Industrial Landfill Guidance
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I. Introduction
A. Background
During its 2008 session, the Minnesota Legislature assigned the Minnesota Pollution Control Agency (MPCA) to facilitate a Work Group to report to the Legislature on the land management of construction and demolition (C&D) and industrial wastes. The Work Group submitted its report to the Legislature, titled “Report to Minnesota Legislature on Management of Industrial Solid Waste and Construction and Demolition Debris in Land Disposal Facilities” (Report), on January 15, 2009.

As described in the Report, “The Work Group feels the current mix of statutes, rules, and policies with respect to industrial landfills are disjointed. The MPCA should develop a comprehensive risk-based policy addressing industrial waste management. Such a policy would ensure that regulations pertaining to the permitting and design of facilities accepting industrial waste will be clear, easily identifiable, and—most importantly—environmentally protective”.

B. Purpose
The Work Group recommended that the MPCA should develop an Industrial Waste Guidance document (Guidance) that sets forth a comprehensive risk-based approach to industrial waste management. The Report also suggested clarification on post-closure care regulations, and established regulations for terminating post-closure care obligations for all landfills, including C&D and industrial landfills.

The purpose of this Guidance is to provide improved consistency and predictability in how the MPCA, counties, facility owners, and facility operators manage industrial landfills under the existing solid waste management rules. This Guidance will be applied to all new and existing industrial landfills in accordance with the implementation plan included in Appendix C.

[PCA to meet offline with merchant landfill O/Os to help identify equitability issues. While the agency believes that much of this Guidance has universal applicability to industrial landfills, there are issues that are unique to the interests of merchant industrial landfills (mostly around ISWMPs) that the agency has agreed to address in a future Guidance revision that involves a different group of stakeholders. Below are two language proposals intended to help address this in the current Guidance reflecting the views of the agency and of the merchant industrials:

Neal Wilson proposal: “Additional consideration needs to be given to issues relating to industrial waste going to mixed municipal landfills, and Class 3 demolition landfills. These issues are however out of the scope of this document.”

Ryan O’Gara proposal: “The Work Group and MPCA agreed that industrial waste management issues at merchant facilities (merchant industrial, MMSW, and C&D landfills) will be addressed in a separate process after the required rulemaking. At that time, the MPCA will provide due process to interested parties and will appropriately update this guidance document. This guidance document will not apply to merchant industrial, MMSW, and C&D landfills until the separate process is completed and any resulting changes have been incorporated into this guidance document.”

(cj#288)
The MPCA plans to resolve differences between these proposals.

C. Developing and integrating landfill siting factors
The Report recommended that permitting and regulation of industrial landfills should be based around three key factors (i.e. “the three legged-stool” for landfill siting)

- Local site and siting characteristics (e.g., hydrogeologic characteristics);
- Waste types accepted (using a risk-based evaluation of waste toxicity characteristics);
  and
- Engineered controls (e.g., landfill liners and caps).

Development and subsequent integration of these interrelated criteria is currently underway. One of the three factors, geologic sensitivity, needs to go through the rule-making process before specific applications to the other two factors can be integrated more fully into the landfill siting process.

D. Beneficial use
Minnesota law 115A.02 describes a hierarchy for various solid waste management practices. To the extent practicable, solid waste is to be managed as high on the hierarchy as possible. The waste management practices listed in the statute, in order of preference, are:

- waste reduction and reuse
- waste recycling
- composting of yard waste and food waste
- resource recovery through composting or incineration and
- land disposal

Is this limited to integrated O/O’s? Should apply to 17 captives not the 3 merchants.

In 2004, the MPCA promulgated Minn. R. 7035.2860, which outlined the requirements for the beneficial use of solid waste. The rules provide a means for obtaining approval to utilize waste materials that can provide a beneficial service in either engineering application or agronomic application. Currently there are seventeen pre-approved standing beneficial use determinations for industrial by-products (see [http://www.pca.state.mn.us/waste/swutil-sbud.html](http://www.pca.state.mn.us/waste/swutil-sbud.html)).

II. Facility Classification and Landfill Types

A. Facility classification
Industrial waste is defined in Minn. R. 7035.0300, subp. 45, as follows:
“Industrial solid waste” means all solid waste generated from an industrial or manufacturing process and solid waste generated from non-manufacturing activities such as service and
commercial establishments. Industrial solid waste does not include office materials, restaurant and food preparation waste, discarded machinery, demolition debris, municipal solid waste combustor ash, or household refuse.

In Minnesota, there are (about twenty itemize – table as appendix F; commentary not really guidance; provides context) industrial solid waste landfills. Each of these industrial landfill types may accept different waste types with differing physical and chemical characteristics that need to be accounted for in terms of siting and engineered controls.

B. Types of industrial landfills
The following definitions of industrial landfill types were included in the Report:

- An industrial monofill is a land disposal facility permitted and designed to receive a uniform and well-defined non-hazardous solid waste stream. Examples may include coal ash, mining debris, or industrial manufacture process wastes.

- A private on-site demo-like industrial landfill is a land disposal facility that is owned and operated for the sole purpose of the disposal of non-process solid wastes generated by the owner or owner’s affiliate.

- A merchant landfill is a land disposal facility that accepts solid waste for disposal from any entity that is willing to pay its tipping fee, and has wastes that meet its criteria of acceptance. Examples would include C&D, industrial, and mixed municipal solid waste (MMSW) landfills. [Note that a captive LF can move into this category if it applies for a permit modification.] Jim C

These definitions are useful for addressing requirements that are specific to the landfill type.

III. Location Standards and Industrial Solid Waste Management Plans
A. Industrial landfill rules
The following are current rules that apply to industrial landfills:

1. Minn. R. 7035.1590: The agency's approval or disapproval of the owner's or operator's determination will be based on the hydrogeologic setting, waste characteristics, fill size, soil conditions, operating practices, and the potential for harm to human health or the environment. The interpretation of this language was not fully defined in the rules.


3. Minn. R. 7035.1600, subp. G: Prohibits landfills in “an area which is unsuitable because of topography, geology, hydrology or soils”. The interpretation of this language was not fully defined in the rules, but it has generally been interpreted as a prohibition on locating landfills in areas with karst features and fractured bedrock. [clarify: is this due to monitorability, constructability, stability? PCA uses a different rule to address 7035.2815, subp. 2, siting standards. In addition, the PCA is going to apply these additional rules: /John M. predictable GW flow from MMSW rules is being applied. Airport standard may not apply to all industrial (attractant vector). Current practice./ Gary P.]

4. Minn. R. 7035.1700, subp. B: “The proposed separation between the lowest portion of the facility and the high water table elevation must be a minimum of five feet”. This must be determined by a geotechnical investigation.
B. Geologic sensitivity and landfill siting
In the 2008 budget bill, the following language was included with respect to landfill siting: “The rules for the disposal of solid waste shall include site-specific criteria to prohibit solid waste disposal based on the area's sensitivity to ground water contamination, including site-specific testing.”

The MPCA cannot issue permits for most new landfills until the solid waste rules are modified to include site-specific criteria to prohibit areas from solid waste disposal due to ground water contamination sensitivity (see Appendix B). The MPCA is currently in the process of addressing this legislative requirement, and is working towards having proposed rules developed by December 2009.

C. Industrial solid waste management plans: waste acceptance criteria
In general Industrial Solid Waste Management Plans (ISWMPs) should provide enough flexibility to reflect the range of waste types proposed for disposal at industrial landfills. ISWMP waste acceptance criteria may be tailored to manage a single waste, more complex waste disposal streams, or waste streams that become more complex over time.

The following needs to be addressed in an ISWMP:
1. Each permit application for an industrial solid waste landfill needs to include a list of waste types being accepted at the facility. Waste types need to be described both generically and as appropriate, include known chemical characteristics of the waste.
2. As per Minn. R. 7045.0131 and 40 CFR 261 the waste must be non-hazardous. If the waste is hazardous, it cannot be disposed within an industrial solid waste disposal facility.
3. Is it excluded/included by rule? Is there generator knowledge that it is or isn’t HW. Check Material Safety Data Sheets. If hazardous may not go to IWLF. Material Safety Data Sheets are used to determine if a material is hazardous. They may also be useful to determine what to test for. If not hazardous go to either 4 or 5.
4. TCLP (Toxic Characteristics Leach Procedure).
5. A total composition analysis is to be used to determine which constituents are present in the waste stream. The results can be used to estimate maximum leachable concentrations (i.e. 20-fold dilution used by TCLP) and are used as a basis to determine the appropriate constituents to evaluate the waste stream for using the Synthetic Precipitation Leach Procedure. [Totals should not use method that uses hydrochloric acid.]
6. If conclusive evidence exists that the waste is not hazardous (i.e. as indicated by 2 & 3 above) then the SPLP is to be used solely the appropriate leach procedure, and TCLP testing may not be necessary. In addition to better characterizing the waste, results from the SPLP test are also useful for establishing leachate and groundwater monitoring parameters.
7. Additional testing that may be necessary to properly characterize the waste may include physical appearance, pH, reactivity, bulk density, organic vapor generation in headspaces, volatile organic compounds, herbicides, pesticides, poly-nuclear aromatic hydrocarbons, halogenated organics, ignitability and corrosivity. This list is not considered to be an inclusive list, so additional analysis may need to be done based on what information is available for the processes that generate the waste and the known physical and chemical nature of the waste.
8. The applicant shall propose waste acceptance criteria based on the landfill liner
design and waste types that it proposes to accept. In general the waste acceptance criteria are based on the results of the SPLP, the TCLP and Material Safety Data sheet information; waste acceptance limits are based directly on the waste type or chemical analysis of the waste type. If (in accordance with local rules and ordinances) an industrial landfill incorporates an MSW design, the landfill may accept waste just below the hazardous waste limits. For industrial landfills that are not built to MSW standards when proposing waste acceptance limits the applicant needs to consider known hazardous waste criteria, Minnesota Health Risk Level’s (HRL’s), Environmental Protection Agency Maximum Contaminant Levels (MCLs), Minnesota Soil Reference Values (SRV’s) and Soil Leach Values (SLV’s) established pursuant to applicable State and Federal Rules or guidelines.

10. All wastes that are accepted at the landfill must be compatible with the landfill liner and related landfill storage systems during the construction, operation, post-closure and closure period for the landfill. The applicant must include information in the waste acceptance plan that demonstrates this compatibility.

11. The MPCA may reasonably establish more stringent waste acceptance criteria as is necessary to protect the environment and public health and safety.

12. The applicant must obtain approval of the waste acceptance plan prior to disposal of the waste.

IV. Hydrogeologic Evaluations for Industrial Landfills

A. Existing requirements

As per Minn. R. 7035.1700, subp. S, a water monitoring program must be constructed and operated, and the conditions of monitoring, including the frequency and the analysis of water monitoring samples, must be determined by the commissioner, and may be changed at the commissioner’s discretion.

Under current practice, results from hydrogeologic investigations at a site are used primarily for determining if a site is monitorable and remediable, and for design of the ground water monitoring system. As such, the hydrogeologic investigation was not explicitly used to determine general suitability of a landfill site or to establish engineered control requirements (except for depth to the water table).

B. Proposed requirements

To reduce current subjectivity a formal Phase I through Phase IV Hydrogeologic Investigation as described in the MSW rules (Minn. R. 7035.2815 subp. 3 and 4) will be required for all industrial landfills unless agency determines not needed. This investigation is used to develop a conceptual model of ground water flow, and to design a ground water monitoring network to detect and intercept a contaminant release. These same rules are currently applied by policy for industrial landfill siting and expansion, although the scope of the investigation may be reduced based upon the presumed level of risk posed by the specific waste type to be landfilled.

[allow professional judgment? Doesn’t make sense to not require for class-3 but to require for all ISWLFs. Phase 2 checklist allows for fewer borings—are there enough outs? Performance nd reasonableness]
Initially, a minimum of three piezometers and/or ground water monitoring wells must be installed to establish ground water flow direction. The piezometers must be triangulated around the existing or proposed site and surveyed to a relative datum.

Ground water flow direction will be established by monitoring ground water level measurements on a semi-monthly basis (twice each month) for a one- to three-month period depending on site-specific hydrogeology. The number of measurements required may be changed based on local hydrogeologic conditions.

As described in Minn. R. 7035.2815, subp. 4, a ground water compliance boundary must be established, and as described in Minn. R. 7035.2815, subp. 5(C), the facility must be setback from the property line at least 200 feet to facilitate monitoring, and corrective actions if any are needed.

V. Engineered Controls

Engineered landfill control systems can be designed to provide physical barriers that modify the intrinsic hydrogeologic characteristics of a site with the effect of reducing the risk of contaminant releases to the environment. These engineered features include the following systems:

- Liner with leachate collection;
- Liner leak detection;
- Final cover;
- Ground water monitoring; and
- Gas collection.

The design and construction of engineered controls are performed under the direction of licensed professional engineers, who must certify their design and construction. The engineered controls available to engineers are not static, but change over time as new technologies and products are developed and as knowledge improves concerning how liquid and contaminants move through these natural and engineered structures.

A. Liner systems

In terms of liners for industrial landfills, the Minnesota industrial landfill rules (Minn. R. 7035.1700) do not define the type of liner needed for industrial landfills (unlike the MSW landfill rules which do describe the necessary minimum liner design). The two MSW landfill liners allowed by Minnesota Rule are: 1) four feet of compacted clay, or 2) two feet of compacted clay with a 60-mil thick synthetic membrane (composite liner). See Figure 1 for the engineering detail drawing of a composite MSW liner design.
Without prescriptive liner design requirements required by Minnesota Rule for industrial landfills, the MSW liner design has been utilized as a starting point when determining the appropriate engineering design for industrial landfill liners. In addition, facilities have been evaluated on a case-by-case basis using information on site location, depth to ground water, nearby receptors, soil types, and types of waste received. Currently, there are 20 open permitted industrial landfills around the state (see Appendix A).

Of the 17 industrial landfills with engineered liners, 14 of them have liners that are equivalent to, or fairly similar in design to, the MSW liner prescribed by rule (Minn. R. 7035.2815, subp. 7). The notable exceptions are the lime waste (sugar beet) landfills. The lime waste was permitted for disposal in the former lime slurry ponds that were constructed with a compacted clay liner. This existing liner was determined acceptable due to the nature of the fairly inert lime material, native soil types, depth to ground water, and nearby receptors. The three demo-like industrial landfills have not been required to have engineered liners based on a case-by-case evaluation of site location, depth to ground water, nearby receptors, soil types, and types of waste received.

The coal ash landfills and paper mill landfills have generally installed MSW-equivalent liners. In some cases, geosynthetic clay liners (GCL) have been used in place of one or two feet of the clay liner. The GCL has been considered acceptable as a replacement for two feet of compacted clay, due to the homogenous nature of coal ash and paper mill sludge and the associated minimal risk of puncturing the geomembrane and the GCL during waste placement. In addition, the GCL can provide a lower permeability than the compacted clay and has been demonstrated to be compatible with coal ash and paper mill sludge leachate. When a GCL has been allowed for replacement of two feet of clay, the MPCA has required the electro-resistivity test to be conducted on the installed liner system following the placement of the sand drainage layer. This test method has been proven affective for locating construction-related holes in geomembranes.

Figure 1: Typical Landfill Composite Liner System
With the merchant landfills, a variety of waste types have been accepted at these facilities and thus a variety of liner designs as been employed. The liner designs utilized have been less stringent, equivalent to (or nearly equivalent to), and more stringent than the MSW liner design. The liner designs in place consist of a single synthetic membrane liner, a composite MSW equivalent liner, and a double composite liner. The environmental and human health risk associated with the various waste types as well as site location and soil types, depth to ground water, and nearby receptors, and soil types, were considered when an appropriate liner design determinations were made at each landfill.

Prior to the creation of this Guidance, the MPCA has utilized fact sheets posted on our web page as a means of providing guidance on industrial landfill design. The following link contains several documents that should be referenced for more information on industrial landfill liners: http://www.pca.state.mn.us/waste/pubs/solidwaste.htm. The documents of interest on this page are the following:

- Guidance for Liner Design for Demolition Debris or Industrial Solid Waste Landfills;
- Guidance for Soil Construction Standards and Testing Frequencies – Landfill Cell Construction; and

[Note: Further discussion on alternative models to be included here?]

Terry J: discussion on alternative models (condensed version of presentation). Complex site, take aways, IWEM default, numeric Vs. analytic.

B. Leachate management systems

Engineered liners at the industrial landfills are generally sloped to a low point where the leachate is removed from the liner system via gravity or pumps. Some of the industrial landfills discharge leachate directly to the city sanitary sewer system where it is piped to the local waste water treatment facility.

Other industrial landfills pump their leachate to a storage tank or holding pond prior to trucking the leachate to a nearby wastewater treatment facility and/or spray irrigating the leachate back onto the waste for dust control. The last option has been employed at coal ash disposal facilities throughout the state. A fourth option of treating industrial landfill leachate onsite has not been utilized at industrial landfills (but it has been utilized at MSW landfills), yet it is a viable measure of managing industrial leachate that should be considered.

Onsite wastewater treatment and disposal could be done in a variety of ways. The method of treatment will be dictated by the chemistry of the leachate and via personal choice. There are a number of leachate treatment methods that have the same function (i.e. metals removal or perhaps waste strength reduction).

Disposal of the treated effluent is another aspect of managing leachate. In general, there are three leachate disposal options available: 1) subsurface disposal, 2) spray irrigation, or 3) surface discharging. All three disposal options have different regulatory requirements and would have to be undertaken with the MPCA’s water quality permitting program.
A distinction may be made on leachate recirculation, where perforated laterals are buried within the waste, and spraying leachate on top of wastes for dust control. There may be benefits to leachate recirculation at landfills that contain organic material including accelerated biodegradation of wastes which leads to increased gas generation, waste compaction, and increased leachate strength during open life/early stages of closure.

Paper mill sludge and merchant landfills may be the only types that might contain significant quantities of organic materials. Paper mill sludge landfills should be excluded from leachate recirculation because increasing the moisture content of the waste may make this waste more unstable. Merchant landfills may or may not contain enough organics to see much benefit from recirculation.

Carefully spraying leachate on top of wastes (well within the footprint, considering wind direction and speed) for dust control especially for coal ash may be an acceptable leachate management practice, but will need MPCA approval.

More detail on the leachate collection system design can be found by referencing the MSW landfill liner design requirements and by referring to the guidance documents mentioned above. There are guidance documents and/or Program Management Decisions available on our web site for managing landfill leachate. They can be found at the links below.

- Land Treatment of Landfill Leachate:
  http://www.pca.state.mn.us/waste/pubs/solidwaste.html
- Alternative Leachate Management:
  http://www.pca.state.mn.us/waste/pubs/solidwaste.html

C. Liner leak detection systems
Liner leak detection methodologies that have been incorporated into the engineering design at industrial landfills consist of lysimeters constructed under the area of a cell or phase at the lowest elevation and a ground water monitoring system. The sump is located in the area of the liner at the lowest elevation. A lysimeter constructed under the sump serves to monitor the area of the landfill with the highest leachate head for any leaks through the liner system. Dual liners may help with leak detection, and the ground water monitoring system also exists to detect leachate migration from the lined area. These techniques are discussed in the liner design fact sheet previously mentioned. Refer to that document for more details.

D. Caps/cover systems
Similar to industrial landfill liner systems, final cover systems for industrial landfills are also not prescribed in the Minnesota industrial landfill rules. Once again, the MSW landfill standards have been used as a guideline for designing industrial landfill cover systems. Those rules can be found at Minn. R. 7035.2815, subp. 6. The majority of the final cover designs at the industrial landfills utilize a geomembrane in the barrier layer. In addition to the MSW rules, there is a fact sheet on the MPCA web page for demolition debris cover systems. That fact sheet can also be used for industrial landfills.
The following link contains several documents that should be referenced for more information on industrial landfill covers: http://www.pca.state.mn.us/waste/pubs/solidwaste.html. The documents of interest on this page are the following:

- Guidance for Final Cover for Demolition Debris Landfills;
- Guidance for Soil Construction Standards and Testing Frequencies – Final Cover Construction; and
- Landfill Slope Guidance

E. Gas management systems
The generation of landfill gas is an issue at industrial landfills that dispose of wastes that contain organic material. Gas collection systems have been installed at the paper mill sludge and merchant landfills because the waste types disposed of contain enough organic material to generate methane. If it is determined that gas will be generated the need for proper gas management (monitoring, mitigation) must be part of the permitting process.

F. Construction quality assurance/quality control (QA/QC)
Another method used by industrial landfills to manage liner integrity is to perform proper QA/QC during construction and after construction is complete. Testing conducted on the materials used for construction is used to confirm that the materials meet the design specifications. Liner leak location testing can also be performed via electro-resistivity testing. This method has been proven affective for locating construction-related holes in liners.

Incongruence between current rules and need for FA when it comes to closure/post-closure plans.
VI. Other Permits
In addition to obtaining a solid waste management permit from the MPCA, other permits may be required for industrial landfill projects. Examples of other permits that may be required include:

- Stormwater permits (industrial stormwater permits and/or construction stormwater permits) from the MPCA;
- Air emissions permits from the MPCA;
- Water quality permits from the MPCA for leachate treatment and disposal (if chosen);
- Wetlands permits from a number of entities, including the Department of Natural Resources, Soil & Water Conservation Districts, Counties, etc.; and
- Other local unit of government land use permits.

Prior to permit issuance local units of government typically take action before the MPCA takes final action, and the MPCA’s role is to inform LGUs on the status of pending permits. MPCA policy requires local land use approval and to defer to the local unit of government regarding whether they issue their license, prior to obtaining a state permit.

VII. Operational Practices
A. BMPS [Note to reader: this section needs further discussion; see Ch. 3 of Demolition Landfill Handbook?] Not as much specific items than general approach. Reference training documents/existing guidance. 1.5 day training (John Curry) on operations is a starting point?

  Demo and industrial operate similarly.

  1. Compacting
  2. Working face size (already mentioned)
  3. Wind speed
  4. Waste Screening
  5. Placement of waste, i.e., large bulky stuff at the toe
  6. Cover requirement, how often
  7. Acceptable wastes...how determined if acceptable.

  Add: What needs to go into an operations plan?/John M

B. Monitoring
Sampling and analysis plans will need to be submitted to and be approved by the MPCA that encompass ground water, leachate, and potentially gas.

Based on the ground water flow direction established in the hydrogeologic investigation, monitoring wells must be installed, at minimum, one up-gradient and two down-gradient of the existing or proposed location. Additional wells may be required, depending on the location of human and/or environmental receptors relative to the landfill. Down-gradient wells should be placed within the property boundary, but not farther than 200 feet from the edge of the waste fill area. Wells should be screened in the water table or as dictated by site-specific conditions.

Routine ground water sampling, limited to spring, summer and fall events, typically will take place for a minimum of three years. This sampling is in addition to the required initial baseline sampling. Monitoring parameters for this time period will include the parameter list based on
waste characteristics. After the initial three-year time period, the permittee may request a modification to both the monitoring frequency and the parameter list.

Leachate sampling typically will be undertaken quarterly for the list of parameters reflective of the waste type(s). Gas sampling will be undertaken as required by waste types.

C. Financial assurance
The MPCA uses financial assurance as a tool to protect the environment and public health in the event that a landfill owner fails to undertake necessary actions. The Industrial Solid Waste Land Disposal Rules are not explicit regarding financial assurance requirements. However, the industrial rules under Minn. R. 7035.1800 do require compliance with permit conditions.

Talk about the logic behind timelines (20/30 year). Mechanisms? Opt out options?
Brett B: we require FA on 12 of 20 LFs in state based on risk. Consistent with the way demos are addressed by the MPCA (no class-1 have FA). Currently risk-based. Describe which one’s have FA and why (class of waste: lime waste Vs. coal ash Vs. etc.). Should be risk based and should apply to all landfills.

Components; closing; contingency actions based on waste type; PPC period needs to be assessed (by waste type); after PCC, what different mechanisms can be used and can resources be pooled (like an insurance pool; voluntary?). John M. It might be an issue for some landfills who are concerned about having to support others; who can access money; who controls how spent?/Ryan O. Agency to draft language on what it means to evaluate FA for a facility. Small number of privately OO landfills (>80% public)/Gary P.

PCA to take a shot at developing criteria around which all fac’s under this guidance would evaluate FA as part of repermitting process. Look for summary of one approach for FA.

The MPCA uses authority under Minn. R. 7001.0150 to issue permits which require financial assurance. The decision to require financial assurance is case-by-case depending upon environmental protection needs. Facilities which have liners, active gas management, or other design features necessary to protect the environment are typically required to have financial assurance as a special permit condition.

The requirements for estimating the level of financial assurance needed for closed solid waste facilities are found in Minn. R. 7035.2685. A cost estimate, including an itemized breakdown for closure of each fill phase and the total cost associated with closure activities at solid waste management facilities, must be included in a post closure care (PCC) plan [see Minn. R. 7035.2625, subp. 3(C)].

In the budget bill passed in May 2008, the following sentence was included: “The rules for the disposal of solid waste...shall also include modifications to financial assurance requirements under subdivision 4h that ensure the state is protected from financial responsibility for future ground water contamination.”
Minnesota Rules currently do not have a requirement for financial assurance for industrial landfills. However, under permitting powers, the MPCA has required that industrial landfills have financial assurance. The amount of financial assurance for an industrial landfill is established during the permitting process, where contingency, closure costs, and post closure costs are developed by the permittee and the MPCA. According to MPCA data, there are 21 industrial landfills in Minnesota. Of those, 12 have been required to have financial assurance.

The Minnesota Rules provide several mechanisms to meet the financial assurance permit requirements. These are trust funds, surety bonds guaranteeing payment into a trust fund, self-insurance, and letters of credit. For the self-insurance option, the company operating the landfill must submit a detailed financial statement that proves that there is sufficient cash on hand to cover contingency and closure costs. To account for inflation and cost of money, these mechanisms are updated on an annual basis.

The 12 facilities have a total of $47.7 million in MPCA-approved financial assurance. The range in financial assurance is from $1.1 million to $7 million. Industrial landfills with trust funds have cash in interest-bearing accounts. This form of financial assurance is clearly more secure in protecting the state’s future liability, since the funding is already allocated and would not be impacted by bankruptcies, etc. Initially, the financial assurance might be in the form of bonds, but as deposits are made into the trust fund, the facility would draw down the amount bonded for.

During the PCC period, money can be drawn down from the account to pay for on-going maintenance activities, or larger scale problems, such as ground water contamination. This money, however, is not directly replaced. As such, at the end of the PCC period, no money may be left for any activities beyond the PCC period. Moreover, if any financial assurance money remains after the PCC period ends, landfill owners would like to recover it. If ground water monitoring is discontinued past the 30-year PCC period, ground water contamination may occur that is undetected and uncorrected, human health and the environment may be imperiled, and there may not be any funds set aside to address the problem.

PCC financial assurance money is set aside specifically to address future problems with a facility that generated money from the waste to begin with. To ensure that future generations are not burdened with un-funded environmental liabilities, keeping the financial assurance mechanisms operating near or at their original estimates beyond the PCC period may be warranted.

40 CFR pt. 248 requires facilities to establish financial assurance for closure and the 30-year PCC period. Minnesota Rules require facilities to establish financial assurance for closure, a 20-year PCC period, and the expected value of the worst case scenario of contingency action events.

When Minnesota was approved by the U.S. Environmental Protection Agency (EPA) to administer 40 CFR pt. 248, it was agreed that while landfills would need to maintain a 30-year PCC period, they would only need to fund a 20-year PCC period as the contingency action funding could cover the last ten years of the PCC period. This may not be the case for some facilities, especially if they have need of their contingency action funds during the first 20 years of the PCC period.
Additional thought should be given to requiring facilities to fully fund the 30-year PCC period. This would ensure proper funding for the full PCC period. Then, any remaining contingency action funds could cover ongoing monitoring and mitigation after the 30-year period, if such funds have not already been used.

D. Post closure care
In 1993, the MPCA adopted the EPA’s 30-year PCC period for landfills regulated under 40 CFR pt. 248. Prior to this requirement, all landfills were required to undergo a 20-year PCC period. Minnesota landfills that are not subject to regulation under 40 CFR pt. 248 (including industrial landfills) are still subject to the 20-year PCC period.

- When we get to the end of 20 or 30 years, we evaluate where we’re at and then decide what’s next; site-by-site/case-by-case.

Permitted solid waste landfills in Minnesota must prepare a PCC plan, and may also need to set aside adequate financial assurance money for future cover repair, ground water and gas monitoring and mitigation, and leachate collection and treatment.

At the end of the PCC period, some or all of the requirements included in the closure document may be increased, decreased, or terminated. Due to the uncertainty associated with landfill reactivity at the end of the PCC period, some states require that some or all of the PCC requirements including retaining financial assurance funds continue indefinitely into the future.

In most cases for mixed municipal, combustor ash, and industrial landfills, some level of upkeep, inspections, and ground water monitoring may need to continue indefinitely, and a high level of financial assurance money should be reserved to ensure that adequate funds are set aside to address problems in the future. The requirements for post closure of a solid waste facility are found in Minn. R. 7035. 2645. “Post closure” and “post closure care” mean actions taken for the care, maintenance, and monitoring of a facility after closure that will prevent, mitigate, or minimize the threat to public health and environment posed by the closed facility (see Minn. R. 7035.0300, subp. 82.).

When a solid waste facility closes, a certification that the facility has been properly closed in accordance with the rule requirements must be submitted to the MPCA for review and approval.

Agency has ability to access split samples, but currently normally trusts data submitted by consultants. Agency requires use of approved labs. Require split samples? There should be a lot of data gathered 3x per year times 20-years.

Daniel Pena suggested forming a subgroup to wrestle with this question. Need 1-pager addressing thinking about post-post closure./Marc H. PCC staff to LAG #5/Gary P.

Several Minnesota rules relate to the PCC period, and the following summarizes what must be undertaken during the PCC period of landfills:
• restrict access to the facility;
• make repairs to the final cover;
• maintain and monitor the gas and ground water monitoring systems;
• continue to operate the leachate collection and removal system;
• prevent run-on and runoff from damaging the final cover;
• protect and maintain surveyed benchmarks;
• survey the facility at least annually to determine the extent of settling or other events;
• submit an annual report to the commissioner; and
• complete repair work within 30 days of discovery.

The MPCA currently has no set criteria for terminating PCC requirements, and needs to further consider these issues including what controlling documents should be used, and refining the decision-making criteria.

Similarly to other states it is suggested that at the end of the PCC period, a certified PCC termination report be submitted to the MPCA that addresses all of the issues relating to the facility (see Appendix A).

Due to the reactivity, potential threat, and very long time periods involved it would seem that only the most benign demolition landfills be granted complete termination of all PCC requirements. For other facilities some degree of monitoring, inspection and up-keep should be provided indefinitely.
Contact Information
For more information on industrial landfills, the first point of contact should be:
Minnesota Pollution Control Agency, 520 Lafayette Road, St. Paul, MN 55155-4194
Phone: 651-296-6300, 800-657-3864; TTY: 651-282-5332.

Stakeholders list
The MPCA thanks the representatives from the following stakeholders for their participation in
developing this Guidance.

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Grinning Bear Demolition Landfill

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BARR

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MPCA Solid Waste Permit Engineer

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Polymet Mining/Mining Minnesota

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BARR

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Mark Rys
MPCA Solid Waste Hydrogeologist

Mark St. Lawrence
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Ainars Silis
MPCA Land Permits Supervisor

Susanne Spitzer
MPCA Planner

Bob Tipping
MGS, University of Minnesota

Michael Tibbets
MPCA Industrial Section Manager

Richard Thul
MPCA Process Facilitator

Neal Wilson
MPCA Solid Waste Hydrogeologist, principal document author
Appendix A
Table of Suggested References

- MPCA main page of guidance: http://www.pca.state.mn.us/waste/pubs/solidwaste.html
- Liner design guidance for industrial landfills: http://www.pca.state.mn.us/publications/w-sw5-02.pdf
- Liner soil construction standards and testing frequencies: http://www.pca.state.mn.us/publications/w-sw5-07.pdf
- Cover soil construction standards and testing frequencies: http://www.pca.state.mn.us/publications/swguidance-finalcoverconstruction.pdf
- Guidance for the use of the IWEM model which is related to the link for the EPA: industrial waste manual http://www.pca.state.mn.us/publications/w-sw5-03.pdf
- Slope guidelines (mostly apply to industrial landfills): http://www.pca.state.mn.us/publications/reports/solidwaste-pmd-landfillslope.pdf
- Industrial Solid Waste Management Plan guidance: http://www.pca.state.mn.us/publications/w-sw3-36.doc
- U.S. Congress General Accounting (now “Accountability”) Office (GAO, 1990), in the Executive Summary of its report, “Funding of Post closure Liabilities Remains Uncertain,” under a section labeled “Funding Mechanisms Questionable”
Appendix B

Minnesota Statute Section 116.07, Subdivision 4, as amended (extract of pertinent language, 2008):

The rules for the disposal of solid waste shall include site-specific criteria to prohibit solid waste disposal based on the area's sensitivity to ground water contamination, including site-specific testing. The rules shall also include modifications to financial assurance requirements under subdivision 4h that ensure the state is protected from financial responsibility for future ground water contamination. Until the rules are modified to include site-specific criteria to prohibit areas from solid waste disposal due to ground water contamination sensitivity, as required under this section, the agency shall not issue a permit for a new solid waste disposal facility, except for:

(1) the re-issuance of a permit for a land disposal facility operating as of March 1, 2008;
(2) a permit to expand a land disposal facility operating as of March 1, 2008, beyond its permitted boundaries, including expansion on land that is not contiguous to, but is located within 600 yards of, the land disposal facility's permitted boundaries;
(3) a permit to modify the type of waste accepted at a land disposal facility operating as of March 1, 2008;
(4) a permit to locate a disposal facility that accepts only construction debris as defined in section 115A.03, subdivision 7;
(5) a permit to locate a disposal facility that:
(i) accepts boiler ash from an electric energy power plant that has wet scrubbed units or has units that have been converted from wet scrubbed units to dry scrubbed units as those terms are defined in section 216B.68;
(ii) is on land that was owned on May 1, 2008, by the utility operating the electric energy power plant; and
(iii) is located within three miles of the existing ash disposal facility for the power plant; or
(6) a permit to locate a new solid waste disposal facility for ferrous metallic minerals regulated under Minnesota Rules, chapter 6130, or for nonferrous metallic minerals regulated under Minnesota Rules, chapter 6132.
Appendix C
Industrial Landfill Guidance Implementation Plan

INTRODUCTION
This appendix serves as the implementation plan (Plan) for the demolition landfill guidance document (Guidance). The Plan explains that the Guidance applies to proposed, new facilities as well as to existing facilities. This document will be used to guide the MPCA decision-making process. Occasionally, decisions will be made that fall outside of the general guidelines described in this Guidance. This level of flexibility is necessary to effectively make decisions for the wide variety of situations that exist across the state.

PROPOSED FACILITIES - Initially, for new, proposed facilities, a site evaluation will be done to determine the overall hydrogeologic characteristics. For most industrial landfills, the extent of the overall hydrogeologic investigation will be the same as required for mixed municipal landfills. These requirements are found in Minn. R. 7035.2815, subps. 3 and 4.

EXISTING FACILITIES - Existing facilities will be reviewed per the Guidance as current permits expire. Similar to what is done for proposed facilities, existing facilities will be evaluated in terms of location standards, depth to ground water, soil types, types of waste received, nearby receptors, etc. as described above. Re-evaluation of financial assurance. Add discussion about FA for existing facilities—do they have it; do they need it? Is this a thorough site analysis done over again? Julie H/Neal W

For facilities that may wish to change their operations before their current permit expiration date, ISWMP templates will be available from the MPCA. A permit modification could be done after receipt of the new ISWMP, which, if approved, would allow the facilities to receive other waste types. What is intent of this paragraph? < to provide for changing waste types between permit (major or minor modification). PCA to use Guidance when landfill requests changes or when permit comes up for renewal. ISWMPs should have mechanism with limits that define minor changes that are acceptable within permit./Brett B.

MPCA HYDROLOGIST AND ENGINEERING FORUMS - Proposed and existing sites may be peer reviewed at MPCA hydrologist forums. The purpose of the forums will be to discuss site conditions, facility classification, and unique site features that may create special concerns, past decisions on similar sites, etc. The forum process will help ensure that evaluations are done in a more consistent manner. The engineering staff hold similar forums at which technical issues related to solid waste permits are discussed, in order to help set more consistent permit conditions on a statewide basis.

ELECTRONIC DATA - Ground water monitoring data must be submitted electronically. The MPCA intends to make these data available to owners and operators through the MPCA’s web site at a future date. This will enable owners and operators to easily track and view the data.

TRAINING – The MPCA will incorporate the relevant portions of this Guidance into the Demolition Landfill Operator Certification Training.
Appendix D

HYDROGEOLOGIC EVALUATION

COMPLETENESS CHECKLISTS

for Solid Waste Land Disposal Facilities

MINNESOTA POLLUTION CONTROL AGENCY

August 1991
PHASE I
PRELIMINARY INVESTIGATION REPORT

The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

A person with expertise in hydrogeology must sign the Phase I Report and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subp. 3, item E; SONAR pages 334-338

1. Evaluation of previous investigations for the facility

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| detailed description of the purpose and results of previous investigations
| evaluation of the results and conclusions of previous investigations
| evaluation of the quality, reliability and accuracy of previous investigative work
| supportive maps and data
| if applicable, history of waste acceptance and location of filled areas

2. Description of regional information

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| description of published sources of information used to describe the regional setting
| regional description of the following areas:
| geologic history
| stratigraphic sequence
| soils
| topography
| vegetation
3. Well inventory

_____ identification of all residential wells within one mile of the site
_____ identification of all high-capacity wells and community water supply wells within three
miles of the site
_____ well inventory including the following:
_____ * survey of active, unused, and abandoned wells
_____ * well logs and other information regarding well construction
_____ * water levels and well usage
_____ * review of state and local collections of water well records

4. Existing monitoring system

_____ For existing facilities, evaluation of the existing monitoring system:
_____ * adequacy of existing monitoring system
_____ * compliance with chapter 4725, Minnesota Department of Health Water Well
Construction Code
_____ * water quality data

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for
the MPCA Solid Waste Management Rules.
PHASE II
DETAILED SITE INVESTIGATION WORK PLAN

The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

The previous phase report must be submitted before the subsequent phase work plan is reviewed. Before implementing the work plan, the previous phase report and the current phase work plan must be approved by the MPCA. For example, before the Phase II work plan is reviewed, the Phase I report must be submitted. The Phase II work plan cannot be approved until the Phase I report has been approved. A person with expertise in hydrogeology must sign each document and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subp. 3, item F and subp. 10; SONAR pages 338-349 and 493-503.

1. Number, distribution, and depth of soil borings

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</table>
2. Soil sampling, analysis, and classification

MPCA Use
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- Field Protocol
  - * sample collection: max 5’ intervals and changes in soil type
  - * at least one boring continuously sampled for every 10 acres of proposed fill area
  - * sample collection ASTM method (or equivalent)
  - * sample preservation and transportation
  - * field classification by a person with expertise in hydrogeology
  - * boring log form
- Laboratory Protocol
  - * rationale for selecting soil samples for laboratory testing
  - * laboratory classification
  - * particle size distribution
  - * porosity
  - * vertical permeability
  - * clay mineral content or cation exchange capacity

3. Piezometers

- proposed locations and screened intervals, and supporting rationale
- construction specifications/design diagrams
- cleaning of well construction materials
- development procedure
- proposal for stabilization or recovery rate tests
- survey for horizontal and vertical control
- proposal to characterize fluctuations in hydraulic heads and vertical gradients
- program to determine in-situ hydraulic conductivity
- evaluation of the effects of pumping from nearby high-capacity wells
- obtain appropriate permits from MDH
- compliance with Minn. Rules pt. 7035.2815, subp. 10, item R

4. Drilling and abandonment procedures

- proposed drilling method(s)
- cleaning of drilling tools and cables
- method of abandonment for monitoring wells, piezometers, and borings

5. Well inventory

- proposal to field-check the accuracy of the Phase I Well Inventory, and update the well inventory, if necessary
6. Other, if applicable

MPCA Use Page No.

___ ___ proposed borehole or surface geophysical methods
___ ___ proposed test pits
___ ___ surface water investigation (elevation, flow rates, etc...)
___ ___ spring and seep survey

7. Implementation of Work Plan

___ ___ proposed schedule for field work

8. Phase II Detailed Site Investigation Report

___ ___ description of items to be included in the Phase II report
___ ___ estimated submittal date for the Phase II report

9. Maps, Tables, Figures

___ ___ Base Map
___ ___ * topography (2’ contours)
___ ___ * property boundary and facility boundary
___ ___ * waste fill boundary (existing and/or proposed)
___ ___ * on-site water supply wells, buildings, and other pertinent features
___ ___ * existing and abandoned monitoring wells, piezometers, and soil borings
___ ___ * proposed piezometers and soil borings
___ ___ * surface water features within the facility boundary, including intermittent streams and wetlands
___ ___ * existing surface water monitoring locations
___ ___ * date the map was prepared
___ ___ * accurate map scale (1”=200’ or larger scale)
___ ___ * north arrow
___ ___ * legend
___ ___ Map showing surface water features, including intermittent streams and wetlands, within ¼ mile of the facility
___ ___ Soil Boring Table
___ ___ * boring number
___ ___ * proposed depth
___ ___ * sequence of drilling
___ ___ * purpose
___ ___ Boring Log Form
___ ___ Well Construction Diagram
___ ___ Others as appropriate to illustrate ASTM procedures

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for the MPCA Solid Waste Management Rules.
The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

Following the Commissioner’s approval of the Detailed Site Investigation Work Plan and completion of the approved work, the Detailed Site Investigation Report is submitted. A person with expertise in hydrogeology must sign the report and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subp. 3, item G, pages 117-118; SONAR pages 349-355

1. Description of soil/bedrock units & properties influencing water flow. Include in the discussion for each unit:

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<td>texture and classification</td>
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<td>particle size distribution</td>
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<td>mineral composition, cementation, and soil structure</td>
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<td>geologic structures (strike, dip, folding, jointing, etc. where applicable)</td>
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<td>permeabilities, field and lab</td>
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<td>porosity</td>
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<td>any heterogeneity encountered: the type, scale, and frequency (i.e., lenses, voids, solution channels, fractures, layering)</td>
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2. Description of hydrologic units

|          |          |
| thicknesses |          |
| hydraulic properties |          |
| role and effect of each as an aquifer, aquitard, perched saturated zone |          |
| actual or potential use as a water supply |          |
3. Description and evaluation of the ground water flow system (specifically discuss the following with respect to their impact on ground water and pollutant movement):

- Identify ground water recharge and discharge areas, other interactions of ground water with surrounding surface waters (perennial or intermittent), facility impacts on recharge areas.
- Existing or proposed ground water and surface water withdrawals.
- The effect of heterogeneity/fractures on ground water movement.
- Directions of ground water movement, include:
  * Vertical and areal components
  * Specific discharge rates
  * Average linear velocities
  * Seasonal or other temporal fluctuations in hydraulic head.

4. Use of ground water models (mathematical or analog), if applicable

- Describe the model, its capabilities and limitations.
- State all assumptions or approximations made.
- Identify quantities/values derived from the model that are not confirmed by direct measurement (i.e., dispersivity, recharge).
- Evaluate the reliability and accuracy of the results (i.e., sensitivity analysis).

5. Environmental and public health impact analysis include:

- Potential and actual releases.
- Projected paths and rates of movement of both water-soluble and low-solubility components of leachate.
- Determine monitoring needs.

6. Plan-view maps and cross sections

- Sections spaced no more than 500 feet apart.
- Sections oriented in directions parallel to and perpendicular to the predominant directions of ground water flow.
- Illustrate: the areal and vertical extent of soil/bedrock units, measured values of hydraulic head, equipotential lines and inferred ground water streamlines.
- Locations of soil and bedrock borings.
- Locations and construction of piezometers and monitoring points.
- Locations of any geophysical measurements used to prepare the cross sections.
7. Logs for borings and piezometers. Include, at a minimum, the following for each log:

- Date of boring
- Name and address of the driller and testing firms
- Drilling and sampling methods
- Surveyed elevation of the ground surface (MSL)
- Surveyed location referenced to permanent benchmarks
- Soil and rock classifications & narrative descriptions
- Contacts between strata/units, sample depths, blow counts, test data
- Observations during drilling
- Water level measurements
- Sealing procedures
- Any geophysical logs
- Signed by a person responsible for logging the boreholes
- Construction record of piezometers as required by Minn. Rules pt. 7035.2815, subp. 10

8. Items specific to facility

- All work plan objectives/items included
- Justification for deviation from work plan

9. Appendices

- Raw geotechnical data
- Sample calculations
- Water elevations

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for the MPCA Solid Waste Management Rules.

MSL: Mean Sea Level
The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

The previous phase report must be submitted before the subsequent phase work plan is reviewed. Before implementing the work plan, the previous phase report and the current phase work plan must be approved by the MPCA. For example, before the Phase III work plan is reviewed, the Phase II report must be submitted. The Phase III work plan cannot be approved until the Phase II report has been approved. A person with expertise in hydrogeology must sign each document and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subp. 3, item H(1); SONAR pages 355-356

1. Proposed monitoring system

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- Description of the proposed monitoring system
- Monitoring point locations shown on a base map
- Thorough evaluation of suitability of any monitoring points proposed for inclusion in the monitoring system:
  - * compliance with Minn. Rules pt. 7035.2815, subp. 10
  - * yield representative water quality samples
  - * distinguish effects of leachate on the ground water versus background quality
  - * allow early detection of contaminant release
  - * capable of determining composition, areal and vertical extent, concentration distribution, and highest concentrations of pollutants
2. Explanation of how the water monitoring system addresses the hydrogeologic conditions identified in previous investigations, including but not limited to:

   - The Phase I Preliminary Investigation Report
   - The Phase II Detailed Site Investigation Report

3. Preliminary version of the monitoring protocol (See also Phase IV Work Plan)

   - Determination of initial water quality (baseline)
   - Qualifications of samplers
   - Laboratory analytical methods to be used
   - Preliminary field protocol
   - Monitoring point locations, elevations, and order of sampling
   - All tests, measurements, and procedures needed at each monitoring point and order to be carried out
   - Measurement of water elevation prior to sampling or evacuation
   - Procedures for evacuation before sampling
   - Procedures for field filtration of samples
   - Procedures for sample preservation
   - Equipment and containers to be used and cleaning between samples
4. Implementation of Work Plan

____ ____ Proposed schedule for field work

5. Phase III Water Monitoring System Report

____ ____ Description of items to be included in the Phase III report
____ ____ Estimated submittal date for Phase III report

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for the MPCA Solid Waste Management Rules.
The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

Following the Commissioner’s approval of the Water Monitoring System Work Plan and completion of the approved work, the Water Monitoring System Report is submitted. A person with expertise in hydrogeology must sign the report and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subp. 3, item H(2) and subp. 10; SONAR pages 355-356 and 487-504

1. Monitoring point construction and installation records

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- Accurate and detailed record of soil or rock types encountered while installing a monitoring point. The record must be logged and completed by a person with expertise in hydrogeology (refer to Phase II work plan checklist, Item 3: Soil sampling, analysis, and classification).
- Construction Record which includes:
  - * copy of the “Water Well Record” (the unique well number on this form must be legible and complete)
  - * well development record
  - * stabilization or recovery rate testing data
  - * suspended solids analysis
  - * other well production tests (if applicable)
  - ** pumping
  - ** drawdown
  - ** yield
  - ** flow direction tests
* logs from geophysical testing completed on the well
* dated, signed, revised landfill plan sheet showing the surveyed location coordinates of the monitoring well to the nearest foot
* statement of accuracy and completeness of the construction records must be verified and signed by a licensed well contractor

** Well construction log
** methods of drilling and installation
** type of drilling rig
** how casing, screen, filter pack, and grout were installed
** description of drilling fluid used
** procedure for cleaning materials or equipment
* observations during drilling and installation
** problems encountered and how solved
** conditions which may affect performance of the monitoring well
* drawing of the well in vertical cross-section
* elevations (Mean Sea Level or National Geodetic Vertical Datum)
* top of each casing (inner and protective), surveyed to the nearest 0.01 foot
* ground surface
** protective concrete slab or plug
* bottom of drill hole
** top and bottom of any dedicated pump, or sampling or measuring device
** top and bottom of the screen or intake interval and of each different size or type of casing
** each change in diameter of the drilled hole
** each change in filter pack
** each change in annular seal
* identification and location of the well
* well casing material type, inside diameter, and casing schedule number, standard dimension ratio, or wall thickness
* well screen material type, product name and description; type and direction of alignment of openings (horizontal or vertical); opening or slot width, type of screen bottom
* methods and materials used to join sections of casing and screen, casing to screen, and well bottom to screen
* granular filter pack
** manufacturer
** product name or number
** mineral composition
** gradations
** quantity of filter pack material used
* annular seal material (grout)
** manufacturer and product name
** proportions of water and solids in the grout mix
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>___ * ___ ** quantity used</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** bentonite seal above filter pack, if applicable</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** method of placement</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** type and source of bentonite</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** if applicable, type of dedicated pump, sampling device, or measuring device</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** manufacturer and model number</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** pumping capacity</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** dimensions</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** location of intake area</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** how secured at the desired elevation</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** type of material used for connected lines or hoses</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** type and location of power source</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** Surface water monitoring points</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** if on permitted property</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** permanently marked</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** if off of permitted property</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** alternative method of marking location if permission to install marker is denied</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** river or stream</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** upstream of ground water discharge area</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** downstream where the discharge has mixed with stream flow</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** within area of maximum projected pollutant concentrations in the discharging ground water</td>
<td></td>
</tr>
<tr>
<td>___ * ___ ** Submit to Commissioner a revised landfill plan sheet showing location and identification of all ground water and surface water monitoring points</td>
<td></td>
</tr>
</tbody>
</table>

2. A description of changes from the work plan

___ ___ Locations
___ ___ Design
___ ___ Installation procedures

3. Evaluation of differences from previously reported hydrogeologic data

___ ___ Soil and bedrock conditions
___ ___ Water levels
___ ___ Ground water flow conditions
___ ___ How the above three conditions complicate the ability to assess impacts at the facility

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for the MPCA Solid Waste Management Rules.
The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

The previous phase report must be submitted before the subsequent phase work plan is reviewed. Before implementing the work plan, the previous phase report and the current phase work plan must be approved by the MPCA. For example, before the Phase IV work plan is reviewed, the Phase III report must be submitted. The Phase IV work plan cannot be approved until the Phase III report has been approved. A person with expertise in hydrogeology must sign each document and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subps. 3 and 14; SONAR pages 356-357 and 561-571

1. Field Portion of Monitoring Protocol must contain:

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- Monitoring point locations and elevations.
- Order in which monitoring points are to be sampled.
- List all tests, measurements, and procedures needed at each monitoring point and order for conducting procedures.
- List equipment and containers to be used and procedures and precautions for their use.
- Procedures for evacuating well before sampling (also see Minn. Rules pt. 7035.2815, subp. 10, item N).
- If surface water sampling, the procedures for establishing exact sampling location and depth.
- If leachate sampling, the procedures for establishing exact sampling location and depth.
- Description of quality control procedures for field activities and sample transport to identify outside sources of error.
Water quality analyses must be performed using methods acceptable to the Commissioner based on their performance records, reliability, sensitivity, precision, and accuracy.

2. The monitoring protocol must contain this laboratory information:

   - Responsibilities of laboratory personnel.
   - Sample containers, preservatives, cleaning of containers and equipment, sample shipment and storage, and sample holding times.
   - Analytical methods and equipment used (include detection limits).
   - Laboratory’s measurements of precision and accuracy for constituents.
   - Methods used to identify and prevent contamination of samples in laboratory and transport.
   - List of analytical quality control procedures used to assess the reliability of results.
   - Description of methods for reviewing and assessing all data for completeness and accuracy.
   - Establish sample retention times after analysis is completed.
   - List inspection, testing, and preventive maintenance programs for equipment.
   - Chain of custody procedures.
   - Procedures for the documentation and retention of quality control results.
   - Continuing education requirements for analytical procedures.

3. The work plan must also include:

   - Schedule for background or initial sampling dates
   - Proposed analytical constituents based upon factors in Minn. Rules pt. 7035.2815, subp. 14, item B, subitems 1 and 2.
Describe methods for data analysis and interpretation to be used in fulfilling water quality monitoring requirements.

Recognition of the requirement to revise, as appropriate, and review at least annually, the protocol.

4. Implementation of Work Plan

Proposed schedule for field work.

5. Phase IV Water Quality Monitoring Report

Description of items to be included in the Phase IV report.

Estimated submittal date for the Phase IV report.

Definitions:

SONAR: MPCA Statement of Need and Reasonableness (1988). This document is the justification for the MPCA Solid Waste Management Rules.
The completeness checklists are a series of checklists, prepared by the hydrogeologists of the Solid Waste Section, Ground Water and Solid Waste Division, Minnesota Pollution Control Agency in August 1991.

The purpose of the checklists is to ensure that the requirements of the Solid Waste Management Rules (Minn. Rules pt. 7035.2815, subp. 3 and other subparts cited within subp. 3) are addressed in the preparation of the four phases of the Hydrogeologic Evaluation work plans and reports. When preparing work plans and reports, users should refer to the specific rule requirements cited in the checklists. When varying from any rule requirement, a technical rationale to support the change must be presented.

Following the Commissioner’s approval of the Water Quality Monitoring Work Plan and the completion of the approved work, the Water Quality Monitoring Report is submitted. A person with expertise in hydrogeology must sign the report and certify the quality of the work.

Indicate on the blanks provided the page(s) of the document where the specified rule requirement is addressed.

Minn. Rules pt. 7035.2815, subps. 3 and 14; SONAR pages 356-357 and 561-571

1. The report must contain:

<table>
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<tr>
<th>MPCA Use</th>
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<tbody>
<tr>
<td>______</td>
<td>Monitoring and quality assurance data.</td>
</tr>
<tr>
<td>______</td>
<td>Analysis of water quality trends.</td>
</tr>
<tr>
<td>______</td>
<td>Identification of constituents that exceed ground water performance standards of Minn. Rules pt. 7035-2815, subp. 4, intervention limits.</td>
</tr>
<tr>
<td>______</td>
<td>Comparison to the current Minnesota Department of Health Recommended Allowable Limits.</td>
</tr>
<tr>
<td>______</td>
<td>Comparison to surface water quality standards, if appropriate.</td>
</tr>
</tbody>
</table>

2. The method for data analysis and interpretation used in this report should be consistent with those described in the approved Water Quality Monitoring Work Plan.

| ______ | ______ |

3. Deviations from the monitoring protocol must be identified and explained.

| ______ | ______ |
MPCA Solid Waste Management Rules Requiring Commissioner Approval
Minn. Rules pt. 7035.2815, subp. 3

The following is a list of areas in the Minn. Solid Waste Management Rules where it is necessary to get the appropriate agency commissioner’s approval to deviate from the minimum standards or requirements of Minn. Rules pt. 7035.2815, subp. 3 if something is to be proposed which is less than these minimum standards. These rule citations are only for hydrogeologic concerns in the solid waste permitting process. NOTE: There are numerous other areas in the rules where commissioner approval is needed for alternatives to standards:

1) Minn. Rules pt. 7035.2815, subp. 3.A. – Commissioner approval needed if existing information is to substitute for rule required work items;

2) Minn. Rules pt. 7035.2815, subp. 3.C. – Commissioner approval needed if a shallower depth of investigation other than that specified in this item is proposed;

3) Minn. Rules pt. 7035.2815, subp. 3.D. – Commissioner may approve or require changes to the requirements of Minn. Rules pt. 7035.2815, subp. 3, items E. thru I. if conditions in Minn. Rules pt. 7035.2815, subp. 3.D. (1) – (4) are met;

4) Minn. Rules pt. 7035.2815, subp. 3.F(4) – Commissioner of Minnesota Department of Health approval needed if borings and/or wells are not to be sealed in strict compliance with the Minnesota Water Well Construction Code;

5) Minn. Rules pt. 7035.2815, subp. 3.F(5) – Commissioner approval is needed if sampling methods other than those specified in this subitem are proposed;

6) Minn. Rules pt. 7035.2815, subp. 3.F(10) – Commissioner approval is needed if an alternative method to estimate the importance of head fluctuation over time is proposed.