RECOMMENDATIONS

FOR A NONHAZARDOUS WASTE DISPOSAL PROGRAM IN ILLINOIS

AND

A BACKGROUND REPORT

TO ACCOMPANY PROPOSED REGULATIONS FOR

SOLID WASTE DISPOSAL FACILITIES

PART A: LANDFILLS

BY

THE SCIENTIFIC/TECHNICAL SECTION OF THE

ILLINOIS POLLUTION CONTROL BOARD

R84-17

DOCKET D

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EDITION NOTE

This report is a combined, revised and updated version of two reports submitted to the Board on June 3, 1987 and June 22, 1987. It is intended to be read along with the proposed regulations submitted to the Board on February 18, 1988. This report and proposal supersede all previous submittals by the Scientific/Technical section of the Illinois Pollution Control Board.

The proposed regulations adopted by the Board contain changes and additions to the February 18, 1988 proposal that are not addressed in this report. These changes and additions are explained in the Board's First Notice Opinion and Order, dated February 25, 1988 (Docket R88-7).

Copies of the February 18, 1988 proposal are available upon written request from the Illinois Pollution Control Board (100 West Randolph Street, Suite 11-500; Chicago, IL 60601) for the cost of reproduction and postage, $34.17.

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I. RECOMMENDATIONS

A. Introduction

Consistent with the Board's Orders of February 19, 1987 and March 5, 1987, the Scientific/Technical Section (STS) reviewed the information in the record of Proceeding R84-17, Dockets A, B, and C. The STS provided recommendations to the Board in the form of a background report and proposal. These were submitted to the Board on June 3, 1987 and designated as Docket D. This report contains an analysis of the major technical issues and provides substantiating information, background, and an explanation of the basis for the accompanying proposed regulations. It has been updated and amended with new information as a result of the comments and testimony received between June 1987 and December 1987.

We propose that the format and language in the Board's present regulations for landfills (part 807) be reorganized, with separate sections for permitting requirements, construction quality assurance, and design and performance standards. These recommendations include minimum design standards, performance standards for special circumstances and alternative technologies, a new procedure for implementing experimental practices, new permitting procedures and requirements for a groundwater impact assessment.

The proposed regulations are limited to nonhazardous waste disposal facilities. For the purposes of this report and proposal we define nonhazardous waste disposal facilities as all facilities not regulated under The Resource Conservation and Recovery Act (RCRA). The proposed regulations do not apply to waste generators, waste haulers, temporary storage of waste, waste treatment facilities, surface impoundments and hazardous waste disposal facilities. Except for sections specifically related to permits and permit functions these requirements are intended to apply to onsite disposal facilities.

This report represents the opinions and recommendations of the Scientific/Technical Section. The primary author was Richard A. DiMambro, environmental engineer with the Scientific/Technical Section. The report was reviewed in whole or part by Dr. Harish Rao, environmental engineer with the Scientific/Technical section, Dr. Gilbert Zemansky, chief of the Scientific/Technical Section and now a private consultant, and Karyn Mistrik, librarian with the Scientific/Technical section, who also assisted in the literature survey. Kathleen Crowley, attorney assistant to Board member Joan Anderson, reviewed the proposal as to form and procedure consistent with the Board order of February 19, 1987. Dr. David E. Daniel, Dr. Robert K. Ham, and Dr. Aaron A. Jennings each reviewed parts of the report and provided comments.

B. An Overview of The Record to Date

The present regulations in Part 807 are inadequate. They do not meet existing minimum federal criteria for nonhazardous waste disposal facilities. They are more or less outdated, having been adopted for the most part in 1973. They barely recognize the problems of landfill gas monitoring and collection, groundwater monitoring, and liners and leachate collection systems. The minimum standards for onsite waste disposal facilities, which are exempt from permit requirements pursuant to Section 21 (d) of the Environmental Protection Act (Act), are in some respects difficult to understand and implement because some standards are tied directly to permit conditions. Finally, the organization of the regulations does not lend itself easily to reorganization or expansion.

The Illinois Environmental Protection Agency (Agency) submitted a proposal on May 31, 1984 and was the subject of hearings held in proceeding R84-17 Docket A. The Agency proposal can be generally characterized as a design standard based approach because the regulations are quite specific about how a waste disposal facility is to be designed and constructed. While two hearings were held, the background information necessary to support the technical requirements was never presented to the Board. Nevertheless, there are some interesting aspects, particularly in groundwater monitoring, that we recommend adopting. The organization, however, is confusing because it references and supplements the RCRA hazardous waste disposal requirements in Parts 700 through 725 and the nonhazardous waste disposal requirements in Parts 807 and 809. Because the Agency provided no technical support for the design standards, their merits cannot be comprehensively evaluated.

The Illinois State Chamber of Commerce (ISCC) prepared a proposal (R84-17 Docket B) based primarily upon the existing Parts 807 and 809 and submitted it to the Board on April 4, 1985. This proposal can be generally characterized as a performance-standard based approach. General standards of facility performance are prescribed with procedures for implementation of Agency design criteria. Several hearings on this proposal were held in which waste generators and disposers underscored the need for a waste management system based upon the relative risk of the waste on the environment. However, because this proposal retains nearly all of the present language of Parts 807 and 809, adoption of this proposal would perpetuate existing problems.

Waste Management, Inc. (WMI) proposed a third set of requirements (R84-17 Docket C). The goal of WMI "in preparing these regulations was to follow the Congressional directive under RCRA Subtitle D and to develop a regulatory proposal at the state level which would generally track with the proposed Subtitle D standards as they are currently being developed" (R. 1247-1248, Docket C). This proposal contains several new concepts not discussed in the others, including a detailed set of location standards with the intent of limiting facility development to areas with suitable hydrogeological characteristics, and a classification system called DRASTIC, which gives potential sites a numerical rating based upon weighted, site-specific factors. The specific standards for waste disposal facilities can be generally characterized as performance-standard based. The proposal by WMI retains some of the old language, but greatly expands the number of requirements and scope of Agency review. The proposal contains sections which would bring the regulations into compliance with the existing federal criteria, 40 CFR 257. The proposal was also supported by extensive testimony by WMI and their consultants. We expanded and clarified many of WMI's concepts in this proposal.

The weaknesses of the WMI proposal stem in part from the fact that the proposal originated from a similar proposal sent by WMI to the United States Environmental Protection Agency (USEPA). It delegates authority and provides flexibility to the Agency similar to that provided to the USEPA. Some of this delegation violates the Environmental Protection Act and the Illinois Administrative Procedures Act, thus making some critical parts of the WMI proposal as written unworkable in Illinois. We also believe that the groundwater protection requirements are unworkable. This point will be discussed in detail further.

The proposal that follows is a result of our review of the record of this proceeding to date. A proposal and background report was initially filed in June 1987. Hearings were held between June and October 1987. The comments, information and suggestions by participants have been given serious consideration. As a result of new information, suggestions and comments the proposed regulations and the background report have been revised. The regulations are based on sound scientific principles, and combine some of the most desirable aspects of all three proposals with new standards which we have developed from the literature and the recommendations of the experts who testified before that Board. We believe the proposal represents a workable approach to the regulation of nonhazardous waste disposal facilities.

C. The Choice Between Performance and Design Standards

Much of the debate by proponents is focused on the perceived advantages and disadvantages between "performance standards" and "design standards." Generally, a performance standard describes the expected performance of a structure allowing specific design criteria to be developed on a site-specific basis. Design standards delineate specific design requirements applicable to all structures. A clear distinction does not exist between the two; what may be defined as a design standard by one person might be considered a performance standard by another. For example, we can specify that runoff from disturbed areas less than that resulting from the 25-year event be diverted around the landfill site. Some would call this a performance standard because the level of expected performance of the structure has been specified; others would call it a design standard because the 25-year event is the basic parameter used to determine the size of the structure. Because of the difficulty in interpretation of these terms they are not used within the context of the regulatory proposal itself. However, we make liberal use of these terms throughout the report.

The advantages of performance standards are that they increase the flexibility of the landfill designer, allow site specific information to drive the design of the facility, and readily allow the adoption of new technology without changes to the regulations. On the other hand, proper implementation of performance standards requires a much greater effort in processing permit applications. This is because the justification for choosing a particular design standard must be presented for each site. The applicant must hire a large number of qualified individuals or consultants to prepare the designs. The Agency is also obligated to maintain a large, skilled staff to review designs. Whereas overall savings in construction costs are possible, they will be offset in part by the increased costs of preparing and reviewing engineering designs.

Design standards are easily understood by all parties, they lead to equity among all waste disposal operators, they assure consistency in the review process, they are easily enforced by the regulatory authority, and they require less expertise on the part of both the regulatory authority and the operators (both find it easy to follow "cookbook" methodologies rather than develop new design criteria for each site). In order to implement a design-standard based approach, very conservative standards must be established, usually based upon the worst possible conditions expected to be encountered. Most facilities will, therefore, be overdesigned. However, part of this additional construction cost will be offset by the reduced design and engineering staff requirements.

It is not necessary to base an entire regulatory program around solely performance or solely design standards. Instead, we recommend that each element of a solid waste management program be evaluated individually to determine the appropriate regulatory mechanism. Massmann and Freeze (1987) assessed the relative worth of "containment-construction activities, site exploration activities, and monitoring activities as components of a design strategy for a waste management facility subject to groundwater contamination" using mathematical models. A sensitivity analysis indirectly showed that design standards are more effective than performance standards in reducing risk and that design standards are more effective when applied as requirements on the containment structure (liner and leachate collection systems) than on the groundwater monitoring network. But they also found that performance standards are more effective at identifying sites that may fail. Therefore, there is some justification for proposing a regulatory program with a combination of design and performance standards.

In some cases, such as, for example, the number and location of groundwater monitoring wells in the monitoring network, we propose the use of performance standards because the desired performance must be achieved at many sites displaying highly variable geology. In other cases, the judicious use of design standards is utilized where we believe it is necessary and appropriate to set minimum standards to promote equity among the various segments of waste management professionals and to give the Agency a more precise mechanism by which to measure equivalent performance. Design standards are particularly effective for describing the minimum expectations of the engineered landfill structures such as, for example, compacted earth liners and covers. We also use design standards for specifying technology which is so superior that alternate methods are unlikely to ever prove more effective. In cases where design standards are specified we also propose a set of alternate performance criteria which in turn allows designers to utilize different design standards. This is a refined extension of the equivalent performance concept proposed by WMI. The burden falls on the permit applicant to demonstrate to the Agency that the performance criteria are achieved. In the case of onsite facilities, which require no permit by the Agency, the designers who wish to utilize the alternate performance criteria must evaluate the design standards on their own. Should an enforcement action ever take place, the operator of the onsite facility would be required to demonstrate that the performance criteria were achieved.

A third category of standards, often referred to as "construction standards," has also been discussed as a desirable regulatory mechanism. The term construction standard is utilized when prescribing specific methods for constructing facilities, for example, lift thickness, minimum number of passes, type of compaction equipment, and geomembrane compounds. We do not believe that construction standards are an appropriate regulatory mechanism. The use of construction standards can arbitrarily limit desirable design flexibility, and may become so detailed that the original intent of the regulation is lost.

D. Hazardous Constituents in Nonhazardous Waste

Hazardous wastes may legally enter landfills designated for residential and commercial wastes. This waste may be attributable to three sources within the landfill: household hazardous waste, hazardous waste generated by small quantity generators (no manifest is required, this waste may find its way into a sanitary landfill.), and hazardous waste placed in sanitary landfills prior to 1976. Our review to date indicates that the landfills from which data on hazardous constituents were collected may have, at some point, accepted waste that is now excluded from the facility by RCRA. It is impossible to determine what percentage of the hazardous constituents can be attributed to small quantities of household hazardous waste and small quantity generators and what percentage can be attributed to hazardous wastes placed before the stringent requirements of the RCRA. Brown and Donnelly (1985) caution that the "toxicity of the municipal landfill leachate may be due to past disposal, legal or illegal, of industrial waste or be a result of the anaerobic degradation of selected waste constituents."

The presence of hazardous constituents in leachate has several implications that can affect a landfill design and performance. The first is that these constituents can attack both the liner and the in situ soils and destroy their low permeability characteristics. However, the average constituents of municipal leachate are unlikely to cause a liner failure. This will be discussed in more detail in Section II of this report.

Second, it is implied that a wastewater treatment plant is unlikely to accept leachate with hazardous constituents. Dr. Lue-Hing of the Metropolitan Sanitary District of Greater Chicago (MSD) presented a case study to the Board (Lue-Hing, 1986) in which the disposal of leachate from a hazardous waste facility was by discharge to a wastewater treatment facility. Dr. Lue-Hing indicated that the wastewater could be handled as any other industrial point-source discharge (R. 794, Docket A) and that MSD would have little problem dealing with leachate from nonhazardous waste disposal facilities (R. 790, Docket A). He did caution that the ability to handle large amounts of leachate will vary from plant to plant and that varying amounts of pretreatment may be necessary (R. 798-800, Docket A.). After a review of other pertinent literature, described in more detail in Section II of this report, we conclude that the hazardous contaminants in leachate from nonhazardous waste disposal facilities, if properly managed, are unlikely to cause problems in handling and disposal. While some smaller facilities may be unable to handle leachate flow which exceeds about five percent of their inflow, most modern wastewater treatment plants should be able to handle leachate. We have developed standards for leachate handling (Section 811.309) and discuss them in Section II, below.

Finally, it has been suggested that, because sanitary landfills contain hazardous waste and the leachate contains hazardous constituents, all sanitary landfills should meet the minimum design requirements for hazardous waste disposal facilities (Subtitle C of RCRA). The data we have reviewed does not support this extreme position. We agree that hazardous constituents are found in leachate, sometimes in amounts close to the maximum drinking water standard and these may escape from the unit. Such releases appear to be few and far between. If we treat the existing data as an upper bound, then the average concentration of hazardous chemicals in leachate is likely to be much lower or undetectable. Because of the current RCRA requirements for the handling, treatment and disposal of hazardous wastes we do not expect future levels of hazardous leachate contaminants in sanitary landfill leachate to be any greater than studies have shown.

It does not appear that the presence of household hazardous waste and waste from small quantity generators affects the performance of sanitary landfills. This does not constitute an endorsement of such a practice. There may be other valid reasons for removing small quantities of hazardous waste from the waste stream such as, for example, health and safety of collection and hauling personnel.

E. Protection of Groundwater

The protection of the groundwater resource is perhaps the most important factor in the siting and design of solid waste disposal facilities. The Agency proposal required the application of the public and food processing water supply standards in 35 Ill. Adm Code 303, Subpart B at an unspecified point of compliance. It appears that the Agency intended to apply these standards at the point of sampling within the property. The disadvantage to this program is the lack of an enforceable point of compliance.

WMI proposes no specific standards. A point of compliance is established at 500 feet from the waste boundary or the property boundary, whichever is less. If a statistically significant increase in the concentration of any constituent is discovered at that point, then an assessment monitoring program is established. If the assessment monitoring program confirms the contamination, then a risk assessment is performed and followed, if necessary, by a remedial action. It is only when a risk assessment is performed that specific standards for the protection of groundwater are established. This approach is strongly biased towards protecting sources of groundwater currently in use. The risk evaluator is required to consider potential uses of groundwater surrounding the property, but the performance standard proposed by WMI requires that the facility pose "no risk to human health and the environment." Under this standard it is unclear if potential sources of drinking water will receive the same level of protection as sources of groundwater currently in use. The requirement for a risk assessment after contamination is observed provides no assurances before the placement of waste that groundwater will be protected. The only assurance that is provided under this system is that the geologic criteria established under the DRASTIC procedure is adequate to control the escape of any contaminants. No burden is placed upon the operator to demonstrate that the geology, design and operation are sufficient to prevent contamination.

This proposal introduces a new method of setting groundwater monitoring standards which ties the site characteristics, design, operation and monitoring into an integrated system. The methods by which a facility is designed and monitored are modeled after the methodology specified by the Clean Water Act and the National Pollution Discharge Elimination System (NPDES) and based upon existing Board regulations. These proposed groundwater standards should not be considered only as monitoring requirements. A procedure for evaluating site adequacy, the design of the facility and the monitoring program are related. We intend that the groundwater standards be viewed as performance standards that the operator must achieve by following a rigorous procedure for siting and designing the facility.

This procedure starts with the premise that a discharger (to groundwater) is responsible for preventing a discharge to groundwater by using the best economically available containment and leachate removal technology. A discharger may not rely upon the existing natural environment as the primary containment mechanisms. The requirement for onsite leachate management and containment is inflexible; however, the designer of the facility may determine the best containment mechanism by utilizing the equivalent performance standards. In Part II of this report it will be shown that the best available containment and leachate removal technology is a compacted earth liner three feet thick with a leachate drainage layer and collection system. This is the minimum allowable containment technology allowed at any facility that disposes solid waste that will produce contaminated leachate. Variations to this design are allowed if the operator can demonstrate that the performance will be equivalent to, or superior to, the established minimum design standards.

After the containment mechanism is chosen the operator must show that discharges from the facility will not cause an increase in the concentrations of constituent compounds at a point 100 feet from the waste boundary, or property line, whichever is less within 100 years after closure of the unit. If the containment mechanism is inadequate then it must be upgraded or another site must be chosen. We call this procedure a groundwater impact assessment and specify a methodology in Section 811.317.

If the waste to be disposed is inert, then no contaminated leachate is expected to be formed and no containment mechanism is required. It has been suggested that a third category of waste be developed and recognized by these regulations, "benign" wastes. Benign wastes would be industrial wastes such as fly ash, foundry sand, steel mill slags, dusts and sludges. Benign wastes, it was suggested, could be placed in facilities without containment mechanisms if the attenuation mechanisms of the in situ materials would provide "equivalent protection of the environment to the standards set forth herein for 'land disposal sites' receiving general municipal wastes" (Exhibit 33, R 84-17 Docket D). It is strongly recommended that such standards be discouraged as a matter of policy. In order to protect and preserve the environment each discharger to groundwater must utilize the best available and economically feasible technology to prevent the discharge of contaminated leachate to groundwater. The solution to pollution is not attenuation or dispersion. We do not recommend or endorse any standards which rely on the natural environment as the primary containment and treatment mechanism.

It was suggested that "small" sanitary landfills be designed to less stringent standards than "large" landfills. No documentation was presented, however, to demonstrate that small landfills are less likely to cause significant impacts to public health, safety, and cause groundwater contamination and air pollution. The size of a facility does not appear to ba an appropriate criteria for determining the stringency of standards.

The proposal does not contain specific geologic location standards. Several possible methods of implementing hydro-geological location standards have been proposed:

1. Use a categorization method such as DRASTIC criteria rating. This was proposed by WMI. They proposed two categories of acceptable sites, "locationally preferred" and "locationally constrained."

2. Use a set of design standards to establish locational suitability. This is what the Agency proposed. A specific set of distances and minimum hydraulic conductivities would be established. The advantage to a system such as this is that the standards would be very simple to understand and enforce. The disadvantages are the same as any design standards, the requirements are inflexible and would be based upon the worst possible conditions expected to be encountered. The standards that would be chosen will also be somewhat arbitrary.

3. Establish a performance-based approach with no minimum location criteria and require the operator to demonstrate the suitability of a site solely on the basis of a groundwater impact assessment. Such a requirement is subject to manipulation of the predicted performance by the engineered features and can be affected by the quality of the data used to perform the assessment.

The third approach was chosen, with modifications. The operator is required to utilize certain minimum structures such as a liner, leachate collection system, final cover, and will be required to monitor the performance of the facility over time. The suitability of the site and the minimum engineered features are evaluated during the groundwater impact assessment. The Illinois State Geological Survey evaluated the potential effects of the design standards described in this proposal on groundwater in various geological formations found throughout the state. The results of this study indicate that a performance based approach is workable in Illinois. The study showed that a groundwater impact assessment could differentiate good sites from marginal sites and marginal sites from poor sites.

F. Organization of the Proposal

The proposed regulations will replace all of existing 35 Ill. Adm. Code Part 807, at least for landfills. Part 807 is structured in such a way that major modifications would be nearly impossible. The new regulations are divided into five new Parts. All definitions have been placed in one Part and are to be applied consistently throughout. No terms previously defined in the Act, except solid waste, have been modified to avoid confusion. The definition of solid waste is modified to specifically exclude hazardous wastes regulated under RCRA.

Three broad categories of nonhazardous solid waste are proposed. This division reflects the general consensus that wastes should be disposed in a manner consistent with the risk they pose to the environment (R. 13-14, 856, and 862, Docket B). The categories of waste are somewhat consistent with the Agency's proposal of classes of landfill. Instead of delineating the waste by generator, we propose three categories based upon the properties of the wastes. There are three levels of waste disposal regulations, consistent with the category of waste to be placed in the unit. The implementation of a special waste categorization system as described in another Board proceeding, R85-27, may improve the interpretation of these concepts by providing a system of measuring waste properties.

The first category of waste is called inert and is defined as waste that will not burn, biodegrade, serve as food for vectors, form a gas, cause an odor, or produce a contaminated leachate. The proposed regulations for inert waste disposal are intended to prevent erosion, insure stability and prevent unauthorized waste from entering the unit. The requirement for daily cover may be waived if there is no danger of blowing debris or if daily cover would not minimize or eliminate windblown particles. Postclosure care requirements are minimal and relate mainly to surface reconstruction.

The second category of waste is called chemical waste and is defined as a waste that will form a contaminated leachate by chemical or physical processes. Such wastes are produced as a result of some sort of industrial activity and would usually be placed in a disposal unit dedicated to only that waste (a monofill). However, chemical wastes may be codisposed in a putrescible waste disposal unit. The main difference between chemical wastes and putrescible wastes is the recognition of the biodegradable component of putrescible waste. Facilities which accept only chemical wastes need not be equipped with gas collection systems and will not qualify for reductions in the design period based upon shredding and leachate recycle.

The third category of waste is called putrescible waste and is defined as waste that will form a contaminated leachate by biological, chemical or physical means. Municipal waste is considered putrescible waste by definition. This type of waste must be placed in a disposal unit equipped with liners, leachate and gas control systems, final cover caps and other requirements typical of sanitary landfills. This category of wastes is the default category. Any waste which is not regulated under RCRA, cannot be classified as inert and cannot be classified as chemical is considered putrescible.

Hazardous wastes must be handled in accordance with RCRA as well as other state hazardous waste requirements. We propose no changes to any hazardous waste requirements at this time and do not include hazardous wastes in the definition of solid waste for these regulations. An operator, in order to comply with some of the performance standards described in this proposal, may be required to construct structures or perform monitoring that exceeds the minimum hazardous waste standards.

Part 811 contains the design, performance and operating standards for all new waste disposal facilities, including onsite facilities. This part is organized into six subparts. Subpart A contains standards of general applicability for all facilities. Subparts B and C each address additional requirements for inert, putrescible and chemical waste disposal units, respectively, in addition to the requirements of Subpart A. Subpart D contains requirements identification and management of special wastes. Subpart E contains requirements for Construction Quality Assurance. The standards for several structures can be covered by a single set of construction quality assurance requirements. All structures requiring a construction quality assurance program are denoted in either their appropriate sections or in Subpart E. Subpart G contains the closure and postclosure financial assurance requirements.

Part 812 contains requirements for the information to be submitted to the Agency for a permit to develop and operate a waste disposal facility. The standard itself is separate from the procedures involved in demonstrating compliance. The performance, design and operating standards can be implemented by an operator of an onsite facility without permit conditions or other methods of agency approval. Part 812 is intended to be a checklist of materials to be submitted in a permit application.

Part 813 contains procedures for obtaining, modifying and renewing permits for solid waste disposal facilities. There is also a new procedure for implementing experimental practices. In general, there is very little discussion in the record on what constitutes a workable permitting procedure and there is very little information available in the published literature. Most of the procedures in Part 813 are based upon statutory requirements and existing regulations in Part 807; however, we propose some new procedures to address the increased size and scope of permit applications.

We have also reevaluated the Agency's practice of issuing a development and, later, an operating permit to each facility. Continuation of this practice under these proposed regulations would be cumbersome and, in some cases, confusing. The procedures in Part 813 require the Agency to issue a development permit for a solid waste disposal facility. All units, supporting systems, operating plans, and postclosure plans would be approved in a single permit. The Agency will monitor construction by issuing an operating authorization for each structure at the facility built in accordance with a construction quality assurance plan. An operator may not place a structure into service until the Agency reviews the acceptance report submitted by the construction quality assurance (CQA) officer and issues the authorization. Conditions may be placed on the authorization only as they relate to the operation of the structure under review.

Part 814 contains standards for existing facilities. Existing facilities are divided up into three general groups: facilities that may remain open for an indefinite period of time, facilities that will close within seven years of the effective date of these regulations, and facilities which are either unable to demonstrate compliance with the requirements of the first two categories, or are scheduled to close within two years of the effective date of these regulations. Facilities in this last category must close within two years of the effective date of these regulations under their existing permits, in accordance with the requirements of Part 807. The minimum requirements of Part 814 are based upon the existing federal requirements (40 CFR Part 257).

Part 815 describes the information that must be filed with the Agency by facilities exempt from permit requirements under Section 21 (d) of the Act. Facilities would be required to file an initial facility report with the Agency, describing the facility layout and design, annual reports, and quarterly groundwater monitoring reports.

II. A DISCUSSION OF THE PROPOSAL

A. Discussion of Part 810: General Provisions

Section 810.101 Authority, Policy and Purpose

This section sets the scope of the regulations. These new requirements will apply to all waste disposal facilities except hazardous waste management facilities permitted under 35 Ill. Adm. Code Part 700.

Section 810.102 Severability

This section establishes the severability, for appeal purposes, of the new regulations.

Section 810.103 Definitions

We propose deleting all of the existing definitions in Part 807 and starting with a clean slate. We see no reason to change or modify terms defined in the Act, unless absolutely necessary. The goal has been to simplify the definitions, encourage a consistent vocabulary throughout, and minimize confusion. Many definitions have been eliminated because the terms are redundant, obvious from context, outdated, unnecessary, or no different than a "dictionary" definition. We propose one section of definitions that will be applicable throughout Parts 810 through 815.

"Admixtures" are chemicals added to naturally occurring earth materials to improve their physical and chemical properties. The proposed regulations contain a provision to allow earth liners enhanced by admixtures, provided that the performance of the liner is equal to, or greater than, the indicated requirements.

The definition for "applicant" is intended to identify any person, partnership, corporation, or government agency which may apply for a permit. The term applicant is used until the permit is approved, at which point the term "operator" is used. We intend that there be one applicant who will receive a permit which designates a single operating entity.

A definition of the term "aquifer" is necessary to define the bottom of the zone of attenuation. The groundwater standards apply to all groundwater whether or not there is an aquifer. Since the Groundwater Protection Act now contains a definition of aquifer suitable for the purposes of this proposal a new definition is not necessary here. We recommend using the definition of aquifer from the Act.

"Runon" is a term that, unfortunately, is becoming widely accepted in regulatory language. We can find no use of the word in hydrology or engineering texts or papers and the definitions of runon in other state requirements are inappropriate for our purposes. The reason is because runon is a very imprecise and unscientific term. Runoff, however is a widely accepted and precise hydrologic term used to describe the percentage of precipitation that flows overland to and on but not in a defined streamchannel. We propose using this more precise term and using a modifier to distinguish between runoff which must be handled and treated and runoff which should merely be diverted. Runoff from disturbed areas may be discharged only in accordance with the terms of a permit to discharge from the Agency. Runoff from undisturbed areas must be diverted around disturbed areas, to the extent possible, to minimize the amount of water that must be intercepted and treated. "Disturbed areas" are defined as any land which is physically altered during the waste disposal operation and land physically altered for support facilities.

"Earth liners" are narrowly defined as structures constructed from naturally occurring soil materials. So called "natural liners" are excluded from this definition. This point is further discussed in the section on liners.

"Hydraulic Barriers" are defined as structures designed to prevent or control the seepage of water. Several examples are given. An earlier, similar definition of "earth barriers" has been dropped.

We will be using consistently two new terms to describe solid waste disposal sites. A "unit" is a solid waste disposal trench or pit. A "facility" is the entire solid waste disposal operation which can consist of one or more units, the offices and associated buildings, leachate treatment and storage systems, surface water control systems, gas control systems, and all roads connected to and maintained by the facility operator. We feel that any structure which has a direct and exclusive economic relationship with the solid waste disposal operation and is necessary for the operation of the environmental control systems should be included in the facility. The permit area is a three-dimensional boundary around a permitted facility. All units and related structures must be within the permit area.

A definition of "field capacity" is proposed because this term is used in the design and performance standards. A designer must assume the unit is at field capacity when designing a leachate collection system in accordance with the standards in Section 811.307 (b). Saturation of the waste is considered undesirable (Ham, 1986). The definition of field capacity is taken from the testimony of Dr. Robert K. Ham (R. 545, Docket A).

"Gas condensate" is the liquid produced in a landfill gas collection system when the gas is cooled or compressed. This definition is derived from several sources and is intended to cover all liquids within the gas collection, processing, and disposal systems.

The gas management requirements originally proposed have been modified for clarity and as a result of several comments. We propose changing the emphasis from "active" and "passive" management systems to "gas collection systems" and "gas venting systems." This distinction is related to the functions of the various gas management systems available to an operator.

A gas collection system is designed to collect and transport gas to a central point, or points, where it can be burned, treated, or processed for beneficial use. Gas collection systems can be active, meaning that the gas is transported through the system by a mechanically produced pressure differential such as a compressor. Gas collection systems may also function as passive systems, meaning that gas flows to the collection point by a pressure differential created by the biodegradation process.

A gas venting system is designed to direct landfill gas from below ground to the surface, where the gas can mix with air. This definition takes the place of the previously defined "passive system."

We have chosen to use the terms "geomembranes" and "geotextiles" to describe all synthetic materials used in geotechnical engineering applications. Geomembranes are low permeability, synthetic membranes. Geomembrane is a term now coming into wide practice because it correctly implies that these products may function in applications other than lining waste disposal sites, such as covers, for example. Geotextiles are permeable materials with a wide range of applications throughout a waste disposal facility. Performance standards are proposed to provide guidance to the designer.

The term "groundwater," as defined in the Act, is suitable for the purposes of these regulations. We do not feel that it is appropriate to offer a new definition in this proposal. The definition of groundwater is taken directly from the Act.

We have modified the existing definition of "leachate" to broadly apply to all water that comes into contact with a solid waste. Leachate is further defined in context, where necessary, as contaminated or uncontaminated.

A definition of "malodorous odor" is necessary because the existence of such an odor will trigger the installation and operation of a landfill gas control system. In response to comments requesting a more enforceable and less subjective definition, we will use the language from the definition of air pollution, 35 Ill. Adm. Code 201.102.

In order to minimize confusion over the applicability of Section 811.303 (b), a precise definition of a shredding operation is necessary. The intent is to include all operations that cut, tear, puncture or shred a solid waste, exposing more area to degradation processes (R. 638, Docket A) and breaking open protective plastic wrapping and containers that may inhibit the degradation process (Kinman et al., 1986). Baling and other volume modification operations do not qualify because they may not necessarily expose more surface area of the waste to the elements that lead to stabilization.

The procedure proposed by the Illinois State Chamber of Commerce (ISCC) for handling permit modifications is refined by developing a specific definition of significant modification (R. 48-51, Docket B). The definition we propose is to be utilized as a guidance criteria to determine if Agency review of a modification is necessary.

The definition of solid waste has been narrowly defined to exclude hazardous waste disposed in compliance with other Board requirements. Solid waste is further modified into three specific categories based upon the relative ability of the waste to be stabilized and its potential to degrade the environment through air or water contamination.

B. Discussion of Part 811: Standards for Waste Disposal Facilities

SUBPART A
GENERAL STANDARDS FOR WASTE DISPOSAL FACILITIES

Section 811.101 Applicability

The standards in Subpart A apply to all new waste disposal units. They are to be used in conjunction with the applicable requirements of Subparts B and C.

Section 811.102 Location Standards

The location standards here are proposed on the assumption that there are areas clearly unacceptable for development of any kind of waste disposal facility. These location standards are derived primarily from federal requirements. In some cases there are corresponding State of Illinois requirements.

The requirement limiting development of solid waste disposal facilities in 100-year flood plains, Section 811.102(b), is taken from 40 CFR 257.3-1. Development of facilities in the 100-year flood plain may be allowed only if compensatory storage of flood waters is provided and the facility is designed to withstand a flood without breaching. It was suggested by several participants that all solid waste disposal operations in floodplains be banned outright. This suggestion was given consideration. We note that there may be some instances where a floodplain offers the only practical location. For such situations a set of performance criteria would be desirable. The existence of these criteria should not be construed as an encouragement for the development of landfills within a floodplain. One participant noted that the intent of new legislation for the management of floodplains, HB 998, "was clearly to prohibit new construction in the 100-year flood way within northeastern Illinois." This statute does not appear to "clearly" prohibit waste disposal facilities. The Department of Transportation may designate any activity within a floodplain as appropriate in certain cases. A set of standards for facilities constructed in the floodplain is appropriate for those circumstances where facilities are to be developed in a floodplain. We decline to modify this section.

Section 811.101 (c) is taken from the federal requirements. We have modified it to include State landmarks as designated pursuant to the Illinois Historic Areas Preservation Act.

Sections 811.102 (e) and (f) are directly from 40 CFR 257.3-8, with language modifications to conform to state format and administrative procedures. Subsections (c), (d), (e) and (f) require documentation from the respective agencies, either federal or state, that the facility will not cause a violation of the statutes or requirements in question. The Agency is not required to make the determinations. Section 812.109 contains requirements for an applicant to submit documentation from the federal or state agency responsible for enforcing the specific provision.

Section 811.103 Surface Water Control

The surface water control requirements are intended to prevent pollution of surface water by diverting runoff from undisturbed areas around the disturbed areas and preventing the discharge of runoff from disturbed areas that does not meet applicable discharge requirements. All disturbances at a facility must be considered point sources of pollution and all discharges must be regulated under Section 402 of the Clean Water Act. In response to comments we have modified the language to require that discharges meet applicable standards. This changes the focus of the section from treatment to discharge. Waters meeting applicable discharge limitations may be discharged without treatment.

Section 811.103 (a) applies to the collection of runoff from disturbed areas. Facilities must obtain a permit to discharge. This requirement applies to all solid waste disposal facilities, not just those permitted by the Agency.

We recommend that all surface water facilities be designed for the 25-year, 24-hour precipitation event. All runoff resulting from this, or smaller, precipitation events must be discharged in accordance with applicable standards. Runoff from larger events need not be controlled or monitored. We also recommend that treatment facilities be designed to survive the 100-year, 24-hour precipitation event.

The 25-year, 24-hour precipitation event appears in the federal requirements as a minimum. Based upon the probability of exceeding this event over the life of a typical facility and the damage that would occur to public health and safety, the 25 year design event appears appropriate. To determine the probability of exceeding this event a simple statistical evaluation can be performed by assuming, for example, that a landfill will operate for 10 years and take 5 years after closure to establish a healthy stand of vegetation. The probability of equaling or exceeding the 25-year, 24-hour precipitation event at least once during the 15 year lifetime of this example is 46 percent.

It has been suggested that, instead of the proposed criteria, the standards applicable to discharges from coal mining operations, 35 Ill. Adm. Code Subtitle D, be utilized (R. 1897, Docket D). We do not believe that these requirements are applicable to discharges from solid waste disposal facilities. The design precipitation events for mining operations is the 10-year, 24-hour precipitation event. The minimum federal requirements for sanitary landfills is the 25-year, 24-hour precipitation event. The mining discharge requirements are less stringent. The requirements of this section are based upon existing Board requirements for discharges from point sources. No information has been presented to show that discharges from existing solid waste disposal facilities exceed these standards. Finally, the data collected by the USEPA from coal mine sources indicates that only a small number of contaminants appear in discharges, including: iron, lead, ammonia, zinc, fluoride, manganese, total suspended solids and pH. We can expect a wider range of contaminants from solid waste operations, especially where runoff comes into contact with the waste or leachate from the waste. If an operator were required to monitor only the requirements applicable to discharges from coal mines, then many critical contaminants may be missed and substantial amounts of pollution may occur. Finally, the locations, types of materials, size of operations, types of contaminants, and relative risks to the environment are different. It would be inappropriate to expect all discharges from solid waste disposal facilities to be the same as all discharges from mining operations.

The Board received comments contending that some surface disturbances due to landfill activities do not constitute a point source of pollution. We disagree. In general, our interpretation of the definition of a point source in the CWA and the applicable federal regulations at 40 CFR 122.26 indicate that a point source is created once the area has been disturbed.

Runoff from undisturbed areas must be routed around the disturbed areas, to the extent possible. Runoff from undisturbed areas which must be commingled with runoff from disturbed areas is considered to be runoff from disturbed areas and subject to possible treatment. We specify the 25-year, 24-hour precipitation event as the design event for diversion structures to be consistent with the requirements for disturbed areas and the existing federal criteria.

Section 811.104 Survey Control

A disposal operation should take place only within the specified and approved area. The regulations in this section will insure that the facility is properly placed, as indicated by its legal description, and that the limits of the disturbed areas are accurately designated.

The location of chemical and putrescible waste disposal facilities is particularly important. The groundwater quality standards are applicable within a zone of attenuation around the facility that is not subject to stringent requirements.

All permitted operators will be required to conform to elevations designated on a topographic map. A professional land surveyor land should periodically (once a year) check the elevations against established benchmarks and report these elevations to the Agency in the annual report required in Section 813.

Section 811.105 Compaction

Compaction is the key to avoiding or minimizing settling problems. Dr. Ham also indicated that the density of the waste is a factor in the biodegradation process (R. 640, Docket A). Buivid et al. (1981) found that loosely packed, well mixed material is not as favorable for biodegradation as more heavily compacted material. We recommend that all operations compact waste to the maximum extent possible to minimize void spaces. We do not recommend specific design standards such as minimum density, number of passes or size of lifts because they do not adequately cover the range of wastes and disposal practices likely to be encountered. This section is proposed as a performance standard. Likewise, a minimum lift thickness is not specified in this section. We can find no documentation to support any type of minimum construction standard such as the two feet in the existing requirements. A lower lift thickness or more compactive effort may be appropriate for some operations.

The first lift of waste must be placed in a manner which will protect the leachate drainage and collection pipe systems. Therefore, the requirements for the first five feet of waste are handled as a special case in Section 811.321.

Section 811.106 Daily Cover

The requirement for an application of six inches of soil as daily cover appears in the existing regulations, all three proposals and in nearly every other state program we have evaluated. The purpose of daily cover is to minimize windblown debris, minimize access to the waste by vectors, minimize the threat of fires, and minimize odors. We have found no evidence that this requirement is inappropriate or excessive in achieving the desired results.

Dr. Johnson, of the National Solid Waste Management Association (NSWMA), suggested that flexibility be allowed for alternatives to daily cover. We propose an alternate performance standard to allow an operator to substitute a different material or different technique. One example of such a substitute is the use of tarpaulins to cover the active face at the end of the work day (Anonymous, 1979). Tansel et al. (1987) studied novel cover materials and alternatives to daily cover, noting that daily cover "consumes a considerable fraction of total landfill volume and it may be appropriate in some cases to consider alternatives to traditional daily cover soil applications." Among some successful novel covers are synthetic sheeting, chemically fixed sludge, sludge amended soil, shredded refuse, shredded tires, flyash, bottom ash, slag, and others. Alternative techniques include stripping cover prior to resuming waste placement and applying no daily cover at all.

In order to maximize flexibility the proposal contains an alternative performance standard to change or eliminate the use of daily cover at all units. The operator must determine that the novel or alternative daily cover meets the same performance as the six inches of daily cover. This flexibility will apply to all types of waste.

Section 811.107 Operating Standards

The intent of subsection (a) (1) is to require the operator to conduct filling in the most stable manner. Subsection (a) (2) requires the operator to plan the progression of waste placement so that parts of the facility can be closed as quickly as possible.

The performance standard specified in subsection (b) (1) is intended to keep the active operation concentrated to as small an area as possible. This regulation is framed as a performance standard in which the available equipment, safety of the workers, and efficiency of operation must be considered. In general, we believe that the size of the open face will be determined by the operator's ability to apply daily cover in accordance with Board requirements.

Subsection (b) (2) is a design standard that specifies the maximum slope allowable at the working face. Steeper slopes may be appropriate in some cases. The optional performance standard may be used if the waste has sufficient strength. The operator must have sufficient equipment at the facility to maintain compliance with all Board regulations. The types and numbers of equipment necessary for operations are determined by the size of the working face, amount of solid waste accepted at the facility, operating practices and maintenance schedules. This section also requires the operator to maintain all equipment to perform the necessary functions.

Sufficient utilities must be available at all times in order to operate the facility and the environmental control systems. These utilities generally include electricity to operate machinery, water for workers, firefighting, and some processes, and wastewater treatment capability. Other utilities may be necessary to comply with the regulations. This section is not intended to require the construction of utilities that are not necessary for compliance with these regulations.

The environmental control systems at a solid waste disposal facility will probably operate in an acceptable manner at first. Proper maintenance is required in order to keep these systems working at the level necessary to meet the regulations. This requirement is a general performance standard for the operator to provide ongoing maintenance and operation of essential equipment and processes.

Section 811.107 (f) regulates open burning in accordance with Board requirements and the federal criteria, 40 CFR 257.3-7 (a).

Section 811.107 (g) was taken from the existing Board regulation. It is intended to require that dust suppression methods be adopted. Section 811.107 (h) was taken from the Agency proposal and is intended to address any problems due to excessive noise. Sections 811.107 (i) and (j) were taken from the Agency proposal to require the operator to develop vector control and fire safety plans.

Subsection (k) was taken from the existing regulations. The operator is responsible for litter patrol and cleanup at the facility to prevent litter from migrating from the site.

Section 811.108 Salvaging Operations

In keeping with State policy to recycle (Illinois Solid Waste Management Act, HB 3548), salvaging operations should be encouraged. Materials should be removed from the disposal site and reused wherever possible to conserve space. These performance standards allow a salvaging operation within reasonable limitations. Obviously the salvaging operation should never interfere with the operation of the waste disposal facility, particularly the environmental control operations.

By definition, a salvaging operation which has a unique and exclusive economic relationship with a single waste disposal facility is considered a part of the facility.

Section 811.109 Boundary Control

We propose a boundary control section to address three problems: safety, access and unauthorized dumping. The operator will be required to restrict access to the active parts of the fill and prevent access after normal hours. The active waste disposal area can be an extremely hazardous place for people to wander through or children to play in. Section 811.111(a) requires the operator to secure the area, presumably by fencing but other methods are possible.

Access to any waste disposal site should be limited. One problem discovered at inert waste facilities in California is that chemical and putrescible wastes somehow find their way into the facility (R. 1494-1496, Docket C). Any hole in the ground is a potential illegal disposal site. We, therefore, strongly recommend that every waste disposal facility, including inert waste disposal facilities, limit access to authorized people only. Federal criteria, 40 CFR 257.3-8(a), requires that the operator prevent unauthorized access. We also recommend that inert waste be screened just as stringently as putrescible and chemical wastes prior to acceptance by the facility.

We recommend that a sign be posted at the entrance to the facility, showing the information listed in Section 811.113(b). The most critical pieces of information on the sign are the hours of operation and the phone number to call in emergencies. One can assume that activity in the facility after normal operating hours is illegal and anyone observing such activity may call the emergency number if it is easily provided.

The intent of this section is to prevent unauthorized dumping and protect public health and safety. All facilities, including inert waste disposal units, must be secure. Fencing, security checks, warning signs and locked gates should be considered routine at all solid waste disposal facilities.

Section 811.110 Standards for Closure

This section addresses the shape and contours of the final closed landfill. They are generally stated as performance standards so that the operator retains flexibility to designate an appropriate land use for the site and design a final topography compatible with that land use. It is not the intent of these standards to specify a particular land use.

Section 811.111 Postclosure Maintenance Standards

This section describes the closure, and postclosure maintenance and inspection requirements. We have modified the inspection frequency from annual to quarterly inspections for the first five years. After that, the inspections may be reduced to an annual rate if a good stand of vegetation is established and there are no clearly eroding areas.

SUBPART B: Standards for Inert Waste Disposal Facilities

Section 810.201 Applicability

Subpart A applies to all facilities. The standards in this Subpart are tailored to inert waste disposal facilities. If all of the waste streams entering a unit are inert, then the operator would be required to comply with the requirements of Subpart A and Subpart B.

This Subpart is intended to apply mainly to disposal operations at industrial sites which dispose wastes that will not cause or contribute to environmental problems such as groundwater pollution and gas migration. Landfills should be reserved for wastes which may pose a threat to public health and safety. Alternate disposal methods for inert wastes will conserve valuable landfill capacity for wastes which will produce contaminated leachate and gas. Alternate disposal methods, such as those outlined in this Subpart, would reduce the cost of disposal without increasing the threat to public health and safety.

It has been suggested that regulations be developed which categorically define certain industrial waste streams as inert. For example, all steel slag wastes and all foundry waste sands would be categorized as inert by definition. While information is available to show that many wastes produced by many manufacturers are indeed inert, it is clear that all waste streams vary in their ability to produce contaminated leachate and must be evaluated on a case by case basis. Perhaps the most complete investigation of specific waste stream properties was conducted for the American Foundrymen's Society by Ham, et al. (1985). Ham et al. (1985). They found variations in 13 foundry landfill leachates (6 in an unsaturated zone study and 7 in a saturated zone study). Some leachates contained constituents below the drinking water standards while others contained several constituents in excess of the drinking water standards, the latter leachates, if not properly controlled, may cause groundwater contamination. Table 1, showing data from the American Foundrymen's Society (1978) shows the ranges of contaminants in foundry leachates as compared to other wastes. While the range of concentrations shows that foundry leachate is not as contaminated, in general, as municipal leachate it is clear that foundry leachate may be considered contaminated and may cause groundwater pollution.

There are also difficulties in determining the wastes to be included in a generic waste stream. The materials used in the processes at foundries and steel manufacturing plants vary, as do the constituents of the raw materials. It would be impossible to develop a definition of a generic waste stream without including

Table 1: Ranges of Pollutants in Selected Wastes

Component	Foundry Leachate	Urban Landfill Leachate	Septic Tank Effluent	Board Standard*
Organic carbon (mg/L)	4-185	250-28,000	25-200	-
COD (mg/L)	25-1,100	100-51,000	250-1,000	-
Phenol (mg/L)	12-400	-	0-300	.001
Cyanide (mg/L)	20-80	-	-	.025
Sulfate (mg/L)	30-1,200	25-1,500	10-600	500
Fluoride (mg/L)	3-1,20	-	0-10	1.4
Iron (mg/L)	0.1-0.5	200-1,700	0-20	1.0
Zn (mg/L)	0.1-15	1-135	0.15	1.0
Ni (mg)	0-0.6	0.01-0.8	0.02	1.0
Cu (mg/L)	0.02-1.6	0.1-10	0.1	.02
pH	7.2-10.0	4-9	6.8-8.5	6.5-9

*35 Ill. Adm. Code 302.301-302.3

some kind of test of the waste to determine its characteristics, thus defeating the purpose of a generic classification. Clearly, the most appropriate method of categorizing waste is on an individual waste stream basis.

Section 811.202 Determination of Contaminated Leachate

This section describes the acceptable ways to determine if a leachate is contaminated. It is framed as a performance standard so that specific methodologies for extracting leachate samples can be adjusted to account for variabilities in the waste and site specific conditions.

The operator may test leachate by obtaining samples from a laboratory procedure or from an actual landfill. The intent of these requirements is to obtain a sample of leachate that comes as close as possible to the leachate that may be produced under field conditions. These regulations are intended to provide standards for testing, not a standard test and should provide sufficient guidance to the Agency and operators to develop appropriate test methods. We chose to not recommend a specific test procedure in these regulations. It was suggested that a specific test procedure was necessary in order to implement these requirements. We do not agree. The intent of this regulation is to specify the conditions under which the test is to take place to closely replicate field conditions.

It has been suggested that the water quality standards used for evaluation address only certain parameters from the list of chemicals regulated by the Board. The assertion is that there are several standards established in Part 300 that are based upon conditions found only in surface waters that are intended to protect aquatic life and are, therefore, not appropriate for groundwater regulation. This assertion is premised on the concept that groundwater only serves as a source of drinking water for humans. The Board found that while groundwater is used for public water supplies it would be shortsighted to ignore other uses. The Board stated (R86-8, p. II-6):

> In addition to withdrawal by man, natural discharges of groundwater constitute a significant facet of an overall picture of groundwater utility. While not conventionally considered a "use" of water, these dischargers are a major contributor to the natural aqueous environment. Therefore, some consideration of the role they play is warranted and should be borne in mind in any planning for groundwater protection.
>
> Natural groundwater discharges are most obvious at the site of springs. However, natural groundwater discharges also occur into streams, lakes, and wetlands. As such, they contribute water to these environments, and in some cases and at some times they are the dominant source of water added to the environment in question. Clearly, the quality of the groundwater resource, therefore, has ramifications on the quality of the environment into which the groundwaters discharge.

This excerpt shows that the Board does not intend to adopt groundwater standards based solely on their use as a public water supply. In addition to groundwaters which discharge to surface waters, the Board noted in their report (R86-8, p. II-6) that agriculture accounts for 24 percent of the groundwater use in Illinois and that irrigation, the largest agricultural category, alone accounts for 18 percent of the total groundwater used in the state. It is quite appropriate to recommend standards which protect fish, wildlife and vegetation and are consistent with Board recommendations. It can be assumed that the Agency, when preparing proposed standards for Board regulations in accordance with the Illinois Groundwater Protection Act, will consider these recommendations by the Board. The application of standards for inert waste are based upon an assumption that the wastes will not pose a threat to the environment no matter where (within reason) the landfill is placed.

Section 810.203 Design Period

The design period is the period of time the facility is expected to be in operation and serves as the basis for design of structures and calculation of postclosure care costs, the design period for an inert waste disposal unit is a minimum of five years after closure. This period is the minimum allowed by statute and is likely to be sufficient to allow the establishment of a good stand of vegetation so that stability is maintained and erosion is minimized. Biodegradation of the waste is not expected to occur; therefore, no gas monitoring is required. This section establishes the design period only for inert waste disposal facilities.

Section 811.204 Final Cover Requirements

The purpose of final cover over an inert waste disposal unit is to provide sufficient soil to promote vegetation so the area will be erosionally stable and aesthetically pleasing. The depth of final cover can vary as a function of the type of vegetation and land use after filling. We propose that three feet of cover be placed over the entire unit. Warm season perennial turfgrass mixtures require a minimum of three feet of good topsoil for root penetration (Casnoff and Beard). More cover can be specified, if necessary, for areas where root penetration is expected to be higher. The cover need not be impermeable; in fact, good quality topsoil is preferable to promote vegetation growth.

Less cover may be acceptable. This is for cases where no vegetation is planned; for example, if the area is to serve as a parking lot then one foot of compacted base material may be all that is necessary. In all cases we recommend that the final slope configuration be erosionally stable.

Section 811.205 Final Slope and Stabilization Standards

These standards require that all inert waste disposal facilities be designed to resist massive slope failures such as toppling and sliding. The operator will need to perform a slope stability analysis to determine the maximum height and slopes for a specific location. The operator will also find it necessary to investigate the soils under and around the facility for the possibility of a slope failure.

The requirements for vegetation are proposed as performance standards. The operator may choose appropriate species based upon the postclosure land use of the site. The intent of subsection (b) is to require the operator to construct an erosionally stable surface which will not be susceptible to wind or water erosion.

SUBPART C: STANDARDS FOR PUTRESCIBLE AND CHEMICAL WASTE DISPOSAL FACILITIES

Section 811.301 Applicability

The requirements of this subpart apply to all new units that accept putrescible and chemical wastes. By definition, a facility that codisposes both chemical and putrescible wastes is considered a putrescible waste disposal facility. The limits of codisposal of special waste can be determined by the Agency on a site-specific basis in accordance with the requirements of Subpart E.

Section 811.302 Location Standards

These standards provide prohibitions within the vicinity of certain existing structures or designated areas. The intent is to provide a margin of safety over and above that of the engineered features. If the operator has carefully followed these requirements then the probability of a noticeable change in groundwater quality beyond the property boundary is greatly reduced. The setback from public water supply wells is intended to provide a margin of safety to reduce the risk that wells will become contaminated due to discharges from the unit. The setback distances are provided in the Groundwater Protection Act. With this modification we believe that this proposal is now consistent with the Illinois Groundwater Protection Act in all respects.

We consider sole-source aquifers designated by USEPA as a special case for which additional protection must be provided. In addition to the requirements for a liner, leachate collection system, final cover, a groundwater impact assessment and groundwater monitoring, specific geologic location standards for distance to the aquifer and permeability are proposed. The setback distance is increased and an additional showing that the in situ material will effectively control the migration of contaminants into the aquifer is required. We recommend that sole-source aquifers be given the maximum practical protection possible. Any putrescible waste disposal facilities located near sole-source aquifers must provide a high degree of assurance that discharges will not occur. We are unaware of any sole-source aquifers designated by USEPA in Illinois at this time. This should not, however, affect the adoption of stringent criteria for developing waste disposal facilities on or near the aquifers.

It has been suggested that this criteria is not sufficient to insure protection of drinking water. It should be noted that this subsection is an additional set of requirements to all of the other groundwater protection mechanisms, including the setback requirements of subsection (a), the liner and leachate collection system requirements of Sections 811.306 through 811.308, and the water quality standards. We believe that the cumulative effect of all of these requirements is sufficient to protect a source of drinking water.

The setback distances for homes, occupied dwellings and other buildings are intended to establish a noise, odor and nuisance zone between the buildings and the edge of the unit. Note that distances are measured from the edge of the unit to the edge of the building, not the property boundary. In response to many comments on these established distances we propose to allow a smaller setback distance if the owner provides permission to the operator in writing.

Setback distances from surface waters were originally proposed to provide a margin of safety for upsets and failure of the runoff control systems. We have reconsidered these setback standards because:

1. It is difficult to specify which surface waters should be subject to setback standards. The previously recommended section generated many comments on the interpretation of "navigable waters." One suggestion was to establish minimum sizes of ponds and rivers to be subject to these standards. We find such designations somewhat arbitrary;

2. Regulations are already proposed to divert or control surface water runoff resulting from the 25-year, 24-hour precipitation event. The probability of exceeding this event at least once during the 15 year life of a facility is approximately 46 percent;

3. Stringent requirements are proposed for facilities located in 100-year floodplains; and

4. Protection of wild and scenic rivers, sensitive wildlife, and endangered species is assured by other provisions in the proposal.

We, therefore, do not believe that additional numerical setback distances are necessary or appropriate to assure adequate protection of surface water.

Subsection (f) is taken from the federal criteria, 40 CFR 257.3-8 (c). It was suggested that a landfill be allowed within the specified setbacks from an airport if the operator could demonstrate that the hazard from birds to aircraft could be controlled. We do not believe it is appropriate for the Agency to become involved with issues related to airport safety. We decline to accept this suggestion.

Section 811.303 Design Period

Waste disposal units will function for a certain, finite period of time. This period is determined by the length of time the unit is to be in operation and by the amount of time necessary to stabilize the waste. The length of time a waste disposal unit is to be in operation can be fairly accurately estimated. The stabilization time, or postclosure care period, can be estimated with less certainty. We now define a new term, "design period," in context, as the period of time the structures at a landfill must be designed to function properly. The same design period must be applied to all putrescible waste disposal facilities to insure equity among all operators and provide adequate long term performance. The best information available to us suggests that this period ought to be approximately thirty years after closure. All environmental control structures must consist of materials and equipment that can function for a minimum of thirty years after closure.

Ham and Bookter (1982) showed that shredding can accelerate the stabilization process. Dr. Ham stated that shredding is beneficial in the sense that the decomposition will occur more quickly and you will form more of the organic materials leaving the site as methane, as opposed to leachate-borne constituents. It would shorten the period of time over which you must be concerned about it from a water contamination potential. (R. 655, Docket A)

Buivid et al. (1981) found that shredding of paper and other fibrous materials exposed the fibers at the torn edges to "enhanced capillary action and subsequent enzymatic attack." In order to encourage the use of shredding we propose that the design period be reduced to twenty years if all putrescible wastes entering the unit are shredded. The definition for shredding requires that all putrescible waste be reduced so that 90 percent by dry weight will pass a three inch sieve.

If a leachate recycling system is installed and operated in accordance with Section 811.309 (e) then we believe that the design period can be reduced to twenty years. Ham and Bookter (1982), Pohland (1980), and Lu et al. (1985) have observed varying degrees of accelerated decomposition in various laboratory sized lysimeters.

The design period is established only for purposes of preparing designs and estimating the duration of the unit for the purposes of calculating postclosure care cost estimates. The actual stabilization period will be determined on a site-specific basis by monitoring leachate and landfill gas production and surface topography for unacceptable settling, excessive erosion, seeps, cracks, stressed vegetation, and other problems.

It was suggested that the regulations should not allow a reduction in the design period for units that recycle leachate or shred waste. We believe that there is sufficient documentation to show that these practices accelerate the decomposition process and that some incentive must be provided to operators willing to invest in the equipment to recycle leachate or shred waste. The incentive provided by a reduction in the design period is not expected to increase the probability of groundwater pollution because the postclosure care period is dictated by monitoring results. We therefore, decline to accept this suggestion.

The design period for chemical waste disposal units is the operational life of the unit plus 30 years. This may not be reduced because biodegradation is not expected to occur.

Section 811.304 Foundation and Mass Stability Analysis and Section 811.305 Foundation Construction Standards

The liner and leachate collection system are likely to function adequately for the entire design period if they are not subject to excessive movement due to foundation failure. The ability of the material beneath the waste disposal facility to support the expected loadings must be carefully evaluated by a geotechnical engineer. If necessary, patches of poor foundation material must be removed and replaced with suitable soil. Such foundation soil must be placed with the same care as a liner system.

The requirements for mass stability will insure that the facility is not placed in areas prone to landslides and other massive failures. A geotechnical analysis will also show if the final configuration of the facility will cause a failure. The methods for analyzing slopes for stability is a well-established discipline in civil engineering. Many analysis methods are available from hand calculation and graphical estimates to computer analysis programs designed to operate on computers ranging from personal computers to large mainframes.

The safety factor for bearing capacity is the ratio between the ultimate bearing capacity of the soil and the pressure exerted on the soil by the waste disposal unit. A safety factor of 1.0 indicates that the maximum bearing capacity of the soil is equal to the pressure exerted by the unit and failure is imminent. Higher safety factors for bearing capacity than for slope stability are generally used. The factors presented here are within the range of accepted practice for facilities that may be a threat to public health and safety should failure occur. Very high factors of safety are occasionally specified where there is little detailed knowledge of the underlying soils. This is not likely to be the case at solid waste disposal facilities where the hydrogeology must be accurately described.

The factors of safety are derived from Huang (1985) and Sowers and Sowers (1970). The safety factors for slope stability are in the range of standard engineering practice for projects of this type. In simple terms, a safety factor is the ratio between the forces that tend to hold a slope in place and the forces that would cause a slope to fail. A safety factor of less than 1.0 is considered unsafe; safety factors between 1.0 and 1.2 have "questionable safety," according to Sowers and Sowers (1970). Most civil engineering projects are designed in the range of 1.3 to about 1.5. The exact safety factor is generally set based upon the expected hazards, the threat to public health and safety, and the conditions under which the slope analysis is to take place. Static safety factors of 1.5 are specified for earth dams, mining tailings ponds, and coal processing waste embankments. The static safety factor specified here is within the range of standard geotechnical engineering practice where failure of the structure presents a threat to public health and safety.

It is also common practice to specify lower seismic slope safety factors because the probability of these events is lower and the methods of analysis of seismic events are generally considered to be conservative. Again, the seismic slope safety factor specified in the regulations is within the range of standard practice.

These are performance standards. The effect of this section would be to limit the height and maximum permissible slopes of a unit, based upon the ability of the underlying soils to support the weight of the unit and the strength of the material in and below the unit to resist slope failure. If an analysis shows that a safety factor may be exceeded the operator has several alternatives under these regulations to meet the standards:

1. Lower the maximum elevation of the waste, thus providing less pressure on the soil by lowering the weight of the waste disposal unit.

2. Consider removing the weak material under the proposed unit and replacing it with suitable material having a high bearing capacity.

3. Excavate down to a desirable strata of suitable foundation material. This may not be practical if there is an intervening water table.

4. If the facility cannot achieve the required slope safety factors then the operator could reduce the steepness of the slopes or the height of the fill until the desired factor is achieved.

Unless the in situ material is extremely poor, or if the surrounding slopes are prone to sliding, we do not see this section as precluding the construction of a waste disposal facility. However,the size and configuration may need to be modified to comply with these standards.

Section 811.306 Standards for Liners Systems

The operator will be required to utilize the best economically available methods to minimize the discharge of leachate from the unit. The best available, economically reasonable containment system is a compacted earth liner, three feet thick, compacted to achieve a minimum hydraulic conductivity of $1x10^{-7}$ cm/sec. Overlying the liner should be a leachate drainage and collection system to collect leachate that accumulates on the liner.

The liner requirements will apply at all putrescible and chemical waste disposal units, whether or not a so called "natural liner" exists. The operator may choose to recompact the in situ material or import borrow material that will meet the required specifications.

The standards for liners were developed by considering the liner and leachate collection system as an integrated system rather than two separate structures and evaluating the sensitivity of certain design parameters of the leachate collection and liner system for implementation in Illinois. These regulations are intended to be applied in conjunction with Sections 811.307 and 811.308 to provide an integrated leachate collection/liner system. We consider the following design parameters as appropriate for setting regulatory standards: thickness of the earth liner (d), length of the liner cell (S_0), slope angle of the liner (theta), saturated hydraulic conductivity of the drainage layer of the leachate collection system (k_1) and the saturated hydraulic conductivity of the earth liner (k_2).

When leachate is allowed to drain freely from the collection system some of these parameters are less sensitive than others. Sensitivity is evaluated by varying one parameter and holding all the others constant in a series of computer simulations. For each simulation the efficiency is usually calculated. Efficiency is defined as V_d/V_l, or the volume of leachate drained by the leachate collection system divided by the volume leaked through the liner, expressed as a percentage of flow. High efficiency ratios are generally preferred because a higher percentage of leachate is drained by the collection system. Most liners and leachate collection systems rarely exceed an efficiency of about 85 percent.

As d increases the efficiency also increases. This increase is not proportional. This is best shown in the sensitivity analysis performed by Kmet et al. (1981). Using a model proposed by Wong

(1977), in which the leachate flow from a single precipitation event is calculated, they observed that as d changes from 0 to 3 feet the efficiency increases rapidly; as d increases from 3 to 10 feet the change in the efficiency ratio is quite small. The optimum liner thickness is approximately 3 feet. This optimum thickness does not appear to be sensitive to changes in k_2. Demetracopoulos et al. (1984) made the same observation using a quasi-steady state version of the Wong model. Korfiatis et al. (1986), using a more sophisticated finite-element model, found that d is not a significant factor. Clerici and Collison (1982) developed a steady-state model to evaluate leachate collection systems. They were able to use the model to design an efficient liner/collection system and concluded that a well designed leachate collection system can perform more efficiently than a thick compacted earth liner alone. Therefore, we conclude that a liner approximately three feet thick is the most efficient and cost effective barrier when leachate is allowed to drain freely from the system.

Liners are generally constructed by using heavy scrapers, rollers, and dozers (R. 24-25, 1/15/86). Consider, for example, a liner three feet thick compacted in thin horizontal lifts of six inches. Six separate construction operations, one for each lift are involved in building this liner. If for some reason a defect occurs on a small portion of one lift (and is not caught by the quality assurance inspectors) there still remains another five nondefective layers which can provide protection. Therefore, we consider a liner three feet thick as, generally, the minimum practical size that can be constructed by standard equipment and techniques with naturally occurring earth materials, over large areas, and still provide an acceptable margin of safety.

The appropriate hydraulic conductivity of k_2 (liner hydraulic conductivity) has been discussed as a very critical design component. Kmet et al. (1981) found, however, that the ratio k_2/k_1 is a more sensitive factor. They found that the optimum hydraulic conductivity ratio (k_2/k_1) is $1x10^{-4}$, with a practical range between $1x10^{-5}$ and $1x10^{-3}$. Demetracopoulos et al. (1984) observed no change in the efficiency ratio when they varied the hydraulic conductivity of the liner from 0.01 ft/day to 0.0001 ft/day (approximately $4x10^{-8}$ cm/sec to $4x10^{-6}$ cm/sec). Korfiatis et al. (1986) found that the hydraulics of the leachate collection/liner system are controlled by the leachate flow rate, k_1 and k_2. Cosler and Snow (1984), using a finite element flow model, found k_1, as well as drain spacing and the permeability of the drain filter to be significant. However, this study only applied to one site in which pressure on the liner and leachate collection system was evaluated instead of the efficiency ratio and the liner parameters were not evaluated at all.

In order to derive an appropriate value for k_2 we looked at practical values of k_1. Berg et al. (1984) estimated the hydraulic conductivity of naturally occurring clean sand and gravel in Illinois as approximately $1x10^{-3}$ cm/sec. An operator should have no trouble finding large quantities of suitable material for a leachate collection system drainage layer that can achieve a minimum hydraulic conductivity of 1x10^{-3} cm/sec. We, therefore, propose that k_1 be a minimum of 1x10^{-3} cm/sec. An optimum value for k_2 can now be derived by setting k_2/k_1 equal to 1x10^{-4} and substituting 1x10^{-3} cm/sec for k_1, resulting in an optimum k_1 of 1x10^{-7} cm/sec. Conventional construction techniques using naturally occurring soils can be used to construct the liner and leachate collection system to achieve the required hydraulic conductivities (Reades, 1986; Gordon et al., 1984). An operator may adjust these requirements for site specific conditions by using the equivalent performance criteria.

Gordon et al. (1984) investigated four clay-lined landfills in Wisconsin. While problems were discovered at some sites, the overall performance of liners in Wisconsin demonstrated that compacted earth liners can "provide a high level of groundwater protection for municipal solid wastes and many industrial wastes." They further recommend a sound, detailed engineering plan and proper oversight to implement that plan. We, therefore, recommend that the compacted earth liner be constructed in accordance with a construction quality assurance plan.

Should the groundwater impact assessment show that more protection is necessary the designer has several options: increase the thickness of the earth liner (very inefficient, as indicated above, but possible), add a geomembrane over the earth liner, add a geomembrane and another leachate collection system (the RCRA double liner), use special construction techniques to decrease the hydraulic conductivity, or use admixtures to improve the characteristics of the liner. Other factors related to leachate production can be controlled such as changing the final cover design to decrease infiltration and changing the final topography to increase surface runoff. A competent designer will consider several of these options and choose a combination that is most economical. The proposed regulations allow the designer this flexibility.

Natural liners have been defined (in this proceeding, at least) as naturally occurring clayey soil deposits which function as earth barriers and are not modified by construction equipment. Excavations into the clay form the sides and bottom of the landfill. One can argue that recompaction of natural material is not necessary at certain sites because the material already meets or exceeds the appropriate requirements. However Griffin et al. (1985) found that natural in situ material contains sand lenses, joints, fractures, microstructure and other anomalies that may cause excessive leakage. Field testing techniques can account for some of these factors but we have seen no evidence that large clay deposits are sufficiently homogenous throughout the large areas necessary for land disposal units. Field testing is also impractical for large scale construction quality assurance programs. Natural liners alone may not be utilized under this proposal. All liners must, therefore, consist of compacted earth meeting the minimum design requirements discussed in this section. If sufficient material is not available onsite then it must be imported. The requirements for compacted earth liners and leachate collection systems at all putrescible and chemical waste disposal units are prudent technically feasible and economically reasonable when compared to the requirements proposed by the Agency and WMI (a compacted earth liner 10 feet thick).

Chemicals may attack earth liners and destroy their low permeability characteristics. In general, "organic chemicals must be present in a separate phase from the water (for example, gasoline floating on top of groundwater), or be dissolved in water at a concentration greater than 50 percent organic solvent in order for the organic chemical to pose any significant threat to the integrity of the earthen liner" (Daniel, 1985). Such a circumstance is unlikely at a municipal landfill.

Shimek and Hermann (1985), using sanitary landfill leachate samples from a Wisconsin landfill, found no change in permeability over periods between 6 months and one year on recompacted clay samples. Wuellner et al. (1985) also found that compacted clays are not affected by sanitary landfill leachate after 4 to 7 pore volumes of leachate passed through the column. Finno and Schubert (1986) observed clay liner compatibility with actual leachate samples at the CID Metropolitan Environmental Complex. They found that the permeability of the in situ liner did not increase after 3 years of exposure to landfill leachate. EMCON Associates (1983) collected and examined specimens of liner material for for changes in physical properties over time from a number of different facilities. A sample of clay liner exposed to leachate for 9 years showed no "cracking, channeling, or unusual changes in texture or consistency." A geomembrane sample of chlorosulfonated polyethylene exposed to leachate for 9 years was swollen and soft, the low-density polyethylene sample appeared to be unaffected after 9 years of exposure. While these studies do not show that a liner can always function effectively for an infinite time period, they do provide some confidence that modern, well-designed liners can effectively maintain the required hydraulic properties for many years. We also emphasize that 80 percent, or more, of the leachate will be drained through the leachate collection system and that the concentrations of contaminants that may contribute to the degradation of a liner in the leachate are expected to decrease with time.

Despite the confidence that a liner can function for long postclosure periods liner materials should be tested for compatibility with leachate constituents, particularly in the case of chemical waste disposal units. The proposed regulations require that all liner materials, including admixtures and geomembranes, be compatible with the leachate constituents at concentrations expected to come into contact with the liner. Bowders et al. (1985) document the advantages, disadvantages and applicability of some common testing methods. Specific test procedures are still under development and appear to be specific to the liner material that is to be tested. We decline to propose a specific compatibility test.

The use of geomembranes as the primary liner system, without a compacted earth liner, is strongly discouraged because of the relative immaturity of this technology and the mechanism of failure inherent in these systems. A puncture or rip is permanent unless the liner is repaired by hand. Compacted earth liners have limited self-healing characteristics and are able to absorb excessive forces and blows. However, a geomembrane and an earth liner composite system combination can be very effective. The geomembrane can withstand tensile loadings that would cause an earth liner to crack and fail while the earth liner provides protection against punctures and compressive stresses. We propose that geomembranes be used only in conjunction with an earth liner meeting the standards of Section 811.306(a).

Forseth and Kmet (1983) evaluated flexible membranes for use in landfills. They recommend evaluating the following factors when choosing a geomembrane: weathering resistance, soil compatibility, resistance to biological attack, physical suitability, installation requirements, and the compatibility of the membrane to the waste.

Elevated temperatures can cause creep and increase the susceptibility to attack from leachates. Low temperatures can cause a membrane to become brittle and crack. A geomembrane should be designed for the temperature extremes normally expected at the site. Ultraviolet light can also attack a geomembrane. A geomembrane installation should be covered as soon as possible after installation. Forseth and Kmet (1983) suggest several test methods for evaluating a liner's susceptibility to weathering forces.

Naturally occurring soil conditions can attack a liner. Tests are available to allow a designer to evaluate the susceptibility of a geomembrane to chemical attack from the in situ soil materials.

Biological attack may consist of microorganisms, plants, insects, burrowing animals and hoofed animals such as deer. There are actually animals that seem to enjoy eating geomembrane compounds. Most of these concerns can be mitigated by covering the liner as soon as possible after construction. All vegetation should be removed from the liner area to prevent damage from plants. This is not likely to be a problem under this proposal because all geomembranes must be constructed over a prepared base.

There are a number of tests available to establish the physical properties of a geomembrane. Forseth and Kmet (1983) point out that the interlaboratory reproducibility of some tests is questionable, mainly because of the lack of specific standards for some tests. This situation is improving, however, because new standards are being established and used. A designer must be aware of the physical limitations of the geomembrane material when designing a waste disposal facility.

The installation of geomembranes is a highly specialized construction operation. Openings in the membrane must be carefully sealed, seams must be properly fabricated and damage to the geomembrane by construction crews must be avoided. The installer of a geomembrane must follow a construction quality assurance plan and submit the acceptance report to the Agency. Performance standards for design and construction are appropriate because of the wide array of geomembrane types, styles and construction techniques. The designer must demonstrate that the geomembrane will perform for the design period under unfavorable stresses and operating conditions and be compatible with the expected leachate constituents.

Less conventional hydraulic barriers such as bentonite slurry walls, cutoff walls and other impermeable barriers are slowly becoming more acceptable. We recommend the use of these technologies only in conjunction with a compacted clay liner.

Slurry walls consist of a narrow trench excavated with specialized equipment or a backhoe which is pumped full of a slurry material which keeps the walls of the excavation from caving in. The slurry can contain bentonite, water, cement and even flyash to reduce permeability (Anonymous, 1986). The standards we propose specify a minimum level of performance but provide considerable flexibility to determine the most appropriate site specific design. Slurry walls must extend into a lower confining unit. In response to a comment criticizing the required key depth of the wall into the confining layer we have changed this construction standard into a performance standard. The slurry wall must extend into the lower confining layer to a depth necessary to maintain a continuous hydraulic barrier and prevent seepage.

Subsection (g) is proposed to allow an operator to utilize a technology not envisioned by these regulations because new technology must be recognized and encouraged. Special construction techniques may be utilized, for example. If more elaborate equipment is available and a thinner liner will perform as well or better than the three foot liner then these special construction techniques may be utilized. A good example was given by Dr. Daniel, who suggested that paving equipment could lay down very thin horizontal layers of carefully mixed material (R. 94, Docket A, 1/15/86). Another example is the use of admixtures such as soil cement, asphalt or bentonite. Fuller and Warrick (1985) present several different admixture types. Soil cement is a mixture of Portland cement, water, and in situ soils. A liner constructed from soil cement is not as strong as a usual concrete slab but will have a very low permeability. Chemical soil additives can be mixed, sprayed or injected into the in situ soil. Some common chemical additives are: petroleum-based emulsions, powdered polymers, and monovalent cationic based salts.

The performance of the alternative technology must be at least equal to the performance of the 3 foot thick liner compacted to a hydraulic conductivity of $1x10^{-7}$ cm/sec. This is the concept of "equivalent performance." The burden is on the operator to demonstrate that the alternative technology can achieve the desired performance. We also propose that the technology be used, at least once, in a similar manner to that proposed. This subsection is not intended to be utilized as a way to conduct experiments on unproven technologies.

Section 811.307 Leachate Drainage Systems

All areas of liner surface must be covered by a drainage layer designed for a maximum head of leachate of 1 foot during the wettest month of the year. The leachate head observed in a properly designed system should not exceed 1 foot more than once per year, and then only for a few weeks.

None of the researchers studying leachate drainage and collection system behavior have been able to derive an optimum value for maximum leachate head. All have found that higher heads encourage more leakage while lower heads result in a lack of driving force to move leachate through the drainage blanket to the collection pipe. The sensitivity analysis performed by Kmet et al. (1981) show that 1 foot is an appropriate criteria, providing high removal efficiency and minimizing leakage. This is intended as a design criteria, not an operating standard. The operator has no control over the amount of infiltration occurring at the landfill after the system is constructed.

Kmet et al. (1981) found no optimum value for collection pipe spacing. In general, efficiency decreases as spacing increases in a fairly linear fashion. The designer will determine pipe spacing on a case by case basis in accordance with the standard requiring a maximum of 1 foot of leachate.

Both Kmet et al. (1981) and Demetracopoulos et al. (1984) found that liner slope angles greater than 1 degree but less than 3 degrees were most effective in increasing efficiency. No significant improvement was observed above 3 degrees, indicating that drainage is controlled by other parameters. There is no optimum value. We, therefore, propose a performance standard which allows designers to choose an appropriate liner slope angle based upon the predicted amount of settlement, the ability of the operator to construct a sloped liner and the other controlling parameters in leachate drainage/liner system design.

The flowrate of leachate used in the design of a leachate drainage system is determined by using a water balance model . The water balance must take into account precipitation, evapotranspiration, runoff, infiltration, storage and discharge (R. 541-576, Docket A). The conditions under which this water balance is to be calculated are provided in the proposal. Several methods are available to perform a water balance but all require some kind of input. The HELP Model has been evaluated by several researchers, Barbour et al. (1985), Warner et al. (1986), and Peters et al. (1986). All found the model useful in designing composite cover systems and predicting the amount of leachate to be generated.

The unit will eventually reach field capacity. The requirement that the landfill be designed to handle leachate after field capacity has been reached is conservative during the early years of a unit but is likely to be a realistic condition during the closure phase.

The leachate drainage system shall be designed under the assumption that a final cover is in place. The time between placement of waste and placement of the final cover is likely to be a few months to a year. The collection of leachate from a closed unit is likely to occur for a minimum of five years to thirty years after closure. It seems logical to design the system around what is likely to be a long term condition. Also, it is impossible to predict the slope configuration and, therefore, the infiltration during the time waste is being placed.

Section 811.308 Standards for the Leachate Collection System

The leachate collection system consists of a network of collection pipes which transports leachate to central collection points for drainage or pumping out of the unit. We propose that all perforated collection pipes be surrounded by a coarse gravel envelope. This envelope serves two purposes. It will prevent solids from clogging the perforations of the collection pipe and, in the event of a pipe collapse, will serve as a flow path for leachate to drain through the nonfunctioning part of the system. The envelope must be designed using standard geotechnical techniques for sizing coarse gravel filters (Sowers and Sowers, 1970, and Bowles, 1979). These same geotechnical techniques can be utilized to determine the need for a graded filter or geotextile between the drainage blanket and the coarse gravel envelope. There are also techniques to allow a designer to choose pipe perforation size to promote optimum movement of water into the collection pipe. The collection pipes must be able to withstand the weight of equipment and material above the system. The operator is required to demonstrate that the pipe will have sufficient strength. In order to further protect the pipes from damage, special operating standards are proposed in Section 811.321.

Ghassemi et al. (1986) investigated problems, such as clogging, related to leachate collection systems at hazardous waste landfills and surface impoundments. However, most of the documented operating experience was found at municipal landfills. Problems were primarily attributed to poor (or no) design, little or no attention to construction quality control, and lack of maintenance and monitoring. The proposed regulations address each of these problems. Clogging of the leachate collection and drainage system was not a problem identified by Ghassemi et al. (1986) at landfills with properly designed collection systems. Where clogs or blockages occur the leachate can move through the drainage blanket along another pathway. Two landfills in Wisconsin reported no clogging problems after ten years of operation (Ghassemi et al., 1986). With proper maintenance and careful design and construction we see no reason why a leachate drainage and collection system could not function for the entire design period and, if necessary, beyond.

Compatibility of all leachate collection system materials is important. Ghassemi et al. (1986) described one case where a drainage blanket consisting of crushed limestone reacted with the acidic leachate and solidified into a solid block. The regulations contain a performance standard requiring that all materials used in the leachate drainage and collection system be compatible with the leachate expected to be produced.

The leachate drainage and collection system must be constructed with as much care, if not more, as the liner system. Therefore, we propose a stringent quality assurance program to insure proper placement and testing of all materials.

Maintenance of the leachate collection system is vital to insure proper performance during the design period. This means that all sections of the collection system must be accessible for inspection and for cleaning by, for example, water jets or brushes. The regulations require the operator to install cleanout points and demonstrate that the number of cleanout points is adequate to insure access to the entire system. We propose that the system be monitored to insure consistent performance.

Landfills located in the saturated zone, or inward-gradient landfills, as they are sometimes called, have been discussed as solutions to areas where the water table close to the land surface. Boutwell and Derrick (1986) examined the unique hazards and presented several case studies of inward-gradient landfills. They describe several successful applications of this design in several Gulf Coast states.

Gordon and Huebner (1984) evaluated two inward-gradient sites in Wisconsin. General problems noted were improper characterization of the hydraulic conductivity of surrounding clay strata and inadequate removal of leachate. In some cases permeable strata intersected the landfill, providing a convenient path for leachate to leave the site. Neither of the landfills were equipped with a drainage layer as required in Section 811.307 of this proposal. Removal of the leachate was not given a high priority. To alleviate these problems Gordon and Huebner recommended detailed site investigations, installation of a drainage blanket and leachate collection system properly designed by using standard water balance estimates, installation of a recompacted clay liner, and the use of analytical techniques to determine collection pipe spacing.

Two of these observations need to be accounted for in these proposed requirements to give guidance to designers of inward-gradient landfills. First, the leachate collection system must be designed for a maximum head of one foot during the wettest month of the year and at the same time the groundwater is at its seasonal high elevation. Second, the level of leachate in the leachate collection system must be at or below the level of the seasonally low water table. All of the other recommendations are accounted for in other parts of the proposal and, in fact, are applicable to conventional landfill design and operating practice. We believe that inward-gradient landfills offer practical solutions to areas that have high water tables, provided that a leachate collection system is properly designed and operated.

Section 811.309 Leachate Treatment and Disposal Systems

In order for the liner and leachate collection system to work at the highest possible efficiency leachate must be able to drain freely at all times to storage or treatment structures. The regulations in this section are intended to allow a flexible design for leachate management facilities in a cost effective manner. A leachate management system is defined in context as the entire sequence of leachate handling processes. For example, a leachate management system may consist of a pretreatment aeration pond with discharge to an offsite treatment works. Subsection (a) requires the operator to collect leachate as it flows or is pumped from the system. The operator is designated as responsible for leachate treatment and disposal.

There are several ways to dispose leachate: direct disposal to a local sanitary authority, treatment and discharge to surface water, pretreatment and disposal to a local sanitary authority, onsite storage and transport to a local sanitary authority and and direct discharge to an offsite treatment works. The proposed regulations are flexible enough to allow each of these methods in any combination. All leachate handling systems must be considered a part of the facility in order for the Agency to retain oversight and insure proper disposal.

This section is divided into four general portions that can be used together to design the leachate management system: standards for leachate storage structures, standards for leachate treatment units, leachate discharge requirements, and standards for disposal to the local sanitary authority. Several participants suggested that the regulations recognize that a combination of storage and treatment be utilized to insure that there is always a system available to accept leachate. Subsection (b) allows the operator to choose any combination of treatment or storage systems necessary to insure continuous leachate flow. The intent of this subsection is to allow the operator the flexibility to combine treatment and disposal options.

Onsite leachate treatment systems are technologically feasible, as described by Ham (1985) and Lu et al. (1985). Biological and chemical treatment plants are, by nature, complex systems requiring expertise for proper operation. Dr. Ham generally recommends onsite treatment as a last resort (R, 697, Docket A). Nevertheless, there may be some areas in Illinois where treatment is indeed the best or only alternative. The regulations we propose for treatment units allow the designer considerable flexibility. Our concern is with having adequate leachate treatment capacity at all times, proper operation of the plant, and compliance with all discharge requirements. A previous requirement for multiple treatment units has been dropped in favor of the more flexible requirements in subsection (b).

The onsite leachate treatment system must be considered part of the facility. The operator must have constant access during the operational and postclosure care period and the only way to guarantee access is for the operator to maintain responsibility for the overall operation and maintenance of the treatment facility. The most appropriate requirements for onsite treatment already exist in 35 Ill. Adm. Code Subtitle C, Water Pollution. An operator or applicant can demonstrate compliance with these requirements by obtaining a permit to discharge from the Agency.

It does not seem to a worthwhile exercise to remove leachate from an expensive liner and leachate collection system only to have the leachate seep into the groundwater from the treatment system. We propose regulations requiring the system to be designed and constructed to minimize seepage and, if necessary, provide secondary containment, and the leachate treatment units and storage facilities must be considered as potential discharges to groundwater and subject to the groundwater monitoring requirements. Violations of water quality standards and remedial actions are handled the same way as discharges from the waste disposal units themselves.

We have to assume that some degree of leachate treatment will be required for the entire design period, and propose a regulation requiring that the system be designed to function for the entire design period. The actual operating period will be determined by monitoring.

Lu et al. (1985) suggest that for "leachate collected from a landfill located near a wastewater treatment system, a convenient method of treatment would be to discharge the leachate to the sewer system." We would extend this to apply to all operations that find it economically advantageous to transport leachate to a POTW rather than treat it onsite. Up to 5 percent by volume of high strength leachate (10,000 mg/L COD) can be added to wastewater at a conventional treatment plant without degrading effluent quality of the plant with regard to conventional parameters (Boyle and Ham, 1974). Chian and DeWalle (1977) found that up to 4 percent could be added before treatment efficiency decreased. These studies, in addition to the testimony by Dr. Lue-Hing (Exhibit 15B, Docket A), indicate that leachate can be handled by the majority of POTW's. The case described by Dr. Lue-Hing consisted of leachate from the CID facility in Chicago. Leachate is pretreated and transported to the Calumet sewage treatment works.

Subsection (d) contains standards for leachate storage systems. WMI suggested that leachate storage structures be designed to hold 5 days worth of accumulated leachate. This seems to be an appropriate number with an adequate margin of safety.

Subsection (e) has been expanded in response to comments from several participants who suggested that more flexibility be provided. The subsection now references offsite treatment plants instead of publicly owned treatment works. This allows a system such as a an industrial wastewater treatment facility to be utilized to treat leachate. The operator must assure that the treatment plant hold a permit to discharge, is operated by a certified operator, and less than 50 percent of the flow to the treatment works is attributable to the solid waste disposal facility. This last requirement is intended to prevent an operator from declaring an onsite leachate treatment operation an offsite plant. Access to the sewage system must be available at all times. If not, an alternate management system must be provided.

Section 811.309 (f) sets parameters for leachate recycling systems. To our knowledge, these are the first regulatory requirements for leachate recycling systems to be proposed in this country. Current landfill practice is generally geared towards preventing the introduction of moisture into a landfill. These regulations allow for the controlled introduction of leachate into a landfill for the purpose of accelerating the degradation processes. We feel that these regulations address all potential problems that may occur. There is a growing body of literature supporting the concept of leachate recycle. Dr. Ham presented testimony on some research of his own acquaintance showing the benefits of leachate recycle under laboratory and pilot scale conditions (R. 647-650, Docket A).

Buivid et al. (1981) found that leachate recycle enhanced methane generation. Leachate recycle enhanced with a nutrient innoculum addition produced the most methane in a laboratory test, compared to no recycle and recycle alone. They stressed the importance of evenly distributing the leachate over the area to be treated.

Leckie et al. (1979) found, in laboratory sized cells, that leachate recycle accelerates the degradation process, increases the microbial population in the waste, and increases gas production. They also noted that a cell seeded with septic tank pumpings, without further management, suppressed vigorous methanogenic organisms. They suggested pH control and leachate recycling to help establish methanogenic activity.

Natale and Anderson (1985) evaluated a full scale leachate recirculation system at the Lycoming County Landfill in Pennsylvania. They found that methane was produced at twice the rate at sections undergoing leachate recycling than at sections where no recycling occurred. This indicates more rapid degradation of the waste and is consistent with the results expected from laboratory and pilot tests. Leachate recycling resulted in more settlement of the waste. This is considered an overall benefit because "early physical stabilization will minimize the years after completion (closure) that the surface will have to be regraded to maintain a uniform surface." The data on leachate quality is a little less conclusive. In general, the degradation rate for COD was approximately 25 to 50 percent of that produced in pilot scale tests; yet that is estimated to be two to five times faster than a pilot scale waste cell without recycle (what was considered typical landfill conditions). Better degradation rates were observed when field capacity was maintained as opposed to saturation.

Leachate recycle can also be effective at putrescible waste industrial monofills. Merritt and Pohland (1985) describe a pilot study on leachate from a landfill associated with a fiberglass insulation manufacturing facility. Leachate recycle in pilot cells filled with insulation waste enhanced biological, chemical and physical processes leading to degradation.

Only select sites, with desirable topography and adequate waste management practices may recycle leachate. We intend that only new facilities and existing facilities that meet all design standards should be allowed to recycle leachate.

Dr. Ham described a gradual degradation process in which leachate quality gradually improves over time. Eventually the leachate will no longer pose a threat to groundwater. Subsection (g) requires the operator to monitor leachate quality throughout the operation of the unit and for a minimum of five years after closure. When the leachate meets the applicable requirements for discharges of deoxygenating wastewater the operator may discontinue the operation of the leachate management system. There is no indication that perpetual leachate collection, treatment and disposal is necessary. Leachate quality is expected to improve at a rate dependent upon the conditions of the landfill such as precipitation, cover configuration, waste density and size, and management practices.

The constituents chosen for evaluation are typical of leachates produced by putrescible wastes. This is not intended to be an all inclusive list of potential leachate constituents, the constituents in (g) (2) are expected to serve as indicators of the stabilization processes occurring in the waste.

Subsection (g) (3) provides some flexibility for industrial type monofills. A more narrow range of constituents can be expected from facilities that accept a limited number of waste streams.

Leachate treatment is no longer considered necessary when the raw, untreated leachate meets the existing effluent limitations in the water pollution requirements, 35 Ill. Adm. Code Part 304. If leachate is approximately the same as any other treated effluent then there is no logical reason to pump it out of the ground, only to discharge it directly to a surface water body. The parameters chosen for monitoring are those for which discharge standards have been developed and also expected to be constituents of the leachate.

The monitoring requirements for chemical waste disposal units allow for more flexibility in choosing appropriate parameters. Some of the constituents expected in putrescible waste leachate are not expected in certain chemical waste leachate.

Section 811.310 Landfill Gas Monitoring

Section 811.310 is the first of three sections of requirements for landfill gas control. This section contains requirements for all units accepting putrescible wastes. The operator must monitor the generation, composition, and migration of landfill gas. All putrescible waste disposal units must be monitored for the presence of landfill gas. Gas collection systems will be necessary only where migration appears to be a problem.

The purpose of the gas monitoring program is to monitor the buildup and migration patterns of landfill gas. This is achieved by placing monitoring probes in and around the unit to obtain a representative sampling of gas concentration and movement. Monitoring begins upon waste placement and continues until gas is no longer detected at significant levels within the probe. We propose four monitoring parameters: methane, oxygen, nitrogen and pressure. It has been suggested that probes within the waste itself serve no purpose and should not be required. The probes within the waste do serve a purpose. They provide an initial pressure reading to calculate the amount of gas being produced and migrating from the landfill. They provide information on the state of stabilization within the unit and can indicate whether unfavorable reactions are occurring. The requirement for probes within the waste is retained.

If a gas collection system is installed, then the monitoring frequency changes to quarterly to insure that the system is controlling the migration of gas from the unit. The monitoring data is used during the postclosure care period to determine if gas collection is necessary after the waste has stabilized.

Lu and Rovers (1980) found that relatively simple techniques of methane measurement can be utilized and that spatial variability in permeable strata was relatively small. Crutcher et al. (1981) observed that gas flows fairly freely throughout a landfill and there are no apparent directional properties. The probes, therefore need not be elaborate affairs and placement does not appear to be as critical as for groundwater wells. However, enough probes should be placed to provide an accurate assessment of gas migration.

Methane is monitored because it may create explosive conditions and, as discussed below, may kill vegetation. We propose a maximum allowable concentration of methane of 50 percent of the lower explosive limit in air to insure that explosive conditions do not occur.

Oxygen is monitored to indicate the presence of air and to establish a potential for explosion. Nitrogen acts as an indication of air leaks which can aid in the interpretation of the validity of the sample and the integrity of the monitoring devices.

The measurement of pressures within a set of probes provides information related to the quantity of gas migrating from the site and the likely route of migration. Such information is useful to future monitoring efforts and when designing a gas collection system.

Arthur et al. (1981) found that natural gas can damage vegetation by acting as a food source for destructive microorganisms. Carbon dioxide can be directly toxic to certain species of plant roots. In order to evaluate the effects of landfill gas on red and sugar maple trees Arthur et al. (1981) exposed their roots to a simulated mixture of landfill gas. The sugar maples began to lose their leaves after 11 days and were completely defoliated by the twentieth day of exposure. The red maples were more tolerant of the gas but they did lose some leaves and the remaining leaves were chlorotic after 48 days of exposure.

Duell et al. (1986) studied the effects of landfill gases on several vegetation types. They found some species of vegetation are much more tolerant of landfill gas than others. Tolerance to landfill gas constituents must be considered by the operator, who must plant vegetation directly over the final cover of the landfill. Such a burden should not be placed on surrounding land owners, who may have made significant investment in or who may derive economic benefits from their vegetation. Esmaili (1975) described a case where methane, in concentrations of 10 to 20 percent had migrated 600 feet from the edge of a landfill. Damage from landfill gas can extend beyond the explosive hazard of methane to destruction of vegetation by CO_2. There is, therefore, justification for controlling the migration of landfill gas, which consists mostly of methane and carbon dioxide, from all landfills, not just those that may affect nearby houses and buildings. Any migration of landfill gas off the property should be considered undesirable and potentially destructive, even where there are no nearby buildings.

There has been some discussion over the presence of volatile organic chemicals in landfill gas. Intuitively, one can assume that if volatile organic chemicals were placed in a landfill, then one would expect to observe some quantity in either the leachate or the gas. Kinman et al. (1986) found traces of volatile organic compounds and recommended further long term study. Colenutt and Davies (1980) evaluated landfill gas extracted from soils around a landfill for the presence of volatile organics. They found negligible concentrations of compounds in the landfill gas. However, an accurate quantitative analysis was almost impossible to achieve because of severe limitations in the sampling and analysis methods. Testing procedures in the ambient air over a waste disposal unit are extremely difficult to implement for such small concentrations. The results would vary greatly by small changes in climatic conditions such as wind speed, barometric pressure and temperature. Furthermore, volatile organic compounds are ubiquitous, they can be attributed to many sources. Proper implementation of a volatile organic compounds testing program would necessitate the use of background monitors to isolate contributions by the waste disposal unit.

Gas will migrate in response to a pressure differential or by diffusion driven by concentration gradients. The pressure differential, in the case of a putrescible waste disposal facility, is created by the degradation process which results in methane. As degradation occurs, the amount of methane within the wastes increases, creating an area of high pressure and resulting in the migration of gas to areas of lower pressure, outside the landfill. It is our hypothesis that gas migration can not occur without sufficient methane to produce a pressure differential. Landfill gas constituents will migrate out of the waste only in the presence of methane, which is easily measured and quantified. Furthermore, methane molecules are smaller than volatile organics molecules and are able to migrate further by diffusion. It is, therefore, more likely that methane will trigger the installation of a gas control system, not the presence of excess levels of volatile organics. We do not recommend a monitoring program for volatile organic compounds.

Fatty acids such as acetic, propionic, and butyric acids have also been observed in landfill gas by Colenutt (1979). While the concentration of methane was observed to be between 20 and 80 percent, the concentrations of fatty acids was never observed to be more than 5.05 percent. In a 25 year old site the concentration of methane was less than 10 percent and the highest concentration of any fatty acid, n-butyric acid, was 0.11 percent. Colenutt pointed out that these acids are the source of the undesirable odors that migrate from landfills. We note their presence and propose a performance standard for implementation of a gas collection system if the operator is unable to control malodorous odors by standard landfill operating procedures such as daily and intermediate cover.

Dr. Ham described the processes which control the amount of methane and carbon dioxide that is produced (R., 618-645, Docket A). Using this information some rough estimates on methane production in a particular unit can be made. Several predictive gas flow models have been developed and are in use for estimating the most likely migration paths and the approximate flowrate. We recommend the use of models to help establish the best location for probes and control systems. We do not recommend the use of predictive models to waive any monitoring or control requirements. We propose a regulation allowing the optional use of a model to predict the best locations for monitoring devices.

Darcy's Law can be assumed valid for gas flow through a permeable medium such as soil, if the gas is assumed to be incompressible. Most gas flow models are developed from this relationship. Lu and Kunz (1981) used this relationship in a model to estimate gas flow from wells at the Fresh Kills landfill in New York. They found good agreement with field conditions. They recommended that high K_h/K_v (horizontal intrinsic permeability/vertical intrinsic permeability) values are advantageous for landfill gas withdrawal. Gas can move easily towards the well while the low vertical permeability impedes the movement of air into the fill. This condition can be approximated in an actual landfill by utilizing relatively impermeable covers and liners and using relatively permeable daily cover and intermediate cover.

Mohsen et al. (1980) developed a finite element model to simulate a practical variety of field conditions including varying horizontal soil strata (simulating covers, liners, waste layers, and other soil layers), various boundary conditions, water table elevations and the presence of gas release systems. They found good agreement between model results and observed field conditions. Findikakis and Leckie (1980) developed a one-dimensional model for the production and flux of CO_2 and CH_4 out of a landfill and found excellent agreement between model predictions and field observations. It is possible to use predictive gas flow models as a tool in designing gas management systems.

Section 811.311 Standards for Gas Management Systems

This section contains the standards under which a gas management system is to be constructed and the standards for designing and operating a gas management system.

There are five conditions which can trigger the installation of a gas management system. The first is when the concentration of methane reaches 50 percent of the lower explosive limit at a point of compliance 100 feet from the edge of the unit or the property boundary, whichever is less. The second is when methane reaches 50 percent of the lower explosive limit in the ambient air. The third is when methane is detected in a building at more than 25 percent of the lower explosive limit. The fourth is when malodorous odors are detected beyond the property boundary, and the fifth is when a leachate recycling system is to be utilized. The intent of these standards is to prevent the buildup of gas to explosive concentrations and prevent odors form migrating from the site.

Several participants stated concerns over the requirement to install a gas management system upon detection of a "malodorous odor." The term is criticized as being too vague and ambiguous for regulatory enforcement and use. It was claimed that in order for the requirements of this subsection to be enforceable, a mechanical measuring device would have to be used because a person's olfactory senses could not be used as a detection device for combustible gases. It was suggested that the subsection (a) (4) be deleted as a triggering mechanism for gas control systems since the use of detection devices under subsections (a) (1), (2) and (3) would be more reliable and provide a measure of accuracy and precision. We do not agree. There will always be some discussion over the exact interpretation about what constitutes a malodorous odor and a mechanism exists, via an appeal to the Board, to address disagreements with the Agency.

As an alternative to the proposed definition, a numerical limitation for odorous compounds was considered. Such numerical limitations are possible, but as pointed out by Dr. Ham (R. 337, Docket D):

I don't think there is going to be a good definition. I guess I am concerned about getting bogged down here with trying to define a bad odor. Sure, there have been people that have done some rather detailed analyses of the chemical constituents of landfill gas, and we believe that some discrete chemical constituents that cause a large part of the odor. But to get into that kind of a thing here I think would be very difficult. You are talking about substantial sampling and analytical costs on a routine basis in order to do this, which I am sure the landfill proprietors would not want to go through; and you are talking about developing a large database such that one could establish that legally.

It is appropriate to require an operator to install a gas management system if malodorous odors migrate offsite. A specific definition of a malodorous odor, based on numerical standards of the constituents of the landfill gas, is not appropriate or justified. The costs of routine monitoring for these standards is not justified on a continuing basis at all facilities. It has never been stated, nor is there any indication that we agree with, the contention that a person's olfactory senses should be used as a detection device for combustible gases. The standards for malodorous odors are additional requirements to those for combustible gases. The operator of a unit that is producing malodorous odors offsite should be required to take appropriate gas management measures.

It was also suggested that the maximum allowable methane concentrations be adjusted higher, to 100 percent of the lower explosive limit in air in the soil and ambient air around the facility. A gas management system would be required after enough methane has migrated from the facility to cause explosive levels concentrations. The proposed levels of 50 percent of the lower explosive limit are intended to prevent explosive levels from ever occurring. It is appropriate to require action prior to the existence of dangerous levels of gas and, therefore, decline to accept this suggestion.

Two types of gas management systems are recognized in this proposal, gas venting systems and gas collection systems. Gas venting systems generally consist mainly of highly permeable materials placed in the path of migrating gas to redirect the flow to the surface or some kind of vent. An impermeable barrier may also be placed to minimize the flow of gas and direct the flow elsewhere. The drawback to venting systems is that gas must be generated in large quantities to create a pressure or concentration gradient large enough to stimulate flow. The pressure difference is affected by changes in atmospheric pressure. Venting systems do not collect gas for disposal but merely redirect it to places where it may mix with ambient air and be carried away. Ghassemi et al. (1986) evaluated a number of systems for interception and disposal of landfill gas. They characterized venting systems as unacceptable for emissions control at municipal and codisposal sites because all of the gas that is generated would be released.

Venting systems can be categorized in two major types, the first being trenches backfilled with a highly permeable material to encourage passage of gas upward to a surface discharge area. This design can be augmented with an impermeable barrier such as a geomembrane to further encourage passage of gas to the discharge area. The flow of gas is not controllable and the trench becomes very expensive to construct at depths greater than 9.1 meters. In order to preserve the integrity of the cover and liner systems a trench system must be constructed outside the landfill perimeter.

Gas venting systems are not appropriate methods of gas control and are not recognized in this proposal as satisfying the requirements for a permanent gas management system. They may be useful as temporary measures to minimize offsite migration until an appropriate gas control system is installed. The only allowable gas management system in this proposal is a system in which gas is collected by wells, trenches or other collection means and transported to a central point, or points, for treatment, processing and disposal. This is defined as a gas collection system.

Gas collection systems may consist of wells or trenches filled with permeable material connected to a pipe which discharges at the surface. Flow is created by pressure gradients due to the natural degradation of the waste. The discharge to the atmosphere is at one or more points at the end of the pipe. This may cause extremely hazardous and odorous conditions in the vicinity of the discharge. A flare or other air pollution control device must be installed. The operation of this flare is uncontrollable because the gas in a passive system flows only as a result of the gas generation rate and the permeability of the soil. Unless the rate of gas flow and gas composition are fairly constant over time the properties of the flare would be impossible to control and complete combustion of certain gas constituents would not be guaranteed. We, therefore, recommend that all systems relying on natural processes to create flow through the system be designed so that they can be easily upgraded to an induced draft system by the installation of a compressor or other mechanical device.

Ghassemi et al. (1986) developed four categories of gas collection systems: horizontal or vertical wells and interior or exterior locations. Vertical gas wells located within the waste unit itself seem to be the most popular method, especially where gas is to be processed for beneficial uses. The gas has a high methane content. (Ghassemi et al. (1986). The wells are sometimes susceptible to damage from settlement of the surrounding waste. A drawdown zone analogous to water wells will exist between the wells (Crutcher et al, 1981). Mathematical models can be used to predict an optimum spacing.

Horizontal gas collection pipes can be placed in envelopes of permeable materials in or on finished lifts of material at an active landfill. The advantages are that significant quantities of gas can be collected while the landfill is in operation because waste can be placed in successive lifts above the collection pipes. Ghassemi et al. (1986) point out that such systems have the potential to remove a greater portion of gas than the vertical wells installed after completion. The main disadvantage of this type of system is that the horizontal pipes are particularly susceptible to differential settlement and there is no way to repair the system short of excavating the overlying waste material.

Vertical wells can be placed outside the unit to create a zone of negative pressure around the unit. Such wells are easier to construct than wells within the waste, are less susceptible to damage from settling, can be established prior to closure of the landfill and have been demonstrated at a number of landfills (Ghassemi et al. 1986). However, the surrounding soils must be relatively porous or the radius of influence will be small. The collected gas will contain more air than wells placed directly in the waste. It would not be economical, in most cases, to process the gas for beneficial uses.

Horizontal pipes in granular soil envelopes can be placed at the bottom of a lift, along the side of the unit. Such a system can begin operation immediately upon placement of waste. The system is not as prone to settlement as other interior systems and the content of methane is high. The system is inaccessible for repair, experience with this type of arrangement is limited, and the operation of the system may interfere with the performance of the leachate collection system (Ghassemi et al. 1986).

The design of the gas collection system is site specific. The designer must weigh all the advantages and disadvantages of each system and choose one to solve the specific problem at a particular site. We choose to establish performance standards for gas collection systems for this reason. The designer is free to choose any configuration of collection wells. The system should be able to function for the entire design period although the actual operating period for the gas collection system will be determined by monitoring the collected gas and the gas probes placed around the unit. The system should also be resistant to corrosion. Differential settlement could be a major problem at some sites. The designer must consider reasonable amounts of differential settlement and make allowances in the design of the system. We feel it is important to ensure that the gas collection system in no way interferes with the operation of the liner, cover, or leachate collection systems.

Gas condensate will form in the collection system (R. 731-733, Docket A). The disposal of gas condensate has been discussed from both political and legal standpoints (Bogardus, 1986). We propose that this material, which is derived from components within the landfill, be handled in a manner similar to leachate for treatment and disposal or recycling. In response to a suggestion by a participant, we have modified this section to allow the management of condensate separately from the leachate, if desired by the operator. The requirements of this subsection are based upon the interpretation that condensate produced from the onsite collection and processing of gas is a nonhazardous waste by definition. Condensate produced at an offsite processing operation not included in the operator's facility will require different handling standards. Condensate produced offsite is a by-product or waste from an industrial process.

Section 811.112 Landfill Gas Processing and Disposal Systems

Once gas is collected at a central point it must somehow be disposed. According to Ghassemi et al, (1986) the two most popular methods are onsite flaring and combustion for energy recovery. Other methods may include carbon adsorption units and processing into pipeline-quality product. Landfill gas can be used "as is" for onsite combustion. It must be upgraded to medium-Btu gas for use in some industrial operations and to high-Btu gas for injection into a pipeline.

In nearly all cases a discharge into air is required. We propose performance standards that would allow any type of combustion or processing operation provided that all discharges are permitted by the Agency's Air Quality Division in compliance with 35 Ill. Adm. Code Part 200, et seq.

Gas processing systems must be evaluated on a case by case basis. One method of processing landfill gas involves converting into pipeline quality methane. There are several systems, both mechanical and chemical for removing the impurities and carbon dioxide from landfill gas. One such method is the use of gas cleaning towers filled with molecular sieve materials. While this may result in appropriate disposal of the gas into a pipeline, waste products from the towers and all condensate must be properly disposed.

The performance standards for flares are taken from federal requirements for flares at petroleum processing facilities. Although not specifically formulated for flares at landfill operations the requirements appear appropriate for discharges of methane and their use as regulations is recommended.

The gas disposal system must be considered a part of the facility, thus ensuring that an adequate system for gas disposal is always available, is accessible and is controllable by the operator. What is not so clear is whether a gas processing operation (and subsequent disposal of waste products) must be considered a part of the facility. To help in this determination we considered the following points:

1. The flow rate of gas from the unit must always be under control of the operator and adjusted as necessary according to monitoring results.

2. The purpose of the gas collection system is to prevent offsite migration and damage by landfill gas, the purpose is not to provide raw materials to an industrial operation.

3. The operator must always have a way to dispose of landfill gas.

4. In the event that an operator forfeits financial assurance the State of Illinois must have access to a gas disposal system or the financial assurance instrument must contain sufficient funds to build and operate a disposal system.

5. The proper disposal of gas byproducts from the processing operation must be ensured.

6. All aspects of the gas removal operation must be under the control of the operator at all times.

The most appropriate way to address these concerns is to require that a gas processing facility that accepts more than 50 percent of its gas from a single solid waste disposal facility be permitted as part of that facility. In some cases a third party may be contracted to process the landfill gas. The requirements in this section do not preclude a third party from purchasing or accepting gas for offsite processing.

There may be opportunities to transport gas to an offsite processor. We propose a new subsection of performance standards in anticipation of the construction of central processing plants that could serve several landfills. The first criteria is to establish that less than 50 percent of the volume of gas processed by the offsite plant is from the facility under consideration, otherwise, it must be considered part of the solid waste disposal facility. Second, the operator must be in control of the withdrawal technology to maintain compliance with all gas monitoring standards. Finally, financial assurance must be assured. To alleviate this, a standard is proposed to require the operator to post financial assurance equal to the cost of installing disposal equipment (such as a flare) in the event access to the processing facility is denied. This requirement appears in Subpart G.

Section 811.313 Intermediate Cover Requirements

Little documentation for optimum values of intermediate cover exists. It appears that the existing requirements, which all three proposals currently before the Board retain in some form are adequate for Illinois. The regulations reflect current Agency practice of allowing the total amount of cover over the waste to be one foot, including the six inches of daily cover

The standards for intermediate cover are similar to the requirements for daily cover, reflecting the similar functions. Where water and gas movement through the landfill is necessary and desirable intermediate cover should be relatively permeable to minimize perched water conditions.

Intermediate cover must be maintained for an indeterminate amount of time, until the next layer of waste or the final cover is placed. Until then, the cover must be graded, inspected and maintained to prevent access to the waste by vectors, and provide drainage.

Section 811.314 Standards for the Final Cover System

Thomas M. Johnson discussed factors in the design and construction of covers for municipal waste disposal sites in testimony before the Board (R. 592-650, Docket A). Mr. Johnson identified three primary cover functions: "water movement, gas movement and susceptibility to erosion." (R. 600, Docket A). The factors affecting these three functions may require different optimal values for each. For example, a cover designed to minimize infiltration is likely to have a high erosion potential because the fine clay particles necessary for a low permeability blanket are susceptible to wind and water erosion and may be difficult to vegetate (R. 601, Docket A). Mr. Johnson suggested one method as ranking the priorities and design the cover by considering a decreasing order of requirements. This may require unacceptable compromises, however. A better approach, recommended by Mr. Johnson (R. 606, Docket A), is a composite cover in which several layers, each with unique characteristics geared to a particular function are constructed.

There are many design possibilities for a composite cover. In general, a composite cover will consist of several horizontal layers of materials with different hydraulic and strength parameters. The minimum cover is a two layer composite consisting of an impermeable barrier overlain by a drainage layer or topsoil. Designs of up to five or more distinct layers have been proposed for hazardous waste disposal facilities. The necessary requirements for final cover are: minimize the amount of percolation into the waste, prevent erosion, control runoff, maximize evapotranspiration, and require little maintenance. In some cases gas migration control may be necessary and in others a special layer will be constructed to facilitate the distribution of recycled leachate.

Dwyer et al. (1985) evaluated the hydrologic performance of a variety of cover designs using the HELP model. The covers consisted of one to three layers of various soil types. They concluded that three layer composite covers were the most effective design. The criteria for evaluating the effectiveness of the design appears flawed in one area. A successful design was considered as one that minimized surface runoff. That is puzzling because there are only three ways for water to leave a cover: runoff, evapotranspiration, and infiltration through the cover to the waste. A successful design will minimize infiltration. If one tries to minimize runoff and infiltration the only remaining path for water is evapotranspiration. But there is only so much water that can be evaporated and transpired because the maximum rate of evapotranspiration will be controlled by climatic conditions, not by the operator. In order to minimize infiltration to the fullest possible extent the designer must maximize runoff. This is not likely to cause problems if the cover is protected from erosion, slopes are gentle and stable, and drainage is provided to carry runoff away. The control of runoff is more effectively handled by standards requiring erosion and stability of the final layer and regulations regarding the construction of runoff control facilities. Using this modified criteria, a three layer composite cover system is still more effective than a two layer composite cover system, but only marginally so, and the costs for a three layer cover system are significantly higher.

Several different cover designs were evaluated at the Omega Hills Landfill in Wisconsin by Montgomery et al. (1987). They found that the two layer composite covers (one layer of compacted clay overlain with topsoil) produced less infiltration than a four layer composite layer designed to produce a "wick effect." They also observed that runoff amount appeared to be related to topsoil thickness, less runoff was produced as topsoil thickness is increased.

Grefe et al. (1987) evaluated landfill cover functions and attributes so that the regulations for the state of Wisconsin could be improved. They found that ice lenses and freezing and thawing cycles could increase the hydraulic conductivity and lower the density of the impermeable cover. A connection to vegetation is also evident. A structurally disturbed and desiccated liner is more likely to allow gas migration, which, as indicated in the gas control section, can kill vegetation, thus causing erosion. They also noted that sufficient topsoil must be provided to allow good root density. A cost analysis showed that the cost of a well-designed cover will, in many cases, be more than offset by reduced leachate treatment requirements and erosion repair costs over the postclosure care period.

A two layer composite cover is proposed in these regulations as the minimum necessary to minimize infiltration and provide protection. One layer will act as a low permeability barrier that may be constructed from compacted earth, a geomembrane or some demonstrated alternate technology. The minimum standard of performance is an earth layer 3 feet thick, compacted to achieve a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec. This layer is placed as soon as possible after the final lift of waste is deposited. The choice of design parameters for the low permeability cover are based upon the results of the analysis for compacted earth liners. These values are the most economically reasonable and technically feasible considering standard equipment and soils typical to Illinois. Just as with the requirements for compacted earth liners we also propose to allow substitutes that achieve equivalent or superior performance.

The depth of final protective layer can vary as a function of the type of vegetation and land use after filling. The soil used to construct the final protective cover must be capable of supporting vegetation. Warm season perennial turfgrass mixtures require a minimum of three feet of good topsoil for root penetration (Casnoff and Beard). More cover can be specified, if necessary, for areas where root penetration is expected to be higher. The final protective layer need not be impermeable. Well graded, easily drained soils containing some organic matter such as peat is preferable to promote vegetation. The final protective layer is also intended to protect the impermeable layer from freezing. The range of frost penetration depth is approximately 6 inches in the extreme southern part of Illinois to approximately 35 inches near the Wisconsin border (Lutton, 1982). The controlling factor, therefore, will be the depth necessary to maintain good vegetative root penetration conditions, three feet of protective soil.

Section 811.315 Hydrogeologic Site Investigations

The purpose of hydrogeologic study is to gather detailed information to be used to evaluate the suitability of the site location, provide input parameters to the groundwater impact assessment, and provide enough information to design a suitable groundwater modeling system. A properly conducted hydrogeologic study can provide sufficient information to address these three tasks. In response to comments on this issue the subsection describing the purposes of the hydrogeologic investigation have been expanded and clarified.

A general three-phase hydrogeologic investigation was suggested by Dr. Richard C. Berg of the Illinois State Geological Survey (ISGS) (R. 439-447, Docket A). The standards in this section are based upon a three phase investigation procedure consistent with these recommendations.

The investigator must establish the area to be studied. The study area must include, at a minimum, the property itself. Areas outside the property are added as necessary to establish the geologic identity of the area. For example, if a particular geologic unit appears continuous across the site, but pinches out a short distance away from the site, it may be necessary to extend the study area to characterize the potential contaminant migration pathways where that geologic unit ends. This area is defined as the study area in context.

It has been suggested that all borings be sampled continuously. Such a requirement is unnecessarily restrictive. Once the stratigraphy has been established by the first boring (which must be sampled continuously) it is necessary for successive borings to be sampled at appropriate intervals.

The first phase consists mostly of a literature survey of existing borings, water-well logs, ISGS publications, and other sources to evaluate the regional hydrologic setting. A minimum of one boring, preferably at the geographic center of the unit, is required to confirm the literature evaluation. This boring is required to be sampled continuously. At this point some of the site location standards can be applied to eliminate the unit from further consideration. The investigator may also choose to terminate the investigation if the area is unpredictable or the site specific data does not fit the regional hydrogeologic conditions. More borings can be drilled to help establish the regional characteristics; however, the number of necessary exploratory borings at a discontinuous and unpredictable site may be quite high, along with the associated costs for exploration and laboratory work.

After the preliminary work is evaluated a Phase II study can be designed and implemented. Exploratory borings are drilled at various points throughout the site; including the corners, topographic low point and topographic high point. After completion of the Phase I study the investigator analyzes the results, prepares cross sections and other useful diagrams to help understand and illustrate the local lithology. The operator is required to begin interpreting the data to find trends, establish stratigraphy, and broad groundwater characteristics.

The Phase III investigation is conducted to confirm the information collected in Phase II and reconcile the stratigraphy of the site. Phase III exploration continues until the characteristics of the site are well known, all known geologic units are identified and tested and sufficient data has been developed to begin a groundwater impact assessment. All stratigraphic units have been identified and correlated, continuity between boreholes has been established and any unusual geologic features have been investigated. The requirements for the Phase III Investigation were taken from USEPA (1986), and ICF, Inc. (1987). A Phase III study can consist of as few as one bore hole or as many as the investigator can afford.

A complex site may require an inordinate number exploration holes. It is the investigator who decides whether the costs involved in characterizing a complex site are justified.

In order to allow for flexibility in conducting these studies a performance standard was developed to allow the investigator to choose an alternate investigation format that may utilize a different number of phases. As long as the required information is collected in a way that is equal to or superior to the methods described in this section and the required information is collected, the alternate investigation plan may be utilized.

Section 811.316 Plugging and Sealing of Drill Holes

This section has been added in response to several comments underscoring the need for a program to properly seal drill holes after they are no longer necessary. The section is written as a performance standard to require the operator to cover all drill holes to protect the public and animals from injury. When drill holes are abandoned they must be sealed so as not to create a path for the migration of contaminants and the area around the drill hole shall be returned to its original condition. The section is not intended to prevent the conversion of exploration holes into monitoring wells. The holes must be sealed when they are no longer necessary to the operation.

Section 811.317 Groundwater Impact Assessment

Consider what we have presented to this point. Sections 811.306, 811.307, and 811.308 established standards which prescribe an efficient and economically reasonable system for controlling the seepage of leachate out of the unit. Sections 811.315 and 811.316 established requirements to insure a thorough understanding of the hydrogeologic conditions at the site. In this section a methodology is proposed to bring these together to evaluate the impacts to the groundwater.

We propose that the Board adopt a policy similar to that used for discharges from point sources to navigable waters under the Clean Water Act of 1972 (CWA). The CWA requires a discharger to utilize the best available technology economically available (BAT) to remove pollutants from the effluent, regardless of the quality of the receiving water. More stringent treatment requirements may be imposed, if necessary, to meet water quality standards beyond an established mixing zone.

The CWA gave broad powers to USEPA to regulate discharges to navigable waters. A permitting program, called the National Pollution Discharge Elimination System (NPDES) was established to implement the provisions of the CWA. The provisions of the NPDES program require a systematic approach to minimizing pollution:

1. Utilize the BAT to treat all discharges from point sources and establish discharge standards based upon the technology.

2. Establish a mixing zone within the navigable water where the discharge standards exceed the established water quality standards.

3. Demonstrate that the technology used to treat the water will be sufficient to prevent exceeding the applicable water quality beyond the mixing zone.

4. If necessary, require technology greater than BAT to successfully meet all applicable water quality standards.

5. Monitor all discharges and water quality to insure compliance.

It is not clear if groundwater should be considered a "navigable water" and if discharges to groundwater must be permitted under the NPDES system. In 1977, in Exxon Corp. v. Train, the 5th US Circuit Court of Appeals held that the USEPA did not have the authority to require permits to control the disposal of pollutants into wells. In that same year the 7th US Circuit Court of Appeals in United States Steel Corporation v. Train held that the USEPA could regulate the discharge of pollutants into a well under the NPDES program. This conflict has never been resolved to our knowledge (Ballew, 1983).

The proposed regulations follow the provisions of the NPDES program. The above court decisions notwithstanding, we do not believe that the Board is required by federal law to follow the NPDES program for discharges from landfills to groundwater. We strongly recommend the adoption of the above five steps as a model procedure to evaluate the adequacy of design and the impacts to the groundwater system. We recommend that the Board adopt a policy of requiring the operator to use the best economically available technology to control the discharge of contaminated leachate from a solid waste disposal facility.

We propose that the seepage of leachate from the unit be treated as a discharge which must be minimized by utilizing the best available, economically reasonable containment technology. Then, using data collected in the hydrogeologic study as well as additional information, the operator must show that the discharge will not exceed established water quality criteria at the point of compliance. If the operator predicts that a water quality standard will be violated, then more stringent control technology must be considered. We call this process the groundwater impact assessment and consider it an important step in the procedure.

The methodology to be used for the groundwater impact assessment is based upon testimony presented by Dr. Robert Griffin on November 17, 1985 (R. 681, Docket A) and outlined in a report by Griffin and Roy (1986). Dr. Griffin proposed that an integrated evaluation of the entire landfill site and design be performed using site-specific data, a contaminant transport model, and reasonable operational assumptions. A point of compliance some distance away from the edge of the unit is specified, as are maximum contaminant levels acceptable at the compliance point. Dr. Griffin made clear that the regulatory authority must specify the maximum contaminant levels and the point of compliance (R. 819, Docket A). We are proposing a system of groundwater standards and evaluation techniques to apply to a point of compliance located 100 feet from the edge of the unit or property boundary, whichever is less. These same standards are to be utilized for enforcement as well.

The June 1987 proposal required that the operator demonstrate compliance with the groundwater quality standards over an infinite time period. The acceptability of the assessment would be particularly sensitive to tiny changes in the values assigned to the attenuation and degradation processes, which are difficult to measure accurately. This is an unintentional effect. It is, furthermore, impractical to make predictions beyond a certain time period. We, therefore, propose that an evaluation period of 100 years be used in the groundwater impact assessment. The operator must demonstrate that discharges from the source of contamination cause no statistically significant increase over background concentrations beyond the zone of attenuation for 100 years after closure of the unit. This limitation greatly simplifies the assessment and still provides a high degree of protection, as the study conducted by the ISGS shows.

The first step in the groundwater impact assessment is data collection. The information from the hydrogeologic investigation must be adequate to perform the impact assessment. This information may have to be supplemented by such information as geochemical parameters and diffusion and dispersion data needed to input into a contaminant transport model. The constituents of the leachate and any applicable degradation parameters must be established and estimated. The investigator is required to use, at a minimum, the minimum design standards for the liner, leachate collection system, and cover, if applicable. Some physical and chemical data to be used in the assessment must be determined from applicable literature and previous surveys.

Once the information is collected the investigator will be required to utilize a contaminant transport model to show the resulting concentration of contaminants at the compliance point using the minimum prescribed design standards for the landfill. Minimum output shall be in the form of concentration profiles in 5 year increments and breakthrough curves for all intermediate monitoring points and at the point of compliance.

If the assessment shows that the minimum design and performance standards in Part 811 are inadequate to prevent contamination of the groundwater outside the zone of attenuation then additional protection must be provided. This additional protection may consist of:

1. Finding another, more suitable site;

2. Changing the final configuration of the unit to promote more runoff and less infiltration;

3. Prohibiting or limiting the disposal of certain wastes containing the offensive contaminants;

4. Adding a geomembrane to form a composite liner system;

5. Adding a geomembrane and second leachate collection system (the RCRA double liner);

6. Increasing the thickness of the compacted clay liner (however, thicknesses over three feet appear to have little effect on the rate of seepage through the liner. This alternative would be effective only for borderline cases where a small decrease in liner seepage is necessary to achieve compliance);

7. Using admixtures or special construction techniques to improve the properties of the liner; or

8. Any combination of these, or other practices that achieve the same result.

The groundwater impact assessment can again be performed using the modified design. The process of designing and assessing the impact is repeated again until compliance can be demonstrated, the project becomes prohibitively expensive, or the site proves to be clearly unsuitable despite all engineered solutions.

An important aspect of the groundwater impact assessment will be the required use of a predictive contaminant transport model. A segment of the technical community discourages the use of predictive modeling as a regulatory mechanism. Many comments were received regarding the use, reliability, accuracy, and wisdom of contaminant transport models. They cite inaccurate predictions, lack of sufficient input data, and manipulation of seemingly insensitive parameters to achieve the desired results as disadvantages. While these shortcomings can, and do, exist, safeguards can be designed into the procedure for maintaining high quality predictions and allowing for periodic updates of the predictions.

All of the previous proposals before the Board require, ultimately, some sort of predictive modeling. The Agency's proposal (Docket A) contains a requirement for predictive modeling, Section 734.202. However, the purpose of this requirement and the standards by which compliance with this section can be measured are unclear. While not addressing predictive modeling directly, both the Chamber of Commerce proposal (Docket B) and the Waste Management proposal (Docket C) would require extensive use of predictive models to demonstrate that the design of the facility would "not cause or tend to cause water and air pollution" (Exhibit 1, Docket B).

Dr. Aaron Jennings was invited on behalf of the Board, to address the issues of contaminant transport modeling for regulation. He painstakingly reviewed the fundamental science of groundwater contamination modeling and offered his comments on using models as a component of these solid waste disposal regulations. Dr. Jennings

(1986) stated the advantages and disadvantages of deterministic models:

a. They explicitly use all the mechanistic science that is known about the transport phenomena. Their scientific foundation is stated and may easily be inspected.

b. They yield unique transport predictions. Their predictions are completely reproducible and are independent of the numerical procedures used to generate them.

c. They can be used to identify missing data or incorrect interpretation of the predominant mechanisms in operation.

d. [They] have the ability to extend their predictive capabilities to new conditions for which they have not been calibrated. If, for example, the relationships between temperature and chemical reaction kinetics are known, then mechanistically based models should be able to predict the impacts of temperature changes on the mass transport process.

However:

e. Deterministic models are often crippled in the absence of essential data.

f. Deterministic models have a great deal of difficulty accommodating the natural variability of many environmental attributes.

These last two issues actually reflect the quality and quantity of data available to the investigator. The modeling study will only be as accurate as the data input to the model. This could be construed as a shortcoming to this procedure but any landfill location criteria will be hampered by the lack of accurate data.

Several comments stated that the use of a contaminant transport model as part of a groundwater impact assessment provides an assurance which may not be justified or realized under actual field conditions. Because of their complexity and the numerous assumptions made in model design and data entry, the results are no more than an indication of what might occur at a site if leachate is discharged. Only in a rare instance would a modeled concentration ever be found in a monitoring well placed at a location where the model predicted it. It was suggested that modeling not be performed as a regulatory requirement but as an optional tool, presumably at the discretion of the operator, to be used to show reasonable estimates of how the design may perform in the given site conditions and allow for redesign when predicted concentrations are significantly greater than water quality standards. "Significant" was defined as an order of magnitude from the applicable standards (Public Comment 47).

The authors of the comments apparently assume that the purpose of calculating the maximum allowable concentration within the zone of attenuation is to predict the exact concentration of contaminants in each well at all times, and that some sort of punishment is in store for the operator who fails to accurately predict the fate of contaminants in the groundwater. That is not the case, the predictions serve as the maximum value expected at the well and it must be shown that this maximum concentration will not cause a violation outside the zone of attenuation. The maximum predicted concentration need not be achieved and, unless conditions are altered which would increase the probability of groundwater contamination, the operator will probably not be required to update the impact assessment. By choosing relatively conservative values for certain predicted parameters the operator is unlikely to ever exceed the maximum allowable concentrations. There is no punishment for conservative estimates unless the site has borderline hydrologic and attenuation capabilities, in which case it is certain to be carefully scrutinized. This is certainly an appropriate use of a predictive modeling tool and a prudent design procedure. The groundwater impact assessment is part of a rational design procedure used every day by engineers in the design of buildings, bridges, foundations, retaining walls, roads and pipelines.

Several specific inadequacies were identified by participants. The first was that no two models predict the same contaminant profile even when all other variables are held constant. That is correct. Two models would predict similar, but not the same concentration profiles. Two investigators using the exact same model may derive different concentration profiles, based upon the quality and interpretation of the available data and the scenarios being used for the analysis. This is not an inadequacy, it is a normal circumstance in any design procedure. The authors of this comment appear not to appreciate, as a general matter, how designs are developed. Design engineering is not an exact science. No methodologies exist that will insure that the exact same design is derived by all designers and such are not necessary. The regulations provide a methodology to demonstrate that the design will perform as indicated and in compliance with the water quality standards. We are aware of no technology that insures exact solutions in any engineering discipline. No two engineers will ever design something, be it a building, a bridge, a landfill, or a groundwater monitoring system exactly alike and nobody should expect them to do so. If a groundwater impact assessment appears acceptable and is supported by the recommendations of a qualified designer who utilized reasonable, conservative assumptions based upon well developed data and followed a rigorous evaluation procedure, then that solution must be given serious consideration. Furthermore, it is not necessary to predict the exact concentration at the monitoring point. The operator predicts a reasonable value based upon an operating scenario devised by the operator. It is necessary only to show that the value predicted by the operator will not cause the water quality standards to be exceeded outside the zone of attenuation. This is an appropriate use of a contaminant transport model.

The second inadequacy is that long term historical data for the input parameters will not be available to calibrate the model, and since contamination has not occurred, the transport of contaminants cannot be verified through the use of historical data.

Again, this is true, but the only ways to address this concern would be to limit the construction of new facilities to areas that have a history of contamination that can be documented or require the operator to perform a groundwater impact assessment only after contamination is observed. Both solutions are unworkable.

Long term historical data is not likely to be available at a location unless contamination has already occurred. It is, therefore, all that much more important to carefully consider the quality of the input data and implement a monitoring program to check the predictions. Both of these are considered in the proposed regulations. The long term data will be developed during the life of the facility by establishing a monitoring network. Opportunities are available when the permit is renewed and when the maximum allowable concentrations have been exceeded to change them based upon any new data. The lack of long term data should not prevent an investigator from developing a groundwater impact assessment and a monitoring program.

It would be inappropriate to assess the potential for contamination of a design after the landfill is placed into operation and contamination occurs. The operator should show that the facility is unlikely to cause groundwater contamination before a permit is issued, not after contamination has occurred. Tests performed in the field which stress the environment in a predictable manner may also be conducted to help estimate certain design parameters. For example, tracer dye studies and pump tests can be conducted to observe the behavior of different conditions on the system.

Finally, it was asserted that the results of transport models are never considered to actually represent the real world, but are to be used as a tool to indicate what may occur at a site under certain conditions, not provide absolute answers. Again, this is a correct assertion and consistent with the methodologies and expectations outlined in this proposal. The contaminant transport model is used as a tool to indicate what may occur at a site under certain conditions, a task certainly within the capabilities of a contaminant transport model. A monitoring program and an opportunity to correct the impact assessment prior to a remedial action are necessary and prudent safeguards against unreliability in the assessment. It is not necessary to obtain absolute, real world answers, only confirm that the values predicted by the investigator are not likely to be exceeded. This is an appropriate use for a contaminant transport model. There are no absolute, "real world" design methodologies being used by engineers today in any specialty.

Several alternative facility design methodologies were proposed by participants. One suggestion was to adopt standards based upon "good engineering practices and past landfill performance" (Public Comment 47). Standards would be established to require the operator to "prevent the migration of wastes or leachate out of the landfill to the aquifer or surface water during a time period equal to the active life of the landfill." These standards provide no realistic way to evaluate what constitutes "good engineering practice" and "past landfill performance." The proposed language to require that a liner prevent contaminant migration only during the operating period of a facility may provide insufficient protection to groundwater. This alternative proposed methodology is vague, unsupported by any technical background, and cannot be reviewed or enforced by the Agency.

Another suggestion was to utilize "analogous" facilities as a design standard. The operator would copy the design of an existing facility located in similar geology if the existing facility is shown to be "protective of human health and the environment" (Public Comment 47). As has been discussed throughout this report, a large number of interrelated characteristics influence the quantity and quality of leachate discharged from a landfill. These characteristics (for example: cover design, rainfall, evapotranspiration, soil types, waste types, vegetation, height of the fill, design of the leachate collection and liner systems, and the geochemical properties of the surrounding soils) would have to be evaluated at every site, saving the designer no time or money. It would be almost impossible to prove that two designs at two different sites are analogous without collecting the minimum data and performing the steps necessary for a groundwater impact assessment. Standards based upon this concept would be difficult to evaluate and enforce. They are unlikely to save time and most certainly will save no money for an applicant. We are unaware of any existing facilities that can truly demonstrate that they are protective of human health and the environment. It is more appropriate to evaluate the design of a facility against an absolute performance standard such as those proposed here rather than proving that a new facility is "analogous" to an existing facility.

Based upon a review of the information presented by Dr. Jennings we recommend that deterministic models be utilized in a groundwater impact assessment. A groundwater impact assessment will usually be performed for an area that has not been previously stressed by a waste disposal operation. A stochastic model is unlikely to be successfully utilized on sites where no waste has been disposed and little contaminant transport data exist. The standards are based upon an assumed use of deterministic models. Stochastic models are not specifically excluded because they are performance-based standards. An operator wishing to use a stochastic model would need to be creative in demonstrating the adequacy of the model to the Agency.

We propose that the requirements for the groundwater impact assessment be written as general performance standards rather than design standards. There are too many variables, techniques and approaches to this discipline for more than a framework for evaluation and a set of safeguards. We do not recommend the adoption of a standard groundwater model to be used by all operators. There are many acceptable models which are constantly being updated with changes in technology that any contaminant transport model that is specified might easily become outdated by the time regulations are implemented.

The standards in Section 811.317 (c) are based upon Jennings (1986) description of the components of a complete contaminant transport model:

Application-independent information: These are general physical and chemical properties that may be measured independently of the site. Examples of these are solubility and reaction rate constants.

Application-dependent information: These consist of the specific hydraulic and chemical properties of the soils and water at the site. These properties can be measured in the field or in the laboratory but the information will be site-specific

Initial and boundary conditions: These are the conditions which define how the contamination source varies as a function of time and the fundamental magnitude of the chemical source. The must be stated explicitly and known with a reasonable degree of accuracy.

The proposed standards also address Dr. Jennings' four comments on groundwater contamination modeling for solid waste disposal (R 1156-1164, Docket A):

The solution to pollution is not dispersion: The ground water impact assessment may not be utilized to waive the minimum requirements, it is intended only as a confirmation that the design will not cause groundwater contamination at this particular site. This requirement also drove the choice of an attenuation zone 100 feet wide. Dispersion alone is inadequate to reduce the concentration of any contaminant to background levels within 100 feet, some attenuation by other means such as adsorption must occur.

The quality of the models being used must be guaranteed: Proprietary codes are assembled by professionals and checked, and are generally dependable products. The regulations do not specify the origin of the model, whether proprietary, public domain, or in-house. Any model that meets the minimum standards of subsection (c) may be utilized.

The quality of model input data must be carefully regulated: Poor information yields poor results. A detailed hydrogeologic assessment is required by these regulations and standards are proposed to document the quality of information. It has been suggested that the quality of information dilemma is the fatal flaw to the groundwater impact assessment approach. We do not agree. All landfill evaluation systems, including the alternate systems such as DRASTIC and the design standards proposed by the Agency require high quality information to produce acceptable results. The groundwater impact assessment is no exception and is no more susceptible to poor quality hydrogeologic information than anything else.

The results of single component models must be used with caution: It is important to recognize that chemical reactions and other processes are taking place as the contaminants move toward the point of compliance.

The modeling results are used to show that the minimum design standards will provide the necessary amount of protection at the site of the facility. Model results can never be utilized to waive the minimum design and performance standards. Unlike the Agency proposal, the modeling study we propose has a stated purpose. It shall be used to confirm, not derive, the acceptability of the design parameters.

The output from the model will consist of a series of concentration profiles and breakthrough curves. We require that profiles be created for various critical times in the life of the landfill and that breakthrough curves be calculated at the point of compliance and at several intermediate monitoring points.

One of the shortcomings discussed by Dr. Jennings was the quality of information that is available for input into the predictive model. Some of this information goes beyond that necessary to characterize the hydrogeologic setting; the specific geochemical attributes of a soil must be evaluated. Dr. William Roy was invited to present testimony on batch adsorption procedures for estimating soil attenuation properties of pollutants. (R. 657-679, Docket A). Adsorption is a process most contaminant transport models incorporate. Dr. Roy outlined a laboratory technique which yields adsorption data for the soil being tested. He emphasized that standardization of procedures is important to achieve accurate, reproducible laboratory results. The most significant results of Dr. Roy's testimony is that input parameters to a contaminant transport model can be developed to obtain reproducible results, are economical to perform, and yield data useful to a modeling effort. Section 811.317 (c) requires the operator to demonstrate the veracity of the data. The testimony of Dr. Roy shows that such a demonstration is possible for soil sorption data. We recommend that the Agency develop standardized procedures for collection of sorption and other site specific data, particularly the procedures proposed by Dr. Roy (Ainsworth et al., 1984).

Many modeling parameters must be derived in the laboratory. Therefore, standardization, or at least a minimum standard of laboratory practice, must be established and updated periodically. The available information suggests that laboratory and analysis procedures are best addressed in Agency guidelines that retain flexibility for quickly updating procedures that take into account improvements and technological advances.

Based upon the information provided by Dr. Roy, Dr. Griffin, and Dr. Jennings we feel that adequate, reproducible laboratory and field procedures can be implemented to determine the input parameters to a contaminant transport model. Furthermore, the results from a properly implemented contaminant transport model can be relied upon and used for meeting the requirements of these regulations. It is appropriate to utilize contaminant transport models in this manner. The standards that are proposed in this section constitute a prudent design methodology for solid waste disposal facilities.

Section 811.318 Groundwater Monitoring Program

The groundwater monitoring requirements apply to all putrescible and chemical waste units. There are no circumstances recognized by this proposal in which it is reasonable to ignore the potential impacts to groundwater, even in the most secure formations. Furthermore, the results of the groundwater impact assessment must be confirmed. All facilities must implement groundwater monitoring programs.

The groundwater monitoring standards are based on a comparison of upgradient, or background, groundwater quality to downgradient water quality. The establishment of background wells is discussed in Section 811.320 (d). The establishment of a statistical test is guided by Section 811.320 (e). The location and operation of background wells are extremely important to the overall monitoring system. They should be carefully chosen and completed.

The downgradient monitoring system consists of a network of wells completed within the zone of attenuation and less than halfway between the edge of the zone and the unit in order to encourage early detection of contaminants and to provide an additional buffer around the unit for the inevitable delay between detection of an excursion and initiation of a remedial action. The number and location of each monitoring well is determined on a site specific basis in accordance with the requirements of subsection (b).

One monitoring well, at a minimum, is to be established at the compliance point. The procedure for wells at or beyond the zone of attenuation is different from those within the zone of attenuation. Significant increases in contaminant levels over background are not expected outside the zone of attenuation for at least 100 years after closure of the unit. Any increase in concentration attributable to the unit outside the zone of attenuation is a violation of the water quality standards. In this case the operator moves from detection monitoring to assessment monitoring to remedial action. A groundwater impact assessment is not performed. This requirement is reflected in Section 811.319 (b) (5).

Subsection (d) is a relatively new concept. The maximum allowable concentration at any monitoring point is established by predicting the concentration at that point and time with a groundwater contaminant transport model. The maximum allowable concentrations within the zone of attenuation are intended to be action triggers. If an increase over the predicted values is observed the operator moves to an assessment monitoring program.

A breakthrough curve is a profile of concentration against time at a specific point. A breakthrough curve must be generated for each monitoring point. This breakthrough curve shows the maximum concentration possible at that point in order to meet the required water quality standard outside the zone of attenuation. As long as the monitoring results show concentrations less than or equal to the maximum possible predicted concentration we can be assured that the standard will not be exceeded outside the zone of attenuation. The allowable concentration at a monitoring point close to the unit will be higher than one near the edge of the zone of attenuation because contaminants will attenuate out of the groundwater as they move to the boundary.

It has been suggested that this is an inappropriate use of a contaminant model and that it would be more appropriate and easier to enforce if standards were established. It is not necessary to predict the exact concentration, the operator need only show that the predicted maximum value at the monitoring point will not exceed the established standards. The use of models is discussed in the previous section. We do not believe that the person who performs the groundwater impact assessment will intentionally try to mislead the Agency or the public when determining the impacts and developing the maximum allowable concentrations. We believe that this proposal contains sufficient safeguards to insure protection of all groundwater. For example, if an operator purposely overestimates the amount of attenuation expected then the breakthrough curves at the edge of the zone of attenuation will indicate that no impact will occur while the breakthrough curves closer to the unit will show lower concentrations than are likely to occur. The result will be that during operations contaminants will be detected in the monitoring wells closest to the unit at higher concentrations than predicted, forcing the operator into a remedial action program.

Likewise, an investigator may underestimate the attenuation likely to occur, leading to higher predicted concentrations throughout the zone of attenuation. The result would be higher allowable concentration predictions at the monitoring points. The contaminants would not exist in concentrations sufficient to trigger a remedial action. We do not anticipate this occurring because an underestimation of attenuation is conservative and may show a certain amount of degradation beyond the zone of attenuation. The designer would have to provide additional protection, such as a geomembrane, to the facility. Both of these scenarios will be difficult to initiate, however, because the groundwater impact assessment must be performed with reliable methods and site-specific information which must be supported by the applicant.

An alternative monitoring strategy was suggested, based upon a model rule developed by the National Solid Waste Management Association and WMI. No standards are established, the operator monitors groundwater quality at wells located at a point 500 feet from the waste boundary. If a statistically significant increase in the concentration of any indicator parameter is detected, then an assessment monitoring program is established. If the facility is the cause of the discharge, then the operator performs a risk assessment to determine if the facility poses a "reasonable probability of adverse effects on human health and the environment." (Public Comment 47). This approach is not recommended because "the probability of adverse effects on human health and the environment" should be established before a permit is issued, not after contamination has been observed. A risk assessment is unnecessary in all cases. All water must be protected to a certain degree; it makes no difference if the adverse impact is to an existing or potential source of drinking water. Existing Board regulations generally designate all waters for public and food processing use. The applicable standards may be adjusted beyond the public water supply standards if the water does not, and will not, serve as a public or food processing water supply. This approach does not assist in confirming the success of the facility design. In order to assess the success of the design (which is the purpose of the monitoring program) the same standards used to design the facility must be used during monitoring.

Monitoring during the postclosure care period is no different than monitoring during operation. We make no separate provisions for postclosure monitoring.

There is a growing awareness that the methods and materials used to construct the monitoring well affect the quality of the sample. Procedures for completing wells are constantly updated. We propose performance standards for monitoring well construction.

Several types of casing materials are available for monitoring wells. Some casing materials may be fabricated from materials that may contribute contaminants to the samples. In general, the cost of the casing material is directly proportional to its inert properties (Barcelona et al., 1983). The performance standard we propose requires the casing to not affect the sample. This gives the operator the flexibility to choose a well-casing material that is cost effective for the type of constituents to be sampled. Because solvent cement type couplings have been proven to release organics their use is prohibited.

All wells should be screened to prevent clogging. The same procedures for designing graded filters in the leachate collection system can be used to choose properly sized gravel and well-screen openings. As above, the screen should be made of a relatively inert material.

Barcelona et al. (1983) state that it is "critical that the screened portion of each monitoring well access groundwater from a specific depth interval. Vertical movement of water in the vicinity of the intake and around the casing must be prevented to obtain samples representative of that in the formation of interest." Rainwater can infiltrate through the backfilled material and contamination can spread from an aquifer through the annular space. We propose regulations addressing the sealing of the formation above the screened interval and at ground level to prevent the unwanted migration of water through the hole. The requirements of Section 811.318 (g) 4, 5, 6, and 7 are taken from Barcelona et al. (1983).

Barcelona et al. (1983) eloquently describe the necessity of a sampling strategy: "The importance of proper sampling of monitoring wells cannot be overemphasized. Even when wells are correctly located, constructed and developed, special precautions must be taken to ensure that the sample collected is representative of the groundwater at that location. Care also is needed to ensure that the sample is neither altered nor contaminated by the sampling and handling procedures." Testing the transmissivity of the formation is necessary to establish a sampling strategy. Field testing techniques are preferred. Gibb et al. (1981) make recommendations for the collection of groundwater samples:

1) A brief 2 or 3 hour pumping test should be conducted on each monitoring well to be sampled. Analyses of the pump test data and other hydrologic information should be used to determine the frequency at which samples will be collected and the rate and period of time each well should be pumped prior to collecting the sample.

2) The general rule of thumb of pumping 4 to 6 well volumes will in most cases produce samples representative of aquifer water. For aquifers with unusually high transmissivities, pumping for periods long enough to remove the "stagnant" water column may induce migration of water from parts of the aquifer remote from the monitoring well. The calculations of percent aquifer water with time provide a more rational basis on which the length of pumping can be determined. Samples should be collected in the minimum time required to produce water representative of the aquifer.

3) A controlled sampling experiment, similar to those in this study, preferably using a peristaltic or submersible diaphragm type pump, should be conducted to accurately determine the chemical quality of the aquifer water and to verify the response of the monitoring well to pumping as predicted from the pump test data. Once the chemical character and responses of the monitoring systems have been determined, key chemical constituents for routine sampling can be selected.

4) Based on the sensitivity of the selected chemical parameters, a choice of pumps for routine sampling can be made. The use of air- or nitrogen-lift pumping mechanisms should be restricted to chemical constituents insensitive to oxidation-reduction reactions and changes in pH. Although this study dealt with inorganic constituents, the data suggest that these types of pumping mechanisms probably would also strip volatile organic compounds from the water during pumping. The peristaltic or submersible diaphragm pumps and the bailer are recommended for most applications. If a bailer is to be used, the procedures outlined in the results sections of this report should be followed.

5) The monitoring well should be pumped at a constant rate for a period of time that will result in delivery of at least 95 percent aquifer water. The rate and time of pumping should be determined on the basis of the transmissivity

of the aquifer, the well diameter, and the results of the sampling experiment.

6) Measurements of pH, Eh, and specific conductance should be made at the time of sample collection. These measurements should be made within a closed cell, which will prevent the sample from coming into contact with atmospheric conditions. All samples should be promptly filtered through a 0.45 um pore size membrane and preserved according to recommended U.S. EPA procedures for the chemical constituents of interest.

Gibb et al. (1981) also note that there are no clear procedures to deal with some aquifer conditions. Regulations must be flexible enough to accommodate emerging technology. The proposed regulations allow the flexibility to deal with these areas where the best technology is not yet clearly defined:

1. Sampling procedures for organic compounds are still evolving and may, in some cases, be dependent upon the type of sampling equipment, sample containers, distance to laboratory and extent and accuracy necessary for the facility.

2. Sampling procedures for wells in zones of extremely low hydraulic conductivity need to be evaluated because such wells can easily be pumped dry before a representative sample is collected.

3. Seasonal and other natural variations in water quality can affect the interpretation of data. The establishment of background wells upgradient of the unit can account for natural and seasonal variability. The locations of background wells are critical to the success of a groundwater monitoring program.

4. In situ sampling procedures are desirable to minimize the possible artificial introduction of contaminants into the well during the monitoring procedure.

Monitoring devices for the unsaturated zone mostly take the form of collection lysimeters and pressure-vacuum lysimeters. Kmet and Lindorff (1983) reviewed the use of lysimeters to monitor discharges to the unsaturated zone as an indication of landfill performance. Potentially, lysimeters located immediately below the liner will provide an early confirmation of the assumptions made in the groundwater impact assessment. A collection lysimeter, which generally consists of a geomembrane section placed beneath a waste disposal unit overlain by a permeable layer to collect groundwater and direct it to a collection pipe, can provide an indication of the quality and quantity of seepage from a unit. The technology is relatively new but shows some promise. An early confirmation of the assumptions to a groundwater impact assessment would provide assurance as to the adequacy of the design. The drawbacks to lysimeters appear to be that they cannot be repaired if they fail to operate properly and cannot be replaced after the liner has been placed into operation. We do not take notice of lysimeters in the proposal but strongly encourage their use at all new facilities.

These regulations are flexible enough to allow lysimeters and other methods of sampling the unsaturated zone to be incorporated into a monitoring program.

The establishment of a groundwater monitoring network is a very important aspect of the operation of a landfill. An interdisciplinary approach is required and detailed knowledge of the hydrology, geology, chemistry, and design and operation of the landfill are absolutely vital to the success of the program. The elements of a successful monitoring program are perhaps best described by Barcelona et al. (1983):

> Groundwater Monitoring is more complex and challenging than the collection of reliable data in natural surface waters. The lessons of past monitoring efforts clearly demonstrate the need for multidisciplinary inputs to planning groundwater investigations. The input of both chemical professionals and laboratory personnel is essential to a successful program.
>
> The wise monitoring program director should attempt to consider carefully all existing information on local well drilling practices, hydrogeology, and the potential impact of waste constituents on subsurface geochemistry prior to implementation of a groundwater monitoring plan. In this way, maximal benefits will accrue from the considerable outlay of funds, time, and effort involved in subsurface monitoring activities. The most important result may be that in the future we will be in a far better position to effectively manage and protect our groundwater supplies.

Section 811.319 Procedures for Groundwater Monitoring

This section outlines the procedures for monitoring. A four-phase program is proposed: detection monitoring, assessment monitoring, a groundwater impact assessment and a remedial action program. The standards for detection monitoring require sampling on a quarterly schedule. If an increase in the concentration of an indicator parameter over the maximum allowable concentration is observed, confirmed and verified, then the operator moves on to an assessment monitoring program. If assessment monitoring confirms that the increase exists and exceeds the maximum allowable standard the operator performs a groundwater impact assessment to determine the potential impacts of the contamination. Only if the impact assessment predicts an impact to groundwater outside the zone of attenuation is a corrective action required. However, if contamination due to discharges from the solid waste facility are observed outside the zone of attenuation in statistically significant concentrations, the operator skips immediately to the remedial action section. The impact has already occurred.

The operator is required to sample quarterly during both the active life of the facility and the statutorily mandated minimum five year postclosure period. After the five year postclosure care period, monitoring may be phased out by going to annual sampling periods, until monitoring is no longer necessary. This requirement is intended to phase out the monitoring systems on a well by well basis. It would not be unusual to find some wells at a facility being monitored on a monthly basis, older ones quarterly, and some annually. If an increase in the concentration of any constituent is observed during the annual monitoring period then the monitoring frequency in that well changes back to quarterly.

It is expected that the operator will monitor groundwater for a suite of indicator parameters. The indicator parameters are chosen in accordance with the criteria presented in subsection (a) (3). The indicator parameter must be present or expected in the leachate. The indicator parameter must be considered a pollutant or contaminant. It must be possible to establish a procedure to collect a sample and analyze it to establish the concentration of the constituent. One should not establish indicator parameters for compounds that cannot be reliably measured.

The new groundwater impact assessment required by subsection (c) must be performed by the operator in accordance with the previously discussed standards for the impact assessment and contaminant transport modeling. The purpose is to reevaluate the impacts upon the environment by the unit. Permitted operations can work with the Agency to interpret the results of the assessment and develop a remedial action program to control discharges of contaminants beyond the zone of attenuation.

The fourth step is the implementation of a remedial action program which can range from minor operational adjustments to an elaborate groundwater treatment system. In short, any action that is necessary to assure that water quality standards beyond the zone of attenuation are not violated must be instituted.

The regulations on remedial actions assume that an "active" remedial action will take place; that is, the operator will perform some mechanical function or construct a hydraulic barrier to prevent the contamination from spreading or to remove the contaminated water for treatment. It was suggested that "passive" remedial actions be considered as acceptable in this subsection. While there are situations in which a passive remedial action may be appropriate, this subsection is premised on the necessity to prevent a violation of a water quality standard by an active remedial action. If a passive remedial action is contemplated and if the remedial action would result in the temporary violation of an established water quality standard then the operator will have to either seek a variance, a site specific standard, or an adjusted water quality standard (see Section 811.320 (b)) in order to avoid one of the cleanup options. This proposal does not allow remedial actions which may result in the violation of water quality standards. The routine approval of passive remedial actions by the Agency is not recommended.

Section 811.320 Groundwater Quality Standards

The numerical limitations in this section are based upon the existing requirements of 35 Ill. Adm. Code Part 302. Section 302.105 states that:

> Waters whose existing quality is better than established standards at the date of their adoption will be maintained in their present high quality. Such waters will not be lowered in quality unless and until it is affirmatively demonstrated that such change will not interfere with or become injurious to any appropriate beneficial uses made of, or presently possible in, such waters and that such change is justifiable as a result of necessary social and economic development.

The standards in Section 811.320 are based upon the existing nondegradation criteria established by the Board in Section 302.105. This section, however, is inadequate to specifically define the maximum allowable concentrations and how and where contamination is to be evaluated. This section provides a more complete groundwater quality section that addresses discharges to groundwater by waste disposal facilities. Subsection (a) prohibits the degradation of groundwater beyond the zone of attenuation. Thus it is vital for the operator to obtain detailed knowledge of the groundwater flow regime and background concentrations.

The operator may petition the Board for adjusted standards, if necessary, by utilizing the procedures in Section 811.320 (b). The procedure in (b) (2) is to be used when the groundwater in question meets all applicable drinking water standards. This procedure may not be used to allow degradation below any applicable drinking water standard if the groundwater already meets or exceeds the standards.

If the water is already contaminated beyond the public water supply standards then the procedure in (b) (3) is used. The Board may adjust the standard to whatever level is appropriate. The criteria in (b) (3) (B) are taken from the requirements for underground injection control programs, 35 Ill. Adm. Code Section 730.104, and have been modified to protect shallow sources of groundwater.

The existing standards for public water supply and food processing water (Sections 302.301, 302.304, and 302.305) are used to define a source or potential source of drinking water. If the groundwater contains concentrations of constituents which are less than the public water supply and food processing standards then the standards may be adjusted to no more than the standards for public water supplies and food processing water. It has been asserted that these standards were not written and developed from a record with respect to groundwater and that these standards do not make sense with respect to groundwater.

The intent of these requirements was to utilize, to the extent possible, existing Board water quality and effluent standards. It is not the intent of this proposal to modify or revise the water quality standards. The standards for public water supplies and food processing waters apply to waters of the state, including groundwater. This interpretation is supported by the interpretation employed by the Illinois Supreme Court [Central Illinois Public Service Company v. PCB, 116 Ill. 2d. 397, 507 N.E. 2d 819 (1987): "While there are no specific standards for groundwater, groundwater is subject to existing water quality standards which vary on the use or potential use of the water involved"].

The procedures to be used for all adjusted standards in this proposal are the procedures developed by the Board for adjusted standards under RCRA. It is not necessary to introduce a new system for filing petitions, notice, conduct of hearings, and other procedures within this section.

The "zone of attenuation" is roughly analogous to the surface water mixing zone. The intent is to provide a buffer area between the source of the discharge and the point at which the applicable groundwater standards are enforced. The zone of attenuation is defined as a three-dimensional volume bounded at the top by the ground surface or top of the saturated zone, below by the bottom of the uppermost aquifer, and on each side by a plane located at the property boundary or 100 feet from the edge of the unit, whichever is less. All contaminants must be attenuated by the time the groundwater reaches the edge of the zone of attenuation. This distance is intended to accomplish several objectives:

1. Establish monitoring points as close to the unit as possible;

2. Keep the volume of geologic material that must be evaluated during a groundwater impact assessment to a minimum;

3. Keep any potential contaminated area to an absolute minimum; and

4. Establish an enforceable boundary at which an excursion (a significant increase in the concentration of any contaminant, attributable to the unit, and more than the allowable maximum concentration at that point) during the operating period is likely to be discovered before the end of the postclosure care period.

In order to assist in the evaluation of the distance chosen for the zone of attenuation, the Illinois State Geological Survey performed a computer modeling project. The purpose of the modeling project is to quantitatively assess the potential for contaminant migration through sequences of geologic materials typical to the state of Illinois using two landfill scenarios and six contaminants. The results of this work may be used to evaluate the appropriateness of a 100 foot compliance distance from the edge of a sanitary landfill, outside of which no degradation of groundwater quality may occur during a 100 year period. As of this writing the project is still being conducted, but some results are available and will be discussed and clearly demonstrate that the proposed distance of 100 feet is workable and practical.

Berg et al. (1984) mapped the upper 50 feet of geologic materials throughout the state of Illinois. They then qualitatively ranked these sequences for potential for contamination based on the hydrogeologic and attenuation properties of the materials. Fifteen of these sequences have been selected for detailed evaluation in this study using mathematical models. Those sequences not modeled either are not likely to be landfill sites, are relatively rare in occurrence, or are too complex to model within the scope of this project. Brief descriptions of the fifteen sites modeled for this study are shown in Table 2.

Two landfill operating scenarios were modeled. The first scenario consists of a landfill with a leachate collection system over a clay liner which is three feet thick. The total head of leachate in the landfill is one foot above the bottom liner. This scenario is similar to that proposed in Section 811.306. The second scenario represents current practice and consists of a landfill with a clay liner ten feet thick, a total head of leachate 10 feet above the bottom liner, and no leachate collection system is in operation. The landfill operating scenarios were remained constant for each site.

Two mathematical models were utilized: The Prickett Lonnquist Aquifer Simulation Flow Model (PLASM) and the Random Walk contaminant transport model. This comparative modeling study does not purport to model any particular existing landfill. For each geologic unit the initial conditions, assumed design of the landfill, leachate parameters, and gradients are the same. Only the hydrogeologic parameters of each sequence are changed. This provides a test of the sensitivity of the proposed landfill liner and leachate collection standards to various geologic conditions. The results are most useful when compared to each other, not to the actual performance of a landfill in the field. The transmissivity, hydraulic conductivity and porosity values were chosen as representative of typical materials in Illinois. Table 3 shows the hydrogeologic parameters. Table 4 shows the retardation factors and initial concentrations of each contaminant. Chloride is the least likely to be attenuated. Chloride can, therefore, be considered a worst case because it is likely to migrate the farthest from the unit in a given amount of time.

Table 2: Geological Sites Chosen For Modeling Study

Unit	Description
A1	Twenty feet of sand overlying fractured limestone.
A1B	Twenty feet of clay overlying fractured limestone.
A2	Twenty feet of clay overlying unconsolidated sand.
A4	Twenty feet of clay overlying cemented sandstone.
A4B	Twenty feet of clay overlying sandstone.
B	Twenty feet of unconsolidated sand overlying silty-clay.
C1	Thirty-five feet of clay overlying fractured limestone.
C2	Thirty feet of clay overlying a sand layer ten feet thick.
C2B	Thirty feet of silty-clay overlying a sand layer ten feet thick.
C4	Thirty-five feet of clay overlying cemented sandstone.
C5	Fifty feet of clay with discontinuous sand lenses.
C5B	Thirty feet of silt overlying clay.
D	Fifty feet of silty-clay.
E	Fifty feet of clay.
F	Twenty feet of clay over shale.
G	Thirty-five feet of clay over shale.

Table 3: Hydraulic Conductivity and Porosity Values Used In This Project

Unit	Hydraulic Conductivity (cm/sec)	Porosity
Fractured Limestone (A1 sequence)	10^{-4}	.15
Fractured Limestone (C1 sequence)	10^{-3}	.15
Sand	10^{-3}	.30
Sandstone	10^{-4}	.25
Cemented Sandstone	10^{-5}	.20
Silt	10^{-5}	.45
Silty-clay	10^{-6}	.40
Clay	10^{-7}	.40
Shale	10^{-9}	.05

Table 4: Retardation Factors and Initial Concentrations Used in This Project

Contaminant	Initial Concentration(mg/L)	Retardation Factor				
		Sand	Clay/ Till	Sandstone	Shale	Limestone
Chloride	4000.	1.00	1.00	1.00	1.00	1.00
Cadmium	0.4	62.	607.	80.2	4940.	81.7
COD	90000.	1.31	1.61	1.40	5.94	1.16
Methylene Chloride	20.	1.23	1.76	1.30	7.18	1.20
Trichloro-ethylene	0.6	2.41	5.61	2.81	38.5	3.45
Xylene	0.15	5.47	18.8	7.99	146.	5.74

Figure 1 shows the maximum extent of the chloride plumes at a time of 100 years. Plumes have migrated more than 1000 feet at the A2 (sand), B (sand), C1 (till over fractured limestone), and C2B (sandy till over sand) sites. The plumes generated using the 3-foot liner scenario generally have greater extent than those generated using the 10-foot liner scenario. For two geologic sequences (C1-till over limestone and C2-till over sand) no migration beyond the boundary of the landfill occurred using the 10-foot scenario while more than 500 feet of migration occurred using the 3-foot scenario. The reason for this difference in migration rates appears to be related to the thickness of the confining zone beneath the landfill. The extra 7 feet of confining material (liner) for the 10-foot scenario causes an increase in the amount of time required for a particle to reach the underlying layers. For the C sites underlain by clay till (all except C2B and C5B) this delay is enough to prevent particles from reaching the underlying aquifer within 100 years.

Figures 2 and 3 show maximum chloride concentrations recorded during the simulations at the 100 foot compliance distance (both figures show the same data, however the vertical scale on Figure 2 only goes to 500 mg/L). For all except the B sequence, the maximum concentration was recorded after 80 years had past. The concentrations generated with the 10-foot scenario are much higher than those generated using the 3-foot liner scenario. This difference is due to the estimated mass of contaminants removed by the leachate collection system. Section 811.307 requires that the leachate drainage system be capable of maintaining a maximum leachate depth of 1 foot during the wettest month of the year. The steady state assumption of 1 foot is conservative. That head represents a 90% reduction in the volume of leachate in the landfill for the 10-foot scenario; therefore the corresponding mass of contaminants for the 3-foot liner-leachate collection scenario was reduced by 90 percent from the mass used for the 10-foot scenario.

The 15 geologic sites can be placed into three general groups: those sites for which it will be extremely difficult or impossible to demonstrate compliance with the nondegradation standards, those sites for which the nondegradation standards will be easily met, and an in between group. Depending on leachate strength and amount, local geologic conditions and the addition of engineered features such as a geomembrane, many of these borderline sites might be made acceptable for solid waste disposal.

Insert Figure 1 Here

Figure 1: Maximum Extent of Chloride Migration After 100 Years. See Table 2 for a description of each geologic sequence. This figure shows the maximum distance chlorides will migrate in 100 years. Range shown is from 0 to 2600 feet from the edge of the landfill.

Insert Figure 2 Here

Figure 2: Maximum Concentration of Chlorides at Point of Compliance. See Table 2 for a description of each geologic sequence. This figure shows the maximum concentration predicted at a point 100 feet downgradient from the landfill within a 100 year time period after waste placement. Range shown is from 0 to 500 mg/L.

Insert Figure 3 here

Figure 3: Maximum Concentration of Chlorides at Point of Compliance. See Table 2 for a description of each geologic sequence. This figure shows the maximum concentration predicted at a point 100 feet downgradient from the landfill within a 100 year time period after waste placement. The range shown is from 0 to 6000 mg/L.

The groundwater impact assessment methodology is sensitive to changes in geology. The A1, A2, and A4B sites all clearly show contaminant movement past the zone of attenuation. It is unlikely that any design will be sufficient to contain pollutants In accordance with the water quality standards described in Section 811.320. Any seepage from a facility located within any of these sites will quickly migrate out of the zone of attenuation. Figure 4 shows the distance the plume will travel over time.

No migration beyond the zone of attenuation was predicted for sites C4, C5, D, E, F and G with the liner and leachate collection system designs proposed in Part 811, as shown in Figures 5 and 6. The groundwater impact assessment is likely to demonstrate that facilities located at these sites will be in compliance with the groundwater standards. The C1, C2 and C2B sites show small increases in chloride concentration at the compliance point within 100 years. These are borderline geologic situations where care must be taken when evaluating the impacts. Site specific changes in geology or leachate characteristics may affect the acceptability of facilities located on these sites.

For certain cases, it may be possible to contain contaminants at sites in areas where aquifers occur 20 to 50 feet below land surface (those areas mapped by Berg et al. (1984) as C) and where a competent confining layer more than 15 feet in thickness separates the base of the landfill from the aquifer.

Caution must be exercised for sites constructed over sandy till so that no permeable lenses of sand exist near the disposal site. Otherwise sanitary landfills in this type of environment (mapped as D by Berg et al., 1984) should be able to contain contaminants.

Sites constructed in areas where aquifers do not exist (Mapped by Berg et al. (1984) as E. F, and G) and with hydrogeologic conditions similar to those modeled in this exercise will probably be able to contain contaminants within the 100 foot compliance zone for long periods of time.

If the compliance distance were 50 rather than 100 feet (a more stringent standard), only the C4, C5, E, F, and G sites modeled here would meet the standards after 100 years. If the compliance distance were 500 feet (a less stringent standard), the A4, A4B, C4, C5, CB5, D, E, F, and G sites would meet the standards after 100 years. Therefore, a tentative conclusion is that the 100 foot compliance distance is reasonable. A lesser compliance distance may be overly restrictive while a larger compliance distance may allow severe degradation of aquifers.

Insert Figure 4 Here

Figure 4: Distance Versus Time Profiles for the A and B Sites. See Table 2 for a description of each geologic sequence.

Insert Figure 5 Here

Figure 5: Distance Versus Time Profiles for the C Sites. See Table 2 for a description of each geologic sequence.

Insert Figure 6 Here

Figure 6: Distance Versus Time Profiles for the D, E, F, and G Sites. See Table 2 for a description of each geologic sequence.

Subsection (d) contains location and sampling standards for the establishment of background concentrations. Because a non-degradation groundwater standard is applied at the compliance point it is in the operator's best interest to establish, beyond all reasonable doubt, the background water quality. All groundwater down to the uppermost aquifer should be evaluated to determine stratigraphic variations.

The data from the groundwater monitoring program must be analyzed by statistical techniques to differentiate minor changes in concentration due to sampling techniques, natural variability, and analysis techniques from actual increases in concentration due to an excursion. Subsection (e) contains minimum standards for statistical analysis of data. The operator may choose any method which provides a 95 percent level of confidence. Two common tests are specifically mentioned and more sophisticated techniques may be utilized if they meet the equivalent performance criteria.

Using the techniques outlined in the section on groundwater impact assessments, the minimum standards proposed for landfill design, and the groundwater quality standards proposed in this section an operator should be able to design a solid waste disposal facility and demonstrate that discharges from the facility have a high probability of complying with the standards. Now it will be shown that suitable areas exist throughout the state where the minimum design criteria can be successfully applied. In order to assess the applicability of the minimum design standards to typical geologic conditions found in Illinois the Illinois State Geological Survey calculated the areas for which the groundwater standards can be achieved (ie., the groundwater impacts are acceptable) by applying the minimum design criteria. A preliminary evaluation, subject to correction, shows that of the 35.6 million acres of land comprising Illinois approximately 47.0 percent, or 16.7 million acres may be suitable for solid waste disposal operations. Of the remaining areas some can be made suitable by designing a more secure landfill utilizing, for example, a geomembrane or a slurry wall system. Parts of the remaining areas may be suitable for operations where a less contaminated leachate than assumed for this study is expected to be generated. For example, Table 1 shows that foundry leachate contains different contaminants in different ranges of concentration. The designer of a landfill must take these factors into consideration. Figure 7 shows most of the suitable areas for landfills for the leachate conditions assumed in this study (E, F and G sites), in black, throughout the State. Nearly every county has some suitable land.

The groundwater quality standards proposed in this section can be achieved by utilizing widely available, economically reasonable, and technically feasible methods on almost half of the land in Illinois. The groundwater impact assessment procedure is sensitive to specific geologic conditions and provides a practical procedure for evaluating the adequacy of the proposed design of a landfill in a systematic manner.

Insert Figure 7 Here

Figure 7: Geologic Deposits Suitable for Landfilling of Nonhazardous Wastes. This map shows geologic deposits E, F and G in black. These are locations where nonhazardous wastes may be safely disposed by utilizing the minimum design criteria. Other areas may be suitable if the engineering design were improved by adding more containment protection.

Section 811.321 Operating Standards

After much consideration of the comments and testimony presented at hearing the requirement to begin operations at the most downgradient portion of the facility has been retained and moved to Subpart C from Subpart A. The advantage to beginning in the most downgradient portion is that all seepage from the facility is likely to flow through the initial monitoring wells and under the previously filled areas. The disadvantages cited by several participants were related to convenience. It is sometimes appropriate to schedule operations to favor wind conditions to minimize litter and to use higher portions of the fill during precipitation. The regulations allow the use of areas other than the most downgradient under certain conditions.

Subsection (b) describes special procedures to be followed during initial waste placement. The purpose of this subsection is to minimize damage to the leachate drainage and collection system from vehicles operating over the structure and protect the liner from freezing by a placing layer of waste five feet thick over the entire liner before it is subject to freezing conditions. In the event the liner is exposed to freezing conditions the operator inspect the liner and show that it still meets the required specifications. It may not be necessary to rebuild the liner if no damage is found.

Section 811.322 Final Slope and Stabilization Standards

The intent of this section is to require the operator to construct the final configuration of the disposal unit in a manner consistent with the postclosure land use.

Operators are encouraged to consider the setting and drainage patterns when designing the final topography. To the extent possible the facility should blend with the surrounding terrain. Slopes should be gentle, able to support vegetation, and prevent standing water. Principles of geomorphology are appropriate when determining final grades. A well-designed facility is likely to require little maintenance, is less likely to erode, and will not interfere with established drainage patterns.

Subsection (d) contains standards for structures over the unit. There is no reason to believe that carefully designed buildings cannot be constructed over a waste disposal unit. The structures can be designed to vent gases away and not interfere with the operation of the cover, leachate collection system, and liner.

Section 811.322 Postclosure Maintenance Standards

This section contains the standards for the operator's post-closure care inspection and maintenance responsibilities for surface disturbances. The intent is to require the operator to inspect the site each year and concentrate revegetation efforts on areas that show erosion. In some cases there will be no choice but to recontour the surface so that continuing erosion problems are solved permanently. The minimum maintenance period is five years, however, we propose a performance standard to monitor until the entire surface is stabilized with vegetation.

SUBPART D
STANDARDS FOR IDENTIFICATION AND MANAGEMENT OF SPECIAL WASTES

Section 811.401 Scope and Applicability

This Subpart is intended to apply to all facilities that accept special waste, as defined in the Act. This Subpart is written to reflect existing policies for the transportation and disposal of special wastes. Only those waste streams approved by the Agency may be accepted at permitted facilities. Supplemental permits are still required.

This Subpart is applicable to onsite facilities as well. Manifests would not be required but the inspection, testing and disposal requirements are necessary to assure that only designated waste streams enter the disposal unit.

This Subpart is intended to supplement existing Part 809. Additional regulations for the management of special wastes are under consideration by the Board in a separate proceeding.

Section 811.402 Notice to Generators and Transporters

This section requires the operator to provide notice by placing a sign at the entrance to the site. The sign provides a warning to a transporter as to the types of waste accepted and permitted at the site.

Section 811.403 Special Waste Manifests

This section is based upon the Agency proposal and the transportation record proposed by WMI. The intent is to maintain the requirements for transporting and disposing special wastes as currently practiced by the Agency. Changes to the special waste system are under consideration in a separate docket, R85-27. As a result of any recommendations under that proceeding changes may be made in this Subpart at a future time.

Section 811.404 Identification Record

The identification record provides information about the special waste to the operator. The record contains any test results or a certification that the special waste has not changed since the supplemental permit was approved by the Agency. The requirements were taken from the WMI proposal.

Section 811.405 Record Keeping Requirements

This section requires all parties to retain records until the facility is closed and the postclosure care period is over.

SUBPART E: CONSTRUCTION QUALITY ASSURANCE PROGRAMS

Section 811.601 Scope and Applicability

This Subpart outlines the minimum requirements for a construction quality assurance program. Each major structure at the facility shall be constructed by utilizing the construction quality assurance procedures outlined here. Facilities that are exempt from permitting requirements can implement these procedures, but are not required to submit the inspection reports or acceptance reports to the Agency.

The standards in this Subpart were taken mainly from the USEPA technical guidance document: "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities" (1986). Although developed for hazardous waste facilities, many of the procedures and recommendations are directly applicable to nonhazardous waste disposal facilities. The standards of this Subpart are framed, for the most part, as performance standards; however, the reporting requirements and statistical sampling techniques are rather specific.

Section 811.602 Duties and Qualifications of Key Personnel

The operator is responsible for delegating the task of quality control to a construction quality assurance (CQA) officer. We do not mean to imply here that a single CQA officer is all that is allowed. A different CQA officer may be designated for each individual structure. In fact, this may be preferable because certain people may be more qualified to oversee the construction of compacted earth liners while others are qualified to oversee the construction of geomembranes. We see some difficulty where two shifts may be constructing a facility structure. One CQA officer must be in responsible charge of a single structure.

Certain functions, such as the collection and testing of samples can be handled by properly trained technicians. The CQA officer is the supervisor responsible for the quality of work performed by these designated inspectors.

The CQA officer should be a professional engineer registered in the State of Illinois. The CQA officer must be familiar with the design, the construction and fabrication techniques, sampling, testing, and inspection.

Section 811.603 Inspection Activities

This section outlines the activities at which a CQA officer shall be present. Some are already covered by a requirement in Subparts A through D, others are mentioned only here.

Section 811.604 Sampling Requirements

This section requires the CQA officer to implement an inspection and sampling program to insure the quality of materials and operations (such as seaming a geomembrane). The sampling procedures should provide a confidence level of at least 95 percent. The sampling strategy should insure the quality of the materials and procedures used.

Section 811.605 Documentation

Three types of documentation are required: daily reports, filled out by the CQA officer, inspection reports from each inspector which are included in the daily report, and acceptance reports, which includes all daily reports and the as-built drawings.

The daily inspection reports are each inspector's record of their daily activities. They are incorporated into the CQA officer's daily summary.

When a major phase of construction is complete the CQA officer prepares an acceptance report. We do not provide a specific definition for "major phase of construction" so that the operator can have the flexibility necessary to begin operations, after a portion of the construction is complete.

Section 811.606 Additional Requirements for Foundations and Subbases

The remainder of the sections in this Subpart deal with additional requirements for specific structures. The most critical aspect of this section is the requirement for an inspection of the foundation for undesirable objects and soil.

Section 811.607 Additional Requirements for Compacted Earth Liners

This is likely to be perceived as an extremely critical section. We follow the recommendation of USEPA (1986) and Daniel (1985) and will require the construction of a test liner section to evaluate the materials and construction methods prior to full-scale construction.

The record contains some debate on the wisdom of field permeability tests and laboratory permeability tests. In general, field permeability tests potentially provide a more realistic determination of hydraulic conductivity in liners where cracking, settling, lack of homogeneity, and improper breaking of clods result in channeling. Laboratory tests are less expensive than field permeability tests and can provide acceptable results where careful quality control results in no macrostructures and channeling. We propose that field testing be performed on the test liner section, in conjunction with a laboratory testing program. The purpose is to compare the two. If the laboratory tests compare favorably to the field tests then the adequacy of the full-scale liner can be verified by using laboratory tests. If not, then there are probably some contaminant transport pathways that the laboratory techniques may not be able to detect.

We do not recommend the use of field tests to verify construction of the full-scale liner for the following reasons:

1. They can take months to run, the liner would be destroyed by sunlight, subject to freezing conditions or other climatological factors. The data would be useless to a contractor, who could not wait around the site for months while the test is being conducted;

2. Part of the liner would be destroyed during the installation of the infiltrometer; and

3. They are too expensive to perform in the numbers required for a statistically significant sampling.

It is, therefore, vital to establish a testing protocol during the test-liner phase to establish a sampling program that will give values that may reasonably be expected in the field.

Generally, when changes in construction equipment, materials or procedures occur a new test liner must be constructed. A standard is proposed to allow the operator to demonstrate that a new test liner is not necessary because the change is not significant enough to change the conditions under which the liner is constructed.

SUBPART G
FINANCIAL ASSURANCE AND POSTCLOSURE CARE

Section 811.700 Purpose, Scope and Applicability For Closure

This Subpart was taken form existing regulations in Part 807. Several changes have been made to maintain consistency with the proposed regulations and to allow more flexibility.

The two Subparts in Part 807 (E and F) are combined here because the differences between operational requirements, closure requirements, and postclosure requirements are now rather subtle.

Sections from the existing Subparts have been deleted because they are either covered elsewhere in the proposal or are no longer necessary. These sections include: Biennial Revision of Cost Estimates, Interim Formula for Cost Estimates, and Time for Submission of Financial Assurance. Changes to the postclosure financial assurance sections are related to calculation of cost estimates, revisions to cost estimates and length of applicability of financial assurance. Section 811.700 combines previous Sections 807.600 and 807.601.

Section 811.701 Upgrading Financial Assurance

The operator is required to upgrade the cost estimate whenever a change is made that affects the closure or postclosure care costs. A provision (subsection (c)) requires the Agency to always retain an amount equal to five years of postclosure care. This provision is expected to be useful during the last five years of the design period. After the design period is up the postclosure care period is extended, if necessary, for five more years.

Section 811.704 Cost Estimate for Closure and Postclosure Care

The standards in Part 811 are used as the basis for a cost estimate. This section contains additional requirements for estimating postclosure costs.

Subsection (c) requires the operator to base the estimate on the highest costs for closure during the next term of permit, which is no more than five years. The cost estimate will be recalculated at every permit renewal to account for work performed in the last five years and an estimate of closure costs for the coming five years. The cost estimates will increase each permit term in proportion to the amount of disturbance. This is a much more cost effective method of assessing financial assurance than the existing requirements for an estimate of the entire cost of closure for the entire facility at maximum disturbance.

The requirements for subsection (e) are taken from Section 807.621 (d) (2). Another item is added to prohibit an operator from deducting the value of landfill gas processed and sold to a third party.

The items in subsection (h) are intended to be considered in addition to any required in Part 811. An extra item is (h) (3). This requires the operator to post financial assurance for alternate landfill gas disposal when gas is shipped or sold to an offsite processor. The reason this item is added is to assure that, should access to the offsite processing facility be eliminated, an alternate disposal system can be implemented.

Subsection (h) (4) provides guidance on postclosure care for those facilities where waste stabilization is still occurring after the end of the design period. In this case the postclosure care period is extended for five more years.

Section 811.705 Revision of Cost Estimate

This section requires an operator to revise the cost estimate at every permit renewal (every five years) instead of every two years, as now required.

Sections 811.706 to Sections 811.715 are taken directly from the existing requirements in Part 807, Subpart F. The only changes have been to require all instruments such as letters of credit, bonds, and self insurance to expire in five years, thus the financial assurance will be consistently evaluated in five year blocks.

C. Discussion of Part 812: Information to be Submitted in a Permit Application

This Part applies to all permitted operations. In effect this is a listing of all the information that must be submitted in a permit application. All of the information must be submitted in order to have a complete application. Subpart A contains requirements for all waste disposal facilities. Subpart B contains additional requirements for inert waste disposal facilities and Subpart C contains additional requirements for putrescible and chemical waste disposal facilities.

The intent of this Section 812.104 is to require a demonstration by the applicant that the proper local government authority has been apprised of the plans for a waste disposal facility and approval is either granted or pending. Lack of approval should not hold up the determination of a complete application, however, the requirements of this section must be fulfilled by the Agency decision deadline date or the Agency may deny the application.

The Agency argued that proper local government authority must be provided before the review of a permit application by the Agency should be initiated. However, it appears that the Act is designed to accommodate concurrent review of the permit application while under review by a local government. The applicant is required to furnish proof prior to the Agency deadline date.

The balance of this Part requires little background and discussion. The maps and narrative descriptions are necessary for the Agency to review the application for compliance. It is intended to be as complete as possible and to act as a sort of checklist for an applicant.

D. Discussion of Part 813: Procedures for Permit Applications, Renewals and Modifications

SUBPART A
PROCEDURES FOR PERMIT APPLICATIONS

Section 813.101 Scope and Applicability

Part 813 applies only to facilities requiring permits. Onsite facilities are exempt from these requirements pursuant to Section 21 (d) of the Act. Subpart A contains the procedures applicable to permit applications. These same procedures are also used for significant modifications, renewals, and for the repermitting of existing facilities.

Section 813.102 Delivery of Permit Application

This language is taken directly from the existing requirements in 35 Ill. Adm. Code 807.205 (e). Several participants suggested that this requirement is inappropriate because there are no consequences in not following the standards, that the standards are out of date because delivery methods such as overnight express services and messenger services are not considered.

In response to these comments several modifications are proposed. First, the section has been modified to require the applicant to obtain a receipt from the Agency or an acknowledgment that the Agency received the application on a date certain. In the absence of a receipt, the Agency determines the applicable decision deadline date. The applicant may utilize any type of service that will provide a signed, dated receipt.

Section 813.103 Agency Review for a Complete Filing

The development of a new, comprehensive set of standards also necessitates a reevaluation of the procedures to obtain a permit. Several standards in Part 811 require other government agencies to make determinations prior to review by the Agency. Part 811 also substantially increases the amount and scope of information to be submitted by the applicant. The Agency should focus its finite resources to the review of permit applications which contain all of the required information. To address these two issues we recommend the adoption of a two phase review. The first phase is a review by the Agency to determine whether all the elements required in Part 812 are included in the permit application. The second is a review of the information for compliance.

Section 813.103 contains a new procedure requiring the Agency to find an application "complete" or "incomplete" within 45 days of filing. The Agency must inform the applicant of all incomplete items, all other items not addressed by the Agency are assumed to be complete. The applicant will then have an unspecified time period in which to gather all of the necessary information and amend the application. Upon filing this new information the Agency has 45 days to make a finding of completeness. If the application is still incomplete the Agency notifies the applicant and the process begins again, with a (presumably) shorter list of incomplete items. Each time an amended application is filed the 90 or 180 day "clock" starts again, from zero. Once the Agency finds an application complete only the applicant can waive the deadline for Agency decision.

Section 813.104 Agency Decision Deadlines

It is appropriate to paraphrase the Act at this point to state the minimum Agency decision deadline. Only the applicant may allow a waiver of the deadline.

The word "landfill" appears in this section instead of facility. This is intended to direct the Agency and an applicant to the Act to determine the mandated deadline. This section was not intended to limit the scope of the Act in this regard.

Section 813.105 Agency Concurrence on Phase I and Phase II Geohydrological Investigations

This section is intended to provide an incentive for the Agency and a potential applicant to discuss, prior to the investigation, the plans for a detailed site investigation. The three phase investigation should involve consultation with the Agency, particularly during the planning of each phase. If the applicant performs the studies as arranged with the Agency then the Agency may not find the Phase I or Phase II investigations incomplete. This section does not affect the ability of the Agency to find a Phase III investigation incomplete and request additional information.

This review process is discretionary on the part of both the Agency and a potential applicant. An applicant need not solicit Agency concurrence to conduct an investigation. The Agency may choose not to review the information or may decide not to issue a concurrence. Neither of these could prevent the applicant from performing an investigation. Therefore, an appeal mechanism is not necessary.

We emphasize that Agency concurrence of the plans for an investigation is not to be considered approval of the site for waste disposal purposes, nor is it necessarily an acceptance of the data generated by the plan. The Agency is only agreeing that the study, as proposed, will meet the minimum requirements, based upon the existing site-specific information. Ultimately, the investigator will have to convince the Agency with the information in a permit application that the hydrogeologic investigation was conducted in accordance with all requirements, that enough information exists to perform the groundwater impact assessment, and a groundwater monitoring system can be designed and implemented. If the Agency issued a concurrence and the investigation was carried out in strict compliance with the plan for that investigation, then the permit application may not be deemed incomplete with respect to an inadequate hydrogeologic investigation.

Section 813.106 Standards for Issuance of a Permit and Section 813.107 Standards for Denial of a Permit

The minimum standards to be followed by the Agency are found in the Act, which are paraphrased here for continuity and convenience.

Section 813.108 Permit No Defense

This section was taken from 35 Ill. Adm. Code 807.208.

Section 813.109 Term of Permit

This requirement follows the Agency's proposal to limit the duration of a permit to no more than five years of disposal operations. The Agency will then have the opportunity to review the existing monitoring systems and operating plans and recommend modifications, if necessary to maintain compliance with the regulations. In response to comments this section has been modified to require a time period of five years, not a cumulative period of five years. In addition, financial assurance must be updated and renewed every five years.

Many participants criticized this requirement as burdensome, indicating that financial assistance such as loans would be difficult or impossible to secure unless a permit were issued for the life of the facility. This contention was not supported by documentation from financial experts or loan officers. We speculate that the consequences of a five year term of permit would be far less dire than predicted. Many other permits are issued for five year terms: NPDES permits are issued for five year terms, air discharge permits are issued for five year terms, coal mining permits are issued for five year terms, hazardous waste permits are issued for five year terms but may be extended by the Agency for up to ten years. While the requirements to renew a permit may be considered burdensome and ministerial there appear to be no documented cases of an operator's inability to obtain capital solely on the basis of the term of the permit.

Section 813.111 Transfer of Permits

The intent of this section is to assure that when a permit is transferred from one operator to another a demonstration of financial assurance is made by the new operator.

Section 813.112 Draft Approved Permits

The issuance of a draft permit is discretionary on the part of the Agency. This section makes clear that such permits are for informational purposes. Because they do not represent final Agency action, they are not appealable to the Board.

Section 813.113 Authorization to Engage in Experimental Practices

This section is intended to provide operators an opportunity to utilize experimental practices at solid waste disposal facilities. It is to be used when an experiment cannot be conducted in accordance with all of the requirements of Part 811. While this procedure may seem more cumbersome than the existing "experimental permit" section (35 Ill. Adm. Code 807.203) it provides an equitable and flexible process. The final decision on the granting of an authorization is left to the Board, using the procedures for adjusting standards in Section 28.1 of the Act.

Part 811 contains many performance standards that require a demonstration to the Agency that the performance of an alternative technology is equivalent or superior to the design standards. In the event that the applicant cannot make that demonstration this procedure can be implemented to obtain information. The following sequence of events serves as an example of how this process is envisioned to work:

1. An applicant applies for a permit from the Agency. The permit application contains a request to use an alternative technology that will achieve equivalent or superior performance to the applicable design standard. The Agency refuses to allow the alternative technology because the applicant can not demonstrate that the alternative procedure can work in this specific circumstance.

2. The applicant then petitions the Board in accordance with the procedural rules established for adjusted standards for authorization to conduct an experimental practice. The Agency may also participate as a copetitioner in accordance with the Board's procedural rules. The petition must contain a monitoring plan with a set of criteria to evaluate the success or failure of the practice.

3. The Board evaluates the merits of the experimental practice and, if granted, issues an adjusted standard for the period of time the experiment is to be conducted. The Agency modifies the permit to allow the practice. The operator gives the Agency financial assurance equal to the amount necessary to restore the site to compliance with all Board regulations.

4. The operator conducts the experimental practice and monitors the results.

5. At the conclusion of the time period the monitoring results are compared to the previously established criteria and the experiment is evaluated. If the experiment is a success then the Agency returns the performance bond. Otherwise the operator must perform whatever restoration work is necessary to bring the facility back into compliance with all Board regulations before the performance bond is returned.

6. The operator may utilize the experimental data for a significant modification to demonstrate that the alternative technology can achieve equivalent or superior performance.

The Agency is not required to accept the results of the experiment as sole justification of an alternative technology. More data under different conditions may be necessary.

An applicant may apply for an authorization from the Board at any time. However, experimental practices may only be conducted at permitted facilities. If an authorization is obtained prior to Agency approval of a permit application the applicant must still obtain the permit from the Agency before implementing the experimental practice.

The applicant is not constrained to a specific time limit to conduct an experiment. The Board approves a time limit when it adjusts the standards based upon information provided by the applicant. We recommend extending this time period only under the most unusual circumstances; otherwise, this procedure is open to abuse.

Section 813.114 Procedures for Contaminant Transport Models Used for Groundwater Impact Assessments

This section is intended to allow the Agency to work with potential applicants before a groundwater impact assessment is conducted. The applicant can be assured that the model meets the minimum technical requirements and the Agency needs to evaluate a model for compliance with Section 811.317 (c) 1, 2, and 3 once. We also encourage the Agency to maintain a list of acceptable models and provide technical assistance to applicants looking for appropriate contaminant transport models.

Several concerns were stated over how the Agency will review the potentially hundreds of models that could be used to perform the groundwater impact assessment and the effect of using a model not yet reviewed and accepted by the Agency. If a model that has not been reviewed by the Agency is used then the applicant must submit all the information required by this subsection in the application. In effect, the review and acceptance takes place during permit review. This has been clarified by the addition of a new subsection.

There are indeed hundreds of models that predict groundwater contaminant transport. Some do not contain the necessary mechanisms to predict attenuation, some produce output that is unusable for a groundwater impact assessment, many contain insufficient documentation to allow the Agency to review them, others do not perform the necessary tasks to allow a groundwater impact assessment, and others require data that cannot be readily collected by the investigator. It is not necessary to review every model, only the ones that may be used in a groundwater impact assessment.

We do not believe it is necessary or fruitful for the Agency to review the code for a model. A simple analogy was presented by Dr. Jennings (R. 1131, Docket A) to illustrate this:

If you were to do some calculations you would be ex pected to get up in court and tell the court and judge exactly how your calculator worked.

We are all in big trouble if we have to explain the electronics of our calculator. Right?

Well, in some sense this is like that. We have a predictive machine that is supposed to work properly. Why should I have to testify in court on the details of every FORTRAN statement in that code?

It is not necessary to explain the electronics of a calculator in order to show how you multiplied two numbers together, you need only show that you entered the correct numbers and that the calculator was working properly. Likewise with models, it is not necessary, or even desirable, to review, line by line, the intricacies of a complex computer program in order to demonstrate that the theory is sound. Proprietary code may be utilized as long as the background on the model is available to demonstrate compliance with these requirements.

SUBPART B
PROCEDURES APPLICABLE TO SIGNIFICANT MODIFICATION OF PERMITS

A significant modification is defined in Part 810. An operator may apply for a significant modification at any time. The Agency may modify a permit only to correct a typographical error or an error in calculation or upon an order of the Board.

The applicant refers to Part 812 and submits only the information necessary to the significant modification. The same procedures for application, review and appeal of a new permit application apply. This may seem excessive for simple modifications but there may be some significant modifications for a large, complex system such as, for example, a new gas collection system or a new unit.

SUBPART C
PROCEDURES APPLICABLE TO THE RENEWAL OF PERMITS

Permits may be issued by the Agency for up to five years of waste disposal operations. The information for renewal includes an updated groundwater impact assessment. Because the maximum allowable concentrations of contaminants at the monitoring wells are determined by the data used in the groundwater impact assessment it must be periodically updated to reflect new operating conditions or improved exploration and laboratory data. The operator must also update financial assurance. Other information includes anything in Part 812 that has changed. In some ways a renewal resembles a significant modification. We see no reason why an operator could not use a renewal application to request significant modifications to the facility. The operators may request a permit renewal at any time, however, the renewal application must be submitted 90 or 180 days prior to the expiration date of the current permit.

SUBPART D
PROCEDURES FOR TEMPORARY AND PERMANENT CLOSURE AND POSTCLOSURE CARE

Section 813.401 Agency Notification Requirements

This section, taken from existing requirements for closure and postclosure care, require the operator to notify the Agency that closure has begun.

Section 813.402 Certification of Closure

The Agency confirms that each unit has been closed in accordance with the requirements and the closure plan. The Agency provides the specific date that postclosure care begins.

Section 813.403 Termination of the Permit

This section outlines the procedures for terminating the permit for a facility. A permit termination relieves the operator of all monitoring and maintenance standards. The operator must demonstrate that the facility meets all requirements for leachate quality, gas migration, surface stabilization and surface water quality. Although listed together, it is entirely possible to satisfy these postclosure requirements on an item by item basis. For example, the landfill gas monitoring program may have been terminated years before the affidavit for closure is filed.

SUBPART E
REPORTS TO BE FILED WITH THE AGENCY

Section 813.501 Annual Reports

All permitted facilities must submit annual reports. Such reports contain waste volume summary data and monitoring results. This is intended to be a review for completeness. The Agency has 45 days to review the report and ask for more information.

Section 813.502 Quarterly Groundwater Reports

This section requires the operator to submit the results of the quarterly groundwater monitoring data to the Agency. The annual report is intended to be a summary of this data, with appropriate statistical analysis and calculations.

Section 813.403 Acceptance Reports

Before a structure such as a liner and leachate drainage and collection system is placed into service the operator must send an acceptance report to the Agency, documenting the construction quality and confirming the design criteria. The Agency may attach conditions to the operation of the structure or deny the acceptance report. Ie effect, the issuance of an operating authorization by the Agency is a permit action. The sections pertaining to permit actions are referenced. All denials, conditions, and requests for more information may be appealed as a permit denial.

Section 813.404 Information to be Retained at or Near the Facility

This section is intended to apply to information such as daily inspection reports and other monitoring results that will be compiled and sent in an acceptance report or an Annual report to the Agency. An inspector may request access to these documents, so they should be available at near the facility.

E. Discussion of Part 814:
Regulations for Existing Operations

SUBPART A
GENERAL REQUIREMENTS

Section 814.101 Scope and Applicability

These regulations are intended to apply to existing units. Units exempt from permitting requirements in accordance with Section 21 (d) of the Act are subject to the standards but need not apply for a permit.

Section 814.102 Definition of a New Unit

An existing unit is defined as a unit accepting waste as of the effective date of these regulations. Units under construction (that have not yet accepted waste) as of that date are considered new units. Expansions to existing units are also considered new units.

Section 814.103 Information to Be Submitted in a Permit Application

The intent of this requirement is to utilize Part 812 to the maximum extent possible. Additional information to demonstrate compliance with Subpart B is necessary. The sections of Part 812 that are not applicable to existing operations need not be supplied.

Section 814.104 Procedures for Obtaining a New Permit to Operate

This section is intended to accomplish three objectives. First, it requires the Agency to modify all permitted operations within four years of the effective date of these regulations. Second, existing facilities which are unable to comply with the new requirements or are planning to close in the near future can close under their existing permit within two years of the effective date of these regulations. Third, this section allows the procedures and time periods in Part 813 to be used to review and approve new applications.

Section 814.105 Standards for Inert Waste Disposal Units

This section is intended to clearly specify that all existing inert waste disposal facilities are subject to all of the new standards of Part 811. All of the standards in Part 811 Subparts A and B can be implemented without redisturbing previously placed waste and without drastic operational modifications.

SUBPART B

STANDARDS FOR EXISTING UNITS ACCEPTING CHEMICAL AND PUTRESCIBLE WASTES THAT MAY REMAIN OPEN FOR MORE THAN SEVEN YEARS

Section 814.201 Applicability

The requirements of this Subpart apply to all existing units, including onsite, that accept putrescible and chemical wastes. Units meeting the requirements of this Subpart may remain open for more than seven years after the effective date of these regulations.

Section 814.202 Applicable Standards

The primary requirement for units in this category is a leachate collection system. It does not have to meet the requirements of 35 Ill. Adm. Code 811.307, but it should be capable of collecting some leachate. This leachate collection system must be operated.

Existing units in this category are also subject to the groundwater standards in Part 811. Enough site specific information should be developed to implement a monitoring program. All existing units must be in compliance with the existing federal criteria.

Some requirements in Part 811 may be waived because of the difficulty in retrofitting a liner or a foundation. Also, it would be inappropriate to apply the location standards of 35 Ill. Adm. Code 811.302 (a), (c), (d), and (e) to existing units.

In response to comments received by several operators we have proposed a modification of the design period to ease the transition to a 30 year design period. The existing statutory requirement for postclosure care is five years, and we presume that most facilities have given financial assurance to the Agency reflecting a five year postclosure care period. The prices charged by operators presumably reflect the cost to maintain this financial assurance for five years. It would be a burden to immediately require a sudden increase (approximately a factor of six) in the requirements for financial assurance without providing the operator with sufficient time to adjust prices. It is proposed that the design period coincide with the length of time a unit will remain open after the effective date of these regulations. The regulations would require the operator to increase the design period by three years for every year after the effective date of these regulations that the facility will remain open, up to a maximum of thirty years. Table 5 shows how the design period will increase.

SUBPART C: STANDARDS FOR EXISTING UNITS ACCEPTING CHEMICAL AND PUTRESCIBLE WASTES THAT MUST CLOSE WITHIN SEVEN YEARS

Section 814.301 Applicability

Many existing facilities are not equipped with leachate collection systems and are located in geologic areas that may be unsuitable for solid waste disposal. This Subpart is intended to allow facilities that meet the existing federal guidelines for solid waste disposal to operate for up to more than five years on previously disturbed areas.

Table 5: Increase in Design Period For Existing Operations

Years of Operation Remaining (years)	Design period (years)
1 or less	5
2	6
3	9
4	12
5	15
6	18
7	21
8	24
9	27
10 or more	30

Section 814.302 Applicable Standards

Certain requirements of Part 811 are not applicable to these facilities. An existing facility cannot retrofit a foundation or liner. Some operators have attempted to retrofit a leachate collection system (Knight et al., 1983) but we recommend that this practice be optional, not required. As above, the location standards of 811.302 (a), (c), (d), and (e) do not apply to existing facilities. Although it is not stated explicitly, an operator may retrofit a leachate collection system to continue operating past the the five year deadline. The operator would be subject to all of the requirements of Subpart B, however.

The groundwater standards for this class of existing facilities are less ambitious than for new facilities. The standards in Section 814.302 (b) (3) are taken from the federal criteria. They apply at the edge of the unit and are applicable only in aquifers used for drinking water. The Board may adjust the standards based upon site-specific conditions and a petition from the applicant.

The limitations placed upon existing units in this category are intended to discourage their use and encourage all units without leachate collection systems to close as soon as possible. The area disturbed prior to the effective date of these regulations defines the limit of this class of existing units. Waste may only be placed over existing lifts, not on newly disturbed areas. The limitations on special waste streams are intended to drive special wastes to more modern facilities equipped with leachate collection systems.

Facilities that fail to demonstrate compliance with these regulations are, technically, open dumps and must close within two years of the effective date of these regulations in accordance with the requirements of Subpart D.

SUBPART D
STANDARDS FOR EXISTING UNITS ACCEPTING CHEMICAL AND PUTRESCIBLE WASTES THAT MUST CLOSE WITHIN TWO YEARS

Section 814.401 Applicability

This Subpart requires facilities that do not meet existing Subtitle D criteria or are scheduled to close within two years of the effective date of these regulations to close under its existing Agency permit within two years.

The intent of this Subpart is to ease the work burden of the Agency and encourage borderline facilities to close as soon as possible.

F. Discussion of Part 815:
Procedural Requirements for Facilities
Exempt from Agency Permit Requirements

SUBPART A
GENERAL REQUIREMENTS

Section 815.101 Applicability

This Part requires the operators of onsite facilities to report their ongoing activities to the Agency. While these requirements will be useful in collecting data and monitoring onsite activities they should not be mistaken for a permitting requirement. Nothing less than a permitting program equal to that of nonexempt facilities will assure the protection of public health and safety from the land disposal of solid waste.

The exemption for onsite facilities comes from Section 21 (d) of the Illinois Environmental Act which reads:

No person shall conduct any waste -storage, waste-treatment, or waste-disposal operation :

1. Without a permit granted by the Agency or in violation of any conditions imposed by such permit, including periodic reports and full access to adequate records and the inspection of facilities, as may be necessary to assure compliance with this Act and with regulations and standards adopted thereunder; provided, however, that no permit shall be required for any person conducting a waste-storage, waste-treatment, or waste disposal operation for wastes generated by such person's own activities which are stored, treated, or disposed within the site where such wastes are generated; or,

2. In violation of any regulations or standards adopted by the Board under this Act.

Facilities which dispose wastes generated at the site within the boundaries of the site are exempt from the requirements to obtain a permit from the Agency. However, these facilities are not exempt from the responsibility for properly disposing all solid wastes in a manner consistent with the Act and all Board regulations. In order to assure that all facilities are in compliance the Agency must be aware of the existence of a facility and must be assured access to monitoring data. The requirements of this Subpart are intended to provide the Agency and the public with a report on each onsite waste disposal facility in Illinois and ongoing monitoring reports on groundwater and other environmental monitoring systems.

This Part does not apply to facilities holding a permit for a landfill issued by the Agency. The requirements of this Part may be applicable to facilities holding other Agency issued permits, such as wastewater discharge permits.

Section 815.102 Required Signatures

This section is similar to the requirement for permitted facilities. A duly authorized agent must sign all reports filed with the Agency

SUBPART B
INITIAL FACILITY REPORT

Section 815.201 Applicability

The initial facility report is a complete description of a facility including its design, operation, location, monitoring , postclosure care, final contours, and land use. The operator is required to describe how compliance with all regulations will be achieved.

Section 815.202 Filing Deadline

This section gives an existing exempt facility two years to prepare the initial facility report and submit it to the Agency.

New exempt facilities will be required to file the initial facility report prior to the time waste is accepted.

Section 815.203 Information to be Filed

This section draws on the requirements in Part 812 to explain the detail and types of information necessary to a facility report. In general, all of the information that would normally appear in a permit application must be placed into a facility report. The only exceptions are procedural requirements specifically aimed at permitted facilities: permit application fees, postclosure care cost estimates, local government siting approval, and signatures.

Existing facilities may be subject to less stringent standards; the information to be submitted is adjusted in accordance with the requirements of Part 814.

SUBPART C
ANNUAL REPORTS

Section 815.301 Applicability

These requirements are applicable to exempt facilities. The requirements are a slight modification of those for permitted facilities.

Section 815.302 Reporting Period

All exempt facilities must submit an annual report for each year waste is accepted and the entire postclosure care period.

Section 815.303 Information to be Submitted

The requirements in this section are similar to the requirements specified for permitted facilities. Instead of filing each significant modification separately, each facility will be required to provide a summary of all significant modifications in the last year

SUBPART D
QUARTERLY GROUNDWATER REPORTS

This Subpart requires the operator to submit groundwater monitoring data on a quarterly basis throughout the time that groundwater is monitored.

SUBPART E
INFORMATION TO BE RETAINED ONSITE

This Subpart also tracks the requirements for permitted facilities. Reports and data which has yet to be forwarded to the Agency or information that is not required to be submitted to the Agency but must be retained nevertheless (such as construction quality assurance reports) must be available at the site for Agency inspection.

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