

BASIS AND BACKGROUND DOCUMENT

PROPOSED AMENDMENTS TO THE SOLID WASTE  
MANAGEMENT REGULATIONS - N.J.A.C. 7:26

SOLID WASTE DISPOSAL REGULATIONS

PROPOSED AT: 18 N.J.R. 883(a)

N.J.A.C. 7:26-1.4, 2, 2A and 2B

PREPARED FOR:

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BY:

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## I. INTRODUCTION

The Department of Environmental Protection (Department) is proposing amendments to the nonhazardous solid waste regulations, N.J.A.C. 7:26, to effectively regulate solid waste facilities so as to ensure environmentally sound waste management. The amendments to N.J.A.C. 7:26 will revise subchapter 2 for all types of solid waste facilities by establishing general requirements and will add subchapters 2A and 2B which will contain regulations for specific solid waste facilities. The amendments update existing regulations which were originally adopted in 1974 and incorporate the substantial state-of-the-art advances in the technologies of solid waste facilities that have occurred since then.

The Department recommends that the Summary as outlined in Appendix A be used as a guide to the proposal. Appendix A summarizes the proposal through the paragraph level and denotes the associated page numbers.

Nationally, the problem of environmentally sound waste management has escalated substantially in recent years, primarily due to increases in population, sprawling land use and greater reliance upon "throw away" packaging. These factors have resulted in an increase in waste quantity and changes in material composition of waste for disposal. In addition, sprawling residential, commercial and industrial development has greatly minimized the number of potential sites suitable for the development of new state-of-the-art solid waste facilities. One of the greatest challenges in waste management can be found in New Jersey, historically a very urbanized and industrialized state with the highest population density in the nation.

At present, approximately 9.8 million tons of solid waste are disposed of annually in New Jersey. To meet the disposal needs for this volume of material, approximately 10,000 acre-feet of landfill space is required annually. This can better be understood by visualizing an annual need for an area of approximately 5 sq. miles, covered with a three foot layer of compacted solid waste.\*

In conjunction with the increasing waste generation, there has been a decrease in available disposal capacity. Since 1977, the total number of operational sanitary landfill facilities has declined from 302 to 94, representing an 8.6% annual reduction in operating landfills, 33 of these closed landfills were operated as "major" facilities. Over this same period of time only two new state-of-the-art sanitary landfills have come on-line. What makes this situation even more alarming is that presently 12 major landfills currently accept over 92% of the solid waste disposed of in the state.

One of the reasons for the strong resistance to the siting and construction of new solid waste facilities has been the nature of past

\*(assuming a 667 lbs/cubic yard in-truck density and a two to one in-place compaction ratio)

disposal practices, which did not provide adequate safeguards to insure disposal of waste in a secure and environmentally sound manner. There are 166 sites described in the Department's Site Description for Hazardous Waste Site Clean-up in New Jersey 1984-1985, of which 20 of the sites were operated as solid waste landfills. The engineering and design costs as delineated in the Department's New Jersey Waste Site Remedial Action Management Plan (1984) for the first four year period of the initial phase of the clean-up State's program of which the 20 landfill sites represent a major portion, are estimated to be 45 million dollars and the total clean-up costs could run into the hundreds of millions of dollars.

The problems cited above of increasing waste generation, decreasing landfill availability and the difficulties of siting and constructing new disposal facilities, due to the problems caused by past disposal practices, have resulted in the dilemma faced today in which disposal capacity demands are rapidly depleting the supply of disposal capacity. The present demands have put a significant burden on the existing facilities. The remaining major sanitary landfills in the State are currently being environmentally upgraded by implementing remedial state-of-the-art design and construction to adequately handle the increasing need for solid waste disposal without jeopardizing public health or the environment. This environmental upgrading of existing facilities has cost in the tens of millions of dollars and represents only a short term, "stop gap" solution to the problems. The long term solution to the waste disposal needs is the implementation of an intergrated waste disposal program of recycling, and the design and construction of state-of-the-art resource recovery facilities and sanitary landfills.

The goal of the federal Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq. (RCRA) is the conservation of natural resources and energy thorough reuse of waste materials. The Department is firmly committed to a waste management program that will not only protect the public health and welfare and the environment but will maximize the use of waste material in a beneficial way. The State's goal is to recycle 25% of all municipal solid waste by the end of 1986 and to coordinate the development, licensing and implementation of high technology resource recovery facilities. It must be stressed that full utilization of resource recovery technologies on a statewide basis is four to six years away. In the interim, sanitary landfilling will remain the primary method of solid waste disposal in New Jersey.

The problems faced in our State in waste disposal are immediate. New Jersey has, at present, less than two years of approved landfilling capacity at current waste generation rates. Even with the implementation of a recycling program and resource recovery facilities approximately 25% of the total annual solid waste as residual, bulky and non-recoverable solid waste will need to be disposed of by landfill.

\*\* (these figures are 1983 dollars and do not include long-term maintenance cost; such as ground water pumping and treatment. This amount could increase substantially depending upon further finding and contractors bids)

The proposed solid waste disposal regulations which specifically address the design, construction, operations and maintenance requirements are mandating technically achievable limits. These technologies have been in place for a number of years and a majority of the regulations serve to codify what is already being implemented by the Department through policy and permit. The regulations were developed to ensure that these state-of-the-art technologies are properly implemented and once implemented, are properly operated and maintained, to ensure safe disposal of solid waste in a secure and environmentally sound manner.

## II. HISTORY

In 1965, the Federal Government passed the Solid Waste Disposal Act (SWDA). This act established a national research and development program to improve methods of disposal. In 1976, this act was amended to address the scope of the solid and hazardous waste disposal problems. This act, RCRA, prohibited open dumps and promulgated guidelines for solid waste collection, transport, recovery and disposal.

The guidelines established in accordance with Sections 6941-6949 of RCRA recommend preferred methods for the design and operations of sanitary landfills and resource recovery facilities. The guidelines were set after examining the various available technologies and expected levels of performance need to protect the environment. These federal criteria were not intended to prevent or restrict the authority of the states to develop more stringent criteria.

Effective May 6, 1970, the New Jersey Solid Waste Management Act N.J.S.A. 13:1E-1 et seq. (Act) gave the Department the power to promulgate, amend and repeal codes, rules, and regulations concerning solid waste collection and solid waste disposal activities. These codes, rules and regulations are to establish the procedures relating to the preparation and submission of environmental impact statements prior to the construction, acquisition or operation of any solid waste facility and are to establish standards for the construction and operation of solid waste facilities. The standards are to include all measures deemed necessary to protect the public health and safety and the natural environment. All codes, rules and regulations adopted by the Department relating to solid waste collection and disposal shall have the force and effect of law. Such codes rules and regulations shall be observed throughout the State and shall be enforced by the Department and every local Board of Health.

The rules, codes and regulations adopted by the Public Health Council relating to refuse disposal, Chapter VIII of the State Sanitary Code, which were transferred from the Department of Health during the reorganization of the Department, pursuant to N.J.S.A. 13:1D-1 et seq., were adopted by Department as the Rules of the Bureau of Solid Waste Management and continued in full force and effect.

On June 28, 1974, the Department adopted the Rules of the Bureau of Solid Waste Management, N.J.A.C. 7:26, which became effective on July 1, 1974. These regulations required any person engaging in the disposal of solid waste to be registered with the State, to obtain approval of engineering designs before constructing a new facility and to operate an existing facility in accordance with the operational requirements of 7:26-2 and obtain an approved engineering design. N.J.A.C. 7:26-2 contained the operational requirements for solid waste facilities and the guidelines and criteria for the preparation of engineering designs. With minor revisions, aside from closure regulations, these rules have remained the regulations for the disposal of solid waste until this time.

The first major step in the development of cohesive engineering requirements and standards for sanitary landfills was the adoption of the Closure and Post-Closure Care regulations which are presently codified at N.J.A.C. 7:26-2.9. These regulations were adopted pursuant to the Sanitary Landfill Facility Closure and Contingency Fund Act, N.J.S.A. 13:1E-100 and became effective March 7, 1983. These regulations delineated the systems which are to be provided in the design, implementation and maintenance of the Closure and Post-Closure Care Plan.

Between 1974 and 1985 the changing technologies and advances in the solid waste disposal industry were handled by the permitting process. These proposed regulations serve to codify what, to a large extent, has been required through policy, guidelines and permits. The proposed regulations serve to delineate, in an orderly fashion, what is needed for a solid waste facility application, environmental and health impact statement and engineering design (general and specific). Additionally the proposed regulations serve to identify the procedures which are to be followed for the submission and review of a solid waste facility application, the permit-decision making procedures and the public hearing procedures. The proposal also codifies the operation and maintenance requirements (general and specific) for solid waste facilities.

The proposed regulations took approximately two years to develop. During this process they have undergone numerous changes and revisions. The revisions were based on the comments received from in-house review of the various drafts circulated within the various review agencies.

The drafts were reviewed by various Elements and Bureaus within the Division of Waste Management (Division) and various agencies within the Department including:

1. Division of Water Resources,
2. Division of Environmental Quality,
3. Division of Coastal Resources,
4. Division of Fish, Game and Wildlife,
5. Office of Science and Research,
6. Pinelands Commission,
7. Planning Group, and
8. Office of Environmental Analysis.

Further the various drafts were distributed to affected state agencies for their review and comment in regards to their particular areas of concern, including:

1. Department of Agriculture,
2. Department of Transportation,
3. Department of Health;
4. Board of Public Utilities; and
5. Department of Energy.

In addition to the extensive review by the applicable agencies within the Department and at the various state agencies, several drafts of the

proposal were distributed for review and comment to a number of advisory groups, task forces and experts in the field including:

1. The "Industry Task Force" which was formed at the request of the Commissioner by the Division and which consists of members from the academic community, representatives from the National Solid Waste Management Association, the New Jersey Alliance for Action, and representatives of solid waste industries;
2. The "Waste Management Advisory Group", which was formed by the Division and which consists of members from the academic community, representatives from public interest groups, environmental groups, local environmental agencies and authorities, and the general public;
3. The "Advisory Council on Solid Waste Management", which was formed pursuant to N.J.S.A. 13:1E-7a and which consists of appointed members representing the Commissioners of the Board of Public Utility, the Commissioner of Community Affairs, the Secretary of Agriculture, the Commissioner of Health and seven additional members including representatives of solid waste industries and the general public;
4. The "Hazardous and Solid Waste Industrial Advisory Committee" which was created by the Governor and which consists of members representing New Jersey industries and business associations; and
5. The "District Solid Waste Coordinators" which consists of members from each of the 21 counties, the Hackensack Meadowlands Development Commission (HMDC) and the New Jersey and New York Port Authority (PA). The members of the group are those persons responsible for the implementation of the various solid waste programs within the 21 counties, the H.M.D.C. and the P.A.

The suggested revisions and comments from these groups have been most valuable in the development of this regulation and their input has been incorporated in the current proposal.

### III. SUBCHAPTER 2 DISPOSAL

#### 1. Introduction

Subchapter 2 "Disposal" includes the application and permit procedures; the environmental and health impact statement (EHIS) requirements, the general engineering design submission requirements and the general operational requirements for solid waste facilities. The proposed subchapter 2 has been organized so that these requirements are set forth in an orderly arrangement. The proposal codifies a number of Departmental policies and guidelines that have been employed by the Department to administer the solid waste program and were practical and has brought the solid waste procedures in line with the procedures administered by other programs within the Department such as the hazardous waste program and New Jersey Pollutant Discharge Elimination System program.

The Department recommends that the Cross Reference table in Appendix B to the proposed changes be used cross reference to the replaced existing regulations.

#### 2. 7:26-2.4 and 5 Application Procedures for a Solid Waste Facility Permit and Public Hearing Procedures

The requirements set forth at N.J.A.C. 7:26-2.4 and 2.5 establish the procedures the Department will use to review a complete application and the associated time frames involved with that review. The sections set forth the requirements needed for a complete application, the application review procedures, the public notice procedures, the public comment period procedures, the public hearing procedures, and the permit decision-making procedures. These sections are based on Departmental policy and the mandate of N.J.S.A. 13:1E-5.1.

The Department realizes that not all solid waste facilities, dependent on the technologies utilized and their capacity, exhibit the same magnitude of impacts on the environment and public health. Therefore, the Department has established comprehensive application submission requirements for major solid waste facilities and "scaled-down" the requirement for minor facilities. This approach will allow the Department to conduct its mandated review of all solid waste facilities without burdening the applicant with extensive application requirements and permit procedures for facilities which are expected, by their operation, to have minimal environmental and health impact.

The Department has determined that leaf composting facilities, small-scale incinerators, small-scale material recovery facilities and transfer station and small-scale Class III sanitary landfills should be exempted from the major application submission requirements because of their minor impacts on the environment. N.J.A.C. 7:26-2.4(c) establishes the requirements which must be complied with in order for the applicant to meet the scaled down permit review and application submission requirements.

The leaf composting facility category was developed based on the Department's review of the operational history of the 155 permitted facilities. These facilities had only a small number of complaints or violations of the operational rules and regulations. In order to obtain this exemption the waste type accepted at the facility must be primarily leaves.

The requirements for the small-scale incinerator category are in conformity with the Division of Environmental Quality's permitting system. In order to obtain this exemption the waste disposed of must be generated on-site and the incinerator's engineering design must be installed, constructed and operated in accordance with the rules and regulations of the Division of Environmental Quality as set forth at N.J.A.C. 7:27. In addition the permitted capacity must be less than 800 pounds per hour or 9.6 tons per day.

The requirements for small-scale material recovery facilities and transfer stations were developed to be in conformity with N.J.S.A. 13:1E-117. In order to obtain this exemption an applicant for a material recovery facility or transfer station must submit for approval an engineering design sufficient to meet the requirements of N.J.A.C. 7:26-2.10 and demonstrate that the permitted capacity of the facility is less than 31,200 tons per year.

The requirements for small-scale Class III sanitary landfills (a sanitary landfill that accepts only ID type 12, bulky waste for disposal) were developed to be in conformity with N.J.S.A. 13:1E-117. In order to obtain this exemption an applicant for a Class III sanitary landfill must submit for approval an engineering design sufficient to meet the requirements of N.J.A.C. 7:26-2.10 and demonstrate that the total permitted capacity of the sanitary landfill is less than 300,000 cubic yards or 50,000 cubic yards annually.

3. 7:26-2.6 Procedures and Grounds for Modification, Revocation and Reissuance and Termination of Solid Waste Facility Permit N.J.A.C.

N.J.A.C. 7:26-2.6 sets forth the conditions that will require the modification, revocation and reissuance or termination of a permit and the conditions that will require a hearing on that approval. The reason for the hearing requirements of this section is to allow the public the opportunity to comment on the modification in the permit of a solid waste facility if that modification will result in an increased impact on the environment or public health. In addition this section establishes the procedures for modification of the permit without public hearings if the modification is an upgrading of an environmental control system which will result in an increased environmental performance of the facility or is classified as a minor modification, such as a deletion of a waste type or a change in an interim compliance date.

4. 7:26-2.7 Duration of the Permit; Permit Renewal Requirements; continuation of an Expiring Permit, and Transfer Pre-Approval of an Existing Permit

N.J.A.C. 7:26-2.7 sets forth the procedures for the duration, renewal, and continuance of a permit. This section allows for the renewal of an existing permit if existing capacity is available and the solid waste facility is included in the approved District Solid Waste Management Plan.

While the Department recognizes that many facilities must remain open for periods of time longer than five years to be economically viable, the Department has decided to issue five year permits and allow for their renewal in order to be consistent with other programs administered by the Department. This procedure will permit the facility to continue for a longer period of time while allowing the Department to call in the permit for renewal every five years. In this manner the Department can ensure the environmentally sound operation of a facility by requiring amendments in the engineering design or operations to upgrade the environmental performance of the facility at the time of renewal.

#### 5. 7:26-2.9 Environmental and Health Impact Statement Requirements

N.J.A.C. 7:26-2.9 establishes the requirements for the preparation and submission of an Environmental and Health Impact Statement (EHIS). This section was developed from the Departmental guidelines entitled "Guidelines; Preparation of an Environmental Impact Statement", prepared by the Planning Group of the Department. The guidelines have been modified to include requirements specifically impacted by and associated with solid waste facilities.

While the Act requires that the Department to assess the environmental impacts within an environmental impact statement (EIS) the Department has determined that the environmental soundness of a solid waste facility can not be properly analyzed unless the applicant addresses the health impacts resulting from the emissions or discharges of the solid waste facility. Health impacts have been an issue raised at past public hearings on solid waste facilities and the intent of the public health assessment required by N.J.A.C. 7:26-2.9(c)9, is to address those concerns by establishing a format for health risk assessment. The health risk assessment is only applicable to major facilities.

This section establishes a standardized EHIS format for solid waste facilities. As required by the Act, this section requires an impact statement for every proposed solid waste facility, but it also allows the scale of the EHIS to be tailored to the particular facility, depending on the type, location and size of the facility.

The Department does not expect a 500 ton per day transfer station to submit an EHIS or undergo the same degree of EHIS review as a 3000 ton per day thermal destruction facility. Even with similar capacity Class I sanitary landfill submissions there will be site-by-site distinctions such as, a proposed facility located on a 50 foot thick impermeable geologic formation will not require the same magnitude of an EHIS as a proposed facility located within a permeable critical public water supply area. While the most comprehensive EHIS requirements are expected for Class I

sanitary landfills and thermal destruction facilities the analysis and review must be performed on a case-by-case basis.

6. 7:26-2.10 General Engineering Design Requirements

N.J.A.C. 7:26-2.10, which will replace the existing regulations at 2.12, establishes minimum engineering design and submission requirements applicable to all types of proposed solid waste facilities requiring engineering design approval. The proposed regulations contain the present language of the existing regulations at N.J.A.C. 7:26-2.12 and have been expanded to include the requirements of a geologic report, engineering report, operations and maintenance manual and landscaping plan.

The engineering submission requirements proposed in N.J.A.C. 7:26-2.10 will provide the Department with the information necessary to effectively evaluate the environmental soundness of a proposed solid waste facility. Additionally, this section incorporates the common engineering requirements for all types of solid waste facilities into one section.

7. 7:26-2.11 General Operational Requirements

N.J.A.C. 7:26-2.11 establishes the minimum operational requirements applicable to all types of solid waste facilities. The proposed regulations contain the basic language of the existing regulations at N.J.A.C. 7:26-2.5 and 2.11 and have been expanded to include provisions for right-of-entry to perform inspections and ensure that the facility is maintained in accordance with the regulations, the permit conditions and the final approved operations and maintenance manual.

Reorganizing the common operating requirements for all solid waste facilities into one section will allow for a more consistent application of the regulations. Furthermore, the additional operational requirements will provide the Department with a more thorough means of regulating solid waste facility operations and thereby insure more effective protection of the environment and public health.

## IV SUBCHAPTER 2A Additional, Specific Disposal Regulations for Sanitary Landfills

### 1. Introduction

The Department is proposing N.J.A.C. 7:26-2A to apply specifically to sanitary landfills. The requirements in this subchapter are in addition to the general requirements as set forth in N.J.A.C. 7:26-2.10. This subchapter sets forth the additional engineering design submission requirements, performance standards, design standards, construction requirements, operational maintenance, inspection and monitoring requirements and closure and post-closure requirements for all classes of sanitary landfills.

The Department recognizes that not all sanitary landfills will have the same degree of impact on the environment and public health because of their location within different geologic formations, their location in relation to environmentally sensitive areas and the different types of waste accepted for disposal. Therefore, the Department has established performance standards for sanitary landfills. Depending on the location of the proposed sanitary landfill, the Department will allow for variance from the design standards and construction requirements set forth in this subchapter so long as the performance standards are met.

A properly designed and operated sanitary landfill is an engineered site where solid waste is disposed on or into the ground in a manner that protects the environment, minimizes and controls environmental and public health impacts, and prevents pollution. The intent of the proposed sanitary landfill regulations is to ensure that this description of sanitary landfills is achieved in practice.

When solid waste is landfilled it degrades, initially through aerobic processes and then, primarily, through anaerobic processes. The chemical and biological reactions within the landfill produce a highly complex mixture of solid, liquid and gaseous by-products. This mixture contains soluble organic, inorganic, ionic and nonionic constituents, bacteriological matter and suspended solids within an aqueous medium. With the initial moisture content of the waste, and the addition of moisture that is generated from decomposition and infiltrated through the landfill from direct precipitation, surface run-on and groundwater flow, significant quantities of these by-products can be leached into the environment. The resultant liquid is termed leachate. Since precipitation in New Jersey exceeds the evapo-transportation rate, leachate will be produced at all sanitary landfills located in New Jersey.

Leachate will move vertically through the soil in response to a pressure and gravitational gradient and horizontally through the soil in response to a pressure gradient. Another factor in the movement of leachate through the soil is dispersion and diffusion (hydrodynamic dispersion). The pressure gradient, the gravitational gradient and the hydrodynamic dispersion influence the movement of leachate through the soil in descending order of magnitude.

Because of these influences on the movement of leachate through a soil there will always be a potential for leachate to move through any porous medium. However, it is the uncontrolled movement of leachate into the subsurface soils and ground and surface water systems, at a rate which over-taxes the time dependent natural attenuation systems, which results in degradation and pollution of the environment.

The gaseous by-products of solid waste decomposition, which are mainly carbon dioxide in the aerobic phase and predominantly methane in the anaerobic phase, represent another source of pollution. Gases migrate laterally through the soils, travelling large distances at times, in response to the pressure and concentration gradients. The uncontrolled migration of gases off site damages surrounding vegetation, by replacing the oxygen in the root zone of the plant. In addition the uncontrolled migration of gases off-site represents a potential safety hazard. Methane is potentially explosive when present in air at concentrations between 5 and 15 percent.

Another source of pollution from landfills is surface water run-off. The uncontrolled run-off from either the active landfilling area or the covered slopes can carry suspended and dissolved solids into adjacent surface water systems resulting in pollution of the receiving waterway.

The quantity and quality of the leachate and gaseous by-products produced within the landfill is a function of the type of waste landfilled, moisture content, temperature, pH and time. At this point we have little control of the temperature and pH variables within the sanitary landfill. The waste variable can be controlled by limiting the waste type which is permitted to be disposed of at the landfill. Moisture content can be controlled by the proper construction and maintenance of run-on and run-off devices and the final cap.

Time is the one variable where direct control can be exerted in the design and construction of a landfill. To control the migration of leachate and gases from sanitary landfills it is necessary to minimize the leakage, to essentially zero, and maximize the hydraulic confinement time of the liner to prevent environmental degradation and pollution. This is accomplished by the proper design and construction of a containment and leachate collection system.

The problems of leachate migration, gas migration and surface run-off, as delineated above, can be controlled by the proper design, construction, operation and maintenance of state-of-the-art sanitary landfills. The intent of the proposed sanitary landfill regulations is to ensure that the methods and procedures necessary to minimize and control adverse impacts and prevent pollution are required and properly implemented and maintained.

## 2. 7:26-2A.4 General Prohibitions

This section establishes the procedures to environmentally upgrade those facilities determined, through enforcement action, to be violating the conditions of this subchapter and the Act or to be operating as an Open Dump

as defined by subtitle D of RCRA. The Department has determined that these requirements allow for an adequate time period to accomplish the required work. This determination is based on the Department's previous experience with remedial action.

3. 7:26-2A.5 Additional Engineering Design Submittal Requirements for Sanitary Landfills

This section, in addition to the requirements of N.J.A.C.7:26-2:10, sets forth the engineering and environmental data and analysis which must be submitted as part of an application for a permit for a sanitary landfill. The requirements set forth in this section will provide the Department with the information it needs to perform a full environmental and engineering evaluation of the sanitary landfill to determine the proposed facility's environmental impact.

The submission requirements have been substantially increased over the currently promulgated regulations. However, many of the proposed requirements have been implemented through Departmental policies and guidelines during the past few years for permit reviews. This proposal represents a codification of those policies and guidelines. The areas that were expanded over existing regulations are N.J.A.C. 7:26-2A.5(b)5, engineering report, (b)6, geotechnical report and (b)8, operations and maintenance manual. N.J.A.C. 7:26-2A.5(b)7, concerning quality assurance and quality control plan is a new addition to the submission requirements.

N.J.A.C. 7:26-2A.5(b)5, 6, and 8 contain what the Department has determined is necessary in an application submission for a permit given the advances in technology of sanitary landfill designs, construction and operations and the Department's need to have an accurate definition of the geohydrologic location and performance of the proposed landfill.

The Department strongly recommends that the geologist or geotechnical engineer developing the geological report required by N.J.A.C. 7:26-2A.5(b)6, work in concert with the design engineer developing the engineering report required by N.J.A.C. 7:26-2A.5(b)5. It is the Department's belief that if this work is developed in concert it will result in the development of an environmentally sound design, based on the site specific geology and geohydrology.

The geotechnical requirements for site investigation, as with all construction requirements, are minimum requirements. A site specific investigation program must be put together by the geologist or geotechnical engineer to define the physical and engineering properties of the site. Historical data of the area can be useful in developing a site investigation program, but it is the opinion of experts in this area, that no two sites are alike and there can be no substitute for an accurate site specific investigation. Given the critical nature of the construction this site specific investigation must be completed within the minimum framework required by N.J.A.C. 7:26-2A.5(b)6. This approach best serves both the environmental and economic concerns.

N.J.A.C. 7:26-2A.5(b)7, requires the submission of a quality assurance and quality control (QA/QC) plan for the construction phase of the landfill. This paragraph represents a major addition to the existing submission requirements. However, the additional requirements are fully warranted because this requirement is the most important item in determining the overall environmental soundness of the design and construction of a sanitary landfill.

#### 4. 7:26-2A.6 Environmental Performance Standards

This section establishes the minimum performance standards for sanitary landfills. The location of the sanitary landfill within specific geologic areas will dictate the design and construction of the proposed landfill. This design and construction must in turn meet the performance standards established by N.J.A.C. 7:26-2A.6(c). This section has been developed so that the design performance and efficiency of the landfill match the location to ensure that adverse impacts are controlled and minimized.

N.J.A.C. 7:26-2A.6(c) establishes the required performance standard for sanitary landfills. The standard is a twofold test. The sanitary landfill must first, not cause a change in the quality of the groundwater within the aquifers located below the sanitary landfill at the property line of the sanitary landfill. The sanitary landfill must be designed so the groundwater at the property line of the sanitary landfill is in conformity with criteria and standards required by N.J.A.C. 7:9-6 "Ground Water Quality Standards." Secondly, the sanitary landfill design must not cause any significant decrease in the quality of the groundwater as modelled at existing potable water wells located within the the area of influence of the sanitary landfill at the time of proposal. The Department will permit the use of the Student's t-test at the 0.01 level of significance to determine statistically the effect on existing potable water wells. The performance standards in subsection (c) were selected based on the Department's water quality standards, the ability to monitor for this performance and the applicant's ability to model the proposed design to meet these standards.

In order to evaluate the performance of the proposed sanitary landfill the Department is requiring that the applicant perform a three-dimensional mass transport modeling of the proposed discharges of the sanitary landfill design within the existing hydro-geological regimen. The state-of-the-art in mass transport modeling is sufficiently advanced in this area to justify this requirement.

Subsection (d) establishes a standard design for the containment and leachate collection systems for sanitary landfills located in low permeable stable geologic formations. The hydraulic conductivity for these areas is set at  $1 \times 10^{-6}$  cm/sec. or less.

This hydraulic conductivity has been proposed because the attenuation capabilities of low permeable formations, in particular the clay fraction of that soil, has long been recognized. The attenuation occurs because of the slow movement of fluids through the low permeable media which allows for the physical, chemical and biological interaction of the leachate and the soil

matrix through filtration, absorption, ion-exchange, chemical precipitation, complexing and biodegradation. Although the relative dominance of the mechanisms are not fully understood, the overall affect is well documented.

For landfills located in these areas the standard design is:

- A. A three foot clay liner with a hydraulic conductivity equal to or less than  $1 \times 10^{-7}$  cm/sec,\* and
- B. A one foot sand drainage layer with a minimum hydraulic conductivity equal to or greater than  $1 \times 10^{-2}$  cm/sec designed with sufficient leachate collection pipe spacing and slope to insure that the leachate head on the liner does not exceeded one foot at any time. \*\*

In order to meet this standard the leachate collection system should be designed using real time precipitation events which allows for evaporation run-off and storage to accurately define the percolation to the liner. The Hydrologic Evaluation of Landfill Performance (HELP) Model or an equivalent modeling system can adequately define percolation to the liner provided substantiated history data, on the order of 20 years, is used.

This design for the liner and leachate collection system was chosen based on the following three independent sensitivity analyses performed by or for the Department.

- A. The Landfill Leachate Flux Equations, as revising the Modified Wong Model by the Division of Water Resources;
- B. The USEPA Landfill and Surface Impoundment Performance Evaluation Model, SW-869 1984 revised, by the Division of Waste Management; and
- C. Mathematical Modelling of Leachate Generation and Transport at Solid Waste Landfills, by Rutgers University for the Division of Waste Management.

These analyses indicated that for a porous material, such as clay with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec., the most efficient designs of the containment and leachate collection system is a three foot thick liner and a drainage layer with a hydraulic conductivity that is five (5) orders of magnitude greater than the clay. The latter factor is the most critical

\*clay - A fine grain soil containing sufficient plastic fines (No. 200 sieve) on the order of 20 percent so that the soil behaves like a clay and achieves the minimum hydraulic conductivity.

\*\*sand - An open graded coarse grain soil with no appreciable fines (no 200 sieve)

to the overall efficiency of removing leachate away from the liner.

Equivalent systems that are demonstrated to meet or exceed this standard design will be acceptable provided the systems are in accordance with the design standards and construction requirements set forth at N.J.A.C. 7:26-2A.7. The analysis of equivalent systems should be conducted in terms of:

- A. The leakage performance of the landfill;
- B. The efficiency of the overall systems to direct leachate from the landfill;
- C. The hydraulic confinement time during the operational phase and through the closure and post-closure phases;
- D. The attenuation performance of the system;
- E. The overall structural integrity and stability of the system; and
- F. Conformance with the design standards and construction requirement.

N.J.A.C. 7:26-2A.6(e) requires applicants proposing to site sanitary landfills outside of a low permeable stable geologic formation (a hydraulic conductivity greater than  $1 \times 10^{-6}$  cm/sec.) to increase the performance and efficiency of the containment and leachate collection systems over that required by N.J.A.C. 7:26-2A.6(d), in order to prevent pollution of the underlying aquifers. Such increased performance and efficiency may include, depending on the proposed location, the following:

- A. In the case of the containment system performance
  - i. Increased liner thickness - greater than three<sub>7</sub>(3) feet;
  - ii. A more impermeable clay - less than  $1 \times 10^{-7}$  cm/sec;
  - iii. A double geomembrane liner system - geomembrane liners with a leak detection leachate collection system between the primary and secondary geomembranes;
  - iv. A composite liner system - geomembrane and clay or admixture liner; and
  - v. A double composite liner system - geomembrane and clay or admixture liner with a leak detection system between the primary and secondary composite.
- B. In the case of the leachate collection system efficiency;
  - i. A more permeable drainage layer - greater than  $1 \times 10^{-2}$  cm/sec.;
  - ii. Steeper controlling bottom slopes; and
  - iii. Closer leachate collection pipe spacings.

Only<sub>6</sub> those sites located in formations with a hydraulic conductivity of  $1 \times 10^{-6}$  cm/sec. or less would be allowed to design and construct a landfill with a three foot thick  $1 \times 10^{-7}$  cm/sec. clay liner with a maximum of one foot of leachate head. Borderline site, those<sub>5</sub> areas with greater than a  $1 \times 10^{-6}$  cm/sec. but less than a  $1 \times 10^{-5}$  cm/sec. hydraulic conductivity may be allowed to design and construct, at a minimum, a

thicker, less impermeable liner if the geohydrology can support such a design and the performance standards required by subsection (c) are met. Applicants with a proposed site in any other geologic formation will be required to design and construct the sanitary landfill with a double composite liner system. This liner system is required to ensure the control of any potential leakage and prevent leachate migration from the landfill into those areas which the Department has determined are of the greatest environmental concern and require an additional degree of protection.

A composite liner is a liner system consisting of a geomembrane in compressive contact with a low permeable material such as a clay soil or an admixture liner material. A geomembrane is a non porous material. Leakage in geomembrane liners, as opposed to fluid movement through a porous media as described in the "Introduction" of this chapter, is caused by flow through a failure in the seam or within the liner itself. The rate of leakage is controlled by the hydraulic conductivity of the material directly beneath the geomembrane. To control this potential for leakage and to prevent leachate migration into fractured bedrock formations or into aquifers that serve as a direct potable water supply the Department requires a double composite liner system. A double composite liner system would consist of a primary or top composite liner system and a secondary or bottom composite liner system with a leak detection/collection system between the primary and secondary composite liner.

The requirement for a double composite liner system rather than a composite liner system or a double geomembrane liner has been developed because the Department has determined, through analysis of the performance of existing geomembrane liner systems, that the potential for uncontrolled leakage from these landfills into the environment is high. Therefore, to control this potential for leakage and prevent leachate migration a double composite liner system must be constructed in all other locations.

The proposed regulations allow for the use of a double geomembrane liner system or a single composite liner system in areas where it can be demonstrated that the groundwater does not serve the surrounding community as a direct potable water supply or where the bedrock is not in close proximity to or at the elevation of the bottom of the sanitary landfill liner. However, the double composite liner system represents an achievable technological limit that would ensure the control of leachate migration from the landfill over that of any other available system.

This approach allows the Department to exercise its regulatory control of those areas of greatest environmental concern and puts into effect the U.S. Environmental Protection Agency (EPA) recommendations to develop performance criteria and operational guidelines.

The Department requires, in N.J.A.C. 7:26-2A.6(f), the use of a three-dimensional mass transport model to evaluate the performance of the proposed liner and leachate collection system. The Department has determined that there is a sufficient number of technically viable models available to require this method of evaluation of the landfill's performance. N.J.A.C. 7:26-2A.6(f) establishes the guidelines for the

selection of the model. Appendix A "Minimum Guidelines for a Ground Water Modeling Effort" as referenced in this subsection was developed by the EPA and establishes criteria for model selection and N.J.A.C. 7:26-2A.6(f) 1 and 2 were developed for the Department by George Pinder of Princeton University and Alec Demetracopoulos et al of Rutgers University, respectively and are discussions of the capabilities and limitation of modeling systems.

Subsections (g) and (h) list additional environmentally sensitive areas in which the Department will require upgrading of sanitary landfill's performance. These environmentally sensitive areas must be analyzed to determine the potential impact from the sanitary landfill and the additional controls systems or increased performance needed to minimize and control any adverse impacts and prevent pollution. These requirements are not intended to ban sanitary landfill construction in these areas but to identify those environmentally sensitive areas which may need additional protection above that of the standard designs set forth at N.J.A.C. 7:26-2A.6(d) and (e). The liner design and other environmental control systems required for a specific site will be determined by these subsections in addition to N.J.A.C. 7:26-2A.6(d) and (e).

The rationale for requiring the additional performance and environmental control system upgrading set forth in N.J.A.C. 7:26-2A.6(h) for the environmental sensitive areas listed in N.J.A.C. 7:26-2A.6(g) is that problems have historically developed in these areas. As a result of these problems the Department has required some existing sanitary landfills to environmentally upgrade their facility in these areas. In order to avoid the future need to environmentally upgrade facilities and to protect the environment the Department is now requiring that the additional performance and environmental control system upgrading be designed for in these environmentally sensitive areas.

This approach, matching the performance to the location, ensures that sensitive areas are accounted for and protected in the design and construction of new sanitary landfills, and that the applicable provisions of existing federal and state environmental and land use regulations are addressed within the design and construction of the landfill.

For each proposed sanitary landfill the degree of performance or environmental control system upgrading will be handled on a case-by-case basis as determined by the location of the landfill and its impact on environmentally sensitive areas. The scheduling of this case-by-case review will be during the design phase. As an example the Department would expect the following upgrading of environmental control systems:

- A. If the landfills is proposed to be located in a FW-2 watershed and over a sole source aquifer the applicant must demonstrate:
  - i How the design of the run-on/run-off structures or how the existing topography will prevent surface seeps, erosion and pollution of the FW-2 waterway. This may be accomplished by increasing the design storm of the surface drainage system over that required by N.J.A.C. 7:26-2A.7(h); and

- ii How the design of the containment and leachate collection system or how the existing geology will prevent pollution of the underlying aquifer within the water quality standards. This may be accomplished by increasing the performance of the containment system or by increasing the efficiency of the leachate collection system.

N.J.A.C. 7:26-2A.6(i) requires that a minimum set back area and buffer zone be established and maintained between the disposal area and the landfill property boundaries. The set back area is defined as that area between the top of slope of the landfill and the property line and the buffer zone is defined as that area adjacent to the landfill's property boundary line in which no landfill construction activities are permitted. The requirements are needed:

- A. To shield and buffer the surrounding environment from the landfill operations;
- B. To allow for sufficient area for the implementation of remedial action should the need arise and sufficient space to contain any possible migration; and
- C. To insure that groundwater flow beyond the landfill property boundaries does not result in a degradation of the aquifer beyond the background quality or water quality standard.

The set back requirements were developed based on ground water flow rates and to insure the provisions as listed in A, B and C above are met, in accordance with the following:

- A. For sites with groundwater flow equal to or greater than one foot per day the minimum set back is 300 feet;
- B. To ensure that the performance standards required by N.J.A.C. 7:26-2A.6(c) are met the set back may be required to be greater than the minimum distance. This determination will be based on the geologic siting, the groundwater quality and usage and the performance of the sanitary landfill; and
- C. The set back may be reduced in sites with groundwater flows less than one foot per day based on the geologic siting and the performance of the landfill provided the performance standards required by at N.J.A.C. 7:26-2A.6(c) are met, but in no case shall the set back area be less than 150 feet.

In all cases a minimum of 50 feet of the set back area adjacent to the property line must be established and maintained as a vegetated buffer zone.

The Department will allow construction of some environmental control systems, such as gas vents, monitoring wells and surface drainage diversion ditches, within the set back area but strongly recommends that maximum use of the set back, as a buffer zone be developed.

The following are examples of required set backs:

- A. Landfills located in an area with a hydraulic conductivity of less than  $1 \times 10^{-6}$  cm/sec or a clayey soil will more than likely be in areas where the groundwater flow is less than one foot per day and would be allowed to reduce the set back to no less than 150 feet.

This distance will shield the surrounding environment from the landfill activity (50 feet) and provide for a sufficient area, based on the Department's experience, for implementation of remedial action (100 feet), should the need arise.

- B. Landfills located in an area with a hydraulic conductivity greater than  $1 \times 10^{-6}$  cm/sec will more than likely be in areas where the groundwater flow is greater than one foot per day and would be required to have a minimum of 300 feet of set back. This distance may be required to be increased, based on the performance of the landfill and the geologic siting to ensure compliance with the performance standards required by N.J.A.C. 7:26-2A.6(c).

The 300 foot minimum was established to allow for sufficient area for implementation of remedial action and to ensure that sufficient distance is maintained to prevent contaminant migration off-site.

- C. Based on the Department's mass transport modeling of a present contamination case in a highly permeable aquifer with groundwater flows greater than one foot per day and given a performance from the landfill constructed in accordance with the design required by N.J.A.C. 7:26-2A.6(d) the set back area, in order to be in compliance with the performance standard required by N.J.A.C. 7:26-2A.6 (c), would have to be approximately a  $\frac{1}{4}$  of a mile.

In order to reduce this set back distance of  $\frac{1}{4}$  of a mile the performance of the sanitary landfill would have to be increased. Depending on the groundwater quality, the usage of the groundwater in the area and the depth to bedrock a double composite liner would have to be designed and constructed at this location to be in conformance with the minimum set back distances as set forth at N.J.A.C. 7:26-2A.6(i)1 and 2.

As the Department further develops modeling data from existing contamination cases in various geologic formations it will be better able to match the performance of the landfill to the set back requirements based on the geologic siting. The regulations provide the flexibility to revise the buffer zone requirements based on the results of further studies.

The controlling factors which must be used to evaluate the set back distances are:

- A. Leakage performance;

- B. Efficiency of the overall systems;
- C. Hydraulic confinement time;
- D. Attenuation performance of the systems;
- E. Overall structural integrity and stability of the system;
- F. Classification of the usage and quality of the groundwater;
- G. Number and yield of wells in the area;
- H. Presence of critical or principal aquifers; and
- I. Drinking water supply wells or reservoirs in the area.

The Department is proposing the set back requirements for all areas surrounding the proposed sanitary landfill, regardless of groundwater flow direction, because of the potential for external forces changing the direction of groundwater flow in the area by artificially controlling the hydraulic gradient. Since control of the external forces changing the groundwater direction are limited the Department has established the set back requirements equilaterally around the facility.

N.J.A.C. 7:26-2A.6(j) establishes a mechanism for approving a reduced landfill performance, design standards and construction requirements for a Class II or Class III sanitary landfill (sanitary landfills that accept, for disposal one type of ID-27 industrial waste or ID-13 bulky waste). This mechanism is being proposed because monofills and construction and demolition sanitary landfill will have less of an impact on the environment than Class I sanitary landfills (sanitary landfills that accept all types of nonhazardous solid waste for disposal).

The design standards and construction requirements set forth at N.J.A.C. 7:26-2A.7 may be reduced for Class II sanitary landfills if the applicant can demonstrate that the waste will not result in pollution of the environment and that the landfill will meet the performance standards set forth at N.J.A.C. 7:26-2A.6(c).

Class III sanitary landfills may be exempted from meeting the design standards and construction requirements set forth at N.J.A.C. 7:26-2A.7 if the applicant can demonstrate that the site access control and security, the length and scale of the disposal operation and the location of the proposed Class III sanitary landfill will prevent pollution of the environment.

#### 5. 7:26-2A.7 Design Standards and Construction Requirements

N.J.A.C. 7:26-2A.7 establishes minimum standards and requirements for the design and construction of sanitary landfills. The standards establish a performance level for the environmental control systems and the sanitary landfill. The requirements codify current construction practices and are established at the level required to avoid questionable performance or instability.

The requirements and standards are based on the computer model sensitivity analysis discussed previously, EPA recommendations and technical documents, and data collected from technical experts in industry, research organizations, state and federal regulatory agencies and trade or professional associations.

The minimum design standards and construction requirements within this section are established to work within the performance standards of N.J.A.C. 7:26-2A.6 for the landfill design. This approach allows the Department to evaluate alternative designs and to eliminate conditions that could lead to improper construction and poor performance while allowing a reasonable degree of design flexibility.

Simply designing the sanitary landfill to meet all the minimum design standards and construction requirements will not ensure that the applicant will receive approval from the Department. The proposed sanitary landfill must also meet the performance standards of N.J.A.C. 7:26-2A.6(c), the standard design required by N.J.A.C. 7:26-2A.6(d) and (e), plus any additional performance upgrading required due to the landfill's geological and topographic location and the landfill's impact on environmental sensitive area as set forth at N.J.A.C. 7:26-2A.6(g) and (h).

This approach is in conformity with the RCRA requirements 42 U.S.C. 6944, and puts into effect EPA's recommendation to establish performance criteria and operational guidelines.

The Department recognizes that in sanitary landfill construction there should be some degree of latitude to work with the available site materials within a framework of design and construction minimums. Sole reliance on construction requirements can be no substitute for a well engineered site. This section allows for some variation of the design standards and construction requirements provided the sanitary landfill meets the performance standards set forth at N.J.A.C. 7:26-2A.6.

A. 7:26-2A.7(a) General

This subsection establishes the general design standards and construction requirements for sanitary landfills. The major new requirement within this subsection is the requirement for quality control and quality assurance inspections and reporting.

N.J.A.C. 7:26-2A.7(a) requires that an independent quality assurance inspector be on-site during the initial construction of the liner and leachate collection system. Independent means that the inspector is financially independent of the design engineer and the contractor and that the quality assurance inspector is not a subsidiary or partnership with any of the above. This requirement is in addition to that of N.J.A.C. 7:26-2A.7(a)9 which requires that a quality control inspector be at the site during all phases of construction and of that of N.J.A.C. 7:26-2A.7(a) which requires that a New Jersey licensed professional engineer certify each major phase of construction. The purpose of the New Jersey licensed professional engineer's certification is to ensure that the sanitary landfill has been constructed in accordance with the design specifications and permit requirements and that the landfill will perform as designed.

The quality assurance inspector requirements were included because the construction of the liner and leachate collection systems is the most critical phase for ensuring the environmentally sound performance of the

sanitary landfill. The construction of the liner and leachate collection systems are critical because of the limited reconstruction and remedial options that can be implemented to repair these systems once the landfill's operations are initiated. Therefore, the Department has determined that the additional degree of protection is warranted. The quality assurance inspector is required to be on site to observe the liner and leachate collection system construction procedures and will report its observations directly to the Department.

N.J.A.C. 7:26-2A.7(a)15 sets forth the procedures allowing for phase out of the independent quality assurance inspector or for reducing the frequency of inspections. The phase out or reduction in the quality assurance inspection activities will be based on the consistency and precision of the quality control testing of the initial phase of construction. The initial phase of construction means the construction of the first section of the modular landfill design as required by N.J.A.C. 7:26-2A.7(a)3.

B. 7:25-2A.7(b) Foundation and Subgrade

The design of a state-of-the-art landfill requires the construction of a structure within or on the ground. The key to the long term stability of this structure is the integrity of the foundation. The foundation should provide a firm, relatively unyielding, plane surface to support the liner and must be capable of providing support for the construction of the liner. Uncontrolled differential settlement or swell and structural instability of the foundation has the potential to cause extensive liner and leachate collection system damage and would allow for the uncontrolled release of contaminants into the environment.

In the past, the construction of a landfill did not take into account, to any significant extent, for the settlement or swell of the foundation. Today, however, with the advent of impervious liner systems to contain the leachate and leachate collection system to remove the leachate from the bottom of the liner, the integrity of these systems must remain intact, to ensure the prevention of pollution migration into the environment.

The applicant must establish through geotechnical testing and analysis the long term stability of the liner foundation required by N.J.A.C. 7:26-2A.7(b)3. It is strongly recommended that the design engineer work in concert with the geologist or geotechnical engineer who prepared the geologic and hydrogeologic reports to develop a landfill design that will alleviate any potential foundation failures.

The factors of safety established within N.J.A.C. 7:26-2A.7(b)3 were selected for the following reasons:

- i. Repair to the liner or leachate collection systems, should failure occur would not be likely;
- ii. The consequences of failure would result in serious danger; and
- iii. The cost of repair would be much greater than the cost of construction.

In developing the factor of safety for stability of the liner and slopes the Department relied on the guidelines recommended in the EPA, Permits Writer's Training Program, Karl Terzaghi and Ralph B. Peck, Soil Mechanics in Engineering Practices, and T. William Lambe and Robert V. Whitman, Soil Mechanics. The bearing capacity factor of safety was selected based on guidelines developed by Vesic' 1970 as reported in Winterkorn and Fang's Foundation Engineering Handbook for hydraulic structures, and George B. Sower, Introductory Soil Mechanics and Foundations: Geotechnical Engineering.

The most desirable conditions for the foundation would be one in which the material has a uniform characteristic. Given that most proposed sites will contain soils that will not act uniformly and that the majority of landfills will be sited in areas that are not "ideal" locations, in terms of foundation stability, the proposed regulation allow for the sampling scheme to be developed on a case-by-case basis.

The construction requirements for the preparation of the foundation required by N.J.A.C. 7:26-2A.7(c)4 are standard practices and do not represent major deviation from established techniques. The construction requirements were developed from EPA technical resource documents U.S. Bureau of Reclamation (USBR) Earth Manual, U.S. Army Corp of Engineers (USACOE) construction and engineering manuals; and various soil mechanics and geotechnical engineering textbooks.

The depth to groundwater requirements of N.J.A.C. 7:26-2A.7(b)4xii were developed to insure the maximum protection of the groundwater and shall be determined in accordance with the following:

- i When the landfill is located in a low permeable formation, a case-by-case determination will be made to approve the construction within the potentiometric surface. However, the design should maintain, at a minimum, five feet of  $1 \times 10^{-6}$  cm/sec soil between the bottom of the liner system and the aquifer.
- ii. In all other cases the design should maintain, at a minimum, five feet of soil between the bottom of the liner system and the top of the seasonally adjusted groundwater level.

This requirement allows for the construction of the landfill within the saturated zone provided the geohydrological regime can support such a design. However, the Department agrees with the EPA's position as cited in their guidance document Landfill Design: Liner Systems and Final Cover that construction in the saturated zone is "fraught with additional risks and design difficulties," but "given certain hydrogeological circumstances and accommodating designs, location in saturated soil can be environmentally acceptable."

#### C. 7:26-2A.5(c) Containment

One of the key components in the design and construction of an environmentally sound landfill is to contain the leachate generated within

the landfill. Leachate characteristics, such as concentration and quantity, will vary and decrease with time as decomposition reactions proceed. The reason for the requirements of this subsection is to prevent pollution of the environment from the landfill through the proper design and construction of the containment system. This is accomplished by limiting, the amount of leachate released into the environment, to essentially zero, and increasing the hydraulic confinement time of the liner system to insure that the performance standards as required by N.J.A.C. 7:26-2A.6(c) are met.

This subsection requires that the containment systems be a closed system. This means that the containment system must be constructed on all areas of the subgrade or in-situ material where the liner material will be in contact with leachate or solid waste and that the system must maintain its integrity throughout the operational, closure and post-closure period.

N.J.A.C. 7:26-2A.7(c) includes the design standards and construction requirements for liners (c)2-7, and cut-off walls (c)8-10. The design standards are established to:

- i. Restrict and control the migration of leachate and to prevent pollution of the underlying aquifers; and
- ii. Ensure through material testing and quality control testing, that the liner and cut-off wall will possess the appropriate chemical/physical properties and sufficient strength to prevent failure.

a. 7:26-2A.7(c)2-7 Liners

N.J.A.C. 7:26-2A.7(c)2-7 sets forth the design standards and construction requirements for liner systems. Paragraph 2 establishes the general provisions for all liner systems while paragraphs 3-7 set forth the provision for the individual liner materials including clay, geomembranes hydraulic asphalt concrete, soil cement and bentonite.

N.J.A.C. 7:26-2A.7(c)2iii and iv require that the controlling slopes of the liner be greater than two percent and that the final grade deviation should not result in excessive ponding on the liner. The controlling slope is that slope which directly effects the hydraulic head buildup on the liner (i.e. the slope which is perpendicular to the collection pipe). The two percent slope is required to promote drainage. The Department has found that the efficiency of the system, based on the sensitivity analysis of the computer modeling, becomes questionable beyond this point. The five percent slope for the grades of the remaining slopes on the liner is based on previous work performed in the field of roadway and airport drainage systems and agricultural field drainage systems.

N.J.A.C. 7:26-2A.7(c)2vii requires that a soil backfill be placed on top of the liner immediately following construction and quality control testing. This is required to prevent physical damage to the liner from the elements. The required depth of backfill of 12-inches for compacted liners, and 18-inch for geomembranes was selected to promote drainage and protect

the liner from damage. For compacted liners this depth was predominantly chosen based on the need to allow for a sufficient head to develop within the drainage layer in order to promote drainage. For geomembranes the depth was chosen because of the need to protect the liner from damage. Both choices are EPA recommendations as cited in their guidance document and technical resource manual for landfill designs.

N.J.A.C. 7:26-2A.7(c)2ix requires that the liner material have a demonstrated chemical/physical resistance which cannot be adversely impacted by waste emplacement or leachate generation. The Department will consider appropriate historical data for this demonstration of resistance however, in the absence of any available data actual test data must be generated.

The Department is requiring the use of the methods approved by the EPA, test methods 9090 for compacted liners and 9100 for geomembranes to develop actual test data. While these test methods are time consuming, requiring from three to six months to run, they are at this time the only EPA approved methods and will generate sufficient results to determine the suitability of the liner material and its potential to be adversely impacted. This time constraint should be recognized and prepared for early in the landfill design stage. Should the results indicate incompatibility of the liner material with anticipated solid waste leachate, the Department will not accept the use of that material within the containment system design without modification which will make the material compatible .

The key to the landfill operating as designed is the quality control testing. The purpose for the requirements delineated in N.J.A.C. 7:26-2A.7(c)2x and xi and the quality control tests for each of the liner materials listed in paragraphs 3, 4, 5, 6, and 7, is to ensure that the material used for the construction of the liner and the construction procedures followed are in accordance with the requirements and standards of the permit and that the landfill will function in accordance with design specifications.

The hydraulic conductivity testing required by N.J.A.C. 7:26-2A.7(c)2x(3) was selected based on a statistical analysis, with a confidence level of 90-95 percent, as determined on results generated by hydraulic conductivity values submitted to the Department by existing facilities and within J.R. Wardell's and J.S. Doynow's M.A. Thesis, Laboratory Permeability Testing of Fine Grained Soils for Hazardous Waste Disposal Siting Studies, Rensselaer Polytechnic Institute, Troy, New York. The statistical analysis was performed in accordance with the procedures outlined in the U.S. Army Corps of Engineers, Waterway Experimental Station publication, by Joseph Sigolon and Michael F. Kelley, entitled Geotechnical Quality Assurance of Construction of Disposal Facilities . This analysis determines the sample size needed to be selected from the total population, as a function of the confidence level, maximum expected error and standard deviation. Based on the Department's statistical analysis it was determined that the sample size, to be within the 90 to 95 percent confidence level, should be between 3 to 11 samples.

The 200 foot sampling interval required by N.J.A.C. 7:26-2A.7(c)2x(3) will result in the need for the applicant to collect approximately 4 samples per acre. While a set pattern, as required by this sub-subparagraph, does not technically satisfy the need for random selection the Department has determined that if the initial condition is determined randomly then all successive units will be random. Further, if the depth at which the sample is collected is varied from location to location the degree of randomness will increase within the sampling scheme to ensure a higher degree of confidence in the test results.

Mositure/density tests are required by N.J.A.C. 7:26-2A.7(c)2x(1) at 50 foot intervals on each lift of the compacted liner. The Department does not consider this requirement to be excessive given the advent of nuclear densometers which allow for a shorter testing time, minimum disturbance of the soil and the possibility of continuous or repeated measurements at the same location.

The Department is requiring that a field hydraulic conductivity or infiltration test as set forth at N.J.A.C. 7:26-2A.7(c)2x(7) be performed at a minimum of one test per every 10 acres. This is to verify the in-place hydraulic conductivity and to correlate in-place hydraulic conductivity to the laboratory values. A recent article by Olson and Daniels, "Measurement of Hydraulic Conductivity of Fine Grained Soils", published in Permeability and Ground Water Contaminate Transport, ASTM STP 746, has indicated that comparison of corresponding laboratory and field hydraulic conductivity test results show the field values to be higher than the laboratory value, ranging from 0.3 to 46,000 times. This large variation in the results warrants the additional testing.

The Department recognizes that no formally established testing standard exists for measuring fine-grain soils in the laboratory or in the field but has determined that there are sufficiently documented methods to require that these tests be performed and to recommend current methods.

Except for mositure/density and thickness measurements, N.J.A.C. 7:26-2A.7(c)2 allows for the number of all other tests to be reduced after the initial construction phase, provided the source material does not change, based on the precision and accuracy of the initial construction and quality control results. The Department strongly recommends that the engineering properties of the liner material be correlated to the material's index properties in order to maintain a high degree of quality control of the construction with the allowed reduced testing scheme.

For geomembranes, the number of samples and sampling methods for both destructive and non-destructive tests, as required by N.J.A.C. 7:26-2A.7(c)2 xi, was determined based on the information provided by the supplier, manufacturers, designers, and installers of geomembranes. The Department particularly relied on the Guide Specification for Construction of Flexible Membranes prepared by Jean-Pierre Giroud and Kenneth H. Kastman of Woodward/Clyde Consultants for the EPA.

N.J.A.C. 7:26-2A.7(c) establishes minimum construction requirements for each type of liner system in separate paragraphs. The requirements included for each type of material are the minimum liner thickness, material testing, quality control testing and construction requirements and restrictions. These requirements have been developed based on EPA technical resources and guidance documents, USACOE technical and engineering manuals, USSBR Earth Manual, National Sanitation Foundation technical documents, and various bentonite, soil cement, asphalt and geomembrane suppliers and installers manuals and technical documents.

The construction requirements of this subsection are standard construction practices and do not represent major deviation from established techniques. However, the degree of conservativeness was increased to reflect the critical nature of liner construction. In particular, the requirement that admixture materials be mixed in a central mixing plant is proposed to ensure that complete mixing is performed. This requirement is being proposed based on installers and suppliers comments and the Department's concern for high quality construction.

While the Department has included the construction requirements for hydraulic asphalt concrete, bentonite and soil cement, these materials may not possess sufficient chemical and physical properties to prevent failure due to pressure gradients, physical contact with the waste and leachate, climatic conditions and the stresses of installation and operation when used singularly as liner material in Class I sanitary landfills. The Department has included these materials because they may be useful within a composite liner system, as a subgrade modifier in a double geomembrane liner system or in applications of liner systems in other classes of sanitary landfills such as industrial waste, Class II, or bulky wastes, Class III sanitary landfills.

For Class I sanitary landfills the Department is requiring the use of geomembranes and clay in a double composite system. The use of only clay as a liner material will only be allowed in those areas where the geology, a low permeable formation, can support such a design. For these areas, of clay liner design, the Department will allow the clay to be left in the undisturbed state, in-situ design, only if the applicant can demonstrate that no secondary hydraulic conductivity of the clay exists and<sup>7</sup> that the clay meets the minimum required hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec.

Excavating the clay with controlled recompaction will serve to improve the fabric of the clay to a more uniform structure which will in turn decrease the hydraulic conductivity and increase the performance of the liner over that of the random structure put down by nature. The Department is therefore allowing the clay to be left undisturbed, as an in-situ liner, only if the requirements of this subchapter are met and it can be demonstrated that the fabric or structure of the clay will be adversely affected by recompaction or not significantly improved.

In order to ensure the integrity of the liner the Department has established the minimum thickness for the liner materials based on the recommendations outlined in the EPA publication Minimum Technology Document

for the Design and Construction of Landfills and Surface Impoundments. The design standards within N.J.A.C. 7:26-2A.7(c)3,5,6, and 7 allow for the reduction of the liner thickness for Class II and Class III sanitary landfills. This reduction is permitted because of the limited impacts associated with these classes of sanitary landfill. The reduction in the standard will be allowed provided the requirements at N.J.A.C. 7:26-2A.6(j) are met.

The reduction of the required thickness of the clay liner from three feet as required by N.J.A.C. 7:26-2A.6(d) to two-feet as required by N.J.A.C. 7:26-2A.7(c)iv is permitted provided the performance of the landfill as required by N.J.A.C. 7:26-2A(d) is met. The performance of the landfill is a function of a number of factors including the thickness of the liner and its hydraulic conductivity. Therefore, in order to design for an equivalent performance from the landfill with a reduced liner thickness the minimum hydraulic conductivity of the liner must be decreased.

b. 7:26-2A.7(d)8-10 Cut-off Walls

The requirements for the construction of a cut-off wall have been developed to encompass the different construction techniques of a compacted clay cut-off wall design and a slurry trench cut-off wall design.

The design and construction of a cut-off wall requires an accurate and detailed geohydrologic assessment to determine:

- i. The type of excavation equipment utilized;
- ii. The depth of the trench;
- iii. The extent to which the in place soils can be used as backfill;
- iv. The hydraulic conductivity of the confining layer; and
- v. The design performance of the cut-off wall.

N.J.A.C. 7:26-2A.7(d)8i requires that borings be performed at 200 foot intervals. This requirement is based upon the Department's past experience with cut-off wall construction in remedial actions at landfills. The Department has determined that this interval is sufficient to characterize the soils through which the cut-off wall will be constructed and to confirm the depth and hydraulic conductivity of the confining layer. In clay cut-off wall designs, the proposed regulations allow for an increase of the boring interval to 500 feet, provided a qualified geologist or geotechnical engineer is on-site to log the geology of the open trench and certifies that the depth of the excavation is sufficient to key the cut-off wall into the confining layer.

The requirements for the cut-off wall construction have been developed based on USEPA, USBR, USACOE, ASCE technical resource documents and engineering manuals, bentonite suppliers' technical specifications, slurry wall installers' technical specifications and various soil mechanics and foundation engineering textbooks.

The minimum construction requirements for clay and bentonite have been established in N.J.A.C. 7:25-2A.7(c)9 and 10. The construction

requirements, while representing standard construction practices and established industry techniques, have been developed with an increased degree of conservativeness to reflect the critical nature of the construction.

The minimum thickness requirement for clay cut-off walls, set forth in N.J.A.C. 7:26-2A.7(c)9iii will ensure proper compaction of the clay and is an industry wide acceptable value for a stable thickness. The minimum thickness requirements for slurry trench cut-off walls, set forth in N.J.A.C. 7:26-2A.7(c)10vi and vii will ensure stability of the trench. The increased requirement of slurry wall thickness over clay wall thickness is to account for the increased depth the Department anticipates will be needed for slurry cut-off wall construction.

Requirements for material testing and quality control testing of the backfill material used in the slurry cut-off wall design have been included in N.J.A.C. 7:26-2A.7(c)10. The material and quality control testing is in addition to the material and quality control testing requirements as set forth in N.J.A.C. 7:26-2A.7(c)3-7. The reason for the additional test is because this material is critical to the performance of the cut-off wall. It is essential to know how the backfill material will react to ensure proper construction. The performance of the backfill material is dependent on the quality of the field water used in the backfilling operation.

The requirements of N.J.A.C. 7:26-2A.7(c)10 xiii ensure that the slurry within the trench is forced into the formation through which the construction of the cut-off wall is proceeding. In addition, maintaining the level of slurry within the trench will prevent the failure of the trench by increasing the stability of the excavation. These requirements are generally acceptable minimums in the industry. Values above the minimums, as in the case of all construction minimums in the regulations, should be developed on a case-by-case basis by the design engineer with input from the geologist or geotechnical engineer to account for site specific variability.

#### E. 7:26-2A.7(d) Leachate Collection Systems

The leachate collection system consists of a leachate drainage system and a leachate removal system designed to provide effective drainage of the leachate generated within the landfill, to control the leachate pressure on the liner and the minimize the leakage of the liner. This system must be designed and analysed in conjunction with the containment system to prevent pollution and to allow for differing design specifications.

##### a. Leachate Drainage Systems N.J.A.C. 7:26-2A.7(d)2

The leachate drainage system must include those designs and structures necessary to transmit the leachate from the liner to the collection pipe (the drainage layer, slope and pipe spacing). The design parameters of the drainage system as set forth in N.J.A.C. 7:26-2A(d)2 can be modified, within the minimum design standards provided the performance of the standard designs required by N.J.A.C. 7:26-2A.6(d) and (e) are not reduced and the performance standards as required by N.J.A.C. 7:26-2A.6(c) are met. The

minimum requirements for the hydraulic conductivity of the drainage layer and the slope and pipe spacing of the collection pipes, were selected based on the Department's review of the model's sensitivity analysis as described previously in this document. These requirements were established above the level at which this review indicated a significant decrease in the performance and efficiency of the leachate collection system would occur.

N.J.A.C. 7:26-2A.7(d)2iii requires that the drainage system be designed based on the most conservative numbers determined from two different modeling techniques. This means that if the modeling indicates that drainage pipe spacing should be at either 125 or 100 foot spacings, based on the two different design models, the model producing the 100 foot spacing should be selected.

With the advent of the use of personal computers a number of hydrologic models have been made available on the market. The Department is recommending two methods based on their ease of use and simplicity, which supply accurate design numbers but this by no means is the only approach. More complex models can give a more "realistic" design number. However, the amount of data necessary to make the model work also increases.

All models suffer from the same deficiencies. They are mathematical representations of the real world and, as such, some assumptions must be made to match the real world conditions. These assumptions, for a given model, should be known and fully explored by the designer, to determine if the models' approximations, within the geologic conditions, can be used to give appropriate solutions.

N.J.A.C. 7:26-2A.7(d)2iv requires the drainage system to be designed based on 100 percent infiltration at an effective frequency representing the average time between precipitation events greater than 0.1 inches. While this requirement may seem unnecessarily restrictive it is fairly representative of the conditions that the operating landfill will be subject to such as limited run-off and evaporation. The exclusion of storage moisture capacity makes the system conservative and incorporates a reasonable factor of safety into the design of the drainage system given that this system cannot be altered once the landfill begins operation.

N.J.A.C. 7:26-2A.7(d)2vi requires that the velocity of flow within the drainage layer be such that a laminar condition will be maintained within the system. This puts an upper limit on the slope and, in some respects, the hydraulic conductivity of the drainage material (Hough and Cedergren). This will prevent scouring of the liner which would degrade the efficiency of the collection system over time.

b. 7:26-2A.5(d)3 Leachate Removal Systems

The leachate removal system as required by N.J.A.C. 7:26-2A.7(d)3, is defined to include the structures necessary to convey the leachate from the collection pipes to the treatment system (the filter, envelope, collection pipe, man-holes/clean-out risers, sumps and pumps). The leachate removal systems should be designed based on the actual estimated percolation rate

including deductions from the infiltration rate resulting from run-off, evaporation and moisture storage. This allows for a more realistic sizing of the pipes, pipe envelopes, pipe slopes, sumps, pumps and pump stations.

The Department is requiring that the pipe utilized within the piping system have an adequate strength capable of supporting the loads and stresses imposed by the landfill's construction and operation. This will be accomplished by utilizing a material meeting the ASTM standards or by utilizing a material passing the testing required by N.J.A.C. 7:26-2A.7(d)3i. The strength analysis of the pipe must be performed on the effective strength of the pipe. The effective strength is that adjustment made to the pipe strength to account for the decrease in strength resulting from the pipe perforations.

The piping system must be designed to support the anticipated load and the pipe must have a supporting strength equal to or greater than this load plus a factor of safety of 1.5. The requirements for the piping system were developed after a review of ASCE design manual #37 Design and Construction of Sanitary and Storm Sewers and USEPA guidance and technical documents.

While the piping system, within the leachate collection system, does not handle the degree of solids encountered in sewage systems, dissolution problems and the inclusion of fines into the piping system may develop; therefore, the piping system should be designed to be self cleaning. A piping system designed to accommodate a minimum velocity of two feet per second when designed at full or half full conditions is generally recognized as an acceptable range for self cleaning velocities. The system must be designed to allow for access, with a water jet, to permit flushing of the system. The spacing of the cleanout risers or sumps will be dependent on the pipe size used to allow for adequate cleaning of the leachate collection pipes.

The gravel envelope around the collection pipe, as required by N.J.A.C. 7:26-2A.7(d)3ix, serves two purposes. The first is to prevent the intrusion of fines into the pipe by reducing the inflow drainage velocity to the collection pipe, thereby maintaining the efficiency of the system. The second is to serve as a back up to the collection pipe should localized failure within the piping system occur.

The Department strongly recommends that a "filter" of either a graded granular material or geotextile, designed in accordance with the Army Corp of Engineers criteria or equivalent criteria, be constructed above the drainage layer to assist in the reduction of fines in the leachate collection system. While this recommendation will reduce fines in the drainage layer it may, however, actually impair the performance of the leachate collection system and therefore the Department has allowed the option for this design and not required its construction.

The requirement of N.J.A.C. 7:26-2A.7(d)3xi to install the collection pipe system within a shallow trench is included so as to maximize the supporting strength of the system and to minimize the loads to be imposed on the pipe and the leachate head on the liner.

The Department has determined that the perimeter of the landfill is the critical boundaries for leachate control in order to prevent off-site contaminant migration. Therefore, N.J.A.C. 7:26-2A.7(d)3xii requires that the leachate collection system at a minimum control this boundary by requiring that the collection pipe extend completely around the perimeter of the landfill. In addition, the modeling sensitivity analysis performed by the Department indicated that the efficiency of the leachate collection system decreases and the quantity of leachate leakage increases as the drainage distance between the collection pipe increases. In order to maximum the efficiency and performance of the leachate collection system the drainage distance between the pipes has been established at 300 feet.

The number of pumps within the pump station is dependent on the flow to the pump station. A minimum of two pumps are required at the pump station to ensure redundancy of the design. The total pump capacity must be designed to handle the maximum expected leachate production to the area of drainage based on the peak average monthly flow.

The pump station must be designed to allow access to the pumps for repairs. The pump station must provide proper ventilation and lighting and be wired to two separate sources of power. These requirements were developed based on the ASCE engineering manual #37 Wastewater Treatment Plant Design, and the Department's regulations for the Construction of Wastewater Treatment Facilities N.J.A.C. 7:9-1.

The requirements for the leachate collection systems were developed based on USBR, ASCE, USACOE, USEPA guidance documents and technical resource documents and various drainage engineering textbooks.

#### F. 7:26-2A.7(e) Leachate Treatment Disposal

The landfill must be designed and constructed to treat and properly dispose of the leachate which is generated, collected and removed from the landfill. While this proposal includes design standards and construction requirements for leachate treatment and disposal, these designs will be reviewed and permitted in accordance with the Division of Water Resources' (DWR) regulations.

However, N.J.A.C. 7:26-2A.7(e) proposes to prohibit recirculation of leachate as a disposal option. While there may be some good points for allowing recirculation of leachate such as that the landfill will act as a biological filter to treat the leachate, the Department has determined that the negative impacts of odors and increased leakage potential, outweigh the positive aspects.

Subsection (e) requires that the leachate treatment and disposal system be on-line and that all necessary permits and contracts obtained, prior to the start up of the facility. There is sufficient available scientific literature to characterize the leachate quality in order to require the development of a treatment/disposal option prior to the beginning of the operations. This requirement will ensure the implementation of a more environmentally sound design. If the applicant feels it is necessary to

fine tune the system to that particular landfill's leachate N.J.A.C. 7:26-2A.7(f) 10iii allows for a one year extension so long as adequate storage is provided at the landfill.

Additionally, this subsection requires that all treatment and disposal systems be designed and constructed with a liner and where applicable a leachate detection/collection system. It is not environmentally sound to collect leachate from the bottom of a landfill only to allow it to freely discharge into the soil and groundwater from the treatment and disposal system.

G. 7:26-2A.9(f) Gas Collection and Venting Systems

The gas collection and venting systems must be designed and constructed to prevent and control the migration of landfill gases off-site. The proposed gas venting and collection system requirements define two systems for the prevention and control of off-site migration of gas. These two systems are a perimeter venting system and an interior venting system.

Control of the boundary of the landfill is critical in preventing the migration of gases from the landfill. The requirements of the perimeter venting system as set forth at N.J.A.C. 7:26-2A.7(f)3, will control gas at this critical boundary. This section allows for the design of passive venting systems to control migration. However, if methane concentrations equal to or greater than 25 percent of the lower explosive limit (LEL - five percent methane concentration in air) are detected in any area beyond the landfill property boundary an induced draft perimeter venting system will be required to be implemented to control migration. In addition, if significant concentrations of gas are detected in the set back area an induced draft perimeter venting system may be required depending on whether potential impacts are significant.

The Department has chosen the more stringent level of 25 percent of the LEL over the more lenient level of at the LEL because the Department has determined that action to implement corrective action should not be delayed until the problem of gas concentration in the explosive range exists.

The main concern of the Department is in the prevention and control of gas migration off-site. However, the mining of landfill gases can be accomplished in an environmentally sound manner and the Department's regulations strongly support and encourage this activity, where practical.

While the proposed regulations include design standards and construction requirements for gas venting and collection systems N.J.A.C. 7:26-2A.7(g)3 requires that these systems be permitted in accordance with the New Jersey Air Pollution Control Regulations, N.J.A.C. 7:27-8.

Additionally N.J.A.C. 7:26-2A.7(g)15 requires that all buildings constructed on the landfill property be designed and constructed in a manner which will prevent the migration of landfill gases into the structure and prohibits the construction of buildings on top of landfilled areas. The

Department has included this requirement because of the history of explosions and fires caused by trapped gas at landfills.

H. Drainage N.J.A.C. 7:26-2A.7(g)

The landfill must be designed and constructed to hydraulically isolate the landfill from surface water drainage. While the proposed regulations include design standards and construction requirements for drainage systems, these designs will be reviewed by the New Jersey Department of Agricultural and the designs will be implemented in accordance with Department of Agriculture's Soil Erosion and Sediment Control Standards.

A state-of-the-art sanitary landfill must have a properly designed and constructed drainage system to minimize the amount of percolation reaching the liner. This reduces the quantity of leachate generated by reducing the amount of infiltration into the landfill. The other function of a surface drainage system is to divert run-off from the active landfilling areas. This will prevent the degradation of nearby surface waters.

N.J.A.C. 7:26-2A.7(h)1 and 9 require that the performance of the surface drainage systems be capable of, at a minimum, protecting the landfill from run-on and controlling the run-off from the peak discharge of a 24-hour, 25-year storm. Additionally, the performance of the surface drainage systems must be increased if the proposed sanitary landfill site is located in environmentally sensitive area such as wetland buffers and flood fringe areas. The additional design and construction for the surface drainage systems must ensure that pollution of the environmentally sensitive areas impacted or encroached upon is prevented and that adverse impacts are minimized.

I. 7:26-2A.7(h) Monitoring

The key to the control of the landfill's operation is the ability to monitor the landfill's performance to ensure that it is operating in an environmentally sound manner. This subsection sets forth the monitoring systems to be installed at the landfill and that the outputs from those systems be recorded and maintained to allow the Department to evaluate the performance of the landfill.

The Division of Water Resources permits the location and construction of ground water monitoring wells. Therefore, the Department is now proposing to include a new ground water monitoring well requirement in the New Jersey Pollutant Discharge Elimination System Regulations (NJPDDES), at N.J.A.C. 7:14A-6.16.

N.J.A.C. 7:14A-6.16 requires that a groundwater flow model be used in conjunction with the geotechnical information gathered, in accordance with N.J.A.C. 7:26-2A.8(e)6 and N.J.A.C. 7:24A-10.12(e)2vi, to assist in the locating of monitoring wells and sizing of the groundwater monitoring well system. The Department has determined that flow modeling technology is readily available and sufficiently accurate to require its use in the assessment of the proper location and sizing of monitoring wells.

N.J.A.C. 7:14A-6.1b(a)3 requires that in addition to saturated zone monitoring wells, unsaturated zone lysimeters be incorporated within the groundwater monitoring system. The Department has determined that sufficient advances have been made in the field of unsaturated zone monitoring to justify its use within the groundwater monitoring system.

J. N.J.A.C. 7:26-2A-7(i) Capping

The capping system in conjunction with the surface drainage system will serve to reduce and minimize the percolation of liquids into the sanitary landfill thereby reducing the quantity of leachate and gases generated. The capping system must, in conjunction with the containment system, isolate the landfill from the surrounding environment.

N.J.A.C. 7:26-2A.7(i)3 requires that the slopes of the final grade be analysed for stability, within conservative minimum factors of safety. In addition N.J.A.C. 7:26-2A.7(i)4 requires that the side slopes of the final grade be no steeper than 3:1 for uniform and stable foundations and 4:1 where strength data reliability or certainty is low such as in peat, meadow mat or expansive clay soils. The maximum permitted grades for the final slope were selected to ensure stability and to control erosion from the slopes. The requirements are based on the Department's experience with slope failures at existing facilities and EPA recommendations. N.J.A.C. 7:26-2A.7(i)4iii allows for steeper grades for the top slope provided the maximum erosion rate does not exceed two tons per acre as determined by the U.S. Department of Agriculture's Universal Soil Loss Equation.

In order to compact or properly place the impervious cap the final layer of solid waste must be a relatively flat and provide a firm base for construction. Therefore, N.J.A.C. 7:26-2A.7(i)8 requires that the final lift of solid waste be physically or chemically stabilized.

N.J.A.C. 7:26-2A.7(i)9 requires that the cap be as impermeable as the bottom liner. This requirement is included to prevent the bathtub effect which would cause the landfill to fill up with leachate. This condition if allowed to develop will result in surface overflows and seeping of leachate into the surface water system and an uncontrolled rate of subsurface migration of leachate without attenuation. These conditions could potentially result in pollution of the surface and groundwater and subsurface soil systems. The proposed regulations require that the same degree of impermeability designed for the liner be designed and constructed within the cap. However, it is not intended that the same design, constructed for the liner system, be implemented within the capping system.

The drainage layer above the impervious cap required by N.J.A.C. 7:26-2A.7(i)10 is to be designed to function in a similar manner as the leachate drainage system over the liner. It should be designed to provide a path for infiltrating liquids to exit the capping system.

The Department is allowing more flexibility in the design and construction of the capping system than in the containment system, because of its accessibility for remedial action and reconstruction. However,

minimum construction and quality control testing requirements have been established within this subsection to ensure that construction problems or potential failures are detected.

6. 7:26-2A.8 Operational and Maintenance Requirements

N.J.A.C. 7:26-2A.8 establishes the minimum requirements for the operation, maintenance, inspection and monitoring of sanitary landfills. The requirements are based on the existing regulations and have been expanded to include state-of-the-art improvements in operational procedures for sanitary landfills.

This section in conjunction with the construction quality control and quality assurance requirements of N.J.A.C. 7:26-2A.7 are the most important provisions for ensuring that the sanitary landfill is operated in an environmentally sound manner.

N.J.A.C. 7:26-2A.8(b) sets forth the minimum operational requirements. This subsection requires that the work face be confined to the smallest practical area, that the covering operation be on a continual basis throughout the operational day, that solid waste be thoroughly compacted in shallow layers and that no solid waste be left uncovered at the end of the working day. Minimizing the exposed area and effectively compacting the waste will control the odor, dust, and litter impacts and reduces leachate generation at the landfill.

N.J.A.C. 7:26-2A.8(b)4 requires that lifts be no higher than 12 feet. This requirement is based on the Department's past experience with operating landfill and its purpose is to prevent excessive loading rates which may result in instability within the slope which would increase the potential for slope failure.

N.J.A.C. 7:26-2A.8(b)12 requires a cover material that may be used under all weather conditions and further prohibits the use of heavy clays and very fine grain materials. The reason for this requirement is to minimize the impacts of dust and to control surface seeping cause by the use of the prohibited materials.

N.J.A.C. 7:26-2A.8(b)31 requires that a supervisor be present at the site during all operational hours to ensure proper operations. Further the Department is requiring the proper staffing and training of all landfill personnel. The Department is also requiring that the procedures for handling emergencies be delineated within the operation and maintenance manual. These requirements put major emphasis on the operations of the facility and the operators ability, with properly trained staffing, to control and abate environmental nuisances and to prevent environmentally unsound conditions from occurring at the facility. This is the most effective means of ensuring that the operations of the sanitary landfill under all circumstances will be maintained in an environmental sound manner.

N.J.A.C. 7:26-2A.8(c) through (g) establishes the maintenance and inspection procedures that must be followed by the operators of the sanitary

landfill. Frequent inspections and proper maintenance of the environmental control systems, the monitoring devices and the operational procedure of the facility are necessary to ensure that the equipment and system will operate properly.

N.J.A.C. 7:26-2A.8(g) sets forth the systems to be inspected, the logging and recording of all inspections and the requirements for making repairs if deterioration or potential malfunctioning is evident. The requirements were based on regulations promulgated by the Department for hazardous waste facilities.

V. SUBCHAPTER 2B ADDITIONAL, SPECIFIC DISPOSAL  
REGULATIONS FOR THERMAL DESTRUCTION FACILITIES  
TRANSFER STATIONS, MATERIALS RECOVERY FACILITIES,  
CO-COMPOSTING AND COMPOSTING FACILITIES

1. Introduction

This subchapter applies to thermal destruction facilities, transfer stations, materials recovery facilities and co-composting and composting facilities. The requirements of this subchapter apply to all newly proposed facilities and are in addition to the general requirements set forth at N.J.A.C. 7:26-2.10.

All existing facilities which are proposing an expansion or have been shown by enforcement action to be operating in an environmentally unsound manner will be required to be environmentally upgraded in accordance with the applicable engineering design requirements on a case-by-case basis. Given the wide array of facility designs and the associated environmental impacts the case-by-case review of existing facilities approach ensures that these facilities will be designed with state-of-the-art technology and operated in the most environmentally sound manner.

2. 7:26-2B.4 Additional Engineering Requirements for Thermal  
Destruction Facilities

A. 26-2B.4(a) Engineering design submission requirements

This subsection establishes additional engineering submission requirements for thermal destruction facilities. With these engineering design submission requirements and those required by N.J.A.C. 7:26-2.10 the Department will be able determine the feasibility of the design and to evaluate its potential environmental impact.

N.J.A.C. 7:26-2B.4(a)1 through 6 require the submission of the design data for solid waste handling, storage and processing capacity. Further they requires that the procedures for handling the bypass waste and residues be delineated. This data will be used to assess the systems ability to handle the permitted waste flow under normal, peak and down time conditions.

Paragraph 7 requires the applicant to provide documentation of secured disposal sites for all waste generated. The operation of a thermal destruction facility cannot be environmentally sound without provisions for disposal of the residuals and by-pass materials.

Paragraph 9 requires detailed engineering specifications for all processing, control and monitoring equipment. This information will be used to assess the systems capabilities to handle and process all permitted waste flow and to ensure that the design can meet all environmental standards.

Paragraph 14 requires the submission of a waste supply analysis program which characterizes the composition of the waste flow to the facility. This data will be used to assess the design to ensure that the facility is sized

properly. The composition data will be used to evaluate the design combustion efficiency, the degree of emission control equipment needed, the energy production and material recovery capabilities.

Paragraph 15 requires the submission of material and energy balances. These balances will be used to evaluate anticipated emissions, combustion efficiencies and energy production rates. Further this evaluation will be used to assess if there is sufficient redundancy of the systems and excess capacity are available within the systems to allow for an uninterrupted flow of waste through the system.

Additionally, this subsection requires that a safety plan, a training and staffing plan, an emergency contingency plan and a community relations plan be submitted. These plans put major emphasis on the operational aspects of the facility and the facility operator's ability, with properly trained staffing, to control and abate environmental nuisances and to prevent environmentally unsound conditions from occurring at the facility. Due to the critical nature of the operations the Department is requiring that properly trained and supervised staff be on-site at all times and is requiring the operator to plan for emergencies and to have trained staff who can respond effectively to such emergencies.

B. 7:26-2B.4(b) Engineering Design Requirements for Thermal Destruction Facilities

Paragraph 1 requires the facility to be designed to allow for control of the rate of air feed and temperature of burn in the combustion chamber. These controls are needed to ensure the proper and complete combustion of solid waste within the facility, to minimize air contaminant generation and to maximize combustion efficiencies.

The Department recognizes the potential for back fires to occur from the incineration chamber into the feed hopper. Therefore, N.J.A.C. 7:26-2B.4(b)3 requires the proper design and construction of a preventive system to mitigate this potential problem.

Paragraph 12 requires that the steam condensing system servicing a boiler be designed to condense the maximum design output of the boiler without energy extraction. This design allows the facility to receive and process waste at the full rate with the energy production system down and maximizes the uninterrupted flow of waste to the facility.

Paragraph 13 requires that the feedwater system be designed with the ability to deliver 100 percent of the feedwater needed for maximum operation. This requirement allows the facility to receive and process waste at the full rate without the condensing system and maximizes the uninterrupted flow of waste to the facility.

Paragraph 17 requires that the facility be designed to maintained negative pressure within the facility in regards to the ambient atmosphere and that the controlled air flow of this system be directed to the combustion chamber. This requirement will serve to control odors and dust

associated with the facility's operation and prevents any off-site migration of odors and dust.

Paragraph 29 requires that, where feasible, automatic process controls be included within the subsystems of the facility. In addition such instrumentation and monitoring control equipment must be equipped with manual override controls. The process and monitoring controls should be automated to reduce the possibility of human error and provide for a uniformity of operations and response. However, it may be necessary to manually override the systems to provide for a more timely adjustment or to respond to a malfunction. Process controls must be readily accessible and highly visible to ensure proper monitoring and maintenance.

Paragraph 30 requires the installation of a remote telemetry system. The installation of this system within the central control monitoring system will allow the Department to receive pertinent monitoring and operational information on a real time basis and to respond in a more efficient and effective manner.

Paragraph 32 requires that the facility be designed so as not to place demands on the infrastructure of the area beyond the capability of the infrastructure to accept such demands. If the infrastructure or any segment of the infrastructure cannot accept the proposed facility's demands the applicant must submit expansion plans and implementation schedules demonstrating how and when the infrastructure will be developed to provide for the additional demand of the facility prior to operations.

Paragraph 33 requires that all facilities be designed with an auxiliary power system capable of supplying energy to the facility during power outages. A power loss during operations can result in damage to the combustion systems and the uncontrolled release of emissions. Therefore, the auxiliary power system must be capable of processing the waste until the facility can be brought into a controlled shutdown.

3. 7:26-2B.5 Additional Engineering Design Requirements for Transfer Stations and Materials Recovery Facilities

This section will establish additional engineering submission requirements for transfer stations and materials recovery facilities. The additional engineering submission requirements will allow the Department to determine if the facility has been properly designed and to evaluate its environmental impacts.

Since the requirements of this section are generally accepted design parameters with the industry and have been successfully implemented by the Department during the review of permit applications, the Department is not providing any further basis for proposed requirements in this section. However, the Department welcomes comments on the requirements and will respond to such comments in the response document to the proposal.

4. 7:26-2B.6 Additional Engineering Requirements for Composting and Co-composting Facilities

The reason for the additional requirements in this section is to allow the Department to evaluate whether the facility can adequately compost the particular waste proposed for the facility and whether the facility can mitigate all operational impacts. Further it will serve to clarify the joint regulatory responsibilities of the Division of Waste Management and the Division of Water Resources for permitting co-composting facilities.

5. 7:26-2B.8 Additional Operational Requirement for Thermal Destruction Facilities

This section establishes the minimum requirements for the operation, maintenance, inspection and monitoring of thermal destruction facilities. The requirements cover the operations of the broad range of the state-of-the-art technologies included within thermal destruction facilities. The requirements of this section, if properly implemented will ensure the environmentally sound operation of thermal destruction facilities.

Subsection (b) requires that a New Jersey licensed professional engineer be available on-site for all major phases of construction to supervise construction and to certify that the facility has been constructed in accordance with the approved plans and the permit. This requirement is being included because the proper construction of the facility is critical to ensuring the proper operation of the facility.

Subsection (c) requires that prior to operation the facility be tested and that the applicant demonstrate that the facility will be operated in accordance with the approved plans and permit conditions. This subsection will ensure that the facility is capable of proper operations prior to start-up of the facility.

Subsection (d) establishes the inspection program which must be implemented by the facility. The Department recognizes that equipment malfunction or deterioration could occur which would result in a loss of waste processing capability and the potential for environmentally unsound operations. Therefore, the Department is requiring that the facility operator routinely inspect such equipment to prevent such occurrences. A planned program of inspection and preventive maintenance will serve to minimize equipment malfunctions and maximize on-line availability for the receipt and processing of waste.

In addition to routine inspections of the facility's equipment subsection (f) requires the inspection of the incoming waste stream to ensure that only permitted waste type are accepted for disposal at the facility. In this manner the Department can be assured that unauthorized waste types which may cause damage to the combustion systems or cause the uncontrolled release of emissions will not be processed by the facility.

Subsection (e) sets forth the Department's right to station an inspector at the facility 24-hours a day and the facility's duty to provide the inspector with office space and access to the monitoring equipment.

Subsection (h) requires that waste disposal options be established and maintained throughout the life of the facility for the facility's by-pass waste and residuals. Environmentally sound operations at these facilities can not be assured without disposal arrangements for the by-pass waste and residuals.

Subsections (l) through (r) require the storage, sampling, analysis, classification and appropriate disposal of the facility's ash. These requirements will ensure the safe disposal of the facility's ash. In addition, subsection (l) requires the storage of waste residues in containment vessels in order to prevent spillage and leakage to the environment.

Subsections (t) and (u) require the proper staffing and training of all facility operational personnel and require that a supervisor be present on each shift. Additionally subsection (v) delineates the procedures to be followed in responding to an emergency. Proper training of the staff in regards to day to day operations and in responding to emergencies is the only way to ensure an environmentally sound operation at the facility. These requirements will ensure that this training occurs.

## VIII ECONOMIC IMPACTS

### 1. Sanitary Landfill Costs

In developing the economic impacts of the proposed regulations a number of assumptions in regards to constructing and operating a proposed facility must be made in order to evaluate the costs of design, construction, operations, maintenance and closure of a sanitary landfill. The major factors which must be considered include the following:

- A. The location of the site in regards to environmentally sensitive areas;
- B. The geology of the site;
- C. The type of liner system to be constructed;
- D. The area of the facility;
- E. The volume and final elevations of the facility; and
- F. The construction time-frames.

To understand the economics involved the Department has estimated the cost of designing and constructing the following hypothetical sanitary landfill:

- A. The landfill activities will cover 100 acres with a 3:1 width to length ratio;
- B. The landfill will employ a 300 foot set back and buffer area;
- C. The total depth of the sanitary landfill will be 100 feet consisting of 10 feet below grade and 90 feet above grade;
- D. The slopes of the final elevation will meet the requirements set forth in N.J.A.C. 7:26-2A.7(i);
- E. The sanitary landfill will be located within a geologic formation with a hydraulic conductivity equal to or less than  $1 \times 10^{-6}$  cm/sec;
- F. The sanitary landfill will not impact or encroach on any environmentally sensitive area as set forth at N.J.A.C. 7:26-2A.6(g);
- G. The liner will consists of three feet of clay at  $1 \times 10^{-7}$  cm/sec;
- H. The leachate collection system will meet the requirements set forth in N.J.A.C. 7:26-2A.7(d);

- I. The surface drainage system will meet the requirements set forth in N.J.A.C. 7:26-2A.7(g);
- J. The capping system will meet the requirements set forth in N.J.A.C. 7:26-2A.7(i);
- K. The leachate treatment and disposal system will be an on-site system;
- L. The excavated soils will not be used as liner material, drainage material or cover;
- M. No revenues will be generated from the construction of the landfill such as selling the soil from the excavation, clearing of the site or mining of landfill gases;
- N. Two full shifts will be used for construction to meet an accelerated construction time-frame;
- O. Construction will occur from March to November;
- P. Prices include overhead and profit;
- Q. Equipment used for construction will all be rentals;
- R. The sanitary landfill will have a 10-year life;
- S. The cover material is equal to 13% of the total volume;
- T. There will be a 2:1 compaction ratio of in truck densities to in-place densities of solid waste and;
- U. There will be a 1200 pound/cubic yard in-place density for solid waste.

The Department has developed the costs for construction and operation and maintenance from the following:

- A. 1984 Means Site Work Cost Data, 3rd Annual Edition;
- B. The Division's engineering staff estimates from existing facilities; and
- C. The Board of Public Utility's staff estimates from existing facilities.

The costs include the following:

	<u>Capital Cost</u>
<u>Item</u>	<u>Cost</u>
A. Purchase of land	\$2,500,000
B. Clearing	200,000
C. Subgrade excavation	3,000,000
D. Subgrade preparation	650,000
E. Clay liner system	10,000,000
F. Leachate collection system	2,000,000
G. Leachate treatment system	3,000,000
H. Surface drainage system	3,500,000
I. Gas collection/venting system	1,000,000
J. Capping system	8,000,000
K. Fencing	250,000
L. Scale	250,000
M. Soil Testing	200,000
N. Borings and Wells	100,000
O. Surveying	50,000
P. Inspection	100,000
Q. Engineering, permits and legal fees	1,000,000
R. Contingencies	2,000,000
S. Clean-up	<u>200,000</u>
<u>TOTAL</u>	\$38,000,000

Operational and Maintenance Cost Operations

Item	Annual Costs
A. Equipment 4 Compactors 2 Bulldozers	400,000
B. Operators (6) Supervisors (1) 2 Shifts	500,000
C. Cover	1,000,000
D. Fuel	100,000
E. Security Guards (2)	50,000
F. Mechanics (2)	50,000
G. Maintenance	600,000
H. Leachate Disposal	2,000,000
I. Monitoring	500,000

J.	Sludge Disposal	500,000
K.	Office Staff	100,000
L.	Overhead	<u>200,000</u>
	TOTAL	\$6,000,000

Closure/Post Closure

Item	Annual Cost	
A.	Cap Maintenance	50,000
B.	Leachate Disposal	300,000
C.	Maintenance	100,000
D.	Monitoring	<u>100,000</u>
	TOTAL	\$ 550,000

The capital cost, operational and maintenance costs and closure/post closure costs will result in an approximate total cost, in 1984 dollars, of \$114,500,000. If the following waste flows to the sanitary landfill are assumed :

- A. 1,000,000 ton/year
- B. 500,000 ton/year
- C. 250,000 ton/year

the following approximate tipping fees will result:

- A. \$11.45/ton
- B. \$22.90/ton
- C. \$45.80/ton

Assuming a \$22.90/ton tipping fee and given the assumptions of A through U above the sanitary landfill will receive total tipping fees revenues of \$141,309,170.

The cost estimates used above will be subject to escalation due to inflation and interest on debt servicing. However, in relative terms the relationship of the tipping fees to the construction, operations, maintenance and closure and post closure cost will remain constant.

The capital costs and the operations and maintenance costs will be dependent on the proposed sanitary landfill's location and its impact on the environment and public health. The greater the impact, the more environmentally sensitive areas encroached upon and the further removed from "good" geologic formations in which the sanitary landfill is located the higher the costs will be. These factors, the location and facility's environmental and health impacts, will have a major impact on the capital costs and indirectly the operations and maintenance costs.

For a proposed sanitary landfill located in an environmentally sensitive ground water area the costs of designing and constructing the liner and leachate collection systems could more than double in order to meet the performance standards required by N.J.A.C. 7:26-2A.6. Further, for a proposed sanitary landfill located in an environmentally sensitive surface water area the cost of designing and constructing the surface drainage system could double, in order to meet the performance standards required by N.J.A.C. 7:26-2A.6. These added costs will also increase the operations and maintenance costs for the facility and could result in a tipping fee at sanitary landfills in the \$40 per ton range.

The proposed regulations will result in an increase in the cost for the design, construction and operations of sanitary landfills. However, the cost increases are small when compared with the cost required for remedial action and clean-up of contaminated sites, as noted in Chapter 1, "Introduction", of this document, as opposed to the amount required by this proposal for the proper design, construction, operation, maintenance, closure and post-closure of a state-of-the-art sanitary landfill to ensure prevention of pollution and operations in an environmentally sound manner.

The cost for construction and tipping fees noted above are in line with the actual cost incurred by existing sanitary landfills that have either upgraded their facility or been required to environmentally upgrade the facility in order to abate an environmentally unsound condition. As examples:

Construction Cost (1984)\*

Facility	Costs
A. Edgeboro Disposal Inc. #1204A 29 Edgeboro Rd East Brunswick Twp. Middlesex County	\$7,100,000 (1979)
B. H.S.L. Inc. #1913A Old Beaver Run Road Lafayette Twp Sussex County	9,500,000
C. Monmouth County Reclamation #1336E Asbury Rd. Tinton Falls Boro Monmouth County	2,000,000
D. HMDC 1-A SLF #0907M BLK 286 Lot 33 Kearny Twp. Hudson County	4,000,000

E. Ocean County Landfill Corp. #1518B 6,000,000  
 Route 70  
 Manchester Twp  
 Ocean County

Tipping Fee (1984)\*\*  
 (1985)\*\*\*

Facility	Costs (\$/ton)
A. Edgeboro Disposal Inc. #1204A	9.29 10.12
B. HSL Inc. #1913A	6.01 19.55 (closure 12/84)
C. Monmouth County Reclamation #1336E	5.82 13.00
D. HMDC-1A SLF #0907M	13.25 (rate averaging of all HMDC facilities)
E. Ocean County Landfill Corp. #1518B	7.07 22.98

With the implementation of an integrated program of waste disposal including recycling and resource recovery facilities the cost, for design and construction of sanitary landfills could be drawn out over a longer period of time. Resource recovery and recycling will result in a reduced waste flow to sanitary landfills. As the potential waste flow to the facility is reduced, the size of the facility needed to handle the anticipated waste will be reduced, thereby reducing the capital costs for design and construction.

\*(Figures were obtained from the engineering reports of the above noted facilities within the Departments engineering files).

\*\* (Figures were obtained from the district plans on file within the Department's planning files and from tariffs filed with the Board of Public Utilities. These figures represent the tipping fees at the time of construction and do not included the additional cost caused by inflation and upgrading).

\*\*\* (Figures were obtained from the New Jersey Solid Waste Disposal Report published by the Division's Bureau of Registration and Permits Administration. These figures are the most current available and do not include the associated taxes incorporated into the tipping fee. Cubic yards to ton cost were converted by multiplying the cost per cubic yard by 3.33)

2. Thermal Destruction Facilities, Transfer Station, Material Recovery Facilities, Co-Composting and Composting Facilities Costs

The Department contracted with the Mitre Corporation (contract no B52-D-0158) to develop a report on the cost of construction, operations and maintenance at resource recovery facilities and a plan to subsidize the implementation of these facilities within the districts entitled "New Jersey Resource Recovery Financial Plan." This report is completed and is hereby incorporated by reference in this document.\* The proposed regulations are not expected to significantly increase the cost of major thermal destruction facilities. The majority of the costs for these facilities will be due to the construction of the furnaces, heat exchangers, boilers and energy generation units which would normally be implemented in these facilities. Conformance with the other engineering design and submission requirements in N.J.A.C. 7:26-2B.4(a) and (b) add a small percentage increase to these costs.

It is expected that the largest percentage increase in overall cost will be due to compliance with the operational and maintenance requirements of N.J.A.C. 7:26-2B.8. However, the precise cost evaluation is difficult to approximate since New Jersey has at present no operational resource recovery thermal destruction facilities.

\* (This report is available and may be reviewed at the New Jersey Depository Libraries)

3. Household and User Costs

Given the following tipping fees for waste disposal, the Department has estimated the following costs will be incurred by each household as a result of the proposed regulations:

		Tipping Fees		
		1984*	1987	1990**
A.	Low	7.98	11.00	30.00
B.	Average	14.04	20.00	45.00
C.	High	22.09	31.00	60.00

\*(1984 figures are based on operator tariffs filed with the Board of Public Utilities).

\*\* (1990 figures assumes resource recovery is the predominant disposal made and tipping fees are between \$20 and \$40 per ton (1984)).

Annual User Costs (1984)  
(\$/Household/Year)

	1984	1990	2000
A. Low	39.08	69.00	88.00
B. Average	69.05	118.00	151.00
C. High	174.92	150.00	179.00

These figures are from the Solid Waste Management Implementation Plan for the State of New Jersey 1984-2000.

(1984 figures are based on collector/hauler tariffs filed with the Board of Public Utilities and once/week, curbside collection with landfill disposal; more frequent and/or walk-in collection services will result in higher user costs.)

(1990 and 2000 figures assumes resource recovery is the predominant disposal made).

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## Appendix A

### SUMMARY

The Department is proposing new solid waste regulations for incorporation in N.J.A.C. 7:26. The Solid Waste Management Act (Specifically, N.J.S.A. 13:1E-6 provides the authority to establish such regulations. This multi-purpose regulatory proposal includes requirements and standards which will effectively:

1. Revises the definitions at section 1.4 to reflect changes in the proposal.
2. Reorganize subchapter 2 to reflect current policy and mandated changes.
  - A. Create new sections 2.4 and 2.5 which contains the procedures for permit application and decision-making.
  - B. Create new sections 2.6 and 2.7 which contains the procedures for permit modification, revocation and reissuance, termination, duration, renewal continuance and transfer.
  - C. Create a new section 2.9 which contains the requirements for preparing an environmental and health impact statement (EHIS).
  - D. Create an expanded baseline, sections 2.10 and 2.11, of general design and operation requirements applicable to all types of solid waste facilities.
3. Create a new subchapter 2A which contains specific performance standards, design standards and construction requirements, operational and maintenance requirements and closure and post closure core requirements for sanitary landfills.
4. Create a new subchapter 2B which contains specific design requirements for incinerators, transfer stations and resource recovery facilities and specific operational requirements for thermal destruction facilities.

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## Appendix B

### CROSS REFERENCE

#### 1. SUBCHAPTER 2 Disposal

Section 2.1 Dumps Prohibited is being replaced by the proposed section 2.1 Scope and Applicability. The replaced existing regulations can be found at the following proposed referenced provisions:

Existing	Proposed
2.1(a)	2A.4(a)
2.1(b)	2A.4(b)

Section 2.2 Registration is being replaced by the proposed Section 2.2. Construction. The replaced existing regulations can be found at the following proposed referenced provisions:

Existing	Proposed
2.2(a)	2.2(c), 2.2(e), 2.8(c), 2.8(e)
2.2(b)	2.2(e)
2.2(c)	2.2(f), 2.2(q)
2.2(d)	2.8(i), 2.8(j)
2.2(e)	2.8(h)
2.2(f)	2.8(c)
2.2(g)	2.8(d)

Section 2.3 Domestic Refuse is being replaced by the proposed Section 2.3 Purpose. The replaced existing regulations can be found at the following proposed referenced provision:

Existing	Proposed
2.3(a)	2.1(d)

Section 2.4 Submission of Engineering Design is being replaced by the proposed section 2.4 Application Procedures for a Solid Waste Facility Permit. The replaced existing regulations can be found at the following proposed referenced provisions.

Existing	Proposed
2.4(a)	2.4(a), 2.10(b)3, 2.10

Section 2.5 Sanitary Landfill Operational Requirements (General) is being replaced by the proposed Section 2.5 Public Hearing Procedures. The existing replaced regulations can be found at the following proposed referenced provisions:

Existing	Proposed
2.5(a)	2A.8(b)1, 2A.8(b)6
2.5(b)	2A.8(b)2, 2A.8(b)3
2.5(c)	2A.8(b)4
2.5(d) 1-5	2A.4(e)
2.5(d)6	2A.4(f),9
2.5(e)	2A.8(b)4
2.5(f)	2.11(b)3, 2A.8(b)22
2.5(g)	2.11(b)4, 2A.8(b)23
2.5(h)	2.11(b)5, 2A.8(b)24
2.5(i)	2A.8(b)14
2.5(j)	2A.8(b)17
2.5(k)	2.11(b)7, 2A.8(h)36
2.5(l)	2.11(b)8, 2A.8(b)26
2.5(m)	2A.8(b)7,8
2.5(n)	2A.8(b)9
2.5(o)	2A.8(b)10
2.5(p)	2A.8(b)13
2.5(q)	2A.8(b)10
2.5(r)	2A.8(b)12
2.5(s)	2.11(b)9
2.5(t)	2.11(b)10
2.5(u)	2A.4(q), 2A.4(o), 2A.7(c), 2A.7(h)
2.5(v)	2A.4(p)i 2A.7(h) 7:14A-6.16
2.5(w)	2A.4(l), 2A.4(m)
2.5(x)	2A.4(m)
2.5(y)	2A.8(i)
2.5(z)	2.11(b)12

Section 2.6 Sanitary Landfill Operational Requirements (specified) is being replaced by the proposed Section 2.6 Procedures and Grounds for Modification, Revocation and Reissuance and Termination of a Solid Waste Facility Permit. The replaced existing regulations can be found at the following proposed referenced provisions:

Existing	Proposed
2.6(a)	2A.1(d), 2A.4(p), 2A.4(s)
2.6(b)	2A.8(b)2, 2A.8(b)6
2.6(c)	2A.4(s)
2.6(d)	2A.4(s), 2A.4(p), 2A.4(q)
2.6(e)	2A.4(s), 2A.7

Section 2.7 Disrupted Landfill Requirements is being replaced by the proposed Section 2.7 Duration of the Permit, Permit Renewal Requirements, Continuation of an Existing Permit, and Transfer Pre-approval of an Existing Permit. The existing replaced regulations can be found at the following proposed referenced provisions.

Existing	Proposed
2.7(a)	2A.8(j)1
2.7(b)	2A.8(j)2
2.7(c)	2A.8(j)3
2.7(d)	2A.8(j)4
2.7(e)	2A.8(j)5

Section 2.8 Smoking, Smoldering or Burning Landfill is being replaced by the proposed Section 2.8 Registration and General Prohibitions. The existing replaced regulations can be found at the following proposed referenced provisions.

Existing	Proposed
2.8(a)	2A.8(k)1
2.8(b)	2A.8(k)2
2.8(c)	2A.8(k)3
2.8(d)	2A.8(k)4
2.8(e)	2A.8(k)5
2.8(f)	2A.8(k)6
2.8(g)	not proposed

Section 2.9 Closure and Post-Closure Care of Sanitary Landfills is being replaced by the proposed Section 2.9 Environmental and Health Impact Statement Requirements. The replaced existing regulations can be found at the proposed 2A.9 in whole.

Section 2.10 (Reserved) is being replaced by the proposed Section 2.10 General Engineering Design Requirements

Section 2.11 General Operational Requirements for Incinerators, Transfer Stations, Processing Facility and Resource Recovery Facilities is being replaced by the proposed section 2.11 General Operational Requirements. The existing replaced regulations can be found at the following proposed referenced provisions:

Existing	Proposed
2.11(a)	2.11(b)1
2.11(b)	2.11(b)2
2.11(c)	2.11(b)3
2.11(d)	2.11(b)4
2.11(e)	2.11(b)5
2.11(f)	2.11(b)6
2.11(g)	2.11(b)7
2.11(h)	2.11(b)8
2.11(i)	2.11(b)9
2.11(j)	2.11(b)10
2.11(m)	2.11(b)12
2.11(n)	2A.4(s)

Section 2.12 Guidelines and Criteria for the Preparation of Engineering Designs is being replaced and (Reserved). The existing replaced regulations can be found at the following proposed referened provisions:

Existing	Proposed
2.12(a)	2.10
2.12(a)1	2.10(b)1
2.12(a)2	2.10(b)2
2.12(a)3	2.10(b)3
2.12(a)4	2.10(b)4
2.12(a)5	2.10(b)6i
2.12(a)6	2.10(b)5iv
2.12(a)7	2.10(b)6ii
2.12(a)8	2.10(b)4iv
2.12(b)	2A.5
2.12(b)1	2.10(b)6ii, iii, 2A.5(a)2ii
2.12(b)2	2.10(b)6
2.12(b)3	2A.5(a)2i
2.12(b)4	2A.5(a)6vi
2.12(b)5	2A.5(a)6vi(5)
2.12(b)6	2A.5(a)6vi (8)
2.12(b)7	2.10(b)4, 2A.5(a) 6iv, 2A.5(a)6ix
2.12(b)8	2A.5(a)1ii
2.12(b)9	2.10(b)5i
2.12(b)10	2.10(b)6iv, 2A.5(a)3iv 2A.5(a)4xii
2.12(b)11	2A.5(a)3iii, 2A.5(a) 4iii-ix
2.12(b)12	2A.6(i)4
2.12(b)13	2A.5(a)3ii, 2A.5(a)4i
2.12(b)14	2A.5(a)3, 2A.5(a)4 2A.7(b)4xi
2.12(b)15	2.10(b)11
2.12(b)16	2A.5(a)3v, 2A.5(a)4x
2.12(b)17	2A.5(a)2iii
2.12(b)18	2A.5(a)5iii
2.12(b)19	2.4(c), 2.8
2.12(b)20	2.4(c), 2.9
2.12(b)21	2.9(c)7
2.12(b)22	2A.9
2.12(c)	2B.4
2.12(c)1	2B.4(a)1
2.12(c)2	2B.4(a)2
2.12(c)3	2B.4(a)3
2.12(c)4	2B.4(a)4
2.12(c)5	2B.4(a)5
2.12(c)6	210(b)9
2.12(c)7	2B.4(a)6
2.12(c)8	2B.4(a)7
2.12(c)9	2B.4(a)8

2.12(d)	2B.5
2.12(d)	2.4(c)
2.12(d)2	2.10(b)8
2.12(d)3	2.10(b)6
2.12(d)4	2.10(b)6iv
2.12(d)5	2.10(b)9
2.12(d)6	2.10(b)8i
2.12(d)7	2.10(b)8iii
2.12(d)8	2.10(b)8iv
2.12(d)9	2.10(b)8iv
2.12(d)10	2.10(b)9iv
2.12(d)11	2.10(b)9vii
2.12(d)12	2.10(b)9i
2.12(d)13	2B.5(e)
2.12(d)14	
2.12(d)15	2.10(b)3
2.12(e)	

Section 2.13 Sanitary Landfill Resource Recovery Facilities including Material Recovery Facilities and Transfer Station; Records will remain without change. Section 2.14 Applicability is being replaced by the proposed Section 2.14 (Reserved). The existing replaced regulations can be found at the following proposed referenced provisions.

Existing	Proposed
2.14(a)	2.1(b)