

Attachment B5
Radiological Monitoring

WAYNE DISPOSAL, INC. SITE #2
MID 048 090 633

Attachment B5.I Radiological Monitoring

WAYNE DISPOSAL, INC. SITE #2 MID 048 090 633

Wayne Disposal Inc. (WDI) may dispose of Technologically Enhanced Naturally Occurring Radiological Material (TENORM) in accordance with Radiological Waste Acceptance Criteria (WAC) identified in Appendix B of the Waste Analysis Plan. This Attachment outlines radiological monitoring required by Part 111 Section 11132 of Michigan's Natural Resources and Environmental Protection Act, 1994 P.A. 451, as amended. Protocols designed to monitor the environment and personnel for the presence of radionuclides are contained in Wayne Disposal Inc.'s (WDI) Environmental Radiological Monitoring Program (ERMP). As required by Section 11132(6) at a minimum this monitoring program includes:

- A. Radiological monitoring of site workers and at the landfill property boundary
- B. Radium-226, Radium-228, and Lead-210 as parameters analyzed in leachate and groundwater

Environmental Monitoring

The ERMP outlines perimeter air, perimeter passive gamma, groundwater and leachate sampling as required by Section 1132(6)(a) and (b). Program sampling frequencies, and sampling and laboratory analytical methods are specified in the ERMP. In the event samples cannot be obtained during the normal sampling period, where possible resampling events will be scheduled or the sample will be reported as lost data. Radium-226, radium-228, and lead-210 are included among the parameters analyzed in perimeter air, groundwater and leachate samples. Figures showing the monitoring locations for these parameters can be found in the attachments specified in the table below.

Groundwater <i>Attachment B5.A</i>	Leachate <i>Attachment B5.H</i>	Perimeter Air <i>B5.B</i>	Perimeter Passive Gamma
<ul style="list-style-type: none">• OB-40R• OB-19R• OB-48• OB-50• OB-51A• OB-52• OB-53 <ul style="list-style-type: none">• OB-20• OB-15• OB-21• OB-47• OB-22• OB-25• OB-24	<ul style="list-style-type: none">Master Cell VI Subcell• ENE• ENW• ESE• ESW• G	<ul style="list-style-type: none">• Station 5• Station 8• Station 9• Station 11	<ul style="list-style-type: none">• North Perimeter• East Perimeter• South Perimeter• West Perimeter

Personnel Monitoring Program

Site workers who handle, inspect, treat and dispose of exempt, low-activity radiological materials and may be exposed to 100mrem/year or more will be monitored by personnel dosimetry that is available for review at the facility. Worker doses, after being corrected for ambient background, are compared to an annual dose limit of 500mrem/yr.

Self-Monitoring Thresholds

Self-monitoring thresholds are substantially less than the 100mrem/year permissible exposure level for the general public. Thresholds are intended to track non-occupational doses through monitoring and dose calculations and implement controls when necessary. Monitoring data collected is used to calculate potential net annual dose. The dose is then compared to permissible exposure levels.

Thresholds for media have been established at a fraction of each applicable environmental pathway above site background levels as follows:

Table 1. Self-Monitoring Thresholds

	Perimeter Air	Groundwater	Perimeter Passive Gamma
Nuclide	(uCi/ml)	(uCi/ml)	(mrem/qtr)
Ra-226	2.25E-13	1.50E-08	25
Ra-228	5.00E-13	3.00E-08	
Pb-210	1.50E-13	3.00E-08	
Th-232	1.00E-15	5.00E-09	
Th-230	5.00E-15	1.50E-08	
Th-228	5.00E-15	5.00E-08	
U-238	1.50E-14	1.00E-07	
U-235	2.50E-13	1.50E-07	
U-234	2.50E-13	1.50E-07	

Air and ground water thresholds are set at 25% and 50% (respectively) of the effluent levels published by the US Nuclear Regulatory Commission or State of Michigan regulatory limits. The tables published in Tables 1 and 2 of 10 CFR part 20, Appendix B were utilized in the development of the thresholds. The gamma quarterly investigation levels are set at 25% of the 100mrem above background.

Data Review/Threshold Exceedances

Data from each quarterly sampling will be reviewed to verify reported levels minus background are below the values in the self-monitoring threshold table. Exceedances, of all matrices that are used for the perimeter dose calculations (i.e. perimeter air and perimeter passive gamma), will trigger US Ecology to verify doses are below the 100mrem/yr above background limit. If the



Environmental Radiological Monitoring Program (ERMP)

Objective

The purpose of this radiological monitoring plan is to evaluate environmental impacts associated with radiological waste management activities at Wayne Disposal, Inc. (WDI) and to ensure disposal activities are being performed in a manner that minimizes risk to human health and the environment. Unless otherwise specified equipment and sample collection procedures are completed as outlined in WDI's Part 111 Operating License sampling and analysis plans as follows:

- Groundwater Monitoring Sampling and Analysis Plan- Attachment 9
- Leachate Monitoring Sampling and Analysis Plan- Attachment 13

Required Sampling Locations

Figure 1 includes all required environmental monitoring sampling locations monitored by this program.

Analytical Methods

Methods identified in Table 1 are methods anticipated to be used. Alternative methods may be required in order to ensure results obtained are most representative. If an alternative method is utilized this will be noted in the annual monitoring report or exceedance notification report along with information explaining why an alternative method was utilized.

Table 1: Anticipated Analytical Methods

ANALYSIS	METHOD
Gamma Spec Full	EPA 901.1
Radium-226	SM7500RaB M or EPA 901.1
Radium-228	EPA 904 or EPA 901.1
Lead-210	HASL 300 Po-2RC or ALS Pb-210 Soils and Waters
Isotopic Uranium	D3972
Isotopic Thorium	LANL ER200M
Perimeter Passive Gamma	TLD
Passive Gamma Dose	NVLAP*

*National Voluntary Laboratory Assessment Program

Sampling and Analysis Requirements

Leachate

dose as a result of an exceedance is greater than 100mrem above background, US Ecology will notify the Michigan Environment, Great Lakes, and Energy (EGLE), Material's Management Division, Radiological Protection Section (RPS), as discussed in the below Reporting section.

For threshold exceedances with respect to matrices that are monitored, but are not used in dose calculations (i.e. groundwater) or if the dose calculation cannot be performed, the matrix will be resampled in order to confirm the exceedance. If the resample confirms the exceedance, US Ecology will investigate the source of the detection and notify EGLE as discussed in the Reporting section of this attachment.

Reporting

If the dose at the perimeter exceeds 100mrem/year above background or an exceedance above background of a matrix that is not used in the dose calculation occurs WDI shall notify the Division, Hazardous Waste Section, Permit and Corrective Action Unit, by telephone within one working day of discovering the exceedance. Where applicable, arrangements will be made for resampling as soon as possible to confirm the exceedance.

If confirmed, WDI shall investigate the cause of the exceedance and submit a report to the RPS within 90 days of discovery. The report shall include the following:

- Written description summarizing the potential cause of the exceedance
- Laboratory analytical data and dose calculations (when applicable) used to determine the exceedance
- A description of actions taken to reduce the potential for future exceedances

Results of all environmental monitoring required by Section 1132 will be submitted to the RPS by March 15 of each year. The report shall include the following information:

- A summary of the radiological monitoring performed within the calendar year and a comparison to the self-monitoring thresholds and annualized permissible exposure level to the public.
- Background concentrations utilized in threshold evaluation (per sampling location)
- Calculated dose to the public
- Laboratory analytical data collected within the calendar year.
- A summary of any actions taken to reduce exposure (if necessary)
- Laboratory analytical data, monitoring locations, and sampling and analysis methods for voluntary radiological monitoring collected during the calendar year.
- A 3 year trend analysis of perimeter air, penetrating gamma radiation, groundwater, and leachate monitoring data for each location (if historical data is available).

Reports shall be maintained in the operating record until closure of the facility.

For the purposes of this plan, leachate is monitored only from subcells of Master Cell VI in which radiological materials have been disposed including subcells ENE, ENW, ESE, ESW and G.

Analysis is intended to measure radiological constituents that may have leached out of disposed waste. Each of the subcells is analyzed annually for the following required analytical parameters:

- Radium-226
- Radium-228
- Lead-210

Additional parameters that may be analyzed include:

- Gamma Spectroscopy
- Isotopic Uranium
- Isotopic Thorium

All leachate is treated at the facility's wastewater treatment plant by chemical precipitation, clarification, biological destruction, and ultrafiltration, then discharged to the publicly owned treatment works for further treatment. For this reason, the monitoring is only collected for trending and characterization purposes.

Groundwater

There are 28 groundwater monitoring wells associated with the WDI hazardous waste disposal area of which 14 were selected for inclusion in this monitoring plan based on their proximity to the landfill cells in which radiological materials have been disposed. Wells are sampled annually. Of the 14 wells that are included in this plan, 12 are down gradient and 2 are up gradient of the landfill cells of interest.

Up gradient wells include:

- OB-40R
- OB-19R

Down Gradient wells include:

- | | |
|---------|----------|
| • OB-15 | • OB-47 |
| • OB-20 | • OB-48 |
| • OB-21 | • OB-50 |
| • OB-22 | • OB-51A |
| • OB-24 | • OB-52 |
| • OB-25 | • OB-53 |

Each of the monitoring wells is analyzed annually for the following required analytical parameters:

- Radium-226
- Radium-228
- Lead 210

Additional parameters that may be analyzed include:

- Gamma Spectroscopy
- Isotopic Uranium
- Isotopic Thorium

Samples are not required to be collected within the nitrogen glove box. In the event the sampler believes there is potential for cross contamination due to the atmosphere, they may utilize the nitrogen glove box.

Air

The ambient air quality entering and leaving USEM is monitored at four of the seven stations around the perimeter of the site. Monitoring stations included are 5, 8, 9, and 11 as they are located at each end of the site.

All stations are monitored using a high volume Total Suspended Particulate (TSP) sampler. Sampling dates are staggered in a calendar month to include a variety of days without interfering with the normal ambient air monitoring program. Sampling is performed once every two weeks for a twenty-four (24) hour period with a nominal flow rate of 50 cfm \pm 10 cfm. In the event that a sample cannot be collected due unforeseen circumstances (e.g. power outage), a resampling event will be scheduled. Samples for each station are composited together for digestion on a quarterly basis, rendering a quarterly result. Each of the quarterly samples is analyzed for the following required analytical parameters:

- Radium-226
- Radium-228
- Lead 210

Additional parameters that may be analyzed include:

- Gamma Spectroscopy
- Isotopic Uranium
- Isotopic Thorium

Perimeter Passive Gamma

Environmental thermoluminescent dosimeters (TLDs) are placed along the perimeter of USEM to measure the potential external dose to members of the public. Sampling locations at USEM include the north, east, west, and south perimeter of the site. The east perimeter sample is used to establish the background of the facility and is used to determine dose exposure above background.

Sampling is continuous and a quarterly value is obtained using the method specified below. In the event a sample cannot be obtained during the quarterly period the location will be reported as lost data.

Personnel Passive Gamma

External radiation dose to USEM employees that may be exposed to 100mrem/year, is measured by individual monitoring badges (aka dosimeters) issued to workers that directly handle, or are in close proximity to, radiological materials. Sampling is continuous while participating employees are present at the facility (i.e., employees are required to wear their assigned dosimeters whenever at work). Dosimeters are analyzed quarterly. Personnel monitoring is maintained onsite and available for onsite review.

Self-Monitoring Thresholds

Self-monitoring thresholds are substantially less than the 100mrem/year permissible exposure level for the general public. Thresholds are intended to track non-occupational doses through monitoring and dose

calculations and implement controls when necessary. Monitoring data collected is used to calculate potential net annual dose. The dose is then compared to permissible exposure levels.

Thresholds for media have been established at a fraction of for each applicable environmental pathway above site background as follows:

Table 1. Self-Monitoring Thresholds

	Perimeter Air	Groundwater	Perimeter Passive Gamma
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Pb-210	1.50E-13	2.50E-09	
Th-232	1.00E-15	7.50E-09	
Th-230	5.00E-15	2.50E-08	
Th-228	5.00E-15	5.00E-08	
U-238	1.50E-14	7.50E-08	
U-235	2.50E-13	7.50E-08	
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Air and ground water thresholds are set at 25% and 50% (respectively) of the effluent levels published US Nuclear Regulatory Commission or State of Michigan regulatory limits. The tables published in Tables 1 and 2 of 10 CFR part 20, Appendix B were utilized in the development of the thresholds. The gamma quarterly investigation levels are set at 25% of the 100mrem above background.

Data Review/Threshold Exceedances

Data from each quarterly sampling will be reviewed to verify reported levels are below the values in the self-monitoring threshold table. Exceedances, of all matrices that are used for the perimeter dose calculations (i.e. perimeter air and perimeter passive gamma), will trigger US Ecology to verify doses are below the 100mrem/yr above background limit. If the dose as a result of an exceedance is greater than 100mrems above background, US Ecology will notify the Michigan Environment, Great Lakes, and Energy (EGLE), Material's Management Division, Radiological Protection Section (RPS), as discussed in the below Reporting section.

For threshold exceedances with respect to matrices that are monitored, but are not used in dose calculations (i.e. groundwater) or if the dose calculation cannot be performed, the matrix will be resampled in order to confirm the exceedance. If the resample confirms the exceedance, US Ecology will investigate the source of the detection and notify EGLE as discussed in the Reporting section of this attachment.

Reporting

If the dose at the perimeter exceeds 100mrem/year above background or an exceedance of a matrix that is not used in the dose calculation occurs WDI shall notify the Division, Hazardous Waste Section, Permit and Corrective Action Unit, by telephone within one working day of discovering the exceedance. Where applicable, arrangements will be made for resampling as soon as possible to confirm the exceedance.

If confirmed, WDI shall investigate the cause of the exceedance and submit a report to the RPS

within 90 days of discovery. The report shall include the following:

- Written description summarizing the potential cause of the exceedance
- Laboratory analytical data and dose calculations (when applicable) used to determine the exceedance
- A description of actions taken to reduce the potential for future exceedances

Results of all environmental monitoring required by Section 1132 will be submitted to the RPS by March 15 of each year. The report shall include the following information:

- A summary of the radiological monitoring performed within the calendar year and a comparison to the self-monitoring thresholds and annualized permissible exposure level to the public.
- Calculated dose to the public
- Laboratory analytical data collected within the calendar year.
- A summary of any actions taken to reduce exposure (if necessary)
- Laboratory analytical data, monitoring locations, and sampling and analysis methods for voluntary radiological monitoring collected during the calendar year.
- A 3 year trend analysis of perimeter air, penetrating gamma radiation, groundwater, and leachate monitoring data for each location (if historical data is available).

Reports shall be maintained in the operating record until closure of the facility.

Appendix A

Public Dose Calculation Method

Public Dose

As indicated in the ERMP, monitoring data is used to perform and report potential dose to the members of the public. The following provides the method that will be utilized to calculate public dose. The method relies on WDI's voluntary monitoring. In the event that the voluntary monitoring is not utilized, the data will be reviewed as described in the ERMP's Data Review /Threshold Exceedances section. An alternative method may be utilized, but only if concurrence has been obtained from the RPS.

Below are the assumptions used in calculating public dose:

- Penetrating radiation data (gamma) will be used to determine external dose. The data will be used to determine net yearly external dose.
- Air results will be used to determine part of the inhalation dose. For potential dose to the public, the highest average annual fence line results will be used to determine inhalation dose. Dose conversion factors are used to determine dose with respect to the nuclides monitored for.
- Radon monitoring data is also used to determine inhalation dose. Dose is determined through use of dose conversion coefficients. Equilibrium coefficient is assumed to be 50%
- Soil results are not used as part of the dose calculation. It is assumed that any intake of soil is through inhalation of suspended contaminants in the air.
- Ground water is not used as part of the dose calculations, as the groundwater is not consumed.
- Occupancy time for members of the public at the fence line is given a conservative number of hours, such as 2000hrs. Alternative assumptions may be made, but explanations for the change in assumptions will be documented.
- Breathing rate is assumed to be 1.2 m³/hr.

The following equation is used for public dose calculations:

Penetrating Radiation Dose (D_γ):

- (\dot{D}_n) = Net dose rate obtained from environmental TLDs
- (T) = Occupancy factor

$$D_\gamma = (\dot{D}_n)(T)$$

Airborne Particulate Dose (D_{air}):

- Breathing rate = 1.2 m³/hr
- (A_i) = Total inhaled activity in units of Bq per each nuclide
- (DCF_i) = Dose conversion Factor in units of Sv/Bq obtained from FGR 11

$$D_{air} = \Sigma (DCF_i)(A_i)$$

Radon (D_R):

- (C) = Net average concentration in Bq/m³
- (DCC) = Dose conversion coefficient 6.4E-6 mSv/(Bq/m³) hr
- T = Occupancy Factor

$$D_R = (C)(DCC)(T)$$

Total Potential Dose:

$$D_{Total} = D_\gamma + D_{air} + D_R$$

Figure 1

Required Monitoring Points

