MSWLFs may receive from 5 percent to 16 percent of the SQG hazardous waste produced.

Existing information on MSWLF leachate, summarized in the background document on MSWLF leachate quality (Ref. 8), indicates that leachate from MSWLFs generally contain a wide range of inorganic and organic hazardous constituents in varying concentrations. Landfill gas comprises 50 to 60 percent methane, 40 to 50 percent carbon dioxide, and less than 1 percent hydrogen, oxygen, nitrogen, and other trace gases.

2. Review of Waste Disposal Practices

EPA conducted numerous studies to gather existing information on the numbers of Subtitle D facilities, facility design and operating characteristics, leachate and gas characteristics, and environmental and human health impacts associated with different types of facilities. EPA relied on several key sources of information on the number and design and operating characteristics of Subtitle D facilities for this proposal. The first major source was an EPA mail survey of State solid waste management programs conducted in 1985 to gather information on State Subtitle D programs and facilities. The final report on the survey, "Census of State and Territorial Subtitle D Nonhazardous Waste Programs" (State Census), was issued in 1986 (Ref. 46).

The State Census indicated that there are about 227,000 Subtitle D disposal facilities, excluding waste piles (which were not included in the survey). This total includes approximately 16,500 landfills, 191,500 surface impoundments, and 19,000 land application units. In addition, the State Census indicated that there are more than 145,000 oil and gas waste or mining waste facilities, which EPA is addressing in separate efforts.

The States estimated that roughly 37,000 Subtitle D facilities (or 16 percent of all the facilities) may receive hazardous wastes from households or from small quantity generators. The States' estimate of 16,500 landfills included approximately 9,300 MSWLFs; however, the States subsequently identified errors in the numbers reported for MSWLFs and submitted revised figures. These revised State figures and the results from EPA's 1986 municipal solid waste landfill survey, which was a random sample of approximately 1,250 MSWLFs nationwide, indicate that there are a total of 6,034 MSWLFs (as of 1986). The MSWLF survey also provided detailed information on MSWLF design and operation.

In developing this rule, EPA also utilized the results of an industrial facility screening survey, which involved a telephone screening of nearly 30,000 establishments in 22 industries. The primary purpose of this screening survey was to provide EPA with basic information on the universe and characteristics of industrial solid waste disposal facilities.

In general, information on Subtitle D disposal facilities is limited, except for MSWLFs. While new MSWLFs are expected to be better located, designed, and operated, the following observations can be made regarding the universe of existing MSWLFs. According to the State Census, MSWLFs are distributed throughout the country, occurring in virtually every hydrogeologic setting, and generally concentrated near more populated areas; they are owned predominantly by local governments (80 percent), with the remainder owned by private entities (15 percent), the Federal Government (4 percent), and State governments (1 percent). Approximately 42 percent are

small (less than 10 acres) and 52 percent dispose of small amounts of waste (less than 17.5 tons per day); only 15 percent are designed with liners (natural or synthetic) and only 5 percent have leachate collection systems. Current data also indicate that only 25 to 30 percent of MSWLFs have some type of ground-water monitoring system. Results from the 1986 MSWLF survey generally are consistent with these results.

3. Assessment of Impacts

Impacts associated with MSWLFs and industrial Subtitle D facilities are described below. Existing data indicate that some MSWLFs are adversely affecting the environment and could harm human health. Industrial solid waste facilities need to be examined more closely to determine their impacts.

a. Municipal Solid Waste Landfills. State inspection data, case study evidence, risk characterization studies, waste and leachate characteristics, and the current limited use of design controls indicate that some MSWLFs have degraded the environment and that this degradation could continue. Older landfills are of most concern because they may have received large volumes of hazardous waste and, in general, their use of design controls was very limited; however, existing data are not sufficient to conclusively demonstrate that MSWLFs currently are harming human health, other than data indicating acute impacts associated with methane releases. Current human health impacts from past exposure to contaminant releases from MSWLFs are difficult to isolate due to the complex interaction of factors that affect human health. However, the Agency's recently completed risk assessments indicate that MSWLFs present future potential risks to human health.

More than 500 MSWLFs, or about 25 percent of MSWLFs with ground-water monitoring systems, were reported by States to be violating a State ground-water protection standard, although the nature and extent of these violations are unknown. In some States, any detectable degradation of the ground water is considered a violation. Most facilities do not monitor for organic hazardous constituents in ground water, so these violations represent analyses for a limited set of pollutants. States also reported that 845 MSWLFs were cited for air-related violations (many of which are likely to be odor-related incidents), and 660 MSWLFs were cited for surface water contamination. Some of these violations may have been reported at sites established before existing State and Federal regulations were in place.

EPA has summarized case study information documenting ground-water and surface water contamination incidents (Ref. 7). Evaluation of 163 MSWLF case studies revealed ground-water contamination at 146 facilities and surface water contamination at 73 facilities. For most of these landfills, information on the waste received either was not available or was incomplete, although a limited number are known to have received hazardous waste before the Subtitle C regulations were issued. At about 50% of the facilities with ground-water contamination, specific contaminants were identified. The most common constituents were iron, chloride, manganese, trichloroethylene, benzene, and toluene. At several sites, drinking water sources were contaminated. Ground-water contaminant plumes characterized at three of the sites extended to (or nearly to) the base of an aquifer at depths of approximately 70 feet (at two sites) and 300 feet (at one site).

The plume from one site migrated one-half mile downgradient of the landfill, while the plume at another site migrated almost one and one-half miles downgradient.

Typically, those facilities causing ground-water contamination were more than 10 years older than facilities reporting no impacts. Ground-water impacts appeared to be more severe in locations characterized by high net infiltration rates and high ground-water flow rates. Most facilities that had contaminated ground water were located close to the ground-water table, underlain by highly permeable soils, or had no or very limited engineering controls. The case study information identifies several factors that may be related to failure at a particular facility, specifically the landfill's age, location, and engineering design; however, it is unknown whether this sample is representative of the universe of MSWLFs, and it is not possible to isolate the specific factors responsible for each failure.

Analysis of damage cases involving methane indicates that methane must be controlled to protect human health. Methane is produced in MSWLFs through anaerobic decomposition of organic waste and is explosive at sufficiently high concentrations (the lower explosive limit). Existing Federal regulations require that the concentration of explosive gases should not exceed 25 percent of the lower explosive limit in facility structures and should not exceed the lower explosive limit at the facility boundary. Methane is produced in such abundance that methane collection projects are in place at approximately 100 landfills for the primary purpose of resource recovery and energy production. Where methane is not controlled, fires and explosions have occurred. In 23 of 29 damage cases studied, methane has been measured in concentrations above the lower explosive limit at distances up to 1,000 feet off site. Explosions and fires, both on site and off site, have occurred in 20 of the 29 cases, loss of life has been documented in five instances, and injuries have been reported in several others. Most of these sites where injuries or death occurred did not have a landfill gas control system.

EPA also examined the characteristics of landfills on the Superfund National Priorities List (NPL) in May 1986 (Ref. 26). Of the 850 sites listed or proposed for listing on the NPL (in May 1986), 184 sites (22 percent) were identified as MSWLFs. In addition, of the 27,000 sites in the Superfund data base, almost one fourth are MSWLFs. In general, the MSWLFs on the NPL were poorly located and designed. Because most of the NPL sites were in operation before 1980 (the effective date of EPA's hazardous waste rules) and may have received hazardous wastes in addition to Subtitle D wastes, they are not representative of newer, better designed and operated MSWLFs; however, these sites indicate the extent to which older and poorly located, designed, and managed landfills can harm the environment. Current data indicate that 70 percent of existing MSWLFs were in operation prior to 1980.

The State data, case study information, and NPL study were supplemented by a risk assessment of MSWLFs (Ref. 10). The risk assessment was completed using the Subtitle D Risk Model, which was developed to evaluate the risks and resource damage associated with ground-water contamination at MSWLFs and to identify the factors that affect the nature, extent, and severity of environmental impacts from these facilities. The model simulates pollutant release, fate, and transport; exposure; impacts; and corrective action. The model is described in more detail in Section XI of this preamble.

Caveats to the risk and resource damage analysis results presented in the risk assessment need to be recognized. First, the risk and resource damage modeling includes considerable uncertainty. The model components that introduce the most uncertainty are those that predict leachate quality for trace

organics, the probability and consequences of containment system failure, and the human health risk resulting from exposure to toxic substances (e.g., the dose-response models). Second, the model estimates effects from new landfills, but does not analyze the risk and resource damage impacts from existing facilities.

The risk analysis estimates the human health risk for the maximum exposed individual (i.e., the mean of the average lifetime risk over the 300-year modeling period of the facility) and the total population using ground water as a drinking water source within one mile of the facility. Current data indicate that 54 percent of existing MSWLFs have no downgradient drinking water wells within one mile, a finding that strongly influences model results because current data and model limitations do not allow the risk to be estimated at facilities with drinking water wells beyond one mile. Thus, under this model, such facilities are considered to pose no risk.

Using the well distribution indicated by the MSWLF survey (i.e., no drinking water wells located within one mile of 54 percent of the landfills), the risk model estimates that, in the baseline, fewer than 1 percent of MSWLFs pose risk greater than $1\times10_{-4}$ (i.e., an exposed individual would have a greater than one in ten thousand chance of contracting cancer in his or her lifetime as a result of the exposure), 5.5 percent pose risk in the $1\times10_{-5}$ to $1\times10_{-4}$ range, and 11.6 percent pose risk in the $1\times10_{-6}$ to $1\times10_{-5}$ range. Overall, approximately 17 percent of MSWLFs pose risks greater than $110\times_{-6}$. Out of the eight leachate constituents modeled, the three principal constituents contributing to human health risk are vinyl chloride, 1,1,2,2-tetrachloroethane, and dichloromethane.

For landfills located within one mile of a drinking water well (46 percent of all landfills), 14 percent pose risk exceeding $1\times10_{-5}$, and nearly 40 percent pose risk greater than $1\times10_{-6}$. If future wells are located near existing MSWLFs (or new sites are located near current wells), the overall risk distribution may be closer to the estimates for this subgroup. The overall risk distribution changes significantly if it is assumed that all drinking water wells are located at the facility boundary (assumed to be 10 meters from the landfill unit). Using this conservative scenario, it is estimated that approximately 35 percent would pose risk greater than $1\times10_{-5}$, and about 67 percent of MSWLFs would pose risk exceeding $1\times10_{-6}$.

Because risk is the result of a complex interaction among many factors (some of which have not been accounted for in this analysis), no single factor is responsible for most of the variation. Thus, in addition to well distance, the results of the analysis identified other risk-contributing factors, which include infiltration rate, facility size, and aquifer characteristics. These factors are similar to those identified in the case studies discussed above. More detailed discussion of EPA's risk assessment is provided later in this preamble.

b. Sewage Sludge Disposal in MSWLFs. EPA estimates that approximately 6,800 POTWs dispose of their sludge in MSWLFs. This represents the sludge disposal practice used by 44 percent of all POTWs. The total volume of co-disposed sewage sludge is slightly under 3 million tons per year, which is approximately 40 percent of the volume generated annually by POTWs.

EPA has not performed a separate risk assessment addressing the sludge component of municipal solid waste landfills. Sludge typically is a small component of the landfill (i.e., 5 percent). It is not technically feasible to monitor separately the fate and transport of the sludge and its constituents from the fate and transport of other wastes in the landfill and their constituents. Moreover, while there has been some research on the interaction of sludge and other wastes in a co-disposal situation, there are as yet no definitive results from such work. Therefore, the discussion above on the practices and risks associated with MSWLFs constitutes the best current information on those landfills that receive sludge together with the other wastes.

c. Industrial Subtitle D Facilities. In 1985, about 28,000 industrial solid waste land disposal facilities handled approximately 7.6 billion tons of waste. Although few data on specific health and environmental impacts of these facilities are available, the large volume of waste and number of facilities present concerns about actual and potential threats from these facilities. More than half of these facilities are surface impoundments, which create concerns because of the mobility and physical driving force of liquids in impoundments and the current limited use of design controls. Current data are insufficient, however, to determine the extent of potential problems.

Study results indicate only sporadic use of design and operating controls at industrial solid waste landfills and surface impoundments, with only 12 percent and 22 percent, respectively, employing any type of liner system. Study findings also revealed that few of these facilities have monitoring systems and only 35 percent were inspected by States in 1984, the latest year for which data are available.

Limited data on violations of State requirements, coupled with these statistics on design and operating controls, suggest that releases may be occurring, but more data are needed to determine the impacts of industrial Subtitle D facilities. The notification and exposure information requirements in Part 257 proposed today are a first step toward gathering this information.

B. State Controls on Solid Waste Management

Through the State Census, EPA gathered information on State Subtitle D programs in areas such as organization and resources, regulations and permit programs, and enforcement. In addition, EPA completed a detailed review of State regulations in 1984 (Ref. 25) and a supplemental review in 1987 (Ref. 9). The following is a brief overview of State solid waste regulatory programs.

MSWLFs are the Subtitle D facilities most closely regulated by the States. Most States and Territories impose some set of overall facility performance standards; however, among the States and Territories, specific design and operating standards vary greatly. For example, the 1987 regulatory review determined that 24 States and Territories require liners and 27 States and Territories require leachate collection systems. As of 1984, 28 States and Territories required gas control systems, and 38 specified some sort of run-on/run-off controls. Nearly all allow case-by-case exemptions and variances.

Many States and Territories impose some location standards or restrictions on MSWLFs. These usually include floodplain siting restrictions, which range from prohibitions on siting in the 100-year floodplain to specific design or performance standards for operations within the floodplain to a general directive to avoid sites subject to flooding. Although minimum distances from surface and ground waters and from airports and utility lines sometimes are specified, they too vary widely. For example, prescribed distances from habitable residences vary from 200 feet to three-quarters of a mile and required distances from community water supplies range from 400 feet to one mile.

Thirty-eight States and Territories specifically require ground-water monitoring systems, and an additional 12 States have general authority to impose ground-water monitoring on a site-specific basis. With regard to corrective action, 21 States have requirements in their regulations, while 22 others have general authority to

impose corrective action. Approximately half of the States and Territories require methane gas monitoring and/or surface water monitoring. While most States and Territories have general guidelines or requirements for facility closure and post-closure maintenance requirements, these requirements vary widely in stringency. Finally, some form of financial assurance for closure and post-closure care is required in about half of the States and Territories.

As can be seen from the above information, there are certain gaps in some State and Territorial regulatory programs, which may result in inadequate protection of human health and the environment in some parts of the country. In some cases, the gaps in State and Territorial programs may be linked both to the inadequate implementation of the existing Federal Criteria by certain States and Territories and to the absence of certain key regulatory provisions in the current Federal Subtitle D Criteria themselves. For example, the current Criteria do not require ground-water monitoring or monitoring for methane releases, so MSWLF owners and operators may choose not to install monitoring devices (if the State or Territory does not specifically require them) and thus may not detect problems before significant problems have occurred. The existing Criteria also do not require corrective measures in the event contamination above levels of concern occurs. Furthermore, MSWLF owners and operators are not required to provide continued protection of human health and the environment through effective closure procedures and post-closure care. Agency experience since 1979 in both the hazardous waste regulatory program and response actions under Superfund has confirmed the importance of such preventive measures for long-term protection of human health and the environment.

C. Need for Revisions to the Part 257 Criteria

The evidence briefly described above indicates that MSWLFs, when improperly designed and operated, may present threats to human health and the environment. The evidence further indicates that the Federal Criteria are missing several key regulatory provisions. These provisions include location restrictions, ground-water monitoring, and corrective action, which all are mandated by HSWA. In addition, current data point to the need for the addition of methane monitoring, closure and post-closure care, and financial assurance requirements. The Agency believes that the available data clearly indicate that the current Federal Criteria have not proved adequate to protect human health and the environment and must be revised to ensure such protection.

These revisions to the Subtitle D Criteria come at a time when heightened concern is directed at issues of solid waste management. This concern derives from State, Territorial, and local government difficulties in ensuring adequate capability for municipal solid waste management as well as public concern regarding potential hazards presented by waste disposal facilities. EPA is aware of the crisis in solid waste management and believes that these proposed Criteria revisions should be a major step toward alleviating public concern with respect to inadequate controls on solid waste disposal. In addition, EPA believes these proposed revisions provide States and Territories with the flexibility needed to address the practicable capacity of the regulated community.

IV. Public Participation in This Rulemaking

Given the number and diversity of MSWLFs and the potentially significant impacts that the revised Criteria may have on them, EPA involved the public and private sector in the rulemaking process. This effort included public meetings and outreach activities aimed at encouraging participation in the process.

Since the spring of 1985, EPA has hosted or participated in a series of public meetings, workshops, conferences, and other activities focusing on issues in the Subtitle D program. In August 1985, EPA sponsored a conference explaining the major provisions of the Hazardous and Solid Waste Amendments of 1984 that affected three key RCRA programs—Subtitle D, small quantity generators, and underground storage tanks. During the conference, EPA held workshops on the following Subtitle D issues: 1) Identification of available information and case studies, 2) ground-water monitoring and protection requirements, 3) closure and post-closure care and financial responsibility requirements, 4) waste restrictions and liquids management requirements, and 5) liner and location requirements. The workshops provided a forum for EPA and the participating State and local governments, public interest groups, industry, and trade associations to exchange information and discuss significant regulatory issues.

On June 27, 1986, EPA hosted a public meeting in Washington, DC, on the issues and options being considered for the revisions to the Subtitle D Criteria. At that time, EPA presented the Agency's initial thinking on the revised Criteria, solicited comments, and responded to questions from representatives of States, local governments, public interest groups, and private organizations.

On November 18 to 20, 1986, EPA held a three-day conference in Arlington, Virginia, on solid waste disposal facilities and HHW collection programs. At this conference, EPA presented interim results of the Subtitle D Study, reported on the status of the Subtitle D Criteria revisions, and discussed issues associated with HHW collection programs. Conference participants also made presentations on State regulatory perspectives and public- and private-sector views.

EPA also sponsored a series of policy discussion meetings in 1986 involving high-level representatives of the principal interest groups affected by the Subtitle D program, including State and local governments, citizen and environmental groups, and industry and trade associations. The broad objectives of these meetings, which were coordinated for EPA by the Conservation Foundation, were to examine the effectiveness of the Subtitle D program, identify issues likely to affect implementation of the revised Criteria, and suggest innovative strategies to address problems identified.

V. Scope and Structure of Today's Proposal

The revised Criteria EPA is proposing today vary considerably in scope and content from the current Criteria in Part 257. This section explains the basis for EPA's decisions with respect to the scope and structure of today's proposal.

A. Scope of the Existing Part 257

The existing Part 257 Criteria are applicable to all solid waste disposal facilities and practices regulated under Subtitle D of RCRA. With certain exceptions listed in § 257.1(c), the Criteria apply to all types of facilities (i.e., landfills, surface impoundments, land application units, and waste piles) used for disposal of solid waste, as well as all types of solid wastes (i.e., municipal, industrial, commercial, agricultural, mining, and oil and gas waste) regulated under Subtitle D of RCRA.

Part 257 also applies to the disposal of sewage sludges from POTWs, but the Agency currently is developing specific standards for managing POTW sewage sludge under section 405(d) of the CWA.

problems identified with closed sites. EPA specifically is interested in comments on Federal and State strategies that may be used in addressing these closed MSWLFs.

C. Practicable Capability

The Congressional directive to revise the existing Criteria (§ 4010 of RCRA as amended) states that EPA may consider the "practicable capability" of owners and operators of facilities that may receive HHW or SQG waste in determining what these revisions should entail. Congress recongnized that the universe of owners and operators of solid waste disposal facilities included many with limited economic and technical capabilities. For example, many MSWLFs are owned and operated by small local governments with limited resources. Development of today's proposal, therefore, included an analysis of how the "practicable capability" of owners and operators should be taken into account when setting appropriate controls for protection of human health and the environment.

The Agency believes that practicable capability encompasses both technical and economic components. The technical component includes both the availability of technology for addressing a particular problem (i.e., technical feasibility), as well as the technical capability of the owner or operator to implement that technology. The economic component refers to the economic resources available to the owner or operator to implement the revised standards.

To assist in characterizing the practicable capability of MSWLFs, EPA collected data on waste disposal, demographics, landfill size, and landfill ownership. These data indicate that most MSWLFs handle relatively small volumes of municipal solid waste (measured in tons per day). EPA estimates that 52 percent of all landfills manage less than 17.5 tons per day (TPD) and account for less than 2 percent of the waste handled by all MSWLFs. However, the largest landfills (2.6 percent of all MSWLFs) handle more than 1,125 TPD and manage 40 percent of all municipal landfill waste.

These data also clearly indicate that most MSWLFs are located in rural areas and these MSWLFs typically serve a limited number of communities relative to landfills located in more urban areas. EPA matched 1982 Census data with geographic location data (longitude and latitude coordinates) to determine whether landfills are located in low- (rural) or high- (urban) density counties. EPA estimates that 69 percent of existing landfills are in counties with population densities of fewer than 100 people per square mile, supporting the conclusion that most landfills are located in "rural" areas. In addition, EPA Facility Survey data (Ref. 36) show that, on average, only 1.8 communities share a landfill at the village or town level, but that at the city level, there are 3.8 communities per landfill.

To address the economic component of practicable capability, EPA assessed the financial capability and current spending practices of municipal governments. EPA assembled financial and demographic data from the "1982 Census of Governments" and the "1983 County and City Data Book." Based on the 1982 Census data, EPA estimates that communities typically spend less than 1 percent of their budgets on solid waste disposal. In comparison with other municipal services, costs at this level represent a very small obligation. For example, as an average percentage of total community expenditures, communities spend 36 percent on education, 5 percent on police protection, and 3 percent on sewage disposal. The 1982 Census data also were used to develop a composite score of nine various financial and economic vitality measures. This score categorizes communities' financial capabilities as weak, average, or strong. EPA used the score to assess the baseline financial condition of governments and the economic impact of various regulatory scenarios. The development and categorization of the composite score and the economic impact analysis is described in detail in Section XI of this preamble and in the draft regulatory impact analysis for today's proposal.

EPA believes that significant disruptions of solid waste management could result unless these technical and economic factors are taken into account where necessary. The Agency, therefore examined the range of MSWLFs to determine which, if any, might be especially susceptible to technical difficulties or economic hardship. Owners and operators of two classes of MSWLFs were identified as possible candidates for consideration of practicable capability—existing MSWLF units and small MSWLFs.

EPA estimates that there are more than 6,000 MSWLFs currently in operation. Of these existing facilities, about 20 percent are expected to close before 1990 and almost 75 percent are expected to close within 15 years (Ref. 10). EPA evaluated whether requirements should be the same for these facilities as for new MSWLF units.

Regulating new and existing MSWLF units differently allows consideration of practicable capability of the existing MSWLF, although some problems at existing facilities may not be addressed if these units face less stringent requirements. Regulating new and existing units the same way, while conceptually offering greater assurance of protection, could impose very high costs, creating implementation difficulties and posing the prospect of solid waste management disruptions. Comments that EPA received prior to proposal from States, industry groups, and private firms favored different requirements for new and existing units.

Based on these considerations, EPA is proposing today to vary some requirements for new and existing landfill units. These differences fall in three major areas. First, the majority of the location restrictions proposed today would be applicable only to new landfill units (that is, units that have not received wastes prior to the effective date of the rule). EPA believes the application of today's location restrictions to existing units would result in significant disruption of solid waste management in certain areas of the country. However, existing units would be required to comply with the unstable area restrictions (§ 258.15) because the Agency believes these areas pose particular concerns for protection of human health and the environment.

Second, today's proposal does not require that existing units be retrofitted with liners and leachate collection systems. EPA believes that such a requirement would: (1) Exceed the economic capabilities of the majority of owners and operators of existing facilities, (2) present additional public health problems from the excavation of waste, and (3) disrupt existing solid waste management activities.

Third, today's proposal provides a phase-in period of 18 months for all requirements not only to allow States to put in place revised regulations, but also to provide lead time for owners and operators to comply with the new requirements. Furthermore, additional phase-in time is provided for ground-water monitoring due to the resources needed by States and owners and operators to implement this provision. Detailed discussion of the ground-water monitoring provision is provided in Section IX.E of this preamble.

In today's proposal, EPA has not varied requirements for new and existing units in cases where such requirements are equally feasible, technically and economically, at both new and existing landfill units, except existing facilities would have more time to comply with certain requirements. For

5. Section 258.14 Seismic Impact Zones

Today's proposal would require the owner or operator of a new MSWLF unit in a seismic impact zone to design the unit to resist the maximum horizontal acceleration in hard rock at the site. Seismic impact zones are defined as areas having a 10 percent or greater probability that the maximum expected horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

The National Oceanic and Atmospheric Administration and others have documented structural damages resulting from earthquakes. The potential for damage to MSWLFs from earthquakes can be deduced from similar structures damaged by earthquakes. Such damage includes cracks in foundations and complete collapse of structures. EPA believes that the adverse impact of siting MSWLFs in seismic areas justifies the need for a comprehensive standard to prevent releases from these facilities. Types of failure that may result from ground motion are: (1) Failure of structures from ground shaking; (2) failure of unit components due to soil liquefaction, liquefaction-induced settlement and landsliding, and soil slope failure in foundations and embankments; and (3) landsliding and collapse of surrounding structures. The background document supporting this section of the rule (Ref. 2) provides examples of the potential adverse effects on MSWLFs that may occur in seismic impact zones. The Agency believes that these failures may result in contamination of air, ground water, surface water, and soil. Therefore, in order to protect human health and the environment, all containment structures, including any liners, leachate collection systems, and surface water control systems at new MSWLFs, must be designed to withstand the stresses created by peak ground acceleration at the site from the maximum earthquake based on regional studies and site-specific analyses.

The Agency's proposed requirement translates to a 4-percent probability of exceeding the maximum horizontal acceleration in 100 years. The Agency believes that the areas affected by the proposed "seismic impact zone" requirement represent the areas of the United States with the greatest seismic risk, and, therefore, this proposal would be protective of human health and the environment.

The proposed performance requirement would minimize the risk of slope and liner failure due to seismic activity. By minimizing the risk of failure of the landfill slopes, the potential for exposure of solid waste to the atmosphere and the possible contamination of run-off by contacting exposed solid waste also would be reduced. The Agency further believes that today's proposal would reduce the potential for contamination of ground water beneath the landfill resulting from failure of a liner.

Although § 258.13 of today's proposal would prohibit siting new units on or adjacent to active Holocene faults (faults that have had displacement in Holocene time) to protect against releases of wastes from facility failure due to fault rupture, this standard does not address damage that may occur as a result of earthquake-induced ground motion. Studies indicate that ground motion is more important as a failure mechanism than fault rupture, and not all earthquakes are manifested by surface faulting (Ref. 2). Ground motion resulting from earthquakes without associated surface faulting has been found in some cases to be two or three times that associated with quakes with faulting.

Maps depicting the potential seismic activity across the United States at a constant-probability level have been prepared (U.S. Geological Survey Open-File Report 82–1033). The maps indicate that certain portions of the country are at a higher level of seismic hazard than other areas. For example, portions of the eastern U.S., although not subject to frequent earthquakes, are at a higher level of seismic hazard than portions of the western U.S.

The process of designing earthquake-resistant components may be divided into three steps: (1) Determining expected peak ground acceleration at the site from the maximum quake, based on regional studies and site-specific seismic risk analysis; (2) determining site-specific seismic hazards (e.g., soil liquefaction); and (3) designing the facility to withstand peak ground accelerations. Various methods for accomplishing the above steps are available. Methods appropriate to individual MSWLFs should be selected by the owner or operator, subject to State approval.

While the existing Part 257 Criteria and current Subtitle C requirements do not address seismic impact zones, additional location restrictions for hazardous waste disposal facilities under Subtitle C of RCRA are being developed, and a standard consistent with today's proposal is being considered. The Agency believes that this standard is appropriate for MSWLFs because the concerns relating to failure of containment structures are the same for any landfill regardless of waste type. The Agency requests comment on the approach proposed today.

6. Section 258.15 Unstable Areas

EPA is proposing to require owners and operators of new and existing MSWLF units located in unstable areas to demonstrate to the State the structural stability of the unit. This demonstration must show that engineering measures have been incorporated into the design of the unit to mitigate the potential adverse impacts on the structural components of the unit that may result from destabilizing events.

Structural components include liners, leachate collection systems, final covers, and run-on and run-off collection systems. Facilities located in unstable areas may require extensive repairs and/or corrective action following the occurrence of a natural or human-induced destabilizing event. EPA has reviewed documented events that illustrate the problems of locating waste management units in unstable areas (Ref. 2). The impacts resulting from natural or human-induced destabilizing events observed include rapid dispersion of contaminants over a large area, contamination of municipal water supplies, and seepage of contaminants into basements.

EPA is proposing to define an unstable area as a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of the landfill structural components responsible for preventing releases. These areas could include: (1) Subsidence-prone areas, such as areas subject to the lowering or collapse of the land surface either locally or over broad regional areas; (2) areas susceptible to mass movement where the downslope movement of soil and rock under gravitational influence occurs; (3) weak and unstable soils, such as soils that lose their ability to support foundations as a result of expansion or shrinkage; and (4) Karst terrains, which are areas where solution cavities and caverns develop in limestone or dolomitic materials.

National maps are available that locate Karst terrains and landslide-susceptible areas, but weak and unstable soils and subsidence-prone areas appear to be mapped only individually or at the local level. Thus, identification of existing MSWLFs in these unstable areas, and determination of whether the proposed site of a new MSWLF is in an unstable area, would

take place on a case-by-case basis where geographic delineation of these areas is not available on a national scale.

A detailed description and discussion of each of the types of unstable areas identified is contained in a background document (Ref. 2) and a brief summary of each type and the potential threats to MSWLFs follow.

Subsidence-prone areas are those subject to surface subsidence because of natural subsurface conditions, such as Karst formations, or human-made subsurface activities, such as fluid withdrawal or mining. Subsidence at a facility can result in rupture, deformation, or other damage to liners or final covers that may release waste directly into the environment.

Areas susceptible to mass movements include areas with evidence of ongoing slope failure; areas where a small increase in shear stress or a small decrease in shear strength might cause slope failure; areas where geologically similar locations in the same general areas have failed; and areas in the vicinity of pre-existing slope failures. Susceptibility to mass movement is determined from geotechnical and geologic studies.

"Mass movement" covers a variety of slope failures and rapid movement of materials downslope by gravitational influences including landslides, avalanches, flows, creeps, solifluction, block sliding, or a combination of these. Mass movements are caused by imbalances between the forces of gravity (shear stress) acting on the mass of soil or rock composing the slope and the shear strength of the mass. Human activity and natural events can increase the shear stress acting on the mass and/or reduce the mass' shear strength, thereby causing failure. Human-induced causes of mass movement include, but are not limited to, construction operations, seepage from human-made sources of water, and stormwater drainage. Naturally occurring slope failures may be caused by large volumes of water from intense rains or melting snows, vibrations and shock waves generated by earthquakes, frost and freeze/thaw cycles, or intense drying of soils. Mass movements, whether naturally occurring or induced, can carry a facility downslope, rupture a facility in place, or destroy facility control and monitoring systems.

Weak and unstable soils include unconsolidated deposits subject to differential and excessive settlement. This movement under and around a facility can tear liners, rupture dikes, render leachate collection systems inoperable, and possibly alter the ground-water flow.

Karst terrains are areas underlain by limestone and dolomite and often are characterized by extensive solution cavities, sinkholes, and fractures. Sinkhole formation, which may occur in certain types of Karst terrains, can cause rupture of unit liners and covers and can result in collapse of the facility. Karst terrains also promote more rapid movement of leachate from the landfill due to extensive fractures and secondary porosity. Based on map overlays of Karst areas and MSWLF locations, EPA estimates that 4-percent of all existing MSWLFs are in Karst terrain; however, not all Karst terrains would be considered unstable under today's proposal.

Under the proposed requirement, the owner or operator of a new MSWLF must determine, and demonstrate to the State, that the proposed site is not subject to any of these destabilizing events. This demonstration should be maintained in the facility file by the owner or operator as part of the permit application. The following factors should be considered in determining whether an area is unstable: (1) Soil conditions that may result in significant differential settling resulting in damage and failure of dikes, berms, or containment structures (for example, the presence of expansive clays that expand when wet and shrink when dry); (2) geologic or geomorphologic features such as mass-movement-prone areas, Karst terrains, or fissures that may result in sudden or nonsudden ground movement and subsequent failure of dikes, berms, or containment structures; (3) human-induced features or events (both surface and subsurface) such as areas of extensive withdrawal of oil, gas, or water from subsurface formations or construction operations that may result in sudden or nonsudden ground movement and subsequent failure of dikes, berms, or containment structures; and (4) any other features that historically indicate that a natural or human-induced event may impair the engineered structures of the unit and for which protective measures cannot be designed to withstand the event, such as volcanic activity areas.

EPA is proposing to require this case-by-case determination of instability because of the difficulty of clearly delineating unstable areas on a broad scale. EPA believes that case-by-case decisionmaking allows the soundest analysis under the circumstances. Subtitle C currently does not address unstable areas; however, the Subtitle C rules are being reviewed and standards consistent with today's proposal are being considered. EPA believes that today's standard is appropriate for MSWLFs because the concerns relating to failure of containment structures are the same for any landfill regardless of waste type.

Because failure of existing units as a result of destabilizing events in unstable areas poses potential threats to human health and the environment, the Agency is proposing that units that cannot make the structural stability demonstration be closed over time. In EPA's view, continued operation of such units would only increase the possible contaminant loading on the environment in the event of failure. In recognition of the practicable capability of the owner or operator to secure a replacement site, EPA is proposing that existing units in unstable areas close within five years of the effective date of the rule. Upon closure, the owner or operator of these facilities would not be required to remove the waste from the unit because removal of the wastes involves certain risks, and EPA believes removal of the wastes would be a great burden and expense to owners and operators and would exceed the practicable capability of the regulated community.

EPA has selected five years as a phase-out period based upon the belief that five years is adequate time for proper facility closure and for siting and construction of a new facility in an acceptable location. The activities that EPA expects to occur during this period include hydrogeologic investigations and site selection, land acquisition, and design, permitting, and construction of the new facility. The Agency is unable to estimate the number of facilities that would be affected by this requirement. EPA requests comments on the concept of a phase-out period, the appropriate length of the phase-out period, and the number of facilities affected.

EPA recognizes that, in some cases, it may not be possible to find a suitable site and construct a replacement MSWLF within five years. To address this situation, EPA also is proposing a variance to the required phase-out that would allow the State to extend (but not waive) the five-year period if no "practicable alternative" is available and if the existing MSWLF unit will not pose a substantial risk to human health and the environment. The Agency believes this variance is appropriate and justifiable under section 4010 of RCRA, which allows EPA to consider the "practicable capability" of facilities to comply with the Criteria. The variance would allow for State flexibility to determine the length of the time extension and to require any interim

controls necessary to protect human health and the environment. During the extension period, the owner or operator would be responsible for meeting all other applicable requirements in today's proposal.

In deciding whether to grant a variance, EPA would expect the State to consider whether (1) it currently is not economically feasible to find, develop, and operate a new site; (2) it currently is not logistically feasible to locate a new MSWLF in a more suitable area (e.g., the only suitable property is already developed or is located too far from collection centers); or (3) legal barriers exist to the siting, acquisition, or operation of the landfill in suitable areas (e.g., jurisdictional restrictions do not allow wastes from one municipality to be disposed of in the jurisdiction of another). If such conditions exist, and the risks associated with continued operation during the extended period of time do not pose undue threats to human health and the environment, a variance may be appropriate. A specific risk level is not being proposed because the Agency believes that such a decision is best left to the States, who must weigh the various alternatives.

The Agency recognizes that States may interpret the above criteria in various ways, and that decisions may be based on site-specific conditions. The Agency believes that this is appropriate, since the States are in a better position than EPA to determine whether a specific facility should be granted an extension.

Although it may be difficult to site a new MSWLF within the proposed five-year period, EPA does not intend that States grant unlimited time extensions to units located in unstable areas. Various alternatives, such as regionalization of disposal facilities, recycling and source reduction, municipal waste combustion (i.e., incineration), and the use of transfer stations, are available to manage wastes. These alternatives can be used to overcome environmental, logistical, legal, or economic barriers to siting new landfills.

EPA requests comments on whether other location restrictions such as these or others in addition to those proposed today should be imposed for MSWLFs.

C. Subpart C—Operating Criteria

The requirements of this Subpart would apply to all new and existing MSWLFs. These requirements address day-to-day activities, such as application of daily cover (necessary to reduce immediate threats to public health), and long-term activities, such as post-closure care (necessary to minimize or eliminate the possibility of the release of contaminants to the environment).

1. Section 258.20 Procedures for Excluding the Receipt of Hazardous Waste

Section 258.20 of today's proposal would require the owner or operator of an MSWLF to implement a program to detect and prevent attempts to dispose of hazardous wastes (regulated under Subtitle C of RCRA) and PCB wastes at the facility (regulated under the Toxic Substances Control Act). EPA does not intend for this regulation to limit the legal disposal in MSWLFs of very small quantity generator (VSQG) hazardous waste (hazardous waste generated at a rate of less than 100 kg per month), certain wastes containing PCBs at concentrations less than 50 ppm, and empty pesticide containers that have been properly rinsed in accordance with the label instructions as specified under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and regulations in 40 CFR Part 165. Today's proposal also does not restrict the disposal in MSWLFs of HHW, which is exempt from EPA's hazardous waste rules; however, the Agency strongly endorses HHW collection programs and recommends the management of collected HHW in hazardous waste management facilities.

With regard to the disposal of PCBs, regulations promulgated under the Toxic Substance Control Act (TSCA) specify MSWLF disposal as proper for limited categories of PCB materials. Such materials include drained PCB-contaminated electrical equipment (i.e., equipment that formerly contained 50 to 500 ppm of PCBs in dielectric fluids), drained hydraulic and heat transfer equipment, and "PCB articles" (see 40 CFR 761.3 and 761.60(b)(5)) that previously contained 50 to 500 ppm of PCBs and that have been drained of free-flowing liquids. Most significantly, TSCA disposal regulations generally allow the disposal in MSWLFs of "small capacitors" that contain less than three pounds of PCB dielectric. These small capacitors frequently are found in fluorescent light ballasts, high-intensity discharge lighting power supplies, and a variety of consumer appliances, such as microwave ovens and air conditioners.

Measures that MSWLF owners and operators must incorporate in their programs to exclude receipt of hazardous waste include, at a minimum, random inspections of incoming loads, inspection of suspicious loads, recordkeeping of inspection results, training of personnel to recognize hazardous waste, and procedures for notifying the proper State authorities if a regulated hazardous waste is found at the facility. The State may require additional program elements.

The random load checking program is a crucial deterrent to illegal disposal. Such a program might include designation of an inspector to examine several random loads throughout facility operations. The loads could be discharged at a designated location separate from landfilling operations, broken down with hand tools, and visually inspected for indications that suspicious containers may hold Subtitle C hazardous wastes. The rule could require that records be kept of each load inspection. The records should include the date, time, name of the hauling firm, driver, source of the waste, vehicle identification numbers, and all observations made by the inspector.

Each MSWLF would be required to train all necessary personnel to identify potential sources of Subtitle C hazardous wastes. At a minimum, this should include supervisors, spotters, designated inspectors, equipment operators, and weigh station attendants. The training should emphasize familiarity with containers and labels typically used for hazardous wastes and other hazardous materials. If Subtitle C hazardous waste is found in any load inspected, or otherwise found at the facility, the owner or operator should promptly notify the State. The owner or operator should cordon off the area where the material was deposited and make efforts to carry out proper cleanup, transport, and disposal of the material at a permitted hazardous waste management facility.

In developing this proposal, EPA considered specifying the program in detail, delineating all activities and procedures needed to exclude hazardous waste. The Agency decided against a strictly defined program because each landfill will receive different amounts of waste that could contain questionable material. Today's proposal gives States and MSWLF owners and operators flexibility in implementing this requirement.

2. Section 258.21 Cover Material Requirements

EPA proposes to strengthen the cover material criterion imposed under § 257.3–6 of the existing Subtitle D Criteria to require the application of suitable cover material at the end of each operating day, or at more frequent intervals, if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging. MSWLFs receive wastes that consist of a wide variety of materials. In particular, such facilities

receive wastes that contain putrescible materials. As discussed in the background document for this section of the proposal (Ref. 3), the disposal of such materials in MSWLFs results in conditions conducive to the harborage of rodents and other disease vectors. EPA is proposing this requirement because problems associated with putrescible waste at MSWLFs are alleviated in part by cover material. In addition, 45 States and Territories require daily cover, suggesting that this is an effective procedure and that, by not requiring daily cover, the current Criteria are not sufficient.

Cover material serves several specific purposes for protecting human health and the environment: (1) It helps in disease vector and rodent control; (2) it helps contain odor, litter, and air emissions, which may threaten human health and environment and/or be aesthetically displeasing; (3) it lessens the risk and spread of fires; and (4) it reduces infiltration of rainwater by increasing run-off and thereby decreases leachate generation and surface and ground-water contamination. As an additional benefit, cover enhances the site appearance and utilization after completion.

EPA has not specified the type or amount of cover material to be used, leaving the determination of "suitable material" and minimum depth up to the State; however, EPA recommends that a six-inch depth of compacted earthen material be used as cover material. Tests have shown that 6 inches of compacted sandy loam prevent fly emergence; daily (or more frequent) cover has been shown to reduce the attraction of birds and to discourage rodents from burrowing into the waste. In addition, 45 States and Territories already specifically require 6 inches of daily cover and it is considered an accepted practice at most MSWLFs. This and other aspects of cover material are discussed in the background document for this section (Ref. 3).

Today's proposal allows the States to temporarily waive the daily cover requirement on a case-by-case basis in the event of extreme seasonal climate conditions, such as heavy snow or severe freezing, that make meeting the requirement impractical. This provision would allow the State to consider the practicable capability of the regulated community. EPA requests comments on the appropriateness of the frequency and depth of cover application and on whether there are other reasons for exempting daily cover. EPA also is requesting comments on the acceptability of cover materials other than earthen materials (e.g., foams).

3. Section 258.22 Disease Vector Control

Today's proposal would require that each owner or operator of an MSWLF prevent or control on-site disease vector populations using appropriate techniques to protect human health and the environment. This requirement is consistent with existing § 257.3–6, which states that "[t]he facility or practice shall not exist or occur unless the on-site population of disease vectors is minimized through the periodic application of cover material or other techniques as appropriate so as to protect public health."

Municipal wastes are known to contain pathogenic bacteria, parasites, and viruses that can infect humans and animals. These wastes also provide food and harborage from rodents, flies, and mosquitoes that then transmit disease organisms to humans and animals.

The performance criterion set forth in this section would provide States and MSWLF owners and operators flexibility in meeting this requirement to accommodate site-specific differences in vectors and in appropriate control technologies and mechanisms. Today's proposed standard to control disease vectors is intended to prevent the facility from being a breeding ground, habitat, or a feeding area for disease vector populations. The requirements for vector control are to be undertaken in conjunction with the cover material requirements in § 258.21. Cover material applied at the end of each operating day reduces the availability of food and harborage for rodents and other vectors and thus may be adequate in most cases to meet the performance criterion for disease vector control; however, if cover material requirements prove insufficient to ensure vector control, this criterion would require that other steps be taken by the owner or operator to ensure such control. The background document for this section discusses various methods for minimizing disease vectors (Ref. 3).

4. Section 258.23 Explosive Gases Control

The decomposition of solid waste (in particular, household waste) produces methane, an explosive gas. The accumulation of methane gas in MSWLF structures or nearby off-site structures can result in fire and explosions, potentially injuring or killing employees, users of the disposal site, and occupants of nearby structures, in addition to damaging containment structures resulting in the emission of toxic fumes. Several incidents resulting in deaths are discussed in the background document (Ref. 3).

For this reason, EPA established an explosive gas criterion in § 257.3–8 of the original Subtitle D Criteria to regulate the concentration of methane in facility structures and at the property boundary. This requirement is expanded in today's proposal. The lower explosive limit (LEL) of a gas is the lowest percent, by volume, of that gas in a mixture of explosive gases that will propagate a flame in air at 25°C and atmospheric pressure at sea level. Today's proposal would require that the concentration of methane generated by the MSWLFs not exceed 25 percent of the LEL in facility structures (excluding gas control or recovery system components) and the LEL itself at the property boundary. EPA based its selection of the 25 percent figure for the Criteria on a safety factor recognized by other Federal agencies as being appropriate for similar situations (Ref. 3); however, the Agency concluded that a 25 percent criterion was unnecessary at the property boundary because gases at or below the LEL at the property boundary will become somewhat diffused before passing into a structure beyond the property boundary. For these reasons, EPA continues to believe that the LEL standard would provide an adequate safety margin against off-site explosions. The Agency believes that these limits are protective of human health and the environment while not being unduly restrictive.

Further, the proposal includes routine subsurface and facility structure gas monitoring requirements and a requirement that, if methane exceeds the limits specified, the owner or operator must take necessary steps to ensure protection of human health and immediately notify the State of the level detected and the steps taken to protect human health. Such steps could include evacuation and ventilation of affected buildings. In addition, the Agency is proposing that the owner or operator submit a remediation plan to the State within 14 days of limits having been exceeded. This remediation plan must describe the nature and extent of the problem and the proposed remedy. Examples of appropriate remedies include installation of interceptor gas collection trenches, venting in structures, and subsurface gas withdrawal. The owner or operator would be required to implement the plan after State approval.

In reviewing damage cases that have occurred as a result of methane migration from landfills, the Agency has noted that many of these incidents have occurred since promulgation in 1979 of

the existing Criteria, which do not require routine gas monitoring. The Agency believes many of these instances could have been prevented if routine monitoring had been conducted to detect the dangerous levels prior to the incident. This issue is further discussed in the background document (Ref. 3). Early warning would allow the owner or operator to take action to prevent catastrophic events.

Because methane has been the principal source of explosions associated with solid waste disposal, EPA proposes to require monitoring only for methane at this time. EPA may require monitoring for other gases if new information develops at a later time indicating that there are other gases that pose problems; however, EPA currently does not have sufficient information on other gases generated to justify requiring owners and operators to monitor for them.

EPA is proposing that methane monitoring be conducted at least quarterly. As mentioned earlier, monitoring would provide early warning of potential methane build-up that may lead to explosions. The Agency believes that quarterly monitoring is a reasonable minimum frequency that accounts for the seasonal variations in subsurface gas migration patterns. The Agency recognizes that site-specific conditions may require more frequent monitoring, e.g., when facilities are near residential areas or enclosed in structures, and encourages States to require additional monitoring as necessary. There also may be limited situations (e.g., in very remote areas) where less frequent monitoring may be sufficient. EPA requests comment on these situations and the appropriateness of the minimum monitoring frequency specified in today's proposal.

Monitoring is intended to ensure that the performance standard is being met at the MSWLF. EPA considered specifying the type of monitoring and monitoring devices, but such an approach would not allow the consideration of site-specific factors in establishing the appropriate monitoring system. The proposal would allow State flexibility in determining the appropriate monitoring requirements on a case-by-case basis.

Site-specific factors to be considered when determining the type and frequency of monitoring are discussed in an Agency guidance manual (Ref. 12). Factors to be considered in determining the type and frequency of monitoring include: soil conditions, hydrogeologic conditions surrounding the disposal site, hydraulic conditions surrounding the disposal site, and the location of facility structures and relative to property boundaries. These factors control the rate and extent of gas migration and are discussed further in the guidance manual (Ref. 12).

Monitoring in a facility structure normally should be performed after the building has been closed overnight or for a weekend because these are the times when the most dangerous conditions are likely to exist. Sampling should be done in confined areas where gas may accumulate, such as in basements, crawl spaces, attics near floor cracks, and ground subsurface utility connections. Gas recovery and gas control equipment, however, need not be sampled. If all the readings are less than 25 percent LEL, the MSWLF would be in compliance; however, the presence of any methane in a facility structure, even in concentrations below 25 percent LEL, should be considered a problem that deserves attention and steps should be taken to ensure that the level of methane does not reach explosive levels. EPA recommends that continuous monitoring devices be used in facility structures at the landfill site.

For monitoring along property boundaries, at least two monitoring points should be located along the property boundaries closest to residences or other potentially affected structures. The exact location of these points should take into account any gas-permeable seams. In selecting the sampling points, some of the factors to consider include dry sand or gravel pockets, alignment with an off-site point of concern, proximity of the waste deposit, areas where there is dead or unhealthy vegetation that might be due to gas migration, and areas where underground construction may have created a natural path for gas flow (e.g., utility lines).

Monitoring should be conducted at the property boundaries ideally when the soil surface has been wet or frozen for several days because this is when levels are expected to be greatest (Ref. 12). The results, location, date, and time of monitoring should be recorded. If any of the readings are equal to or greater than the LEL, the facility would not be in compliance. It may be necessary to repeat the tests at a later date or under different climatic conditions to verify the readings. Where active control systems are being used, samples should be taken when all pumps have been shut down for their maximum time during normal operation.

Monitoring at the property boundary could be accomplished by using a permanent well or a portable monitoring device. The device should be determined by the State on a case-by-case basis. EPA has provided additional guidance on types of monitoring devices that could be used (Ref. 12). The Agency suggests that methane at a concentration just below the LEL at a monitoring point may indicate a major problem and should not be ignored. The appropriate action would depend on the proximity of off-site structures, possible pathways, and other factors. In all cases, an evaluation should be made so that the danger of explosion is minimized.

5. Section 258.24 Air Criteria

The existing Criteria in Part 257 prohibit the open burning of solid waste but allow infrequent burning of agricultural wastes, silvicultural wastes, land clearing debris, diseased trees, debris from emergency cleanup operations, and ordnance. Today's proposal under § 258.24 maintains this standard. Requirements for compliance with State Implementation Plans (SIPs) under section 110 of the Clean Air Act (CAA) would remain unchanged from the Part 257 Criteria.

The Agency believes that any infrequent burning of the waste types listed above should be conducted in areas dedicated for that purpose and at a distance away from the landfill unit so as to preclude the accidental burning of other solid waste. For the purposes of this proposal, agricultural waste does not include empty pesticide containers or waste pesticides.

Open burning, which is the uncontrolled or unconfined combustion of solid wastes, is a potential health hazard, damages property, and can be a threat to public safety. For example, smoke from open burning can reduce aircraft and automobile visibility and has been linked to automobile accidents and death on expressways. The air emissions associated with open burning are much higher than those associated with incinerators equipped with air pollution control devices. Combustion in a trench or pit incinerator is considered the equivalent of open burning because particulate emissions from trench and pit incinerators equal or exceed those from open burning.

As stated earlier, EPA originally established the ban on open burning in the 1979 Criteria. Commenters on the proposal to the 1979 Criteria questioned the necessity for that ban, stating that open burning reduces the volume of solid waste and helps control disease vectors. The Agency recognized that some volume reduction is achieved, but no data were provided that disease vectors were significantly reduced. EPA established the ban on open burning of

plays an important role in potential evaporation and potential evapotranspiration for a given location; the values for these factors incorporate the effects of temperature.

Run-off, although not a climatic factor, normally is expressed as the amount of water that will migrate from the site in the form of overland flow. Major land surface conditions affecting surface run-off include topography, cover material, vegetation, soil permeability, antecedent soil moisture, and artificial drainage.

In order to achieve the overall goal of this methodology (preventing leachate from reaching the aquifer during the active life of the unit), it is necessary to determine the factor or factors that best represent the potential amount of moisture available for entering the waste, thereby generating leachate. The Agency evaluated the above factors to determine which factor or factors best characterized the climatic elements relevant to leachate generation. The objective of the evaluation was to determine the potential for leachate generation during the active life of a unit. As stated earlier, the Agency believes that once the MSWLF is properly closed and covered, leachate generation should be minimal. No single factor or combination of factors could be found that adequately characterized climatic elements such that leachate generation during the active life could be estimated. EPA, therefore, selected a simple two-step process that can be used to categorize locations based on climate. This process uses mean annual precipitation as the factor in the first step.

The first step of the process requires that the mean annual precipitation (P) for an area be determined. P was chosen because: (1) It is easily determined, (2) it does not necessarily require the collection of new data, and (3) it conservatively describes the amount of water potentially available for infiltration and leachate generation. Using P conservatively estimates the amount of leachate formed because it does not consider evaporation or run-off. Values of P can be obtained from the National Weather Service, the National Oceanographic and Atmospheric Administration (NOAA), and/or USGS Water Atlases. These sources have collected rainfall data over extended periods of time, so values from these sources should be representative of annual rainfall in an area.

The Agency believes that there is a relationship between precipitation and leachate generation. Based on an evaluation of MSWLFs in different climatic settings, EPA has concluded that areas that receive more than 40 inches or precipitation per year generate leachate in quantities sufficient to warrant collection. Therefore, under the categorical approach, units located in areas that receive more than 40 inches of precipitation annually would be required to have leachate collection. For areas that receive less than 40 inches of precipitation per year, the evaluation indicates that leachate may not always be generated in amounts necessitating collection. Therefore, the second step of the process is to estimate the amount of leachate formed in areas receiving less than 40 inches of precipitation to determine if enough leachate is generated to warrant collection.

This estimate incorporates factors that determine the potential for leachate accumulation at a specific landfill. The factors used include P, PET, actual evapotranspiration, soil moisture holding capacity, waste moisture holding capacity, and run-off. Because MSWLFs are ongoing construction projects, the relationship among these factors relative to leachate accumulation continually changes. Therefore, a demonstration method that evaluates the potential amount of leachate accumulation at different stages of landfill construction is necessary. Under this method, the evaluation would be based on the projected landfill configuration at the end of each operating year. The Agency believes that some facilities in low precipitation locations may be able to eliminate the need for leachate collection by adjusting operational characteristics of the site.

The following steps are needed to determine when an LCS is necessary:

Step 1: Estimate topographic contours of the unit at the end of each operating year throughout the active life until final cover has been installed.

Step 2: Compute the quantity of leachate generated for each year of active life using the water balance method. This step may require dividing the landfill unit into discrete areas to take into account differing grades and variations in surface run-off. If so desired, the moisture-holding capability of soil layers used for cover could be considered. Most active portions of a landfull will have no vegetative cover, so moisture loss by evapotranspiration should not be considered in the water balance calculation. Moisture loss from active portions should be accounted for by using estimates of evaporation from bare soil as described in an EPA guidance document (Ref. 35).

Step 3: Calculate the total accumulation of leachate at the base of the unit by adding the amount of leachate generated to the amount predicted for each previous year.

Step 4: If total accumulation of leachate at the base of the unit (as determined by Step 3) exceeds or equals one foot at any stage of the landfill construction, an LCS is necessary. For example, for a unit that has a three-year active life: for year one, it is estimated that one foot of field capacity of the waste remains and no leachate is generated. For year two, it is determined that one foot of field capacity remains and, again, no leachate is generated. However, for year three, before final cover is installed, it is determined that field capacity for the portion of unit planned to be built that year will be exceeded and four feet of leachate will be generated. Presuming that the year three portion of the unit is on top of the year two and year one portions of the unit, the total effect will be to negate the unused moisture holding capacity of the previous two years and result in a head build-up of two feet at the base of the unit, which is sufficient to require the installation of an LCS. This method is further discussed in the backgound document supporting this proposal (Ref. 5).

(b) Geologic Factors. The nature and extent of the geologic material underlying a given MSWLF site strongly influence the fate of any leachate generated. The categorical approach estimates the effects of various geologic materials based on the time it takes water to move through the material above the aquifer. Because leachate is an aqueous solution EPA believes it is reasonable to model water movement rather than leachate movement in the subsurface. The Agency believes this simplifying assumption is conservative. This simplified approach does not include consideration of the variability of MSWLF leachate over time. Also some factors that retard constituent movement, such as absorption, chemical precipitation, degradation, and attenuation, that can result in slower movement of the constituent than the solute (i.e., water) are not a part of this simplified approach. Therefore, the Agency believes that considering only the rate of liquid movement is a conservative approach.

Certain geologic characteristics control the rate at which leachate will migrate to the aquifier. For the categorical approach, the rate must be determined so that design features can be added when the natural conditions do not give adequate protection to the aquifier. The geologic factors evaluated included the following: Depth, saturated

hydraulic conductivity, effective porosity, and linear velocity.

Depth (D) refers to the thickness of the geologic material between the bottom of the unit and the top of the aquifer. This zone is referred to as the overburden. Saturated hydraulic conductivity (Ksat) is a measure of the ability of porous media (soils or rock) to transmit liquids under saturated conditions. Effective porosity (N_e) is a measure of the interconnected pore space in the geologic material. Porosity has a controlling influence on the linear velocity of water in the overburden media. Linear velocity (V) is the speed at which ground water travels in the subsurface under saturated conditions.

Different methodologies were evaluated that could be used to estimate the time for liquids to migrate through the overburden to the aquifier, known as time of travel (T) to the aquifer. The methodologies involve: (1) Calculation of T based on a detailed time-of-travel measurement through the overburden (for saturated and unsaturated geologic material) using the approaches prescribed for determining vulnerable hydrogeology under Subtitle C (Ref. 11), (2) calculation based on Darcy's law, expressed as T=D/Ksat, (3) calculation to T=D/V (based on the linear velocity of water in the overburden with an assumed hydraulic gradient of one), and (4) a wetting front approach for unsaturated soil only.

The detailed time-of-travel analysis results in the most accurate prediction of when leachate may reach the aquifer under ideal conditions; however, it is very data-intensive and complex, particularly for unsaturated conditions. It also requires the development of flow nets.

The second and third methods are more straightforward because the necessary data are readily available from literature and field tests. Because of their simplicity, these methods could be used to pre-screen locations with data available from the literature. These data should be verified by field tests prior to site design because field verification is necessary to ensure that site-specific conditions match conditions predicted by the literature.

D-Ksat is the simpler method to use because it needs only two easily obtained pieces of data: Saturated hydraulic conductivity and depth. Numerous methods are available for determining saturated hydraulic conductivity. For example, in fractured consolidated rock, pressure tests or falling head tests can be used to evaluate Ksat. In unconsolidated materials, constant head gravity tests are commonly used. These and other methods are available and documented. It is important, however, to ensure that the proper methods are used in the material being evaluated. Depth may be obtained easily from a preliminary subsurface exploratory program and/or from boring and drilling logs from surrounding areas.

The third method, D/V, is believed to be more accurate than the second method because the velocity (V) incorporates effective porosity (N_e) in the calculation. As mentioned above, effective porosity is a measure of the interconnected pore space in geologic material. It can be an important controlling influence on hydraulic conductivity (and thus rate of flow) in both unconsolidated and consolidated formations. Porosity values range from 0 to 5 percent for dense crystalline rock, 25 to 40 percent for gravel, and 40 to 70 percent for clay. In fractured rock, secondary porosity also must be considered. When determining the porosity of the overburden at a specific site, both primary and secondary porosity should be considered as warrented.

Although more accurate than D/Ksat, the D/V method has some features that make it less accurate than the detailed time-of-travel calculation discussed earlier. First, it assumes that the hydraulic gradient (a major influence on ground-water velocity) is equal to one. This assumption will result in a conservative time-of-travel value (i.e., the actual time may be longer). Second, it assumed fully saturated conditions, which in most cases will result in a conservative value.

The fourth method involves a wetting front equation and may be a better predictor of flow in the unsaturated zone. The method requires the collection of more data than either the second or third method. This method is based on equations developed for infiltration of water into dry soil and applies simplifying assumptions to calculate the time of travel. The equation used to calculate the time of travel is given as:

$$T=(LWr)/q$$

where:

T = time of travel (T).
L = length of the unsaturated zone (L).
Wr = change in moisture content from soil behind the wetting front to dry soil ahead of the wetting front.
q = infiltration rate (L/T).

The length of the unsaturated zone (L) can be determined from boring logs and piezometer measurements. Moisture content behind and ahead of the wetting front can be calculated, and, therefore, Wr can be determined from field measurements or estimated from empirical equations. The infiltration rate is (q) approximated by using the net precipitation.

The principle assumption of this approach is that there exists a distinct and definable wetting front, and that behind the wetting front the soil is uniformly wet and of constant conductivity. The wetting front approach is applicable for a limited range of conditions. In particular, the approach is useful when a constant water flux is applied to initially dry soil. The approach may not be applicable for soils that are initially moist or that are uniform in moisture content under natural infiltration conditions. The principle value of the approach is in predicting unsaturated flow.

The Agency believes that the D/V method of calculating T is conservative and easy to calculate. The categorical approach assumes saturated flow because the available methodologies that can be used to estimate the flow time of water through unsaturated materials are complex and require extensive data collection. Calculating the time of flow for saturated materials involves less complex equations and requires fewer resources to obtain the required data inputs. Furthermore, the use of saturated conditions is generally conservative in predicting time-of-travel in the overburden because, for the most part, K values increase as soil moisture content increases for a given soil type. The Agency recognizes that in certain unsaturated soils, particularly clays, saturation may not be a conservative assumption. Initial breakthrough of leachate, in small amounts, may occur prior to the prediction, assuming saturation. For the purpose of categorization, EPA believes that it is more important to predict when a major amount of leachate may enter the aquifer. However, the owner or operator has the option of using an alternative method, including the detailed Subtitle C time-of-travel calculation or the wetting front approach.

Under this simplified approach (D/V method), the value selected for T can be used to determine which locations require liners and the type of liner that may be required. The methodology is based on the active life of the unit. A value of T equal to or greater than the active life of the MSWLF unit is classed as "long" and a T less than the active life as "short." A minimum cut-off value for T of 20 years has been selected because a minimum T precludes the siting of short duration units in relatively poor locations. This minimum value of 20 years for T was chosen because the average active life of a

facility is approximately 30 years, and a facility usually consists of more than one unit. EPA therefore selected 20 years as the average life of a unit. T values that are long when compared to the active life of the unit would not need liner systems, while units with T values shorter than the active life of that unit would need liners.

The T value should be determined for each unit rather than for an entire facility. For example, an MSWLF may have a total life of 50 years but comprise several units with active lives less than 50 years each. The T for each of these units is a separate calculation.

(c) Relationship to Design Requirements. Combining P and T values results in a matrix comprising four blocks that correspond to separate categories, as shown in Figure 2. Each location category describes a hydrogeologic and climatic setting with unique characteristics that affect landfill design. For example, Category I has both good climatic characteristics for a landfill (limited precipitation indicated by the low P) and good hydrogeology (acceptable overburden characteristics evidenced by high T value). On the other hand, Category IV represents locations with poor climate and hydrogeology that require specific landfill designs (liners and LCSs) to compensate for the poor locational characteristics. The two key measures of precipitation and time-of-travel to the aquifer are used not only to establish the location categories, but to identify the landfill design requirements needed for a particular location.

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FIGURE 2

CATEGORICAL APPROACH

PRECIPITATION (P)	< Active Life*	≥ Active Life*
≥ 40 in./yr.	IV • LCS required • Liner required	II • LCS required • Liner not required unless needed for LCS
≤ 40 in./yr.	III • LCS not required unless need demonstrated • Liner required	I • LCS not required unless need demonstrated • Liner not required unless needed for LCS

TIME OF TRAVEL TO AQUIFER (T)

* MINIMUM T VALUE IS 20 YEARS

BILLING C 6560-50-C

restriction for unmonitorable areas in the final rule.

Section 258.50(b) specifies that ground-water monitoring requirements of § 258.50 through § 258.55 will be suspended for owners and operators who can demonstrate that there is no potential for migration of hazardous constituents from the landfill unit to the uppermost aquifer during the active life, closure, or post-closure periods. The requirements of § 258.56 through § 258.58 are never suspended, however. The proposed limited suspension of the ground-water monitoring requirements provided in the § 258.50(b) is designed for MSWLF units located in hydrogeologic settings that prevent leachate migration to ground water for very long periods of time. In such a setting, leachate from the MSWLF should not be able to reach the uppermost aquifer during the active life, closure, or during post-closure care. Because of the very favorable hydrogeologic conditions, such settings are highly desirable for the location of MSWLFs and the Agency wishes to encourage the use of these settings. Furthermore, requiring ground-water monitoring in these settings would place an additional financial burden on the owner or operator with very little added protection to human health and the environment. The financial burdens placed on owners or operators in these settings would be high because of increased drilling costs caused by the extreme depths to ground water that are typical in these settings.

The Agency intends to ensure that there is a high degree of confidence in the demonstration that no leachate will reach the uppermost aquifer before an exemption from the ground-water monitoring requirements is allowed. Therefore, today's proposal requires that the demonstration be conducted by a qualified geologist or geotechnical engineer based on site-specific hydrogeologic information or, where that is insufficient, based on assumptions that maximize the rate of hazardous constituent migration.

While § 258.50(a) of today's proposal requires ground-water monitoring at all MSWLFs, except in the rare circumstances described above, the Agency is proposing to ease the burden of this requirement by phasing in the ground-water monitoring requirements over time. The Agency is proposing this approach because the thousands of wells that will be needed at the approximately 6,000 existing MSWLFs are expected to cause shortfalls in the availability of competent hydrogeologists and drilling companies who must assist the owner or operator in sampling and analyzing the landfill's hydrogeology, provide recommendations on well placement, drill the appropriate bore holes and monitoring well holes, and install the monitoring wells.

Furthermore, the Agency recognizes that the proper review and evaluation of proposed ground-water monitoring programs will place significant demands on State resources. Therefore, § 258.50(c) of today's proposal requires States to establish compliance schedules for each facility within six months of the effective date of this rule. This six-month period is the maximum amount of time that a State should take in setting compliance schedules. The sooner an owner or operator knows when the MSWLF must be in compliance with the ground-water monitoring requirements, the better the necessary activities can be planned. The Agency has set goals for the percentage of existing units that must be in compliance after the effective date of this rule. Within two years of the effective date, 25 percent of the existing landfill units must be in compliance; within three years of the effective date, 50 percent of the existing landfill units must be in compliance; within four years of the effective date, 75 percent of the existing units must be in compliance; and all landfill units must be in compliance within five years of the effective date. Any new unit must be in compliance with the ground-water monitoring requirements before accepting waste.

States should set compliance schedules for each facility based on an evaluation of the potential risks posed by the facility. Risks posed to human health and the environment can be weighed by considering the proximity of human and environmental receptors, design of the landfill unit, age of the landfill unit, and resource value of the underlying aquifer. The Agency believes that ground-water monitoring is critical at existing facilities that pose a threat to human health or the environment and expects States to move aggressively to address these facilities as soon as possible.

If a State does not set a schedule of compliance for MSWLF units, § 258.50(d) specifies a compliance schedule for owners or operators of landfills. This "fall-back" schedule is based on distance to the nearest drinking water intake. While this method of setting priorities does not ascertain potential risk as well as the method outlined in § 258.50(c), it is objective and easy for an owner or operator to determine.

2. Sections 258.51–55 Overview of Ground-Water Monitoring Requirements

Today's proposed Criteria revisions require a system of monitoring wells to be installed at new and existing MSWLFs. The proposed Criteria revisions also provide procedures for sampling these wells and methods for statistical analysis of analytical data derived from the well samples to detect the presence of hazardous constituents released from MSWLFs. The Agency is proposing a two-phased ground-water monitoring program and a corrective action program. This phased approach to ground-water monitoring allows proper consideration of the transport characteristics of MSWLF leachates in ground water, while protecting human health and the environment. As shown in Figure 3, the proposed monitoring and corrective action programs provide for a graduated response over time to the problem of ground-water contamination as the evidence of such contamination increases, thereby keeping down costs.

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The proposal requires that all new and existing MSWLFs begin their ground-water monitoring programs by complying with the Phase I monitoring requirements. When a change in ground-water chemistry is indicated by an increase or decrease of two in more of parameters (1) to (15), or when any one of parameters (16) to (24) or the volatile organics (VOCs) listed in Appendix I is detected at statistically significant levels above background, Phase II monitoring is triggered. Phase II requires monitoring an expanded list of hazardous constituents (see Appendix II). If any of the Phase II parameters are detected at statistically significant levels above background, the owner or operator must compare those levels to the appropriate ground-water trigger levels. The State will set the ground-water trigger levels as specified in § 258.52. These "trigger levels" trigger the assessment of corrective measures and establishment of the ground-water protection standard. Corrective action continues until the owner or operator demonstrates compliance with the GWPS for a period of time determined by the State to be appropriate, based on site-specific factors. The Agency is considering changing its Subtitle C requirements from a three-year period to one that is site-specific. EPA requests comment on the appropriateness of a minimum period of compliance for Subtitle D.

The Agency is proposing that ground-water monitoring, once initiated, continue through post-closure care. Adequate post-closure care is essential for continued protection of human health and the environment, and ground-water monitoring is necessary in determining the effectiveness of post-closure care. The Agency has not set minimum monitoring frequencies during the post-closure period, instead leaving that determination entirely up to the State. This decision was based on the idea that the appropriate frequency at which to monitor during post closure will vary significantly not only among units, but also over time. Site-specific information should be evaluated by the State when determining post-closure monitoring frequency. Factors that should be considered by the State include the hydrogeology of the site, the age and design of the landfill, and the operating history of the landfill. During the early years of post-closure care (e.g., 10 years), it may be appropriate to monitor as frequently as during the operating period. In many cases it may be appropriate to lessen the frequency of monitoring in the latter years of post-closure care. If during post closure a unit triggers the next phase of ground-water monitoring, it would be appropriate for the State to set a monitoring frequency the same as the minimum frequency designated for the operating period.

Comments are requested on whether individual monitoring wells at a landfill unit should be allowed to be in different phases of monitoring. The Agency is not proposing this option today, but believes that this option could be appropriate in situations where the unit is very large, and only a few monitoring wells have triggered the next phase of monitoring. Once corrective action had been triggered in one well, however, all of the ground-water surrounding the particular unit would be subject to corrective action provisions.

a. § 258.51 Ground-Water Monitoring Systems. Section 258.51 of the proposed Criteria specifies requirements pertaining to appropriate methods for constructing and placing ground-water monitoring wells. The purpose of these requirements is to ensure that consistent, reliable ground-water monitoring systems are installed at all MSWLFs. The Agency has specified the use of well systems because other technologies may not be as reliable as well systems for detecting changes in ground-water quality. In making this determination, the Agency reviewed many other methods of ground-water monitoring, including resistivity, ground penetrating radar, and lysimeters. Detailed discussions of the strengths and weaknesses of these methods for use in monitoring ground water at MSWLFs are provided in the background document for Subpart E of today's proposal.

The monitoring well system must be designed so as to monitor the performance of the landfill design in terms of its ability to meet the design goal (as defined in § 258.40(b)) in the aquifer at the waste management unit boundary or the alternative boundary as specified by the State pursuant to § 258.40. As such, well location is linked directly to the performance standard for the design of the landfill unit. If the unit is designed to meet the design goal at the waste management unit boundary, wells should be installed at the waste management unit boundary. On the other hand, if the unit is designed to meet the design goal at an alternative boundary, the wells should be installed at the alternative boundary.

Section 258.51 allows the placement of wells at the closest practical distance from the waste management unit or alternative boundary to account for the presence of important structures, such as run-off controls, anchors for liners, and gas lines, that would be impaired or destroyed by well installations in the area. Other factors can affect the exact placement of monitoring wells. In some hydrogeologic settings, perched water tables and/or other hydrogeologic phenomena may cause leachate from an MSWLF to travel horizontally for a significant distance before reaching the uppermost aquifer. Therefore, § 258.51(a) specifies that the State may select the closest practical distance downgradient from the waste management unit boundary or the alternative boundary (as specified by the State) if the State determines, based on site-specific hydrogeologic evaluations required in § 258.51, that the uppermost aquifer would not be affected directly beneath the appropriate boundary by release of leachate from the MSWLF.

In some cases, several discrete units may constitute the MSWLF. Because of topographic conditions and design limitations, constructing discrete cells may be the only means of constructing a landfill on the property. Section 258.51(c) states that separate monitoring systems are not required for each landfill unit at a multi-unit facility if the State approves the grouping of units. Such approval would be allowed only if the multi-unit ground-water monitoring system will be protective of human health and the environment. If local conditions make it infeasible or impractical to install a monitoring system around each landfill unit, the State may allow the grouping of units within one monitoring system. Factors that the State should consider when deciding whether more than one unit should be within a monitoring system include: the number of units, the spacing of the units, the orientation of the units to one another, the age of the units, and the hydrogeologic setting. The State should not approve the grouping of units within one monitoring system if the downgradient portion of the system would be located more than 150 meters from any landfill unit.

The Agency does not believe that there are any differences between MSWLFs and hazardous waste land disposal units with respect to the factors used to determine appropriate types of well materials or well construction techniques. Therefore, today's proposed performance standards for ground-water monitoring system design found in § 258.51(d) are similar to those specified for hazardous waste disposal facilities in 40 CFR Part 264. This similarity ensures consistent design and construction standards for monitoring wells at all RCRA landfill facilities.

Because hydrogeologic conditions vary widely from one site to another, it is not possible to establish requirements specifying the exact number, location, and depth of monitoring wells needed to adequately monitor ground water in the aquifer. Such requirements are dependent on actual site-specific aquifer and geologic conditions. Therefore, in § 258.51(e) the Agency has proposed that specifics of the system be based on aquifer thickness, flow rate, and flow direction, and the characteristics of the material overlying the aquifer. For example, a complex aquifer flow system may require multilevel wells to effectively monitor ground water. A facility located in an area of very low hydraulic gradient may be better monitored by a ring of wells, since mounding could cause contaminant flow in all directions.

b. Section 258.52 Determination of Ground-Water Trigger Level. This section discusses what procedures the State must follow when establishing appropriate trigger levels. Trigger levels must be established by the State before the Phase I monitoring program is initiated. The levels established are health- and environmental-based levels that are determined by the State to be indicators for protection of human health and the environment. Where appropriate, these levels are based on promulgated standards; otherwise, they are established by the State on the basis of general criteria described below.

Contamination exceeding trigger levels indicates a potential threat to human health or the environment that may require further study. Therefore, the owner or operator must conduct an assessment of corrective measures whenever concentrations of hazardous constituents in the ground water exceed trigger levels. Trigger levels provide the owner or operator a point of reference for suggesting and supporting alternative remedies during the assessment of corrective measures (see preamble discussion for § 258.56). Trigger levels must be distinguished from ground-water protection standards, which are established during the remedy selection process.

Under § 258.52 of today's proposal, the concentration limits for the trigger levels are: (1) Maximum contaminant levels promulgated under § 1412 of the Safe Drinking Water Act, or (2) if an MCL has not been established, the concentration limit is a health-based limit established by the State that meets the proposed criteria described in § 258.52(b)(2) (i–iv), or (3) if levels under (1) or (2) are not available, the concentration limit is a level established by the State that is an indicator for protection of human health and the environment, or (4) background levels, if such levels are higher than concentrations under (1), (2), or (3), or if concentrations under (1), (2), or (3) have not been established.

The MCLs are maximum concentrations of contaminants allowed in water used for drinking. They are based upon toxicity, treatment technologies, and other feasibility factors such as availability of analytical methods. The MCLs are set following an analysis based on health considerations as guided by the SDWA.

The use of MCLs is consistent with current ground-water protection standards under 40 CFR Part 264, Subpart F (Releases from hazardous waste disposal facilities). Under the 1986 Amendments to the SDWA, MCLs must be set for 83 specific contaminants by 1989 as well as for any other contaminants in drinking water that may have any adverse effect upon people's health and that are known or anticipated to occur in public water systems. Currently, there are 28 MCLs promulgated; relevant MCLs to these requirements are listed below in Table 2.

TABLE 2—MAXIMUM CONTAMINANT LEVELS

CAS No.	Chemical name	MCL (mg/L)
7440-38-2	Arsenic	0.05
7440-39-3	Barium	1.0
71-43-2	Benzene	.005
7440-43-9	Cadmium	.01
56-23-5	Carbon tetrachloride	.005
1308-38-9	Chromium (III)	.05
1333-82-0	Chromium (VI)	.05
106-46-7	para-Dichlorobenzene	.075
107-06-2	1,2-Dichloroethane	.005
75-35-4	1,2-Dichloroethylene	.007
72-20-8	Endrin	.0002
7439-92-1	Lead	.05
58-89-9	Lindane	.004
7439-97-6	Mercury	.002
72-43-5	Methoxychlor	.1
7782-49-2	Selenium	.01
7440-22-4	Silver	.05
93-72-1	Silvex (2,4,5-TP)	.01
8001-35-2	Toxaphene	.005
71-55-6	1,1,1-Trichloroethane	.2
79-01-6	Trichloroethylene	.005
75-01-4	Vinyl chloride	.002

The Agency is proposing that health-based concentrations established by the State be used for the trigger level when MCLs are not available. These health-based levels must meet four criteria listed under § 258.52(b)(2) (i–iv). First, they must be consistent with principles and procedures set forth in Agency guidelines for assessing the health risks of environmental pollutants, which were promulgated on September 24, 1986 (51 FR 33992, 34006, 34014, 34028).

Second, the levels must be based on scientifically valid studies conducted in accordance with the Toxic Substances Control Act Good Laboratory Practice Standards (40 CFR Part 792) or other equivalent standards. The Good Laboratory Practice Standards prescribe good laboratory practices for conducting studies related to health effects, environmental effects, and chemical fate testing and are intended to assure quality data of integrity. In addition, the Agency guidelines for assessing the health risks of environmental pollutants (cited above) cite several publications that outline procedures for evaluating studies for scientific adequacy and statistical soundness. Third, for carcinogens, these levels must be associated with a risk level within the protective risk range. (See discussion in Section IX.D.1.a. of today's preamble concerning the design goal and EPA's request for comment on alternative risk ranges.) Finally, for toxic chemicals that cause effects other than cancer or mutations, the levels must be equal to a concentration to which the human population (including sensitive subgroups) could be exposed on a daily basis without appreciable risk of deleterious effects during a lifetime. These criteria will ensure that the trigger level represents valid and reasonable estimates of levels in ground water that are safe for human consumption.

Health-based levels that have undergone extensive Agency scientific review, but that have not been formally promulgated, are available for many chemicals. The four criteria proposed in § 258.52 and discussed above will enable the State to use these nonpromulgated levels to derive trigger levels. Appendix III provided health-based levels that the Agency believes meet these four criteria for selected hazardous constituents. These levels may be used to determine trigger levels. EPA established these levels by an assessment process that evaluated the quality and weight-of-evidence of supporting toxicological, epidemiological, and clinical studies. These levels are discussed below.

For noncarcinogens, health-based limits based on Reference Doses (RfDs) have been developed by the Agency's Risk Assessment forum. An RfD is an estimate of the daily exposure a sensitive individual can experience without appreciable risk of health effects during a lifetime. The experimental method for estimating the RfD is to measure the highest test dose for a substance that causes no

statistically or biologically significant effect in an animal bioassay test. The RfD is derived by dividing the "no observed adverse effect level" (NOAEL) by a suitable scaling or uncertainty factor. Confidence in the RfD is dependent on a number of factors, including the quality and duration of the animal study. The derivation of RfDs has been evaluated and verified by internal Agency review. Applying the standard drinking water exposure assumptions (i.e., a 70 kg person drinks two liters of water a day for 70 years) to RfDs yields the ground-water concentration limit. Appendix III lists the RfDs (mg/kg-day) for several hazardous constituents.

The use of the RfD is appropriate only for noncarcinogenic constituents. EPA science policy suggests that no threshold dose exists for carcinogens; in other words, no matter how small the dose, some risk remains. The dose-response assessment for carcinogens usually entails an extrapolation from an experimental high-dose range where carcinogenic effects in an animal bioassay have been observed, to a dose range where there are no observed experimental data by means of a preselected dose response model. The carcinogenic slope factors (CSFs), estimated by EPA's Carcinogen Assessment Group, may be used to calculate a dose that corresponds to a given risk level by dividing the risk level (e.g., 1×10^{-6}) by the CSF. CSFs for selected carcinogens are provided in Appendix III. This dose is called a risk-specific dose (RSD). An RSD is an estimate of the daily dose of a carcinogen that, over a lifetime, will result in an incidence of cancer equal to a given risk level.

The ground-water concentration, in milligrams per liter, can be calculated by multiplying the RSD by the average adult body weight (70 kg) over the average water intake (two liters of water per day). Chemicals that cause cancer also may evoke other toxic effects. These constituents may have both an RfD and RSD available. In these cases, the lower level (i.e., more protective) should be used as the trigger level.

EPA has developed a classification scheme for carcinogens based on the weight of evidence for carcinogenicity. This scheme is presented in the Agency's cancer guidelines (51 FR 3992). Appendix III includes the class for each carcinogen listed. Known or probable human carcinogens are designated as Class A and Class B carcinogens, respectively, under the Agency guidelines. Constituents for which the weight of evidence of carcinogenicity is weaker are known as Class C, or possible human carcinogens under the Agency's guidelines.

Examples are included in Appendix III to illustrate how the States may use RfDs and CSFs to set trigger levels. For carcinogens, the State may use the CSF to determine a trigger level anywhere within the protective risk range. (See discussion in Section IX.D.1.a. of today's preamble concerning the design goal and EPA's request for comment on alternative risk ranges.)

The Agency believes that the protective risk range is appropriate for setting a trigger level for carcinogens without a MCL. For new MSWLFs, the State should consider using the same risk level for trigger levels as was used for the design goal. For example, if the MSWLF was designed to meet a 1×10^{-6} risk level at the chosen boundary, then the MSWLF should be triggered into an assessment of corrective measures once that risk level (for carcinogens with no MCL) is exceeded. For existing MSWLFs, to ease implementation, the Agency suggests that the State choose one risk level to be used at an MSWLF for all carcinogens that do not have an MCL. The State may consider choosing a risk level to use at all MSWLFs within the State. As discussed in the preamble discussion for the design goal, the Agency is requesting comment on two alternatives to the protective risk range. Any change made to the proposed design goal criteria would most likely be made for the trigger level. For example, if a fixed risk level of 1×10^{-6} was required as a design goal, then the trigger levels for carcinogens without MCLs would also be required to be set at 1×10^{-6}.

RfDs and RSDs will be available soon through the Integrated Risk Information System (IRIS), a computer-housed, electronically communicated catalogue of Agency risk assessment and risk management information for chemical substances. IRIS is designed especially for Federal, State, and local environmental health agencies as a source of the latest information about Agency health assessments and regulatory decisions for specific chemicals. The risk assessment information (i.e., RfDs and RSDs) contained in IRIS, except as specifically noted, has been reviewed and agreed upon by intra-Agency review groups, and represents an Agency consensus. As EPA continues to review and verify risk assessment values, additional chemicals and data components will be added to IRIS. A hard copy of IRIS soon will be available through the National Technical Information Service. The background document for Subpart E contains further information on IRIS.

If MCLs or other health-based levels meeting the proposed criteria are not available or cannot be developed for use as trigger levels, § 258.52(b)(3) allows the State to establish a trigger level that acts as an indicator for protection of human health and the environment. In many cases, partial data or data on structural analogs will allow the State to estimate whether the detected level of a contaminant is likely to cause a problem. In other cases, other contaminants will be present at high levels (triggering an assessment of corrective measures in any case), and it will be clear that the constituent for which no level is available is not a driving factor in determining the risk at the site, even under worst-case assumptions concerning its toxicity. In such cases, it may not be necessary to specify a trigger level for that constituent.

Finally, background concentrations may be used as the trigger level when no health-based level or indicator is available or when background is higher than any health-based level.

c. Section 258.53 Ground-Water Sampling and Analysis. Section 258.53 of today's proposed Criteria revisions includes requirements for consistent sampling and analysis procedures that are designed to ensure accurate ground-water monitoring results. Also included in this section are requirements for determining ground-water flow rate and direction, establishing background ground-water quality and applying appropriate statistical analyses to detect any changes in ground-water quality beneath an MSWLF.

Section 258.53(a) requires that the sampling and analysis techniques used by owners and operators of MSWLFs be sufficient to provide an accurate representation of ground-water quality in the uppermost aquifer beneath the landfill. At a minimum, these procedures must address sample collection, preservation, shipment, chain-of-custody, and quality assurance and quality control (QA/QC). The Agency recommends Chapter 2 of the "RCRA Technical Enforcement Guidance Document" (TEGD) for use in complying with this section. Although this chapter of the TEGD contains a number of references to the hazardous waste requirements under 40 CFR Part 264, the recommended sampling and analytical procedures are appropriate for any solid waste disposal facilities, including MSWLFs. These recommendations provide clear descriptions of how to

and remediation will not be required, the assessment may be limited to an evaluation of institutional-type controls to limit exposure.

Under § 258.56(c), the Agency specifies several activities that the State may include in the scope of the assessment. First, the State may require the owner or operator to assess the effectiveness of potential remedies in meeting the requirements and objectives of the remedy (for a discussion of these requirements and objectives, see the preamble discussion for § 258.57 (b) and (c)). Next, the State may require the owner or operator to perform an evaluation of the performance, reliability, ease of implementation, and impacts (including safety, intermedia contaminant transfer, and control of exposures to residual contamination) associated with any potential remedy evaluated. In evaluating the performance of each remedy, the owner or operator should evaluate the appropriateness of specific remedial technologies to the contamination problem being addressed. During this assessment, the owner or operator may need to conduct additional monitoring to characterize the nature and extent of the plume of contamination.

Analysis of a remedy's performance, reliability, and ease of implementation may include an assessment of its effectiveness in achieving intended functions of containment, treatment, remediation, or disposal of the hazardous constituents and the degree of protection afforded human health and the environment. In addition, consideration should be given to the frequency and complexity of necessary operation and maintenance and the extent to which the technology has been successfully demonstrated under analogous conditions. The technical feasibility for the remedial strategy should also be considered in terms of ability to construct and operate the remedial technologies and the availability of necessary treatment, storage, or disposal services, and capacity.

The Agency is particularly concerned about potential cross-media impacts (intermedia transfer of contaminants) of remedies, and, therefore, the Agency specifically identified them as an area that the State may require the owner or operator to consider. Some remedial technologies may cause secondary impacts. For example, in some circumstances, air stripping of VOCs from ground water may release these VOCs to the air unless specific emissions control devices are installed on the air stripper.

In today's proposal, the State also may require the owner or operator to evaluate the timing of the potential remedy (§ 258.56(c)(3)), including construction, start-up, and completion time. Timing will be important in distinguishing among remedies. The State ultimately determines the compliance schedule for final cleanup of the ground water under § 258.57(d).

The owner or operator may be required by the State to include cost estimates for alternatives considered (§ 258.56(c)(4)). Cost estimates will be very important to the State when approving the selected remedy. The practicable capabilities of the facility, including the capability to finance and manage a corrective action program may be considered by the State in determining the duration of the clean-up. Therefore, the cost of the remedy may affect the remedy selected and the timing of the cleanup (see preamble discussion of § 258.57(d)).

The owner or operator may be required to consider institutional requirements under § 258.56(c)(5). For example, local governments may have specific requirements related to the remedial activities that may affect implementation of the remedies evaluated.

Finally, the State may require the owner or operator to evaluate the public acceptability of alternatives. The consideration of community concerns is a decision factor that the State will use in selecting a remedy (see § 258.57(c)(5)).

Under the proposed § 258.56(d), the State may require the owner or operator to evaluate one or more specific potential remedies. These potential remedies may include innovative technologies. The State may know of technologies that have been successful at other landfills with similar contamination problems. The proposed § 258.56(e) requires that, after all remedies have been evaluated, the owner or operator must submit a report to the State on the assessments so that the State may choose which remedy should be implemented.

Under proposed § 258.56(f), if the State determines at any time that human health or the environment are being threatened by the release of hazardous constituents from the MSWLF, the State may require the owner or operator to implement the measures required in proposed § 258.58 (a)(3) or (a)(4) (see preamble discussion of § 258.58(a)).

4. Section 258.57 Selection of Remedy and Establishment of Ground-Water Protection Standard

The proposed § 258.57 outlines the general requirements for selection of remedies for MSWLFs. As structured, it establishes four basic standards that all remedies must meet and specifies decision criteria that will be considered by the State in selecting the most appropriate remedy. In addition, decision factors for setting schedules for initiating and completing remedies are outlined, and specific requirements for establishing ground-water protection standards, including requirements for achieving compliance with them, are contained in this section.

Proposed § 258.57(b) specifies that all remedies must: Be protective of human health and the environment; attain ground-water protection standards as specified pursuant to § 258.57 (e) and (f); control the sources of releases so as to reduce or eliminate, to the maximum extent practicable, further releases that may pose a threat to human health or the environment; and comply with standards for management of wastes as specified in § 258.58(d).

These standards reflect the major technical components of remedies: cleanup of releases, source control, and appropriate management of wastes that are generated by remedial activities. The first standard—protection of human health and the environment—is a general mandate derived from the RCRA statute. This overarching standard requires remedies to include those measures that are needed to be protective, but are not directly related to ground-water protection, source control, or management of wastes. An example would be a requirement to provide alternate drinking water supplies in order to prevent exposure to releases to ground water used for drinking water. Another example would be barriers or other controls to prevent direct contact with the unit.

Remedies will be required to attain the ground-water protection standards that will be specified for the remedy by the State according to the requirements outlined below. The GWPS for a remedy often will play a large role in determining the extent of and technical approaches to the remedy. In some cases, certain technical aspects of the remedy, such as the practicable capabilities of remedial technologies, may influence to some degree the GWPS that are established. It is because of this interplay between cleanup standards and other remedy goals and limitations that today's rule establishes requirements for GWPS within the overall remedy selection structure of § 258.57. Thus, the standard setting process and the remedy selection process occur concurrently with both processes affecting the other.

7. A new Part 258 is added as set forth below:

PART 258—CRITERIA FOR MUNICIPAL SOLID WASTE LANDFILLS

Subpart A—General

Subpart B—Location Restrictions

Subpart C—Operating Criteria

Subpart D—Design Criteria

Subpart E—Ground-Water Monitoring and Corrective Action

Authority: 42 U.S.C. 6907(a)(3), 6944(a) and 6949(c); 33 U.S.C. 1345 (d) and (e).

Subpart A—General

§ 258.1 Purpose, scope, and applicability.

(a) The purpose of this part is to establish minimum national criteria under the Resource Conservation and Recovery Act (RCRA or the Act), as amended, for municipal solid waste landfills and under the Clean Water Act, as amended, for municipal solid waste landfills that are used to dispose of sludge. These minimum national criteria ensure the protection of human health and the environment.

(b) These criteria apply to owners and operators of new and existing municipal solid waste landfills, except as otherwise specifically provided in this part; all other solid waste disposal facilities and practices that are not regulated under Subtitle C of RCRA are subject to the criteria contained in Part 257.

(c) These criteria do not apply to closed units (as defined in this section) of municipal solid waste landfills that close prior to the effective date of this part.

(d) Municipal solid waste landfills failing to satisfy these criteria are considered open dumps for purposes of State solid waste management planning under RCRA.

(e) Municipal solid waste landfills failing to satisfy these criteria constitute open dumps, which are prohibited under section 4005 of RCRA.

(f) Municipal solid waste landfills containing sewage sludge and failing to satisfy these criteria violate sections 309 and 405(e) of the Clean Water Act.

(g) The effective date of this part is [*insert date 18 months after the promulgation date*], unless otherwise specified.

§ 258.2 Definitions.

Unless otherwise noted, all terms contained in this part are defined by their plain meaning. This section contains definitions for terms that appear throughout this part; additional definitions appear in the specific sections to which they apply.

"Active life" means the period of operation beginning with the initial receipt of solid waste and ending at completion of closure activities in accordance with § 258.30 of this part.

"Active portion" means that part of a facility or unit that has received or is receiving wastes and that has not been closed in accordance with § 258.30 of this part.

"Aquifer" means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs.

"Closed unit" means any solid waste disposal unit that no longer receives solid waste as of the effective date of this part and has received a final layer of cover material.

"Commercial solid waste" means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

"Existing unit" means any solid waste disposal unit that is receiving solid waste as of the effective date of this part and has not received a final layer of cover material.

"Facility" means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

"Ground-water" means water below the land surface in a zone of saturation.

"Household waste" means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

"Industrial solid waste" means solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of RCRA. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: Electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

"Landfill" means an area of land or an excavation in which wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under § 257.2.

"Lateral expansion" means a horizontal expansion of the waste boundaries of an existing landfill unit.

"Leachate" means a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.

"Municipal solid waste landfill" means any landfill or landfill unit that receives household waste. This landfill also may receive other types of RCRA Subtitle D wastes, such as commercial

(c) As used in paragraph (a) of this section, the "maximum horizontal acceleration in lithified material" means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 90 percent or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

§ 258.15 Unstable areas.

(a) The owner or operator of a municipal solid waste landfill unit located in an unstable area must demonstrate to the State that engineering measures have been incorporated into the unit's design to ensure the stability of the structural components of the unit. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(b) As used in this section, "structural components" means liners, leachate collection systems, final covers, run-on/run-off systems, and any other component necessary for protection of human health and the environment.

(c) Existing units of a municipal solid waste landfill located in unstable areas that cannot make the demonstration specified in paragraph (a) of this section must close within 5 years of the effective date of this part in accordance with § 258.30 of this part and conduct post-closure activities in accordance with § 258.31 of this part.

(d) The deadline for a closure required by paragraph (c) of this section may be extended by the State after considering, at a minimum, the following factors:

(1) Availability of alternative disposal capacity; and

(2) Potential risk to human health and the environment.

§§ 258.16–258.19 [Reserved].

Subpart C—Operating Criteria

§ 258.20 Procedures for excluding the receipt of hazardous waste.

(a) The owner or operator of a municipal solid waste landfill unit must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes as defined in Part 261 of this title and polychlorinated biphenyls (PCB) wastes as defined in Part 761 of this title. This program must include at a minimum:

(1) Random inspections of incoming loads;

(2) Inspection of suspicious loads;

(3) Records of any inspections;

(4) Training of facility personnel to recognize regulated hazardous waste; and

(5) Procedures for notifying the proper authorities if a regulated hazardous waste is discovered at the facility.

(b) As used in this section, "regulated hazardous waste" means a solid waste that is a hazardous waste, as defined in 40 CFR 261.3, that is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) or was not generated by a conditionally exempt small quantity generator as defined in § 261.5 of this title.

§ 258.21 Cover material requirements.

(a) The owner or operator of a municipal solid waste landfill unit must cover disposed solid waste with suitable materials at the end of each operating day, or at more frequent intervals if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging.

(b) The State may grant a temporary waiver from the requirement of paragraph (a) of this section if the State determines that there are extreme seasonal climatic conditions that make meeting such requirements impractical.

§ 258.22 Disease vector control.

(a) The owner or operator of a municipal solid waste landfill unit must prevent or control on-site populations of disease vectors using techniques appropriate for the protection of human health and the environment.

(b) For purposes of this section, "disease vectors" means any rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans.

§ 258.23 Explosive gases control.

(a) The owner or operator of a municipal solid waste landfill unit shall ensure that:

(1) The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and

(2) The concentration of methane gas does not exceed the lower explosive limit for methane at the facility property boundary.

(b) The owner or operator of a municipal solid waste landfill unit must implement a routine methane monitoring program to ensure that the standards of paragraph (a) of this section are met.

(1) The type and frequency of monitoring must be determined based on the following factors:

(i) Soil conditions;

(ii) The hydrogeologic conditions surrounding the disposal site;

(iii) The hydraulic conditions surrounding the disposal site; and

(iv) The location of facility structures and property boundaries.

(2) The minimum frequency of monitoring shall be quarterly.

(c) If methane gas levels exceeding the limits specified in paragraph (a) of this section are detected, the owner or operator must:

(1) Take all necessary steps to ensure immediate protection of human health;

(2) Immediately notify the State of the methane gas levels detected and the immediate steps taken to protect human health; and

(3) Within 14 days, submit to the State for approval a remediation plan for the methane gas releases. The plan shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon approval by the State.

(d) As used in this section, "lower explosive limit" means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25°C and atmospheric pressure.

§ 258.24 Air criteria.

(a) A municipal solid waste landfill shall not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to section 110 of the Clean Air Act, as amended.

(b) Open burning of solid waste, except for the infrequent burning of agricultural wastes, silvicultural wastes, land-clearing debris, diseased trees, debris from emergency clean-up operations, or ordnance, is prohibited at municipal solid waste landfill units.

§ 258.25 Access requirement.

The owner or operator of a municipal solid waste landfill unit must control public access and prevent unauthorized vehicular traffic and illegal dumping of wastes to protect human health and the environment using artificial barriers, natural barriers, or both, as appropriate.

§ 258.26 Run-on/run-off control systems.

(a) The owner or operator of a municipal solid waste landfill unit must design, construct, and maintain:

u der this paragraph, the owner or operator must:

(i) Notify the State in writing within 7 days of determining statistically significant evidence of contamination that (s)he intends to make a demonstration under this paragraph;

(ii) Within 90 days, or an alternate time period approved by the State, submit to the State a report that demonstrates that a source other than a municipal solid waste landfill unit caused the contamination or that the increase resulted from error in sampling, analysis, or evaluation; and

(iii) Continue to monitor in accordance with the Phase II monitoring program.

§ 258.56 Assessment of corrective measures.

(a) An assessment must be conducted by the owner or operator when any of the constituents listed in Appendix II has been detected at a statistically significant level exceeding the ground-water trigger levels defined under § 258.52 of this part during the Phase II monitoring program.

(b) The owner or operator must continue to monitor in accordance with the Phase II monitoring program. The State may require the owner or operator to conduct additional monitoring in order to characterize the nature and extent of the plume.

(c) The State shall specify the scope of the assessment, which may include the following:

(1) Assessment of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 258.57;

(2) Evaluation of performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(3) Assessment of the time required to begin and complete the remedy;

(4) Estimation of the costs of remedy implementation;

(5) Assessment of institutional requirements such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s); and

(6) Evaluation of public acceptability.

(d) The State may require the owner or operator to evaluate as part of the corrective measure study one or more specific potential remedies. These remedies may include a specific technology or combination of technologies, that, in the State's judgment, achieve the standards for remedies specified in § 258.57.

(e) The owner or operator shall submit a report to the State on the remedies evaluated pursuant to paragraphs (a)–(d). The State shall then select a remedy based on the criteria described in § 258.57.

(f) If at any time during the assessment described under paragraphs (a)–(e) of this section the State determines that the facility poses a threat to human health or the environment, the State may require the owner or operator to implement measures defined under § 258.58(a)(3) and/or (a)(4) to protect human health and the environment.

§ 258.57 Selection of remedy and establishment of ground-water protection standard.

(a) Based on the results of the corrective measure study conducted under § 258.56, the State must select a remedy that, at a minimum, meets the standards listed in paragraph (b) below.

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the ground-water protection standard as specified pursuant to paragraphs (e) and (f) of this section;

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of Appendix II constituents into the environment that may pose a threat to human health or the environment; and

(4) Comply with standards for management of wastes as specified in § 258.58(d).

(c) In selecting a remedy that meets the standards of § 258.57(b), the State, as appropriate, shall consider the following evaluation factors:

(1) Any potential remedy(s) shall be assessed for the long- and short-term effectiveness and protectiveness it affords, along with the degree of certainty that the remedy will provide successful. Factors to be considered include:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) Effectiveness of the remedy in controlling the source to reduce further releases. The following factors should be considered:

(i) The extent to which containment practices will reduce further releases;

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) shall be assessed by considering the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) Practicable capability of the owner or operator including a consideration of the technical and economic capability.

(5) The degree to which community concerns are addressed by a potential remedy(s) shall be assessed.

(d) The State shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. The State will consider the following factors in determining the schedule of remedial activities;

(1) Extent and nature of contamination;

(2) Practical capabilities of remedial technologies in achieving compliance with ground-water protection standards established under § 258.57(e) and other objectives of the remedy;

(3) Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

(4) Desirability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of