

**SOLID WASTE DISPOSAL FACILITY OPERATOR
STUDY GUIDE**

**For
FACILITY MANAGER CERTIFICATION**

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WASTE AND MATERIAL MANAGEMENT
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PREFACE

This STUDY GUIDE represents an effort on behalf of the Department to assist those seeking certification as Solid Waste Disposal Facility Managers. The material contained in the study guide should be used as a supplement to Wisconsin Administrative Codes NR 500 - 590, especially 502, 503, 504, 506, 507, 516 and 524, and other sources of information (e.g., landfill related books and other informational publications).

PURPOSE

This STUDY GUIDE contains the minimum basic information a candidate for the Solid Waste Disposal Facility Manager certification examination needs to know. The information contained in the study guide may not be sufficient to pass the certification examination. Every certified Facility Manager shall have sufficient knowledge regarding landfill design and construction, operation and maintenance, monitoring and reporting, health and safety issues, and heavy equipment management to safeguard the environment and public health and welfare.

Types of Landfills & Certification

There are primarily two types of Landfills; Natural Attenuation type and Engineered or Containment type. Natural Attenuation landfills do not have a liner where as engineered landfills have a liner. Wisconsin administrative code allows another type of engineered landfill, known as Zone –of- Saturation landfills. Although the base of all types of landfills is required to be 10 feet above seasonal high groundwater, base of Zone – of – Saturation landfills is allowed below groundwater table. Zone of – Saturation landfills are located in fine-grained environment. All detected granular or silty soils within 5 feet below base are to be removed and replaced with compacted fine-grained soil. Small construction and demolition landfills are natural attenuation type landfills; all other landfills are engineered.

In Wisconsin, based on waste type, landfills are divided into three categories: Construction and Demolition (C&D), Municipal, and High Volume Industrial waste. Based on waste volume, C&D landfills are subdivided into two categories: small (waste volume, up to 50,000 cubic yards) and intermediate (waste volume: more than 50,000 cubic yards but no more than 250,000 cubic yards). C&D waste typically consists of concrete, bricks, bituminous concrete, wood, glass, masonry, roofing, siding and plaster, alone or in combinations. However, waste paint, solvents, sealers, adhesives and similar materials are not considered as C&D waste. All non-hazardous landfills are regulated under subtitle D of the Resource Recovery and Conservation Act issued by the U.S. government.

A certified site operator must be present during hours of operation at all types of landfills except high volume industrial waste landfills. Non-certified site operators may run high volume industrial waste landfills provided they have landfill design and operation related knowledge as required by NR 524, Wisconsin Administrative Code. Either a facility manager or a certified site operator must be present during all hours of operation in landfills except in small C&D and high volume industrial waste landfills. For all types of landfills where the presence of facility manager or operator is required during hours of operation, if a facility manager is not present at a landfill during hours of operation, then a designated person, who must be able to be contacted by landfill personnel during 75% of the hours of operation, must be present within 50 miles of the landfill. The above provision is allowed only if no violation has been issued against the landfill during the previous three years. For high volume industrial waste, a facility manager need not be present during all hours of operation but must visit the landfill at least once a week during active hours of operation. A facility manager certificate issued by Wisconsin Department of Natural Resources (DNR) is valid for 2 years. To renew a certificate, facility managers must complete 8 hours of continuing education training in solid or hazardous waste management related subjects.

Landfill Design and Construction

New landfills (except C&D landfills) may not be sited within specified distances of the following: navigable lake, pond or flowage; river and stream; flood plain; state or federal

highways; and airports. For details regarding the locational criteria refer to s. NR 504.04(3), Wisconsin Administrative Code.

Although a natural attenuation landfill has no liner at the base, a final cover is required for this landfill type. The final cover for these landfills are constructed with two feet of compacted fine grained soil sloped enough to allow storm water run off.

All engineered landfill are constructed with a base liner and a leachate collection system. The primary purpose of the liner is to prevent groundwater pollution. The liner may consist of clay only or be a combination of geomembrane and clay (known as composite liner). The liner is constructed with at least a 2% slope towards the leachate collection lines to direct leachate to a collection system. The leachate collection system helps withdraw leachate from a landfill and thus helps prevent groundwater pollution. The leachate collection lines in each phase are sloped towards the perimeter because it is easier to collect and withdraw leachate from the perimeter. In clay lined landfills, leachate transfer lines may penetrate the liner on the berm horizontally. An antiseep collar is placed around the transfer line penetrating the liner. In composite lined landfills, leachate is withdrawn using side slope risers. The minimum thickness of a clay liner is 5 feet except in intermediate C&D landfills where 3 feet is allowed. In a composite liner, a 60 mils or thicker geomembrane is placed directly over a 4 foot thick clay layer. Composite liners are required for all new municipal waste landfills.

Based on TCLP (Toxicity Characteristic Leaching Procedure) testing, municipal solid waste combustor residue is most likely to be identified as hazardous waste. The residue is disposed in composite lined monofill cells. However, if the residue exceed allowable concentration limits of certain chemicals, a double composite lined monofill cell with two separate leachate collection system is necessary.

Fine grained soil per the Unified Soil Classification System (USCS) is used for clay liner construction. According to USCS a soil is termed as fine grained soil if minimum of 50% by weight pass through 200 sieve. In addition the clay used for liners, must have a saturated hydraulic conductivity of 1×10^{-7} cm/sec or less after compaction, an average liquid limit of 25 or greater with no values less than 20, and an average plasticity index of 12 or greater with no values less than 10. The clay liner must be protected from freeze – thaw damage during winter months, because freezing and thawing increases permeability of the clay. While constructing clay liners, clods larger than 4 inches should be broken up and the compacted layers must not be

greater than six inches in thickness. The clay must be compacted at or more of wet of optimum moisture content using sheep's foot roller. The following tests are required for clay liner and final cover clay layer: dry density and as-placed moisture content, grain size analysis up to .002 millimeter particle size, Atterberg limits, and hydraulic conductivity of field samples.

The geomembrane in composite liner and final cover must be tested for the following: thickness, tensile properties, density, melt index of the polymer, and environmental stress. The following 'after installation' tests of the geomembrane liner are necessary to ensure proper installation: non-destructive and destructive field test of geomembrane panel seams, field and laboratory shear and peel tests of geomembrane seams, and leak location survey.

A granular drainage blanket made of sand or gravel is placed over the liner. The minimum allowable saturated hydraulic conductivity of the leachate collection blanket is 1×10^{-2} cm/sec for non-municipal waste landfills and 1 cm/sec for municipal waste landfills.

The final cover on engineered landfills, except low strength sludge landfills, consists of a six inch grading layer, a two foot thick clay capping layer, a minimum of two and a half foot drainage and rooting zone layer, a one foot drainage layer, and a six inch top soil layer. If the landfill has a composite liner, then the final cover must also include a geomembrane placed directly over the clay capping layer. The top soil layer is vegetated to reduce the amount of precipitation entering the waste. The amount of infiltration through the final cover is influenced by final cover surface grade, permeability of the capping layer, amount of precipitation on the final cover and quality of the vegetative cover.

Two other types of cover are used in landfills: intermediate cover and daily cover. Intermediate cover must be constructed over areas below final grade that are not going to receive waste for six months or more. If soil is used as daily cover, then it must be six inches thick. Materials other than soil may be used as daily cover. The benefits of using synthetic textile daily cover are: savings in airspace, easy installation, use of one textile piece for several days and lower cost.

Surface erosion must be minimized during landfill construction and also in active and closed landfills. Establishing thick and healthy vegetation is key to minimize erosion. Drainage swales and berms on and around landfills are constructed to divert surface water run off properly. Drainage swales are lined with a minimum of two foot clay. Properly designed surface water control helps to reduce leachate production and soil erosion. Sedimentation basins are

constructed to trap eroded soil and thus help to reduce surface water pollution. Drainage ditches, berms around landfills, and sedimentation basins are important for surface water control at landfills. The difference between erosion control and sediment control is – erosion control prevents or minimizes erosion, while sediment control is the trapping of eroded soil particles.

Precipitation (rain and water from ice melt) is the primary source of leachate formation in landfills. If the landfill base is below the water table, then water may enter the landfill through the base liner. The water already present in the waste, also known as moisture content, generates leachate. If proper surface water control structures are not constructed, then surface water will enter a landfill causing leachate generation. In summary, the quantity of leachate generated in a landfill depends on the amount of precipitation falling on the landfill, moisture content of the waste, the groundwater and surface water entering a landfill.

Biological activities within a landfill lead to the generation of gas. The quality, quantity, and chemical characteristics of landfill gas are primarily function of the type of solid waste placed in landfills. Mainly methane and carbon dioxide gases are generated in municipal and paper mill sludge landfills. Landfill gas may also contain several other gases, like nitrogen, oxygen, hydrogen sulfide, and hazardous air contaminants. In general, an active gas extraction system (that uses pumps or blowers to remove gas) is required for all big municipal waste landfills. Passive gas vents (that do not use pumps or blower) are installed in some C&D, and paper mill sludge landfills where the gas generation is relatively low. The maintenance of passive gas vents include periodic visual examination to assure that it has not been plugged or damaged. The maintenance of active gas venting system is more complicated.

Landfill operation and maintenance

Proper operation of a landfill is essential to minimize odor, noise, insect and rodent problems, wind blown paper, and dust. While operating a landfill, it is also essential to address concerns regarding surface water and air emission. Odor from a municipal landfill can be minimized by using daily cover, proper collection and treatment of landfill gas, and correcting leachate seeps. If clay soil is used for daily cover, then the daily cover must be scarified or removed before placing the next lift of waste. To control dust in ash or foundry sand landfills, waste should be dumped in areas sheltered out of wind, constructing paved or graveled roads

inside landfills, and by not disturbing crusted compacted waste. Unstable waste slope is a problem in sludge landfills.

Slope stability of sludge landfills may be improved by disposing low moisture sludge with a low waste slope. Knowing how to determine the elevation or grade is essential to know whether an active landfill area is close to the grade for which the landfill has been designed. Materials containing friable asbestos containing materials must be covered with three feet of waste after disposal and the disposal location must be recorded. Every precaution must be taken to prevent a landfill fire. In most cases landfill fires are started by hot waste loads.

A landfill must be secured properly using fences, gates or other physical barrier. Surveillance of site visitors and site users is needed for site security and to prevent dumping of unauthorized materials.

Leachate lines must be cleaned with a high pressure water jet immediately after construction and annually thereafter. Eroded landfill surface areas must be repaired immediately to prevent erosion from spreading. An effective maintenance program for landfill structures and equipment minimizes costly repairs.

Although waste oil, yard waste, lead acid batteries, major appliances, infectious waste, and recyclable plastics are not allowed to be disposed in landfills, household hazardous waste may be disposed in Wisconsin landfills. In Wisconsin sharps are regarded as infectious waste. Sharps must be disinfected and rendered non-usable before disposal in a landfill. The following wastes are considered as universal waste: Cathode Ray Tubes, Mercury containing lamps, dry cell batteries, waste oil, and certain pesticides. Universal waste may not be disposed in landfills, except from individual households.

Random load inspections must be done in all municipal waste landfills. The following items must be recorded during a random load inspection: the date and time the load for inspection was received, the name of the waste hauling firm, the name of the driver and the license plate number, Wisconsin solid waste transporter license number, the community or communities in which the solid waste was generated, the waste type (i.e. commercial, industrial, residential or a combined load), name of the manager or site operator inspecting the load, and comments regarding the inspection.

All landfills should have a contingency plan for injuries, illness, and spills and releases. All spills and releases must be reported to DNR immediately.

Monitoring and Reporting

Required monitoring program for a landfill is included in department approvals. In general, the following items may need to be monitored: groundwater, surface water, leachate, ambient air, landfill settlement, stability of berm, side slope and final cover, structures related to surface water control and gradient control, and vegetative growth.

A good monitoring well design include, installation of the well at proper depth below groundwater table, proper screen, pipe and casing design, protective cover pipe and cap lock, surface seal of concrete or bentonite sloped away from the well, and a label identifying the well (e.g., well number). A good knowledge about monitoring of groundwater and other items is essential for proper management of a landfill. While collecting groundwater samples, the following items must be checked at a minimum: the condition of the protective casing and lock cover, condition of the concrete or bentonite ground surface seal, and damage of the protective casing, if any. While groundwater sampling wells are installed to monitor quality of groundwater in vicinity of the landfill site, lysimeters are installed to monitor liner leakage. Leachate head wells are needed to monitor leachate head within a landfill. Monitoring of leachate head within a landfill is important because excessive leachate head over the liner increases the possibility of liner leakage.

The remaining capacity of a landfill and total amount of waste the landfill received in the previous year must be recorded and may need to be reported to the department annually.

Health and Safety, and Employee Training

Health and safety rules must be followed by all landfill personnel working in a landfill, irrespective of whether he/she is a supervisor or site operator. All employees must have a good understanding of the health and safety rules. To prevent accident, public access to the landfill working face must be restricted. In addition, the following practices are essential for accident prevention: regular and effective training of landfill personnel, use of personal protective

equipment where appropriate and observing Occupational Safety and Health Administration (OSHA) requirements such as confined space entry guidance. Examples of confined space in landfills include leachate storage tank man-way, five feet or deeper trench within or outside of a landfill, manholes within or outside of landfills. Concentration of oxygen, methane, and hydrogen sulfide within a confined space must be checked before entering it. Special care should be taken while handling friable asbestos because airborne asbestos particles pose a significant health risk. Friable asbestos containing materials must not be burned because such burning causes release of asbestos fibers into the air.

Although burns and vehicle accidents occur in landfills, the most common causes of injuries in landfills are slips, trips and falls. In addition, the following health and safety problems are usually associated with landfill operation: long-term exposure to loud equipment noise, hypothermia (lowing of the body temperature due to exposure to cold weather), frostbite, heat exhaustion and heat stroke.

Heavy equipment management

Heavy equipment is used to perform tasks at a landfill such as waste compaction, maintenance of roadways inside and outside of landfills, spreading of daily cover. It is essential to have a good working knowledge about operation and maintenance of this equipment. An effective maintenance program consists of start-up checks, shutdown procedures, record keeping of equipment performance, and routine maintenance. Usually a pre-operating checklist consists of checking fluid levels, checking radiator screen and air filters for clogging, and checking tracks for wear, damage or freezing. Pre-operating check out, attention to gauges and warning lights, and record keeping are all part of maintenance program for heavy equipment.