UIC WASTE ANALYSIS PLAN
Class I Deepwell

for
Autumn Hills Landfill

Class I Deepwell IW No. 1;
EPA Permit # TBD

Zeeland, Michigan

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1.0 INTRODUCTION

1.A Background

The purpose of this Waste Analysis Plan (WAP) is to characterize the non-hazardous landfill leachate waste water to be injected into the Waste Management Autumn Hills Landfill Well No. 1 to be located at the Autumn Hills Landfill in Ottawa County, Michigan. Waste Management Autumn Hills (Autumn Hills) will be responsible for implementing this WAP. UIC Well No. 1 will be constructed in 2018 or 2019. Waste will be injected into the Mt. Simon Formation at a projected depth of approximately 5578 feet below ground surface.

Autumn Hills intends to operate the well consistent with Title 40 of the Code of Federal Regulations (40 CFR), Section 146.13 that requires operators of Class I underground injection wells to monitor and analyze the fluids injected into the well "to yield representative data of their characteristics." This waste analysis plan also fulfills the specifications at 40 CFR 146.68 by presenting parameters for which the waste will be analyzed, methods that will be used to test for these parameters, and methods that will be used to obtain representative samples of the waste to be analyzed.

1.B Sources

The Autumn Hills Landfill generates non-hazardous leachate. There is no SIC code for sanitary landfill leachate.

The waste waters produced at the landfill include water collected from leachate collection system, whichoriginates from water infiltration through waste. Some groundwater or run-off may also be added to this leachate if necessary. Fluids generated during well maintenance or testing activities may also be reinjected into the well. The waste stream is primarily composed of inorganic, non-hazardous compounds such as chloride, and potassium, with a TDS of up to approximately 14,000 ppm.

Waste water is first accumulated in each landfill cell, then piped to a leachate collection tank. Although some settling may occur and Autumn Hills may elect to filter waste water prior to injection in the future, no waste treatment is performed in the tank.

1.C Summary

The major components of the Autumn Hills waste characterization and UIC monitoring program include:

- Volume Monitoring
- Sampling and Analysis
- Quality Assurance/Quality Control

These components are addressed in Sections 2 and 3, below.

The WAP may be reviewed and, if necessary, revised if new waste constituents or conditions are identified that may significantly alter the physical properties of the waste. Revisions to the WAP may also be required if new permit conditions are added by the Agency for cause. Any future revisions to the WAP, upon approval, will become part of the administrative record and constitute a minor modification of the permit. Compatibility issues regarding the subsurface rock matrix and well construction materials are documented in the permit application and are not addressed in this WAP.

2.0 PROCEDURES

2.A Volume Monitoring

As discussed in the text of the Permit Application, flow and pressure recorders are to be used to continuously monitor injection pressure, annulus pressure, and flow rate; totalized cumulative volumes for the well will be calculated from monitoring data. A summary of recorded data will be provided to the US EPA per applicable permit requirements. The remaining portions of this WAP address physical and chemical characterization of the waste.

2.B Waste Characterization

Waste analysis parameters were selected based on process knowledge, historical analysis, and analysis suggested by EPA Region 5 guidance. These parameters include pH, TDS, TSS, and applicable organic toxicity characteristics. The pH is generally near neutral to basic (e.g., 7.2 to approximately 8.4 for analyses performed 2012-2017). The total dissolved solids (TDS) concentration of the waste is also a useful indicator of fluid properties. Magnesium, potassium and sodium are among the predominant cations and chloride is the predominant anion, with bicarbonate/carbonate alkalinity also a major component. TDS ranges from approximately 6900 to over 14,000 mg/l. Because the native brine present in the Mt. Simon contains high TDS including high cation-anion concentration, injectate will have a lower TDS concentration that natural formation waters.

Daily testing for pH, Eh, specific conductance and temperature will be performed on days that waste is injected. Although only a limited number of chemical constituents are expected in injectate, a relatively comprehensive analysis will be performed on a quarterly basis. The leachate originates from a sanitary landfill, but a more comprehensive analysis will ensure the non-hazardous nature of injectate. However, analysis excludes compounds like pesticides or herbicides because historical process knowledge indicates that the wastewaters are not expected to contain measurable quantities of these compounds. Wastewater is not expected to be ignitable, reactive, or corrosive, but waste will be analyzed for flashpoint, reactive cyanide, and pH on a quarterly basis as a basic way to monitor the non-hazardous nature of the waste and to ensure any trends or changes are identified.

Table 2-1 of the following section lists the parameters and monitoring frequency used to characterize wastewater to be injected into the Autumn Hills Well No. 1. The table also summarizes the applicable analytical method and reporting units for each. Characterization parameters were selected based on historical leachate sampling and identified for characterization needed to satisfy regulatory requirements and applicable specifications listed in typical Region 5 non-hazardous UIC permits.

2.C Sampling and Analysis

Samples will be collected daily or quarterly via grab sample from the waste injection line or the waste storage tank during calendar days or quarters when injection of waste takes place. The waste analysis to be conducted is designed to acquire representative samples of typical injectate. Autumn Hills Landfill personnel, contractor personnel, or contracted analytical laboratory personnel will collect required on-site waste stream samples. Sampling procedures will be conducted at the direction of site representatives and in accordance with the certified or accredited analytical laboratory procedures, and will meet the minimum current standard US EPA procedures. The grab sample will be sent to an independent contract laboratory for analysis. Sufficient mixing and residence time in the system will have occurred at this sampling point for the waste to be representative of the waste stream that is being injected. The sampler's name, sampling point, and date sampled will be documented using COC methods specified in Section 3.A..

Table 2-1 presents the parameters, analytical methods, reporting unit and sample frequency for each test parameter. Sampling and analytical methods will meet or exceed the standards cited below or as presented in USEPA "Methods for the Chemical Analysis of Water and Wastes" or "Standard Methods for the Examination of Water and Wastewater".

TABLE 2-1
AUTUMN HILLS
CLASS I WASTE SAMPLING AND ANALYSIS SUMMARY

Test Parameter	Example Test Methods*	Reporting Units	Frequency
Ignitability (flash point)	SW846 1010, SW1010A	---	Quarterly
Alkalinity	SM2320-BICARB SM2320-TOTAL	Mg/L	Quarterly
Reactive Sulfide and Cyanide	SW846 7.3.3.2/ 7.3.4.1/ 7.3.4.2	---	Quarterly
pH	USEPA 150.1	pH units	Daily or Continuous
Eh	Measurement using oxidation-reduction potential instrumentation	Mvolts	Daily or Continuous
Specific Gravity	Hydrometer, ASTM 2710F, D5057		Daily or Continuous
Temperature	Thermometer	^{o}F	Quarterly
Wellhead TDS	USEPA 160.1	mg/L	Quarterly

Test Parameter	Example Test Methods*	Reporting Units	Frequency
Wellhead TOC	USEPA 160.2	mg/L	Quarterly
Select Characteristic Constituents			
Benzene (D018)	USEPA 8260B/624	mg/L	Quarterly
Carbon Tetrachloride (D019),	USEPA 8260B/8021B	mg/L	Quarterly
Chlorobenzene (D021),	USEPA 8260B/8021B	mg/L	Quarterly
Chloroform (D022),	USEPA 8260B/8021B	mg/L	Quarterly
1,4-Dichlorobenzene (D027),	USEPA 8260B/8021B	mg/L	Quarterly
1,2-Dichloroethane (D028),	USEPA 8260B/8021B	mg/L	Quarterly
Dichloroethylene (D029),	USEPA 8260B/8021B	mg/L	Quarterly
Tetrachloroethylene (D039),	USEPA 8260B/8021B	mg/L	Quarterly
1,1 Trichloroethylene (D040)	USEPA 8260B/8021B	mg/L	Quarterly
Vinyl Chloride (D043)	USEPA 8260B/8021B	mg/L	Quarterly
Additional Parameters			
Potassium	USEPA 200.8/6020A	mg/L	Quarterly
Sodium	USEPA 200.8/6010B, 6020A, 3005A	mg/L	Quarterly
Chloride	USEPA 325.2/A4500	mg/L	Quarterly
Nitrate+nitrite	USEPA 200.8/6500	mg/L	Quarterly
Total inorganic nitrogen	USEPA 350.2	mg/L	Quarterly
Ammonia	USEPA 350.2	mg/L	Quarterly
Arsenic (D004)	USEPA 6000 series	mg/L (ppm)	Quarterly
Barium (D005)	USEPA 6000 series	mg/L (ppm)	Quarterly
Cadmium (D006)	USEPA 6000 series	mg/L (ppm)	Quarterly
Chromium (D007)	USEPA 6000 series	mg/L (ppm)	Quarterly
Lead (D008)	USEPA 6000 series	mg/L (ppm)	Quarterly
Additional Parameters			
Mercury (D009)	USEPA 6000 Series	mg/L (ppm)	Quarterly
Selenium (D010)	USEPA 6000 Series	mg/L (ppm)	Quarterly
Silver (D011)	USEPA 6000 Series	mg/L (ppm)	Quarterly
Endrin (D012)	USEPA 8081A/8085/8270	mg/L (ppm)	Quarterly
Lindane (D013)	USEPA 8081A/8270	mg/L (ppm)	Quarterly
Methoxychlor (D014)	USEPA 8270D/8081A	mg/L (ppm)	Quarterly

Test Parameter	Example Test Methods*	Reporting Units	Frequency
Toxaphene (D015)	USEPA 8081A/8270	mg/L (ppm)	Quarterly
2,4-D (D016)	USEPA 8151A	mg/L (ppm)	Quarterly
2,4,5-TP (Silvex) (D017)	USEPA 8151A/8321/8085	mg/L (ppm)	Quarterly
Chlordane (D020)	USEPA 8081A/8270	mg/L (ppm)	Quarterly
o-Cresol (D023)	USEPA 8270C	mg/L (ppm)	Quarterly
m-cresol (D024)	USPEA 8270C	mg/L (ppm)	Quarterly
p-Cresol (D025)	USEPA 8270C	mg/L (ppm)	Quarterly
Cresol (D026)	USEPA 8270C	mg/L (ppm)	Quarterly
2,4-Dinitrotoluene (D030)	USEPA 8270C	mg/L (ppm)	Quarterly
Heptachlor (and its epoxide) (D031)	USEPA 8081A/8085/8270	mg/L (ppm)	Quarterly
Hexachlorobenzene (D032)	USEPA 8081A/8085/8270	mg/L (ppm)	Quarterly
Hexachlorobutadiene (D033)	USEPA 821B/8260B	mg/L (ppm)	Quarterly
Hexachloroethane (D034)	USEPA 8270C/D	mg/L (ppm)	Quarterly
Methyl ethyl ketone (D035)	USEPA 8260B/8261	mg/L (ppm)	Quarterly
Nitrobenzene (D036)	USEPA 8270D	mg/L (ppm)	Quarterly
Pentachlorophenol (D037)	USEPA 8270D	mg/L (ppm)	Quarterly
Pyridine (D038)	USEPA 8270D	mg/L (ppm)	Quarterly
2,4,5-Trichlorophenol (D041)	USEPA 8270D	mg/L (ppm)	Quarterly
2,4,6-Trichlorophenol (D042)	USEPA 8270D	mg/L (ppm)	Quarterly
Vinyl chloride (D043)	USEPA 8021B/8260B	mg/L (ppm)	Quarterly

Notes: * Test methods cited are examples; alternative methods with equal or better detection limits may be used

Results of annual analyses collected to satisfy Landfill Operating License are presented in appendices to Section H of the EPA UIC Permit Application. As shown in this Section, analysis shows that only a relatively few organic and inorganic constituents are detected, and inorganic parameters are analyzed on an annual basis as required by the Landfill Operating License. In addition, the waste will be sampled and analyzed for other parameters required by this WAP as shown in Table 2-1, including but not limited to pH, Eh, specific gravity, temperature, TDS and TOC, along with chloride and other inorganic paratmers that make up a major portion of the waste stream. Therefore, based on process knowledge and historical analytical results, the WAP parameter list provides analysis for 1) EPA recommended parameters; 2) TC compounds to ensure non-hazardous compliance, and 3) compounds typically present in injectate at significant concentrations (e.g. chloride).

It is important to note that Autumn Hills Landfill is required to perform ongoing leachate analysis as part of landfill operating permits and requirements. Autumn Hills Landfill may collect and analyze samples of injectate as described in this WAP, and share resulting data with operations to satisfy landfill operating permit requirements.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

3.A General Sampling and Analytical Information

Sampling protocols outlined in this document are to be followed. Autumn Hills is responsible for obtaining data necessary to comply with this WAP, and will ensure adherence to guidelines set forth in the referenced standards listed in Section 2.C or equivalents, as appropriate. Approved sample collection vessels and preservation techniques from 40 CFR 136.3 or equivalent will be followed as applicable and appropriate. These will include preservation in plastic or glass sample containers provided by the laboratory and storage in a sample refrigerator or cooler for shipment to the laboratory. Autumn Hills reserves the option to choose alternate laboratories for testing provided equivalent QA/QC standards are met.

COC Form Content

Each sample taken will be accompanied by facility or contract laboratory Chain of Custody (COC) form that provides a record of sample handling starting with sample acquisition, documenting the process up to laboratory analysis. Samples taken are to be logged in the field using the COC, sealed, and delivered to the laboratory with a COC form. The COC form shall provide the following items collected by the sampler:

1. Sample ID including code or name, in addition to date and time;
2. Name of sample collector; (include sampling company name if not site personnel);
3. Sample collection method;
4. Sample collection date;
5. Sample collection point; and
6. Sample presentation technique, as applicable

Sample container label will also include a COC seal. Sample chain-of-custody will be followed at all times during the sampling and subsequent analysis. Chain-of-custody will be used to document the handling and control necessary to identify and trace a sample from collection through to final analytical results. Standard laboratory COC forms that document the times and dates of all personnel handling the sample, along with standard labels and container seals sufficient to distinguish between samples and prevent tampering, will be acceptable.

Reporting and Records Retention

Analytical reports and regulatory submittals regarding the nature and composition of injected fluids are to be maintained in the well files until authorization is obtained from US EPA, in writing, to discard the records. All laboratory reports submitted to US EPA

will include, at a minimum, the following:

1. Test description;
2. Analytical method for parameter detection;
3. Identification of analysis date and analyst;
4. Result and units; and
5. Analytical reporting limits.

The following sections present QA/QC parameters which will be followed to help to assure the adequacy of the sampling and analytical techniques for wellhead sampling and analysis described in this plan.

3.B Sampling Controls

1. Equipment Blanks

   Fluid samples will be obtained directly from the sample accumulation container before being sealed in the sample container shipped to the laboratory. In this case, no equipment cleaning blanks will be required. If samples cannot be directly placed in the bottles intended for preservation and shipment, equipment blanks will be taken as deemed appropriate by Autumn Hills.

2. Trip Blanks

   If the laboratory analysis is ever suspect because it contains anomalous parameters, trip blanks will be collected to assess in-transit contamination. The trip blank will consist of sample containers filled and sealed at the laboratory with laboratory-provided deionized (DI) water that accompany the sample containers used throughout the sampling event. The sample containers shall be handled in the same manner as the samples. The trip blank(s) will be sent to the laboratory for analysis of, at a minimum, the same parameters specified in the sampling plan above. A minimum of one (1) trip blank per sampling event will be utilized, when deemed necessary. At the discretion of Autumn Hills, trip blanks may be submitted with any sample to verify representativeness of the sampling program.

3. Sample Duplicates

   On advance written request of US EPA, duplicate samples will be taken to further assess the QA/QC program of the laboratory conducting the analysis. Such samples will be drawn from the same site from which primary samples will be taken consecutively from the same sampling tap or sample location to

ensure representativeness. The duplicate will be labeled with a sample number that will not conflict with the other samples, but will not be discernable to the laboratory as a duplicate sample. Upon the request of US EPA or at the discretion of site representatives, one duplicate sample per selected sampling event will be taken and analyzed for the same parameters as the sampling event.

3.C Analytical Controls

1. Equipment Calibration

   The selected analytical laboratories must maintain QA/QC records of the frequency and type of instrument calibration performed at the laboratory and in the field. Any calibration of thermometers, gauges, chromatographs, spectrometers and other analytical equipment will be conducted according to appropriate instrument manufacturer specifications and manufacturer recommended frequencies or as dictated by applicable laboratory QA/QC plans that have been developed by the laboratory. Valid calibration certificates for instruments used offsite by a certified lab will be maintained at that facility. Calibration data for onsite field testing or continuous monitoring will be maintained as part of the site well records.

2. Data Reduction

   Transcription of the raw data into the reportable units is conducted by the laboratory in accordance with the selected laboratory Q/A plan. Data reduction utilized in the analysis and reporting process is presented in the reports to the US EPA for each sampling and analysis event. Data is recorded on hand written or computer work sheets that include identification data, sample data and all data required for calculations, or on computer print-outs accompanied by operator notes and summaries.

3. Data Verification

   Data verification is conducted after each sampling event by assigned laboratory personnel and includes, at a minimum, review of chain-of-custody forms, equipment calibration records and data completeness. Spot checks of raw data versus reported data are performed to review math accuracy, significant numbers and reporting units. In addition, certified laboratory standard quality assurance/quality control requirements or checklists are utilized to verify individual test methods such as blanks, standards, and for comparisons of internal lab test duplicate results. Problems with any of these items will be indicated in the analytical report presented to the agency.

4. Internal Quality Control

   Per the laboratory QA/QC program, certified quality control samples from appropriate commercial sources or the US EPA, may be run periodically with sample batches. Internal quality control are addressed by disclosure of the laboratory's use of blanks, blind standards, matrix spikes and matrix spike duplicates, preparation of reagents, and laboratory duplicate or replicate analyses.

3.D Actions

1. Corrective Actions

   Corrective actions are implemented by laboratories if the analytical or sampling methods do not achieve plan objectives or data verification identifies inconsistencies in the results. Actions may entail re-sampling the waste stream and/or re-analyzing the fluid for a particular parameter, re-calibrating an analytical device, or other appropriate actions as dictated by the specific situation encountered. Action levels are typically taken in accordance with any applicable standards from USEPA “Methods for the Chemical Analysis of Water and Wastes” or “Standard Methods for the Examination of Water and Wastewater”. Autumn Hills representatives may, at their discretion, require re-sampling and retesting to confirm results that fall outside the historical range of expected analytical results, or outside equipment calibration curves.

2. Reports to US EPA Region 5

   Reports of waste analysis to US EPA will contain a table summarizing the sampling date, units and analytical result for each of the parameters listed in table 2-1 of this document. Additionally, analytical results (i.e. data), including chain of custody forms, will be submitted to US EPA.

3.E Re-Characterization

Autumn Hills shall review the results of quarterly leachate analysis to ensure that injectate is sufficiently characterized. At the discretion of Autumn Hills or at the written request of EPA, re-characterization efforts may be conducted should a significant change occur in the injectate composition based on quarterly analyses, or if necessitated or required by process changes or new regulations.

The waste stream will be re-characterized as deemed necessary by Autumn Hills if analyses shows a significant change in parameter concentration, particularly toxicity characteristic compound composition that might affect the non-hazardous nature of the waste. In this instance, sampling may be performed more frequently to obtain more

representative analysis of waste composition, to ensure that the overall composition of injectate is still non-hazardous. Any future revisions to the WAP, upon approval, will become part of the administrative record and constitute a minor modification of the permit upon submittal by Autumn Hills.