

B.5 Environmental Monitoring

MICHIGAN DISPOSAL WASTE TREATMENT PLANT (MDWTP)

MID 000 724 831

2017 ATTACHMENT REVISIONS

Replaces Previous Attachment B.5 Environmental Monitoring

**FORM EQP 5111 ATTACHMENT TEMPLATE B5
ENVIRONMENTAL MONITORING PROGRAMS**

This document is an attachment to the Michigan Department of Environmental Quality's (DEQ) *Form EQP 5111, Operating License Application Form for Hazardous Waste Treatment, Storage, and Disposal Facilities*. See the instructions for Form EQP 5111 for details on how to use this attachment. All references to Title 40 of the Code of Federal Regulations (40 CFR) citations specified herein are adopted by reference in R 299.11003.

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9611 establishes requirements for the environmental monitoring programs for hazardous waste management facilities. Owners and operators of hazardous waste treatment, storage, or disposal facilities must develop an environmental monitoring program capable of detecting a release of hazardous waste or hazardous waste constituents from the facility to groundwater, air, or soil.

This license application template addresses requirements for an environmental monitoring program for hazardous waste management units and the hazardous waste management facility for the Michigan Disposal Waste Treatment Plant facility. The template includes either a monitoring program description or a demonstration for a waiver from the monitoring requirements in accordance with R 299.9611(3)(a) and (b) and R 299.9611(4) as indicated below:

Groundwater Monitoring Program (*Check as appropriate*)

- R 299.9612 compliance monitoring program and sampling and analysis plan for one or more units
 Waiver for one or more units

If appropriate, both boxes may be checked if different monitoring programs and waivers apply to the units at the facility.

Ambient Air Monitoring Program (*Check as appropriate*)

- Monitoring program and sampling and analysis plan
 Waiver

Annual Soil Monitoring Program (*Check as appropriate*)

- Monitoring program and sampling and analysis plan
 Waiver

Table of Contents

B5.A GROUNDWATER MONITORING PROGRAM.....	3
B5.A.1 Unit-Specific Groundwater Monitoring Program.....	3
Table B5.A.1 Groundwater Monitoring Program	3
B5.A.2 Groundwater Monitoring Program Waiver	3
B5.A.2(a) Other Units	3
B5.A.3 General Groundwater Monitoring Requirements	3
B5.A.3(a) Sampling and Analysis Plan	4
B5.A.3(b) Description of Wells.....	4
B5.A.3(c) Procedure for Establishing Background Quality	5
B5.A.3(d) Statistical Procedures.....	6
B5.A.4 Detection Monitoring Program.....	9
B5.A.4(a) Indicator Parameters, Waste Constituents, and Reaction Products	9
B5.A.4(b) Groundwater Monitoring System	13
B5.A.4(c) Background Concentration Values for Proposed Parameters.....	13
B5.A.4(d) Proposed Sampling and Analysis Procedures.....	13
APPENDIX A	14
B5.B AMBIENT AIR MONITORING PROGRAM.....	23
B5.B.1 Sampling and Analysis Plan	23
B5.B.1(a) samplers and location	23
B5.B.1(b) Schedule	23
B5.B.1(C) Sampling and Analysis	23
B5.B.1(D) Monitoring Parameters	24
B5.B.1(E) Quality Assurance	24
B5.C ANNUAL SOIL MONITORING PROGRAM.....	25
B5.C.1 Sampling and Analysis Plan	25

B5.A GROUNDWATER MONITORING PROGRAM

[R 299.9611(2)(b) and (3), R 299.9612, and R 299.9629 and 40 CFR, Part 264, Subpart F, except 40 CFR §§264.94(a)(2) and (3), (b), and (c), 264.100, and 264.101]

This section describes the facility's unit-specific groundwater monitoring program as outlined in Table B5.A.1. The basis for determining the groundwater monitoring program for each unit described below is provided in the, Hydrogeological Report, attached separately to this application, which was prepared in accordance with R 299.9506.

All samples collected for environmental monitoring are collected, transported, analyzed, stored, and disposed by trained and qualified individuals in accordance with the Sampling and Analysis Plan (SAP). The SAP should at a minimum include the written procedures outlined in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, Third Edition, Chapter 1 (November 1986), and its Updates.

B5.A.1 UNIT-SPECIFIC GROUNDWATER MONITORING PROGRAM

TABLE B5.A.1 GROUNDWATER MONITORING PROGRAM

Unit	Name of Unit Subject to Monitoring ¹	Conditional Non-LDF Waiver ²	No Migration Waiver ³	Detection Monitoring ⁴	Compliance Monitoring ⁵	Corrective Action Monitoring ⁶
1	MDWTP	NA	NA	YES	NA	NA
2	SECSA	NA	NA	YES	NA	NA

B5.A.2 GROUNDWATER MONITORING PROGRAM WAIVER

[R 299.9611(3)]

B5.A.2(A) OTHER UNITS

[R 299.9611(3)(a)]

The MDWTP facility is conducting response activities in the area of South East Container Storage Area (SECSA) and the waste treatment plant. The response activities include groundwater monitoring that demonstrates compliance with the provisions of Part 111 of Act 451 and the Part 111 Rules.

B5.A.3 GENERAL GROUNDWATER MONITORING REQUIREMENTS

[R 299.9612 and 40 CFR §§264.97 and 264.91(b)]

The MDWTP facility will comply with the requirements for a groundwater monitoring program by implementing the program described in this section. This program was developed to satisfy the requirements of R 299.9612 and R 299.9629 and 40 CFR §§264.98 and 264.99, except 40 CFR

§§264.94(a)(2) and (3) and 264.94(b) and (c). The basis for determining the groundwater monitoring program for each unit is provided in Template B3, Hydrogeologic Report, of this application, which was prepared in accordance with R 299.9506.

B5.A.3(A) SAMPLING AND ANALYSIS PLAN
[R 299.9611(2)(a)]

A sampling and analysis plan for groundwater monitoring at Michigan Disposal Waste Treatment Plant is included provided in Appendix A. The sampling and analysis plan was prepared in accordance with the requirements specified in R 299.9611(2)(a). All sampling and analysis performed pursuant to this application will be consistent with the QA/QC Plan. All samples for the purpose of environmental monitoring will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan.

B5.A.3(B) DESCRIPTION OF WELLS
[R 299.9612 and 40 CFR §264.97(a), (b), and (c)]

There are two groundwater monitoring programs for the Michigan Disposal Waste Treatment Plant (MDWTP). The first is designed to detect impacts from the waste treatment plant and North Container Storage Area (NCSA) within the uppermost aquifer. This monitoring program consists of 6 wells (2 upgradient and 4 downgradient) numbered OB-18, OB-19R, OB-21, OB-23R, OB-36 and OB-47. These wells are completed in the uppermost usable aquifer, which is the glacial sand and gravel deposit beneath the clay till deposit that underlies this area. The water-bearing surficial sand unit that overlies the clay was removed during construction of the treatment plant and replaced with clay; therefore this unit is not the target for this monitoring program. Wells OB-21, OB-23R, OB-36 and OB-47 are downgradient from the treatment plant at a spacing appropriate to monitor potential impacts from the MDWTP. The two upgradient wells, OB-18 and OB-19R represent the quality of background water that has not be affected by leakage from a regulated unit as they along the north property boundary. The four downgradient wells represent the quality of groundwater passing the point of compliance as close as practicable to the south boundary of the MDWTP which allow for detection of contamination when hazardous constituents have migrated from the waste management area to the uppermost usable aquifer.

Maps showing the locations of the aquifer wells and the SECSA wells are included with this template. The table below summarizes the monitoring well information for the two well networks.

The wells were installed in borings drilled with a hollow-stem auger and were constructed one of three ways. Wells OB-18 and OB-21 are composed of PVC screens and PVC riser pipes with the screened interval annular space containing silica sand and sealed off with bentonite pellets and then non-shrinking cement grout to the surface. Wells OB-36 and OB-47 are constructed with stainless steel screens and galvanized steel casing with the annular space consisting of silica sand, bentonite slurry and non-shrinking cement grout. Wells OB-19R and OB-23R are constructed with stainless steel screens and casing, with the annular space filled with silica sand, bentonite and a pH-neutral grout. All wells are equipped with lockable protective casings.

The second monitoring program is designed to detect impacts from the Southeast Container Storage Area (SECSA). At this location, the surficial water-bearing sand deposit containing a perched water table has not been removed and is therefore the unit targeted for groundwater monitoring. The active operations

performed in the SECSA are the storage of liquid and solid hazardous waste that is treated at the MDWTP. Solid containerized waste is stored on the asphalt surface while waste containing free liquids is stored on cement pads with secondary containment. In the past, the SECSA was the location of a Thermal Desorption Unit (TDU) used to recycle refinery waste, although these operations have ceased, the TDU removed, and the area decontaminated. The historical groundwater flow direction in this unit was to the east, however the flow direction has reversed in recent years.

Well locations for monitoring the SECSA includes wells P-1, P-2R, P-3R, P-4R, P-5 & P-7. Well P-5 is used for water levels only. These wells are completed at the bottom of the surficial sand unit within the rather thin saturated zone of the perched water table. The wells are placed around each side of the area providing coverage in any direction of groundwater flow at approximately 150-foot intervals. MDWTP is proposing to add an additional well (P-8), in order to account for fluctuations in the groundwater flow direction within the surficial sand unit.

All of the SECSA wells are constructed with PVC screens and casing. The screened interval is surrounded by silica sand and sealed from the surface with hydrated bentonite hole-plug and quick grout. Each well has a lockable protective casing.

Maps showing the locations of the aquifer wells and the SECSA wells are included with this template. MDWTP has also included a map showing the proposed location for P-8. The following table summarizes the monitoring well information for the two well networks.

MDWTP GROUND WATER WELL INFORMATION

WELL ID	MONITORING PROGRAM	T.O.C. ELEVATION	SCREEN ELEVATION	WELL DEPTH	UNIT SCREENED	WELL PAIR
OB-18	MDWTP	703.11	589.2	114	AQUIFER ROCK	--
OB-19R	MDWTP	709.17	585.6	124	AQUIFER ROCK	--
OB-21	MDWTP	705.00	600.9	104	AQUIFER SAND	OB-36
OB-23A	MDWTP	702.67	577.5	125	AQUIFER SAND	--
OB-36	MDWTP	702.13	572.1	130	AQUIFER ROCK	OB-21
OB-47	MDWTP	702.70	594.3	108	AQUIFER SAND	--
P-1	SECSA	703.97	685.0	16	SURFICIAL SAND	
P-2R	SECSA	706.98	685.4	19	SURFICIAL SAND	
P-3R	SECSA	705.96	683.0	20	SURFICIAL SAND	
P-4R	SECSA	706.47	684.9	19	SURFICIAL SAND	
P-5	SECSA	702.12	684.0	14	SURFICIAL SAND	
P-7	SECSA	706.30	683.3	20	SURFICIAL SAND	

B5.A.3(C) PROCEDURE FOR ESTABLISHING BACKGROUND QUALITY
[R 299.9612 and 40 CFR §264.97(a)(1) and (g)]

MDWTP Aquifer Program

The background for monitoring of the uppermost usable aquifer (MDWTP program) is calculated as intrawell using the methods described below. An intrawell background was selected because; 1) there is natural spatial variability between upgradient and downgradient locations due to changing hydrogeological

conditions and, 2) the determination that there is no existing contamination in the groundwater due to a release from waste management units at the site. The intrawell background for parameter at each well is calculated by a moving window of 8 sample results that lag 6 to 7 years prior to the current year. Then the calculation of the background quality for the 2 classes of parameters is described as follows:

Primary Parameters are volatile organic compounds that are not naturally occurring and thus are presumed to be non-detectable in background quality. In this case the detection limit is the background for evaluation purposes.

Secondary Parameters are naturally occurring metals, major ions and indicator parameters. The intrawell background quality statistics are calculated from the moving window of 8 samples described above. The background statistics and the method of calculation of the secondary parameters is based on the degree of censorship of each parameter at each well. The secondary parameter list includes parameters which are highly censored (at least half of the values are below detection limits), those which are moderately censored (more than half the values are above detection) and those which are essentially all above method detection limits. Some parameters exhibit varying degrees of censorship at different wells.

If the background data for a parameter contains at least five detectable background values, but contains some non-detects, the non-detects will be alternately assigned values of zero and the detection limit. If all of the background values are above detection, the background quality statistics will be calculated from the background data as is. If half or more of the intrawell background measurements are below detection limits (4 or more BDL values), then the background quality is defined by the proportion of values above method detection limits.

SECSA Program

The background groundwater quality for the SECSA was established from the first eight samples collected from each of the five monitoring wells around the SECSA. The first four sampling events were conducted in November of 2009 before any TDU activities or storage of liquid wastes began. Following these initial four samples, four quarterly samples were collected during the months of March, May, August and November of 2010. As these samples were collected during active operations, it was shown that there were no impacts to the ground water in 2010 and as a result the data was considered background.

Based on an evaluation of the background quality data, it was decided to define background using intrawell procedures. This decision was based on the following reasons; 1) The vast majority of parameters do not have any data above the detection limits and the distinction between interwell and intrawell is irrelevant for these parameters, 2) The spatial variation for parameters that are present at measurable concentrations is very large posing significant problems for interwell statistics, and 3) although two wells (P-2R and P-4R) were upgradient at that time, these wells were immediately adjacent to the TDU and thus could not remain representative of native background conditions. Although the TDU operation was discontinued, the flow direction in the surficial unit has turned out to be quite variable, which is another good reason to define background using intrawell procedures. The statistical definition of background was based on the degree of censorship as described above for the MDWTP monitoring program.

B5.A.3(D) STATISTICAL PROCEDURES [R 299.9612 and 40 CFR §§264.97(h) and 264.97(i)(1), (5), and (6)]

MDWTP Aquifer Program

The methods to be used for statistical analyses of all primary and secondary parameters that have an intrawell background as defined above are described as follows:

Primary Parameters - For each primary parameter, any measured concentration of any parameter which is above the laboratory reported detection limit is considered an apparent statistically significant increase. This is essentially a non-parametric prediction limit test that is suitable for highly censored data for which little or no information regarding the underlying data distribution is available. Detection limits are those recommended by MDEQ in the most recent version of Operational Memo Gen-8. An apparent statistically significant increase will initiate quadruplicate resampling for confirmation of the affected parameter(s), in accordance with the operating license. If the statistical failure is repeated, then a statistically significant increase is confirmed. If the apparent increase is not confirmed, then normal detection monitoring will be resumed.

Secondary Parameters - The statistical analysis of secondary parameters will be conducted by one of two statistical tests depending on the degree that the intrawell background data are censored. If more than half the data are above method detection limits then a control chart approach will be used. If at least half the background data are below detection limits, a test of proportions will be used to analyze the data.

The statistical evaluation of moderately censored or uncensored secondary parameters will be conducted using intrawell statistical comparisons via a control chart approach. This method assumes a normal distribution of the data but is robust to moderate deviations to normality. The combined Stewart-CUSUM control chart will be used to analyze the statistical significance of the measured concentrations of secondary parameters. This approach consists of two statistical tests designed to detect different types of evidence of an apparent statistically significant change in the concentration of a water quality parameter. The Stewart limit is designed to detect a sharp increase in the concentration of a monitoring parameter in a single sample. The CUSUM limit is designed to detect gradual increases in the concentration of a parameter over time. The two techniques are used as separate statistical tests. That is, failure of either test alone (or both) signals an apparent statistically significant increase for a given parameter. The Stewart control chart compares a detection monitoring concentration of a parameter to the intrawell background mean plus a selected number of standard deviations. The test is performed by calculating the standardized mean, Z, for the detection monitoring concentration. As individual samples are collected during each detection monitoring event, the standardized mean for each measured parameter is calculated by:

$$Z = (x_m - x_b)/s_b$$

where: x_b is the intrawell background mean
 x_m is the measured concentration during detection monitoring
 s_b is the standard deviation of the intrawell background

The value of Z is then simply compared to a selected value, U, which represents the number of standard deviations from the intrawell mean. The Shewhart limit (U), or upper control limit will be 4.5, as recommended in the Interim Final Guidance for Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (USEPA, 1989). The statistical test is performed by simply comparing the value of Z to the value of U. If Z is greater than U then it is concluded that an apparent statistically significant increase has occurred.

The CUSUM control chart is designed to detect a trend of increasing concentrations over time that is not abrupt enough to exceed the Shewhart limit. In the CUSUM procedure, the cumulative sum of the values for $Z - k$ are tabulated over time, each time a round of samples are analyzed. The value for Z is computed as described above, and k is a selected parameter. During each analysis subsequent to the background determination period, a value for $Z - k$ is computed and added to the previous total. As long as the cumulative total of $Z - k$ is a negative number the cumulative sum (S) remains zero. As positive values accumulate, the value for S is compared to a selected value, h . If S is greater than h , then an apparent statistically significant event has occurred. The values used for k and h are $k = 1$ and $h = 5$, respectively, as recommended (USEPA, 1989).

For parameters that contain at least half non-detectable concentrations in the intrawell background database, a statistical test to determine the significance of the proportion of detectable occurrences is appropriate. The test of proportions, which is based on the binomial distribution, is statistical test suited to this purpose. This statistical procedure analyzes the significance of an increase in the rate of detectable occurrences over time.

To implement the test of proportions, the proportion of detectable occurrences during the 8 background samples will be compared to the rate of detectable occurrences in the most recent 4 detection monitoring samples. The statistic is computed by the equation:

$$Z^* = \frac{P_m - P_b}{[p(1-p)(1/N_m + 1/N_b)]^{0.5}}$$

where: P_m = proportion of detectable concentrations in the last four detection monitoring samples
 P_b = proportion of detectable concentrations in the eight intrawell background samples
 N_m = number of detection monitoring samples (4)
 N_b = number of background samples (8)
 p = weighted proportion defined as:

$$p = \frac{n_m + n_b}{N_m + N_b}$$

where: n_m = number of detection monitoring samples above method detection limits
 n_b = number of background samples above method detection limits

The value of Z^* is then simple compared to a critical value, Z_c , obtained from standard tables for the normal variate, Z , at the desired level of significance. The test will be conducted at the 0.05 level of significance, therefore Z_c is equal to 1.645. Any value of Z^* greater than Z_c signals an apparent statistically significant increase for that parameter. To guard against the unlikely possibility of a large increase in a single secondary parameter going unflagged by the proportions test, MDWTP will consider any concentration of a secondary parameter that is greater than 10 times the background concentration (or the reported detection limit for highly censored parameters) as a default violation of the statistical tests described above. This will ensure that clearly anomalous data are evaluated.

MDWTP evaluates the secondary parameters as follows. If there is a statistically significant increase in any two secondary parameters at a particular monitoring well (i.e. two failures of the test of proportions or a combination of control chart and proportions test failures), then resampling in quadruplicate would be initiated to confirm the suspected increase. Two parameters are required because it is highly unlikely that only one parameter would increase in the event of a release and some of the parameters (e.g. sulfate, iron) are more likely to change due to non-release related phenomena. Confirmation would be completed if both failures are repeated. If the increase is not confirmed then the mean values of the quadruplicate sampling replace the results of the anomalous (unconfirmed) values within the database.

SESCA Program

The methods to be used for statistical analyses parameters that have an intrawell background as defined above are described as follows:

For volatile organics, semi-volatile organics and metals with greater than 50% non-detects in the background, the non-parametric prediction limit test will be used. The non-parametric prediction limit is the detection limit for parameters that were not detected during the background period and the highest concentration during background for parameters that had less than 50% detectable values during the background period. This is an appropriate test for highly censored data as little is known about the underlying distribution. Detection limits are those recommended by MDEQ in the most recent version of Operational Memo Gen-8. The use of intrawell statistics negates the need to account for seasonal or spatial variability.

For the other metals (less than 50% non-detects) the background mean and standard deviation is computed accounting for non-detects and intrawell control charts will be used to evaluate the data. The control chart method described above is used to evaluate the metals data and any single apparent statistically significant increase must be addressed by quadruplicate resampling.

B5.A.4 DETECTION MONITORING PROGRAM

[R 299.9612 and 40 CFR §§264.91(a)(4) and 264.98]

The basis for determining the detection monitoring program for each unit is provided in Template B3, Hydrogeologic Report, of this application that was prepared in accordance with R 299.9506.

B5.A.4(A) INDICATOR PARAMETERS, WASTE CONSTITUENTS, AND REACTION PRODUCTS [R 299.9506(3)(a) and (f), R 299.9506(4)(a), and R 299.9612 and 40 CFR §264.98(a)]

MDWTP Aquifer Program

The following table lists the parameters that are monitored in the uppermost aquifer upgradient and downgradient of the MDWTP. The list was developed from landfill leachate data and an extensive evaluation of geochemical behavior because any release from the landfill or the treatment plant would be highly attenuated by the thick sequence of low permeability clay till beneath the waste management units. The primary parameters are highly mobile volatile organic compounds (VOCs), including breakdown products that are among the most commonly seen VOCs in the waste streams accepted by MDWTP. These mobile VOCs would be expected to be among the first indicators that a release of waste or waste constituents have penetrated they clay till layer. The secondary parameters were selected based on the background concentrations in the groundwater and the geochemical behavior of each individual parameter.

MDWTP Aquifer Monitoring Parameter List

A. Primary Parameters

Benzene	1,2 Dichlorobenzene	Xylene
1,2 Dichloroethane	1,2 Dichloroethene	Ethylbenzene
Methylene Chloride	Toluene	Trichloroethene
1,1,1 Trichloroethane	Vinyl Chloride	1,1 Dichloroethane
PCB-1016 ¹	PCB-1221 ¹	PCB-1231 ¹
PCB-1242 ¹	PCB-1248 ¹	PCB-1254 ¹
PCB-1260 ¹		

B. Secondary Parameters

Potassium	Sodium	Nickel
Chromium(t)	Lead	Molybdenum
Sulfate	Chloride	Bicarbonate
Carbonate	Arsenic	Cyanide ⁴
Nitrate	Nitrite	Fluoride
Total Phenolics	Total Organic Carbon	Iron

Note: PCB's to be analyzed in samples from wells OB-21 and OB-23A only.
--

As the primary parameters are not naturally occurring, the background is below detection and no background statistics are necessary. For the secondary parameters, the moving window of eight intrawell sample results are used to compute background statistics. These statistics include the mean, standard deviation, coefficient of variation, and proportion of non-detects. Each year the background statistics are recalculated and submitted to MDEQ.

SESCA Program

Following tables contain the quarterly, semi-annual and annual monitoring parameter lists for the SECSA monitoring program. The list is extensive because of the vast number of wastes that can be stored in the SECSA. Unlike the aquifer that is protected by clay, the surficial sand unit is directly below the pavement and thus waste or waste constituents would not be significantly attenuated if released to this unit. The quarterly parameters are targeted for TDU wastes; although the TDU has been removed it did operate for several years. As described above, non-parametric tests are applied to VOCs, SVOCs and metals as these are never or rarely detected in background samples.

MDWTP SECSA Monitoring Parameters

Parameter	Monitoring Frequency	Detection Limit (mg/L)	Parameter	Monitoring Frequency	Detection Limit (mg/l)
Benzene	Quarterly	0.001	2-Chloroethylvinyl Ether	Annual	0.001
Ethyl Benzene	Quarterly	0.001	Chloroform	Annual	0.001
Toluene	Quarterly	0.001	Chloromethane	Annual	0.005
Total Xylene	Quarterly	0.003	Cyclohexane	Annual	0.005
Benzo(a)pyrene	Quarterly	0.001	2-Hexanone	Annual	0.005
Benzo(a)anthracene	Quarterly	0.001	Dibromodifluoromethane	Annual	0.001
Benzo(b)fluoranthene	Quarterly	0.001	Dibromochloromethane	Annual	0.001
Benzo(k)fluoranthene	Quarterly	0.001	Dibromomethane	Annual	0.001
Dibenz(a,h)anthracene	Quarterly	0.002	Diethyl ether	Annual	0.005
Anthracene	Quarterly	0.001	Diisopropyl Ether	Annual	0.005
Chrysene	Quarterly	0.001	1,2 Dichlorobenzene	Annual	0.001
Fluorene	Quarterly	0.001	1,3 Dichlorobenzene	Annual	0.001
3-methylcholanthrene	Quarterly	NA	1,4 Dichlorobenzene	Annual	0.001
Napthalene	Quarterly	0.001	Dichlorodifluoromethane	Annual	0.005
Phenanthrene	Quarterly	0.001	1,1-Dichloroethane	Annual	0.001
Pyrene	Quarterly	0.001	1,2-Dichloroethane	Annual	0.001
pH (field)	Quarterly	---	1,1-Dichloroethene	Annual	0.001
Conductance (field)	Quarterly	---	1,2-Dichloroethene	Annual	0.001
Calcium	Semi-Annual	1	1,2 Dichloropropane	Annual	0.001
Magnesium	Semi-Annual	1	1,3 Dichloropropene	Annual	0.001
Sodium	Semi-Annual	1	Ethyltertiarybutylether	Annual	0.005
Potassium	Semi-Annual	0.1	Hexachloroethane	Annual	0.005
Iron	Semi-Annual	0.02	Isopropylbenzene	Annual	0.001
Chloride	Semi-Annual	1	1,1,2,2 Tetrachloroethane	Annual	0.001
Alkalinity	Semi-Annual	10	1,2,3-Trichlorobenzene	Annual	0.005
Sulfate	Semi-Annual	2	1,2,3-Trichloropropane	Annual	0.001
Arsenic	Annual	0.001	1,2,3-Trimethylbenzene	Annual	0.001
Barium	Annual	0.005	1,2,4-Trichlorobenzene	Annual	0.005
Cadmium	Annual	0.0002	1,2,4-Trimethylbenzene	Annual	0.001
Chromium	Annual	0.001	1,3,5-Trimethylbenzene	Annual	0.001
Hexavalent Chromium	Annual	0.005	1,2-Dibromomethane	Annual	0.001
Lead	Annual	0.001	1,2-Dibromo-3-chloropropane	Annual	0.005
Mercury	Annual	0.0002	1,4-Dichloro-2-butene	Annual	0.005
Selenium	Annual	0.001	Tetrachloroethane	Annual	0.001
Silver	Annual	0.0002	Tetrachloroethene	Annual	0.001
Copper	Annual	0.001	1,1,2-Trichloroethane	Annual	0.001
Nickel	Annual	0.002	1,1,1-Trichloroethane	Annual	0.001
Total Cyanide	Annual	0.005	Trichloroethene	Annual	0.001
Acetone	Annual	0.02	Trichlorofluoromethane	Annual	0.001
Acrylonitrile	Annual	0.005	Vinyl Chloride	Annual	0.001
Bromodichloromethane	Annual	0.001	Methylene Chloride	Annual	0.005
Bromochloromethane	Annual	0.001	Methyl Iodide	Annual	0.001
Bromoform	Annual	0.001	Methyl Tertiary Butyl Ether	Annual	0.001
Bromomethane	Annual	0.005	Methyl Ethyl Ketone	Annual	0.005
Bromobenzene	Annual	0.001	4-Methyl-2-Pentanone	Annual	0.005

MDWTP SECSA Monitoring Parameters (cont'd)

Parameter	Monitoring Frequency	Detection Limit (mg/L)	Parameter	Monitoring Frequency	Detection Limit (mg/L)
Carbon Disulfide	Annual	0.001	n-Butylbenzene	Annual	0.001
Carbon Tetrachloride	Annual	0.001	n-Propylbenzene	Annual	0.001
Chlorobenzene	Annual	0.001	Styrene	Annual	0.001
Chloroethane	Annual	0.005	Tertiary Butyl Alcohol	Annual	0.05
Tetrahydrofuran	Annual	0.005	Tertiary Butyl Benzene	Annual	0.001
Acenaphthene	Annual	0.001	Hexachlorocyclopentadiene	Annual	0.01
Acenaphthylene	Annual	0.001	Aniline	Annual	0.001
Benzenidene	Annual	NA	Indeno (1,2,3-cd) pyrene	Annual	0.002
Benzo(ghi)perylene	Annual	0.001	Isophorone	Annual	0.001
Benzoic Acid	Annual	NA	2-Methylnaphthalene	Annual	0.005
Benzyl alcohol	Annual	0.05	2-Nitroaniline	Annual	0.02
Bis (2-chloroethoxy) methane	Annual	0.002	3-Nitroaniline	Annual	0.2
Bis (2-chloroethyl) ether	Annual	0.001	4-Nitroaniline	Annual	0.02
Bis (2)chloroisopropyl) ether	Annual	0.001	Nitrobenzene	Annual	0.002
Bis (2-ethylhexyl) phthalate	Annual	0.005	N-Nitrosodiphenylamine	Annual	0.002
4-Bromo phenyl ether	Annual	0.002	N-Nitroso-di-n-propylamine	Annual	0.002
Butyl benzyl phthalate	Annual	0.005	1,2,4-Trichlorobenzene	Annual	0.002
4-Chloroaniline	Annual	NA	4-Chloro-3-methylphenol	Annual	0.005
2-chloronaphthene	Annual	0.002	2-Chlorophenol	Annual	0.01
4-Chlorophenyl phenyl ether	Annual	0.001	2,4-Dichlorophenol	Annual	0.01
Dibenzofuran	Annual	0.004	2,4-Dimethylphenol	Annual	0.005
Di-n-butyl phthalate	Annual	0.005	4,6-Dinitro-2-methylphenol	Annual	NA
1,2-Dichlorobenzene	Annual	0.001	2,4-Dinitrophenol	Annual	0.025
1,3-Dichlorobenzene	Annual	0.001	2-Methylphenol	Annual	0.01
1,4-Dichlorobenzene	Annual	0.001	3-Methylphenol	Annual	0.02
3,3'-Dichlorobenzene	Annual	NA	4-Methylphenol	Annual	0.02
Diethyl phthalate	Annual	0.005	2-Nitrophenol	Annual	0.005
Dimethyl phthalate	Annual	0.005	4-Nitrophenol	Annual	0.025
2,4-Dinitrotoluene	Annual	0.005	Pentachlorophenol	Annual	0.02
2,6-Dinitrotoluene	Annual	0.005	Phenol	Annual	0.005
Di-n-octyl phthalate	Annual	0.005	Pyridine	Annual	0.02
Fluoranthene	Annual	0.001	2,4,5-Trichlorophenol	Annual	0.005
Hexachlorobenzene	Annual	0.001	2,4,6-Trichlorophenol	Annual	0.004
Hexachlorobutadiene	Annual	0.001			

B5.A.4(B) GROUNDWATER MONITORING SYSTEM
[R 299.9612 and 40 CFR §§264.97(a)(2), (b), and (c) and 264.98(b)]

See Section B5.A.3(a).

B5.A.4(C) BACKGROUND CONCENTRATION VALUES FOR PROPOSED PARAMETERS
[R 299.9612 and 40 CFR §§264.98(c) and 264.97(g)(1) and (2)]

See Sections B5.A.3(b) and (c).

B5.A.4(D) PROPOSED SAMPLING AND ANALYSIS PROCEDURES
[R 299.9506(3)(e) and R 299.9612 and 40 CFR §§264.97(d), (e), and (f) and 264.98(d), (e), and (f)]

See Sections B5.A.3(a) and (b).

APPENDIX A
Groundwater Sampling and Analysis Plan
Michigan Disposal Waste Treatment Plant (MDWTP)—MID 000 724 831

I. INTRODUCTION

40 CFR, Part 264.97 requires the owner or operator of a hazardous waste facility to develop and follow a consistent program of groundwater sampling and analysis procedures. The program must include procedures and techniques for:

- 1) sample collection;
- 2) sample preservation and shipment;
- 3) analytical procedures; and
- 4) chain of custody control.

This document has been developed to direct the efforts of groundwater monitoring personnel and thereby meet the requirement of the rule referenced above.

II. RECORDKEEPING

The following records are maintained:

1. *Field notebook* contains all pertinent monitoring well data related to a sampling event. These items include, but are not limited to, name of sampler, date, time, sampling point, depth to standing water in the well, calculations for determining the volume of water to be purged from the well prior to sampling, results of any field or lab tests conducted after sampling and any other observations of the sample character or sampling environment. Copies of the field data notes are included in the report sent to Michigan Department of Environmental Quality (MDEQ)
2. *Equipment log* is used to list the inventory (by serial number) of all dedicated pumping apparatus and field measurement devices, inventory, repair and calibration. Any changes of equipment or repairs to equipment must be noted in this log, as well as daily instrument calibrations, etc.
3. *Chain of Custody*
A sample copy of this sheet is included herein as Attachment 1. This sheet must be filled out fully for each sample submitted for analysis.

III. LABORATORY

Analyses of samples from the wells are conducted by Pace Analytical Services, LLC (formerly TriMatrix Laboratories, Inc. (TriMatrix)). Analytical arrangements and sample bottle preparation can be ordered in advance by calling Pace. Request all analyses when calling for bottles so the laboratory personnel can properly prepare the containers.

If MDWTP decides to contract analysis of groundwater samples to another laboratory, the change will be made only after at least two concurrent sampling/analysis events show adequate correlation of analysis results of the existing and proposed contract laboratories.

IV. STANDING WATER LEVELS

The sampling schedule for the uppermost aquifer wells is generally arranged such that the wells are sampled the month immediately following that in which Wells 1A through 17 are sampled. To obtain the best picture of static water levels for the site the following must occur

1. Levels must be obtained for all 49 wells before any water is removed for purging or sampling,

2. Levels must be obtained for all 49 wells in as short a time as possible on the same day, due to barometric pressure effects.

This means that static water levels for the wells are generally determined at least 30 days in advance of their sampling and purging and sampling cannot immediately follow the water level observations.

Water levels from the SECSA must be collected all on the same day, but not necessarily the same day as the uppermost aquifer wells. Further, a measurement of the elevation of the surface of the water level in the south sedimentation basin must be made at the time the static water levels are collected.

The depth to standing water within the well casing is measured from the top of casing (TOC). The top of the well casing is exposed by removing the white plastic well heads. The surveyed point on the casing is always at the edge on the north side of the casing. Additionally, there is a permanent mark on the north side of the casing which marks the edge from which water levels are to be taken. The TOC elevations shall be surveyed at least once every two years to verify accuracy. Removal of the well head is necessary for determination of the standing water level. The depth to water is measured using an electric water level indicator. Attachment 2 describes the operating procedures for the water level indicator, which is used for this purpose.

When using the water level indicator, in order to prevent cross contamination, the probe and submersed portion of the cable are cleaned with distilled water and a clean rag, followed by a distilled water rinse. The depth to standing water is then the distance from the probe tip at the water level to the marking on the cable. Markings on the cable are scaled in 0.01 foot intervals, and as a result are recorded in the field notebook to the nearest 0.01 foot. To take a measurement lower the probe into the casing slowly while watching for the light. Determine the water level by raising and lowering the probe at the water surface, and monitoring the light and buzzer. The distance from the point on the cable at TOC to the nearest marking on the cable within the well casing should be recorded.

V. WELL PURGING

Before purging a well, it is necessary to determine the quantity of water contained within the well casing. This is done by subtracting the depth to standing water from the depth to the well screen. The depth to standing water must be determined just prior to beginning sample collection and recorded in the field notebook. The depth to the well screen for each existing well is listed on Attachment 3. The difference between screen depth and water level depth is the height of water standing within the well. Multiply this height of water by 0.17 gallons per foot (for 2 inch diameter well casing). Multiply that product by 3, the number of standing volumes to be purged, which is the minimum recommended by the MDEQ. The resultant product is the total quantity to be purged from the well, in gallons. Once again,

$$\text{Amt. purged (in gallons)} = (\text{Ht. of standing water}) \times 0.17 \times 3$$

The depth to the well screen should be confirmed every four years by removing the dedicated pump assemblies and lowering the water level indicator probe to the very bottom of the well casing for a determination of the clear depth of the well (make sure that the indicator cable is cleaned between each well). In addition, well depths should be checked if a change in well yield or sample appearance (i.e. turbidity) is noted. It is very important to ensure that the pump and tubing are kept clean when removed from the well (i.e. do not place equipment on ground, rather, wrap in plastic sheeting).

Wells are purged using the dedicated pumps. Once 3 standing well volumes have been removed, measure and record the pH and specific conductance of the water coming from the well. Continue to record these values at a rate of once every 10 minutes. After three values of pH and specific conductance have been obtained in this manner, compare the highest and lowest values. If the difference between the highest and lowest pH value is 0.07 su or less, then the well is considered stabilized with respect to pH. If the difference between the highest and lowest specific conductance values is 18 $\mu\text{mhos/cm}$ or less, then well stabilization with respect to this parameter is considered complete. If the difference between the highest and lowest values for either parameter exceeds this criteria, pump the well another 10 minutes and recheck both parameters. Perform the comparison again; using only the last three monitored values of pH and specific conductance. Once the criteria are satisfied for any 3 consecutive monitored values of both pH and specific conductance, then consider the well fully stabilized and proceed with sampling. Measure and record well water temperature at this time as well. Record in the field notebook all the data obtained to establish well stabilization. In the cases where an individual well cannot be purged to stabilization in a manner described above because the well becomes fully dewatered, then sample the well after completely dewatering (evacuating) the well 4 times. For each sampling event, the second, third and fourth well evacuations should be performed within 3 days of the previous well evacuation. Sampling should be accomplished as soon after the fourth well evacuation as possible, depending upon the rate at which the water level in the well recovers. Measure and record pH, specific conductance and temperature in the field at the time the sample is obtained from such a well. Fully record in the field notebook all instances of well evacuation.

Each well has a submersible pump within it, generally located at the well screen. The control unit and cylinders of compressed nitrogen are the other components that complete this system. Because sampling immediately follows the purging step in nearly all cases, the sampling box is always included during well purging. The sample box is discussed in greater detail in the Sample Collection portion of this document.

Prior to a sampling round for the wells, replace the sampling box discharge tube. To set up the pump system for operation, connect the nitrogen cylinder hose to the supply port on the controller unit. Connect one end of the coiled tubing within the controller unit to the Drive Air Out port on the unit, and the other end to the smaller of the two ports on the well head assembly. Connect the water sample line from the larger of the two well head ports to the back of the sampling box. Make certain that the valve on the rear of the box directs flow out of the box and through the discharge tube, until well purging is completed.

To initiate purging, begin the flow of nitrogen from the cylinder. Measure the quantity of water purged from the well using the graduated 3 gallon bucket kept with this equipment. Note that all purged water should be discharged on the ground away from the well. Do not allow the purged water to re-enter the well or the well protective casing nor should you allow ponding of the water around the well. Further background on sampling operation can be gained by referring to Attachment 4. Report any problems with equipment function to the EQ Quality Environmental Health & Safety (QEHS) Department.

VI. SAMPLE COLLECTION

These sampling procedures apply to both well networks and the sampling of the uppermost aquifer wells and the SECSA wells are considered separate sampling events for the purpose of all QA/QC procedures. Upon completion of the well purging step, or return to a well which has been evacuated four times for purging, the well is ready to sample. Make sure each sample bottle for a given monitoring well has a label (affixed by the analytical laboratory personnel) which contains our facility name, the monitoring well

number, the date and the sampler's initials. If a preservative has been included by the laboratory, such a note should appear on the label.

In the past sampling programs, it has been shown that airborne artifacts from disposal operations and engine exhaust can affect the number of detected constituents and their concentrations within groundwater samples. For this reason, a controlled-atmosphere sampling box was fabricated. Nitrogen is used as the sampling atmosphere, thereby minimizing the probability of impacts to sample quality by airborne artifacts. All samples taken from Site II wells using dedicated pumps shall be taken within the sampling box.

In preparation for sampling, connect the nitrogen cylinder to the sampling box and purge the box atmosphere with nitrogen for 20 to 30 minutes. Make certain that all sample bottles to be used at a given location are placed within the box with caps off prior to purging the box atmosphere. Further, a new laboratory grade tygon tube connecting the wellhead to the sampling box must be used for the collection of samples from each location. When all is ready, turn the valve on the rear of the sampling box, diverting the flow of water from the discharge tube to the sampling tube within the box.

Samples for volatile organic compounds will be filled first. No headspace is permitted in the small glass vials. This may require several attempts but it can and must be done. Make certain not to touch the inside of bottle necks or caps with your hands. Next, fill the bottles for total organic carbon, total phenolics, metals and then other miscellaneous parameters, in this order. Fill each sample bottle to the very top and allow minimal headspace (air bubbles when capped and tipped) and take care not to spill any of the preservatives. Record the number and type of samples taken and the time of sampling on the chain of custody record and in the field notebook.

Trip blanks shall be used every day and shall remain unopened throughout the sampling day. Field blanks shall also be submitted as well. These are all available from the laboratory and consist of VOC vials. There will be one field blank per well. It will be opened in the nitrogen sampling box and will remain open while that well is being sampled. Both kinds of blanks should be handled and shipped exactly as the well samples are. The blanks shall be preserved in the laboratory exactly as samples for Table 3a. Only a limited number of the blanks will be analyzed on a random basis for Table 3a parameters. However, if a positive result for any Table 3a parameter is noted in a given well, the matching trip and field blanks will immediately be analyzed for the offending parameter(s). A complete replicate sample shall be obtained from one well, chosen randomly, during each sampling round and will be analyzed for the same parameters as the sample it replicates.

VII. SAMPLE PRESERVATION AND SHIPMENT

Attachment 5 is a tabulation of sample preservation procedures for Pace (formerly TriMatrix). The samples must be preserved in accordance with the procedures outlined in this attachment. For all samples except dissolved metals, the laboratory provides clean, pre-preserved bottles (where necessary). Samples to be analyzed for dissolved metals can either be field filtered with a 0.45 µm in-line filter cartridge and preserved with a couple of drops of reagent grade HNO₃ to a pH of less than 2, or the samples can be filtered and preserved immediately upon delivery to the laboratory.

When the sample collection step is completed, open the sampling box, transfer all sample bottles to a cooler and pack the cooler with ice. Samples in the cooler are to be stored in the engineering field office or other secure location until they are transported to the laboratory. The samples must be stored in a secure location at all times and in accordance with chain of custody procedures.

At this point, you are ready to prepare for the next set of samples by replacing the tubing for the sampling box, purging the sampling box with nitrogen and by completing sample bottle labels and chain of custody records.

All collected samples and blanks will be stored in a secure location until transport to the contract laboratory. Be sure to take along all chain of custody records. The handling of these forms is covered in the Chain of Custody Control portion of this document.

VIII. ANALYTICAL PROCEDURES

The parameters to be tested for as part of the monitoring program for the uppermost aquifer wells are shown in section B5.A.4(A). For the SECSA monitoring program, the parameters are also listed in section B5.A.4(A).

Specific analytical procedures and target detection limits to be used by Pace for this monitoring program are tabulated in Attachment 1. However, as changes to analytical methods or to the detection limits contained within MDEQ WHMD Operational Memo Gen-8 the contents of Attachment I must be updated accordingly. Further, this attachment should be reviewed periodically to determine if the laboratory has made changes that should be reflected in the attachment. QA/QC frequencies, and precision and accuracy calculations are included in Pace's QA/QC manual. Changes made to detection limits, analytical methods or QA/QC in response to regulatory requirements can be utilized in this monitoring program without changing the plan, but must be included in updated sampling and analysis plans.

Field measurements of specific conductance, pH and temperature will be performed using the equipment and procedures described in Attachment 6. The instruments must be calibrated prior to each day of use and the appropriate notation made in the Equipment Inventory, Repair and Calibration Log described in Section I.

Pace's Quality Assurance Manual is included as Attachment 7. This manual describes the internal policies, guidelines and procedures of Pace's. This manual is not intended to describe the specific details of this particular monitoring program. Rather, we are to use this document as a guideline in evaluating Pace's QA/QC and standard operating procedures to ensure that generally acceptable practices are employed.

IX. CHAIN OF CUSTODY CONTROL

Chain of Custody refers to the record of individuals and external conditions of sample handling through the time of laboratory analysis. The chain of custody record included as Attachment 1 is the principal document of this record. These sheets must be fully filled in with sampling information as well as the persons involved and shipment conditions during transport to the analytical laboratory. These sheets must accompany the samples to the laboratory.

When the samples are surrendered at the laboratory, each chain of custody record must be signed by the person transporting the samples as well as a representative of the receiving laboratory. The lab will make a copy of each sheet for us and keep the originals. Two copies must be made upon return to the site: one for the operating log notebook and one for the Groundwater Monitoring files. Upon completion of a full round of sampling, transmit depth to standing water information, field monitoring data and all chain of custody records to the compliance department.

X. EQUIPMENT AND WELL MAINTENANCE

Equipment used for the collection and analysis of groundwater samples must be maintained in working order and replaced or repaired promptly when necessary. Electrodes for pH and specific conductance should be replaced annually, or sooner if they become difficult to calibrate or appear to malfunction. The dedicated pumps and associated equipment require no routine maintenance but should be promptly replaced or repaired in the event of a malfunction. Any pump removed from a well should be thoroughly cleaned before replacement. Tubing removed from the well should be packaged and stored to prevent contamination or replaced. As outlined in Section I, records of instrument calibration and any equipment replacement or repair must be kept in the Equipment Log maintained at the Engineering field office.

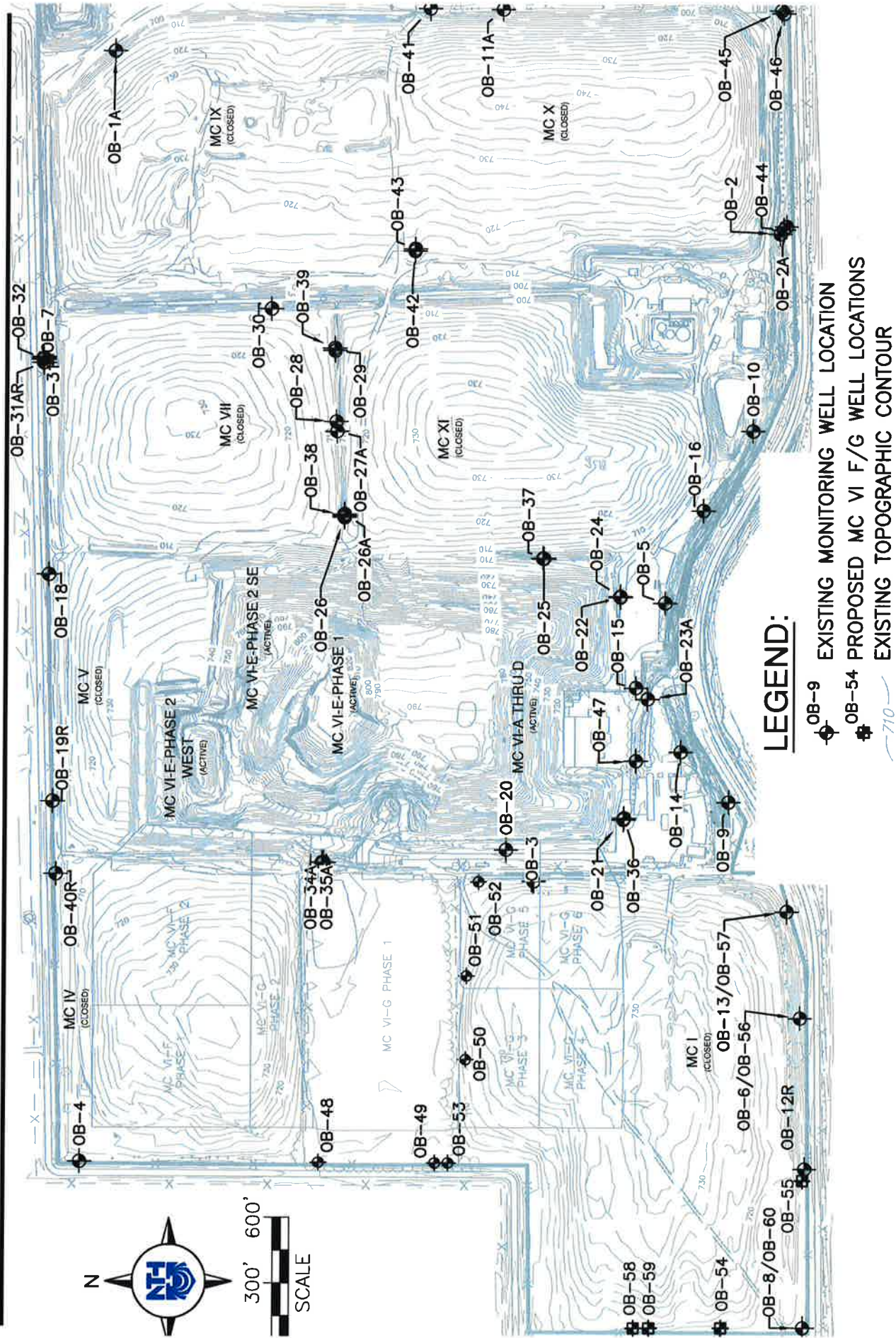
The well casings, protective covers, and pump heads should be inspected for damage at the time of each well sampling. Any damage should be noted in the field notebook and a Monitoring Well Inspection/Damage Report must be filled out. A copy of this form is included as Attachment C-2. Also note any surface erosion, standing water at the well or evidence of a damaged grout seal around the well.

In the event any damage requiring well repair becomes necessary, a Damage Incident Report will be prepared. A copy of this report will be placed in the site Operating Log and the Groundwater Monitoring Operating Log. Prior to undertaking monitoring well or piezometer replacement or repair, MDWTP must obtain written approval of the WHMD. All monitoring wells shall be constructed and abandoned in accordance with the well installation and well decommissioning procedures in the ASTM standards D5092 and D5299 or a plan approved by the MDEQ. Following completion of the well repairs, installation or decommissioning, as-built documentation of the work must be prepared and a copy placed in the Groundwater Monitoring Operating Log and a copy sent to the MDEQ.

XI. Statistical Evaluation and Reporting Requirements

All ground water analyses for the uppermost aquifer wells must be analyzed for evidence of statistically significant increases in concentrations of all primary and secondary monitoring parameters as described in Attachment 8. The groundwater analyses for the SECSA monitoring program will be subjected to the background statistical analysis. When the background sampling is completed, the background statistical analysis in Attachment 9 must be replaced with a final statistical monitoring plan. This plan must be submitted within 60 days of completion of the background data collection and will be approved by WHMD prior to inclusion in this GWMP.

The analytical reports, the records of the field procedures and a report of the statistical analyses (narrative and tubular) must be submitted to the WHMD in Lansing within 60 days after the completion of the sampling for each quarterly sampling event. These reports will also include a summary of the review of QA/QC data, a narrative of the sampling event including dates and sampling personnel, and a description of any unusual events or conditions encountered. The report for the SECSA wells will also include a groundwater contour map and an evaluation of groundwater flow in this shallow sand unit. A copy of the statistical summary must also be sent to the MDEQ Southeast Michigan Regional Office. Copies of the analysis and report must be maintained in designated files at the administration office at the site. In addition, an annual report summarizing the results of groundwater monitoring results and which evaluates groundwater flow directions and rates for both the uppermost aquifer and the upper water-bearing zone must be submitted to WHMD by March 1 of the following year.



LEGEND:

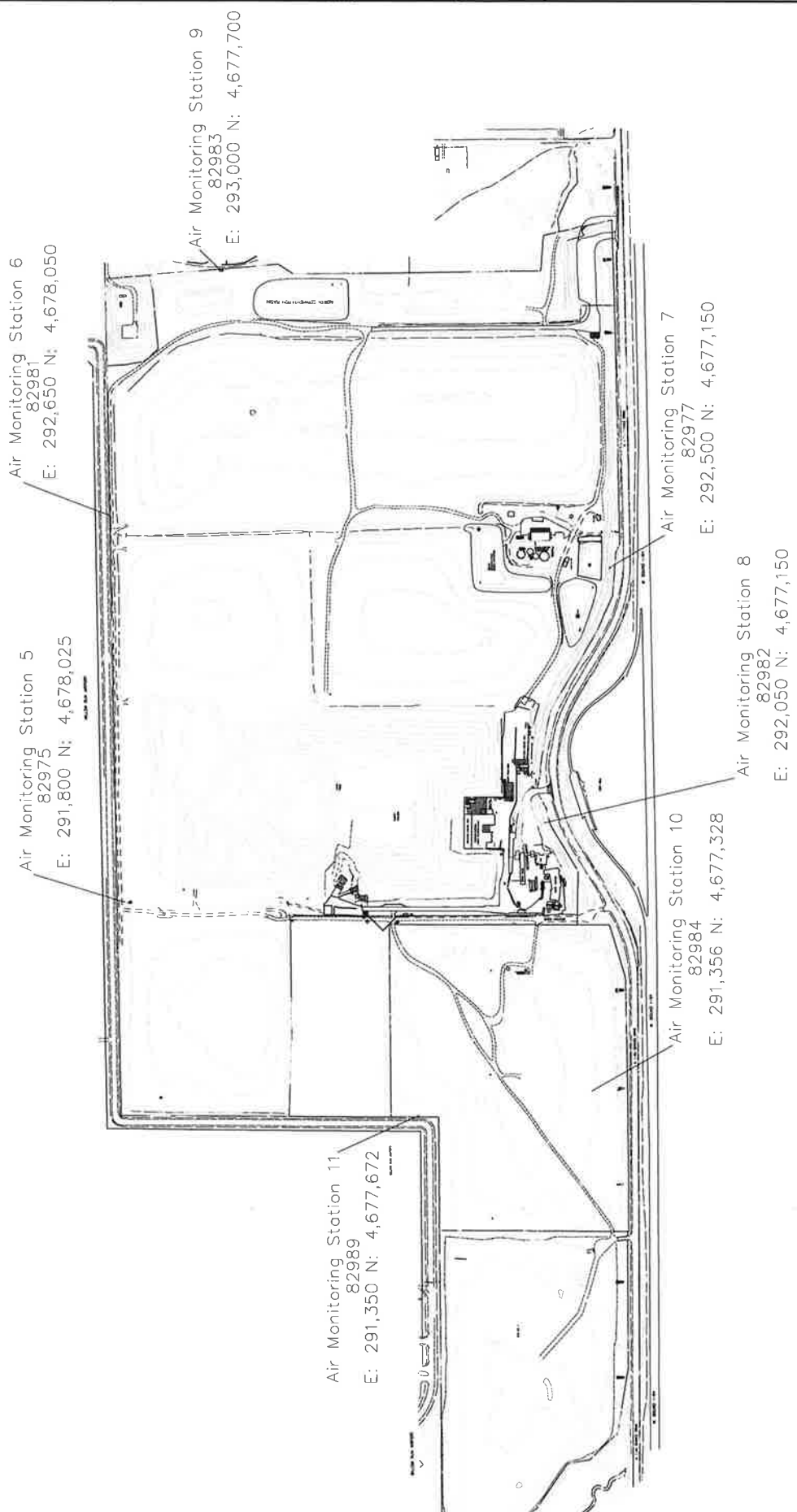
- ⊕ OB-9 EXISTING MONITORING WELL LOCATION
- ⊕ OB-54 PROPOSED MC VI F/G WELL LOCATIONS
- 710 EXISTING TOPOGRAPHIC CONTOUR

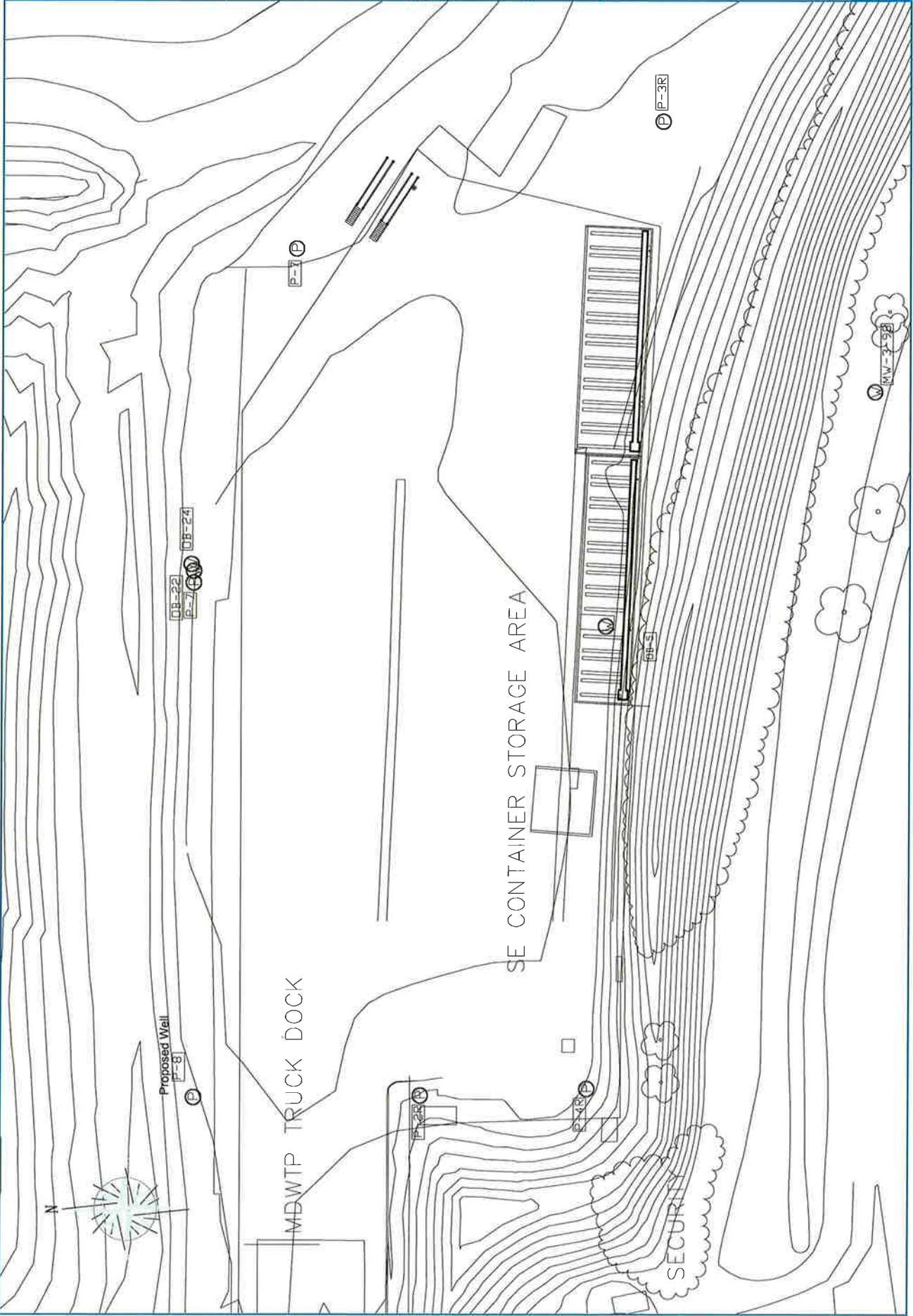
NTH PROJECT No: 13060921-06	DESIGNED BY: DLP	CHECKED BY: ACE	DRAWING SCALE: AS SHOWN	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services	WAYNE DISPOSAL, INC. SITE NO. 2 VAN BUREN TWP., WAYNE COUNTY, MICHIGAN	ATTACHMENT: A
	CAD FILE NAME: 060921-WLM	DRAWN BY: KRO	INCEPTION DATE: 11/16/09			



PROJ. NO.	82982
PROJ. NAME	WAYNE DISPOSAL INC.
W.D.I.	WAYNE DISPOSAL INC.
DATE: 10/31/13	SCALE: 1"=300'
SHEET OF	DESIGNED BY: CAC

AIR MONITORING STATIONS	
PROJ. NO.	82982
PROJ. NAME	WAYNE DISPOSAL INC.
W.D.I.	WAYNE DISPOSAL INC.
DATE: 10/31/13	SCALE: 1"=300'
SHEET OF	DESIGNED BY: CAC





B5.B AMBIENT AIR MONITORING PROGRAM

[R 299.9611(2)(c) and (4)]

B5.B.1 SAMPLING AND ANALYSIS PLAN

[R 299.9611(2)(a)]

A sampling and analysis plan for ambient air monitoring for MDWTP and WDI is included in the QA/QC Plan. The sampling and analysis plan was prepared in accordance with the requirements specified in R 299.9611(2)(a). All sampling and analysis performed pursuant to this application will be consistent with the QA/QC Plan. All samples for the purpose of environmental monitoring will be collected, transported, stored, and disposed by trained and qualified individuals in accordance with the QA/QC Plan.

The MDWTP and WDI facility will conduct ambient air monitoring to demonstrate compliance with the provisions of Part 55 of Act 451 and will be utilized to characterize the air quality associated with both MDWTP (MID 000724831) and WDI (MID 048090633) Site #2.

Data will be reported within 60 days of MDWTP receiving the analytical results.

B5.B.1(A) SAMPLERS AND LOCATION

Ambient air quality will be monitored at seven stations around the perimeter of the site, one of which is a collocated station. These locations are noted on the map attached. All seven sites are equipped with a polyurethane foam (PUF) sampler, high volume Total Suspended Particulate (TSP) sampler, and a sorbent tube sampler, with the collocated station having two of each sampling apparatus. Sampling equipment is inspected before and after use.

B5.B.1(B) SCHEDULE

The sampling schedule for the high volume samplers is every 12th day for 24 hours (to coincide with the USEPA national sampling schedule). When required, resampling will occur on an alternate sampling day as designated by the national sampling schedule.

B5.B.1(C) SAMPLING AND ANALYSIS

PCB sampling will be conducted using a high volume PUF sampler and analyzed and reported as total PCBs. Sampling for the PCB compounds will be conducted in adherence to the USEPA's Toxic Organic Compendium Methods TO-4A or TO-10A. The PUF samplers will operate at an air sampling rate of approximately 200 to 280 lpm.

Metal concentrations will be determined from the samples collected in a high volume TSP sampler. The sampling for multi-metals will adhere to the requirements of 40 CFR Part 50, Appendix G for the determination of lead. All sections referenced by Part 50, Appendix G will likewise be followed. Then

analysis will be performed using USEPA Reference Methods for lead and the other metals listed in the attached table to this monitoring plan. Quality control and assurance requirements specified in the method will be incorporated in the sampling protocol. Samples will be collected with a nominal flow rate of 50 cfm \pm 10 cfm.

VOC's will be sampled utilizing a system of sorbent tubes capable of effectively collecting the listed compounds in the attached table. A constant flow sampling pump is operated at approximately 0.10 liters per minute (lpm). Samples will be collected at a flow rate adequate to reach the required limits of detection. Sampling will be conducted in adherence to the USEPA's Toxic Organic Compendium Method, TO-17 for solid sorbent tubes.

B5.B.1(D) MONITORING PARAMETERS

The table below provides a list of parameters monitor and the minimum detection limit.

WDI & MDWTP - AMBIENT AIR - MONITORING PARAMETERS (METALS and PARTICULATES)	
<u>COMPOUND</u>	<u>DETECTION LIMIT (ug/m³)</u>
CADMIUM	0.005
CHROMIUM	0.009
LEAD	0.025
TSP	-
WDI & MDWTP – AMBIENT AIR - MONITORING PARAMETERS (ORGANIC COMPOUNDS)	
<u>COMPOUND</u>	<u>DETECTION LIMIT (ug/m³)</u>
BENZENE	0.04
CARBON TETRACHLORIDE	0.25
CHLOROFORM	0.05
ETHYLBENZENE	1
METHYLENE CHLORIDE	1
1,1-DICHLOROETHANE	1
1,1,1-TRICHLOROETHANE	1
TETRACHLOROETHENE	0.1
TRICHLOROETHENE	0.1
TOLUENE	1
XYLENE (TOTAL)	1
PCBs (TOTAL)	0.02

B5.B.1(E) QUALITY ASSURANCE

On each run day, samples from the collocated site shall be analyzed and reported to the MDEQ for the assessment of sampler precision. One sample day per month, one blank sorbent tube and metals filter shall accompany the samples to the collocated site , not have air pulled through it, then submitted to the laboratory as a “trip blanks”. All laboratory quality assurance, such as the analysis of blanks and standards,

shall be made available to the MDEQ upon request for the determination of accuracy. If any parameter that is analyzed by the laboratory and determined to be non-detectable, the value of the method detection limit for that compound divided by 2 (MDL/2) shall be reported. Staff from the MDEQ may audit the ambient air monitoring program, files, and samplers at their discretion.

B5.C ANNUAL SOIL MONITORING PROGRAM

[R 299.9611(2)(d) and (4)]

B5.C.1 SAMPLING AND ANALYSIS PLAN

[R 299.9611(2)(a)]

MDWTP is requesting a waiver from the soil monitoring requirements of R 299.9611(2)(d). Soil monitoring is not needed because the entire area is paved, and any areas designated for the storage of liquid waste has secondary containment in the form of concrete floors, curbing and sumps to collect precipitation as well as any spills. All active waste treatment or processing occurs within the MDWTP, which is inside a building. The treatment tanks contain leak detection and the treated concrete floors drain to blind sumps that are cleaned out if any liquids accumulate. Thus there are no areas where spills would occur onto an unpaved area. In the unlikely event that any waste or waste constituents penetrate the pavement, the entire area (excepting the SECSA) is underlain by either clay fill or native clay till. Therefore there would be very limited ability for transport in any direction. As described above, the SECSA, which is either asphalt (for solid waste) or concrete with secondary collection (for liquid waste) is underlain by surficial sand that is monitored by shallow groundwater wells. In addition, the closure plan requires sampling the soil beneath the pavement at the time of closure.

Attachment 1
Chain of Custody

Attachment 2
Operating Procedures for the Water Level Indicator



KECK INSTRUMENTS, INC.

KECK TAPE GUARD

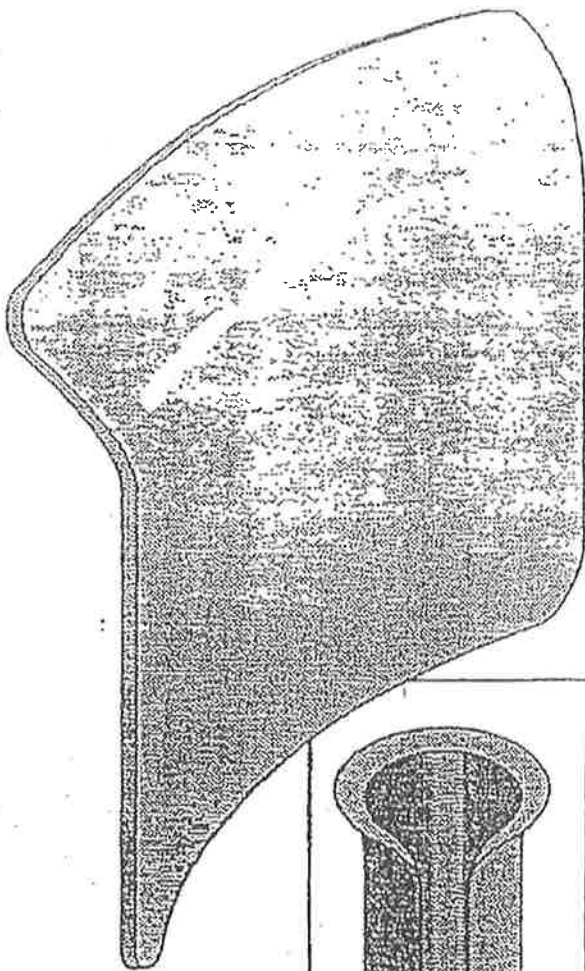


FIGURE 1
TAPE GUARD

The Keck "Tape Guard" was developed to protect instrumentation, tapes and sample tubing from the wearing edges of well casing. Made of smooth flexible polystyrene, the "Tape Guard" easily adapts to any 2" or 4" well.

Instructions

Simply compress the "Tape Guard" and insert

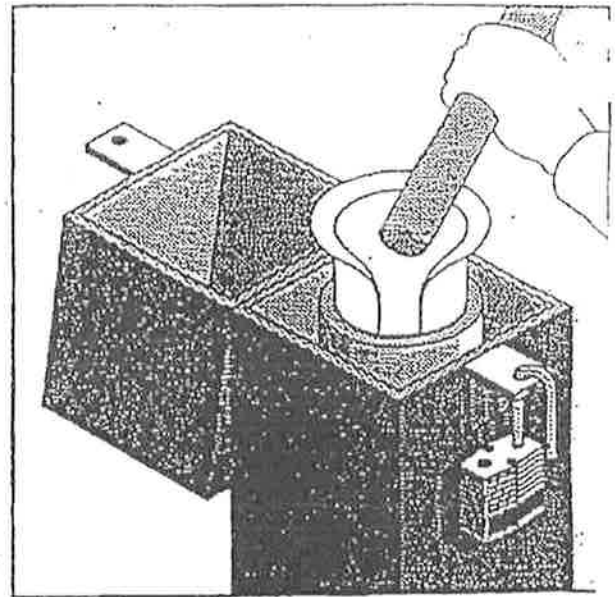


FIGURE 2
TAPE GUARD USAGE

into the opening of any 2" to 4" well pipe. Allow instrumentation, tubing or tape to ride on the smooth surface of the "Tape Guard" to prevent wear.

ET-89

The Keck Instruments ET-89 is a portable reel mounted device used to accurately measure water levels in a borehole. Water levels are detected by a 5/8" O.D. stainless steel probe attached to a 100 FT. Tefzel coated engineer's tape. The tape is graduated in 100ths of a foot with metric divisions on the reverse side. The ET-89 relies on fluid conductivity to determine the presence of water and emits an audible signal with light. Controls include a sensitivity adjustment to eliminate false readings due to cascading water or casing effect and a battery test switch.

Operational Procedure

1. Turn the instrument "On" and check the battery voltage by pressing the "Batt Test" button. A dim red light indicates a low battery and should be replaced.
2. Lower the probe down the well to the water surface, the light and buzzer should be activated. At this point adjust the probe sensitivity counter-clockwise until the light and buzzer turn off.
3. With the probe still in contact with the water, adjust the probe sensitivity until the light and buzzer barely activate. In this setting the probe will detect water level and not be effected by condensation from the casing well.
4. Water level measurements can now be taken from the top of the casing.
5. After completion of water level measurements the device should be properly stored.

Maintenance and Cleaning Procedures

1. Remove the three faceplate screws.
2. Release the faceplate using the sensitivity knob to pull the components out of the reel.
3. Make note of the battery location on the circuit board and the position in reel cavity.
4. Remove the 9 volt battery from the connector by grasping the battery and the black connector. Replace with new battery.
5. Position the battery in the notch of the circuit board and align the battery with the recessed slot in the reel.
6. Place the faceplate in the reel and replace the three retaining screws. Do not over tighten these screws.

Decontamination and Cleaning

The ET-89 can be cleaned with any detergent or lab soap such as Liquinox that does not effect polypropylene. The reel should not be submerged at any time but can be wiped with a damp cloth.

Please call our technical staff if further assistance is required at 1-800-542-5681.

Attachment 3

Summary of Monitoring Well Information

MONITORING WELL INFORMATION
WAYNE DISPOSAL SITE #2 LANDFILL

WELL ID	PROGRAM(S)	T.O.C. ELEV.	SCREEN ELEV.	WELL DEPTH	DESIG.	STRATUM SCREENED
OB-1A	Part 115	706.01	579.9	126	UG	SILT/ROCK
OB-2A	Part 115/MCIX	701.37	587.8	114	DG	SAND
OB-3	Part 115	709.01	577.9	131	DG	SAND
OB-4	Part 115	712.54	638.9	74	UG	SAND
OB-5	Part 115	705.21	603.8	101	DG	SAND
OB-6	Part 115	704.78	627.1	78	DG	SAND
OB-7	Part 115/MCIX	703.59	627	77	UG	SILT/SAND
OB-8	Part 115	707.61	629	79	DG	SAND
OB-9	Part 115	701.20	614.1	87	DG	SAND
OB-10	Part 115	707.84	621	87	DG	SAND
OB-11A	Part 115/MCIX	699.00	611.4	88	DG	SAND
OB-12	Part 115	705.01	620.6	84	DG	SAND
OB-13	Part 115	703.30	619.9	83	DG	SAND
OB-14	Part 115	702.16	600.1	102	DG	SAND
OB-15	Part 115	707.68	617.3	90	DG	SAND
OB-16	Part 115	700.88	596.5	104	DG	SAND
OB-17	Part 115	708.29	626.2	82	DG	SAND
OB-18	Part 111 (MDWTP)	703.09	589.2	114	UG	CLAY/ROCK
OB-19R	Part 111 (MDWTP)	709.18	585.6	124	UG	ROCK
OB-20	Part 111/TSCA	706.25	609.9	96	DG	SAND
OB-21	Part 111(MDWTP)/TSCA	704.98	600.9	104	DG	SAND
OB-22	Part 111	704.01	568.3	136	DG	SAND/ROCK
OB-23A	Part 111(MDWTP)/TSCA	702.74	577.5	125	DG	SAND
OB-24	Part 111(MDWTP)/TSCA	704.62	614.4	90	DG	SAND
OB-25	Part 111/TSCA	711.03	620	91	DG	SAND
OB-26A	Part 111/TSCA	714.16	628.5	86	DG	SAND
OB-27A	Part 111	708.30	636.5	72	DG	SAND
OB-28	Part 111	709.07	583.9	125	DG	SAND
OB-29	Part 111	705.58	609.4	96	DG	SAND
OB-30	Part 111	703.94	607.4	97	DG	SAND
OB-31AR	Part 111/MCIX	700.66	628.1	73	UG	SAND
OB-32	Part 111/MCIX	701.51	565.3	136	UG	ROCK
OB-34A	Part 111/TSCA	711.96	617.8	94	DG	SAND
OB-35A	Part 111	711.35	577.5	134	DG	ROCK
OB-36	Part 111 (MDWTP)	702.15	572.1	130	DG	ROCK
OB-37	Part 111	711.33	572.7	139	DG	ROCK
OB-38	Part 111	714.14	573.4	141	DG	ROCK
OB-39	Part 111	707.59	561.9	146	DG	ROCK
OB-40R	Part 111/TSCA	708.77	610.2	99	UG	SILT/SAND
OB-41	MCIX	701.99	562	140	DG	ROCK
OB-42	MCIX	717.29	624.4	93	DG	SAND
OB-43	MCIX	717.51	595.1	122	DG	SAND
OB-44	MCIX	701.30	639.5	62	DG	SAND
OB-45	Part 115/MCIX	701.28	628	73	DG	SAND
OB-46	MCIX	701.19	600	101	DG	SAND
OB-47	Part 111 (MDWTP)	702.71	594.3	108	DG	SAND
P-1	Part 111 (MDWTP)	703.50	685.0	19	DG	SURFACE SAND
P-2R	Part 111 (MDWTP)	707.00	685.4	22	UG	SURFACE SAND
P-3	Part 111 (MDWTP)	706.88	686.7	20	DG	SURFACE SAND
P-4R	Part 111 (MDWTP)	706.40	684.9	21	UG	SURFACE SAND
P-5	Part 111 (MDWTP)	701.28	684.0	17	DG	SURFACE SAND
P-6	Part 111 (MDWTP)	700.70	685.5	15	DG	SURFACE SAND

UG = Upgradient Well

DG = Downgradient Well

Attachment 4
WELL WIZARD
Dedicated Sampling System
Installation, Operation, and Maintenance User's guide
Part No. 34999

(This manual is on file at MDEQ-WHMD, Lansing and at MDWTP)

Attachment 5

Sample Container and Preservation Procedures

Handling Requirements of Monitoring Parameters

Parameter	Perservation	Holding Time	Bottle Type	Minimum Volume
Total Phenolics	1,2	28 Days	Glass	0.5 L
Sulfate	2	28 Days	Plastic	50 ml*
Total Alkalinity	2	14 Days	Plastic	100 ml*
Fluoride	2	28 Days	Plastic	300 ml*
Chloride	2	28 Days	Plastic	50 ml*
Nitrate/Nitrite	1,2	48 Hrs	Plastic	0.5 L
Arsenic	3,5	6 Mos	Plastic	200 ml**
Cadmium	3,5	6 Mos	Plastic	200 ml**
Calcium	3,5	6 Mos	Plastic	200 ml**
Chromium	3,5	6 Mos	Plastic	200 ml**
Iron	3,5	6 Mos	Plastic	200 ml**
Potassium	3,5	6 Mos	Plastic	200 ml**
Lead	3,5	6 Mos	Plastic	200 ml**
Magnesium	2,3,5	6 Mos	Plastic	200 ml**
Manganese	2,3,5	6 Mos	Plastic	200 ml**
Molybdenum	2,3,5	6 Mos	Plastic	200 ml**
Nickel	2,3,5	6 Mos	Plastic	200 ml**
Sodium	3,5	6 Mos	Plastic	200 ml**
Zinc	3,5	6 Mos	Plastic	200 ml**
Cyanide	2,4	14 Days	Plastic	500 ml
Copper	3,5	6 Mos	Plastic	200 ml**
pH		Immediate	Plastic	25 ml
Bicarbonate	2	14 Days	Plastic	100 ml*
Carbonate	2	14 Days	Plastic	100 ml*
TOC	2,7	28 Days	Glass	100 ml
Specific Conductivity	2	28 Days	Plastic	100 ml
Volatile Organics	2,6	14 Days	Glass	2x40 ml

- 1) pH<2 with concentrated Sulfuric Acid
- 2) Store at 4 degrees Centigrade
- 3) pH<2 with nitric acid
- 4) pH>12 with sodium hydroxide
- 5) Filtered in the field using 0.45 micron membrane filters on the time of collection
- 6) 4 drops HCL, no headspace
- 7) pH<2 with hydrochloric acid

* Note: One liter for all of these parameters stored similarly

** Note: One liter for all of these parameters stored similarly

Attachment 6
Field Measurement Equipment and Procedures
Yellow Springs Instrument Co. (YSI) Equipment Instructions
(pH, Specific Conductivity, and Temperature)

(This manual is on file at MDEQ-WHMD, Lansing and at MDWTP)

Attachment 7
Current Laboratory's Quality Assurance Manual

(This manual is on file at MDWTP)

Attachment 8

Statistical Monitoring Plan for Ground Water Monitoring Data

Statistical Procedures for Ground Water Monitoring Program Michigan Disposal Waste Treatment Plant

1.0 Introduction

The following statistical procedures are used to analyze the statistical significance of measured concentrations of ground water monitoring parameters at the Michigan Disposal Waste Treatment Plant (MDWTP). This program was developed in accordance to meet the requirements of 40 CFR 264.97 and Rule 506 of the Administrative Rules for Part 111, Hazardous Waste Management, of the Natural Resources and Environmental Protection Act, 1995 PA 451, as amended.

2.0 Overview of Statistical Procedures

The statistical evaluation program for MDWTP is designed to signal statistically significant concentrations of monitoring parameters measured in samples collected quarterly or semi-annually from the wells in the monitoring well network. Different statistical techniques are used for different monitoring parameters depending on the nature of the data. The statistical comparisons are either intrawell (each well is compared to its own background) or based on the detection limit, which is generally the standard laboratory detection limit. When intrawell statistical comparisons are used, the statistical procedure is selected based on the degree that the background data are censored.

The monitoring parameters measured during each analysis are divided into four categories: primary parameters, secondary parameters, tertiary parameters, and field parameters (see Figure 1). The list of primary parameters is comprised of volatile organic compounds that are known to present within the waste. As these compounds do not generally occur in nature at measurable concentrations, a confirmed concentration above a statistically based detection limit for any single parameter will result in a statistically significant increase as defined by the operating license.

The secondary monitoring parameters are mainly inorganic parameters that are found in elevated concentrations within the leachate. As these parameters are naturally occurring, their presence in ground water may or may not be an indication of a release and it is often necessary to determine the significance of changes in concentration relative to estimates of the true background concentrations. In this program secondary parameters are used to detect a possible release in the following ways. First, a confirmed statistically significant change in the concentration of any two (or more) secondary parameters in a single well will result in a statistically significant increase as defined by the operating license. This approach is designed to detect relatively subtle changes in ground water quality as evidenced by several parameters at once. In addition, a confirmed, order of magnitude increase (10 times the background concentration) in the concentration any single parameter will also result in a statistically significant increase. This will ensure that a large increase in one secondary parameter is appropriately investigated.

The tertiary parameters are those parameters for which background has already been established. The tertiary parameters in this program are further subdivided into two groups: parameters that have an already established background but will not be measured during detection monitoring, and parameters that will continue to be measured during detection monitoring but will not be subjected to the statistical analyses described below. The former group is not being analyzed because they do not appear to be useful monitoring parameters. The analytical results from the latter group will be used to evaluate potential non-release related ground water quality changes, such as might be caused by well corrosion and grout contamination. These parameters will not be analyzed statistically because they are poor indicators of a release.

Field parameters are those parameters measured in the field during sample collection, mainly for the purpose of showing that ground water quality has stabilized during well purging. These parameters will not be analyzed statistically.

3.0 Description of Statistics for Detection Monitoring

The statistical tests to be used for all detection monitoring events are described in the following section. This section includes the definition and procedures for calculating "background", and the procedures for conducting the statistical analyses.

3.1 Parameters

The parameter list for the ground water monitoring program is presented on Figure 1. The following descriptions of background calculation and statistical analyses are presented separately for the primary and secondary parameters, respectively.

3.2 Background

The background statistics for all monitoring parameters are to be calculated using the methods described below. The recalculation of the moving background for secondary parameters, as described below, will also follow these procedures. For new wells, or replacement wells that cannot utilize the data from the replaced well, an interim background as defined in section 3.3 will be used for applicable secondary parameters until eight samples are collected. Then the background described below will apply.

Primary Parameters - The decision of whether or not there is a statistically significant increase in a primary parameter is essentially the decision of whether or not the parameter is present in the ground water. For all of the primary parameters the occurrence of the parameter above the laboratory's reported detection limit is considered to be a statistically significant event and resampling must be initiated to confirm or refute the occurrence.

Secondary Parameters - Determination of the initial intrawell background statistics was completed utilizing the first eight sampling events beginning in 1988. However, beginning at the end of 1995, each time four new analyses were completed, the oldest four measurements have been dropped from the database, the next four added, and the background statistics recomputed. This is repeated each year keeping about a six year lag between the background period and the detection monitoring samples.

If the program moves to semi-annual monitoring (such as in post-closure), the background will be updated every year until the moving background reaches the point where years with semi-annual sampling are to be included. Then the background will be updated every two years (after four new samples have been collected) and thus the moving background window will continue to lag at least six years behind.

The nature of the background statistics and the method of calculation of these statistics for the secondary parameters is based on the degree of censorship of each parameter at each well. The secondary parameter list includes parameters which are highly censored (at least half of the values are below detection limits), those which are moderately censored (more than half the values are above detection) and those which are essentially

all above method detection limits (the method detection limits are defined in the operating license). Some parameters exhibit varying degrees of censorship at different wells.

If the background data for a parameter contains at least five detectable background values, but contains some non-detects, the non-detects will be alternately assigned values of zero and the detection limit. If all of the background values are above detection, the background statistics will be calculated from the background data as is. The mean and standard deviations will be calculated using the standard statistical equations for these quantities and the data will be analyzed using control charts as described below. In no case will a standard deviation of less than 10 percent of the mean be used in a statistical test. If the calculated background standard deviation is less than 10 percent of the mean, then 10 percent of the mean will be substituted for the background standard deviation.

If half or more of the intrawell background measurements are below detection limits (4 or more BDL values), then the background statistics will be calculated based on the proportion of values above method detection limits. This quantity will be used to conduct a test of proportions as described below.

3.3 Performance of Statistical Tests

The methods to be used for statistical analyses of all primary and secondary parameters that have a background as defined in Section 3.2 are described below. For new wells, the primary parameters will be evaluated as described below but the secondary parameters will be evaluated using the "interim" statistical procedures contained in Appendix A. For replacement wells, a decision must be made as to whether the existing background from the well replaced is appropriate for the new well. If it is, such as might be expected when a damaged well is replaced by a well screened in the same stratum, then the existing background can be used with the statistical tests described below. If the replacement well can not be placed in the same strata, or the old well is believed to have yielded unrepresentative results, then the replacement well is considered a new well for the purposes of statistical analyses and will be handled as described above.

Primary Parameters - For the primary parameters, any measured concentration of any parameter which is above the laboratory reported detection limit will initiate quadruplicate resampling for confirmation of the affected parameter(s), in accordance with the operating license. If the statistical failure is repeated, then a statistically significant increase is confirmed. If the apparent increase is not confirmed, then normal detection monitoring will be resumed.

Secondary Parameters - The statistical analysis of secondary parameters will be conducted by one of two statistical tests depending on the degree that the intrawell background data are censored. If more than half the data are above method detection limits then a control chart approach will be used. If at least half the background data are below detection limits, a test of proportions will be used to analyze the data. There is

also a default provision to investigate a dramatic increase in any single parameter regardless of the results of outcome of the statistics.

If there are statistically significant increases for any two secondary parameters at any single well, and the increases represent less than a ten-fold increase over background, then MDWTP shall undertake the procedures identified in the operating license, including resampling in quadruplicate. In this case, both failures must be verified by resampling in order to confirm the statistical increase. If any single secondary parameter exhibits a ten-fold increase over background, then this occurrence must be verified by quadruplicate resampling. If the increase is confirmed then a statistically significant increase has occurred.

The statistical evaluation of moderately censored or uncensored secondary parameters will be conducted using intrawell statistical comparisons via a control chart approach. The combined Shewhart-CUSUM control chart will be used to analyze the statistical significance of the measured concentrations of secondary parameters. This approach consists of two statistical tests designed to detect different types of evidence of a release. The Shewhart limit is designed to detect a sharp increase in the concentration of a monitoring parameter in a single sample. The CUSUM limit is designed to detect gradual increases in the concentration of a parameter over time. The two techniques will be used as separate statistical tests. That is, failure of either test alone (or both) will signal a statistically significant increase for a given parameter. Therefore, if one parameter fails the CUSUM test and another exceeds the Shewhart limit, then an apparent statistically significant increase will have occurred and confirmation of both failures must be undertaken. Confirmation of an apparent failure of one of the two tests must be confirmed by an additional failure of that particular test.

The Shewhart control chart compares a detection monitoring concentration of a parameter to the intrawell background mean plus a selected number of standard deviations. The test is performed by calculating the standardized mean, Z , for the detection monitoring concentration. As individual samples are collected during each detection monitoring event, the standardized mean for each measured parameter is calculated by:

$$Z = (x_m - x_b)/s_b$$

where: x_b is the intrawell background mean

x_m is the measured concentration during detection monitoring

s_b is the standard deviation of the intrawell background

The value of Z is then simply compared to a selected value, U , which represents the number of standard deviations from the intrawell mean. The Shewhart limit (U), or upper control limit will be 4.5, as recommended in the Interim Final Guidance for Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (USEPA, 1989). The

statistical test is performed by simply comparing the value of Z to the value of U. If Z is greater than U then it is concluded that a statistically significant increase has occurred.

The Shewhart control chart will be used in the following manner. If a secondary parameter(s) exceeds the Shewhart limit and at least two secondary parameters fail a statistical test at any given well during a given sampling event, the well would be resampled in quadruplicate for the offending parameters, and the mean(s) of the quadruplicate analyses would be used to confirm whether the Shewhart limit(s) is exceeded. If there is confirmation, then it would be concluded that there has been a statistically significant increase. If the increase is not confirmed, any unconfirmed measurements would be dropped from the control chart and replaced with the means of the quadruplicates.

The CUSUM control chart is designed to detect a trend of increasing concentrations over time, regardless of whether the Shewhart limit is exceeded or not. In the CUSUM procedure, the cumulative sum of the values for Z - k are tabulated over time, each time a round of samples are analyzed. The value for Z is computed as described above, and k is a selected parameter. During each analysis subsequent to the background determination period, a value for Z - k is computed and added to the previous total. As long as the cumulative total of Z - k is a negative number the cumulative sum (S) remains zero. As positive values accumulate, the value for S is compared to a selected value, h. If S is greater than h, then a statistically significant event has occurred. The values used for k and h will be $k = 1$ and $h = 5$, respectively, as recommended (USEPA, 1989).

The CUSUM limit will be utilized in conjunction to the Shewhart limit and proportions test as follows. If the CUSUM limit is exceeded and at least two or more secondary parameters have failed a statistical test at any given well during any given sampling period, quadruplicate resampling of the well in question will be initiated. The mean values of the quadruplicate sample will then be used to recompute S. If S again exceeds h, then the increase is confirmed. If the increase is not confirmed then the mean values of the quadruplicate sampling replace the results of the anomalous (unconfirmed) values within the CUSUM statistic for future analyses. These non-confirmed exceedances must be removed from the CUSUM control chart because their inclusion may cause additional false positive results when subsequent sample results are added to the cumulative sum.

For parameters that contain at least half non-detectable concentrations in the intrawell background database, a statistical test to determine the significance of the proportion of detectable occurrences during detection monitoring will be used. The test of proportions, which is based on the binomial distribution, is statistical test suited to this purpose. This statistical procedure analyzes the significance of an increase in the rate of detectable occurrences over time.

To implement the test of proportions, the proportion of detectable occurrences during the 8 background samples will be compared to the rate of detectable occurrences in the most recent 4 detection monitoring samples. The statistic is computed by the equation:

$$Z^* = \frac{P_m - P_b}{[p(1-p)(1/N_m + 1/N_b)]^{0.5}}$$

where: P_m = proportion of detectable concentrations in the last four detection monitoring samples
 P_b = proportion of detectable concentrations in the eight intrawell background samples
 N_m = number of detection monitoring samples (4)
 N_b = number of background samples (8)
 p = weighted proportion defined as:

$$p = \frac{n_m + n_b}{N_m + N_b}$$

where: n_m = number of detection monitoring samples above method detection limits
 n_b = number of background samples above method detection limits

The value of Z^* is then simple compared to a critical value, Z_C , obtained from standard tables for the normal variate, Z , at the desired level of significance. The test will be conducted at the 0.05 level of significance, therefore Z_C is equal to 1.645. Any value of Z^* greater than Z_C signals a statistical failure for that parameter.

Each time a new detection monitoring sample is collected, the result would be added to the previous three samples for determining the proportion of detectable occurrences. Thus, both the background and detection monitoring proportions involve a moving window, with the background lagging at least six years behind the window of detection monitoring. If detection limits are lowered during the monitoring program, the proportion of detectable occurrences will be the proportion of results above the older background detection limit until the background is updated to include the new lower detection limits. For example, if the old detection limit was 20 and the new detection limit is 10, then only concentrations above 20 (even though a concentration of 11 or above is now "detectable") will be considered detectable until the moving background window is based on samples with a detection limit of 10.

MDWTP will use the proportions test as follows. If there is a statistically significant increase in any two secondary parameters at a particular monitoring well (i.e. two failures of the test of proportions or a combination of control chart and proportions test failures), then resampling in quadruplicate would be initiated to confirm the suspected increase. Confirmation would be completed if both failures are repeated.

To guard against the unlikely possibility of a large increase in a single secondary parameter going unflagged by the above statistical program, MDWTP will consider any concentration of a secondary parameter that is greater than 10 times the background concentration (or the reported detection limit for highly censored parameters) as a default violation of the statistical tests described above. This will ensure that clearly anomalous data are evaluated even if only a single secondary parameter is affected.

Attachment 9
Background Statistics for Well Sampling

Background Statistics for Well OB-18

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.500	0.0035	0.001	0.0015	0.00087	0.58	n.a.
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	2	1.8	1.92	0.19	0.054	n.a.
Iron	8	0.02	0.875	0.047	0.02	0.036	0.011	0.3	n.a.
Lead	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Molybdenum	8	0.025	1.000	0.085	0.072	0.076	0.0076	0.053	n.a.
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	1.9	1.2	1.48	0.25	0.17	n.a.
Sodium	8	1	1.000	100	79	86.75	8.68	0.074	n.a.
Alkalinity, Bicarbonate	8	10	1.000	230	220	222.5	22.25	0.021	n.a.
Alkalinity, Carbonate	8	10	0.125	10	5	n.a.	n.a.	n.a.	10
Nitrogen, Nitrite	8	0.01	0.125	0.018	0.01	n.a.	n.a.	n.a.	0.5
Nitrogen, Nitrate	8	0.01	0.500	0.055	0.01	0.021	0.02	0.93	n.a.
Chloride	8	1	1.000	14	13	13.13	1.31	0.027	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	0.250	4.3	2	n.a.	n.a.	n.a.	4.3
Organic Carbon, Total	8	0.5	1.000	1.8	1.4	1.54	0.15	0.092	n.a.
Phenolics, Total	8	0.01	0.125	0.139	0.005	n.a.	n.a.	n.a.	0.139

Background Statistics for Well OB-19R

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	2.4	1.4	1.81	0.29	0.16	n.a.
Iron	8	0.02	1.000	0.1	0.051	0.063	0.016	0.25	n.a.
Lead	8	0.001	0.125	0.0019	0.001	n.a.	n.a.	n.a.	0.0019
Molybdenum	8	0.025	1.000	0.054	0.044	0.049	0.0049	0.065	n.a.
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	1.4	1.2	1.25	0.13	0.06	n.a.
Sodium	8	1	1.000	100	83	88.88	8.89	0.07	n.a.
Alkalinity, Bicarbonate	8	10	1.000	230	220	222.5	22.25	0.021	n.a.
Alkalinity, Carbonate	8	10	0.000	10	5	n.a.	n.a.	n.a.	10
Nitrogen, Nitrite	8	0.01	0.250	0.013	0.01	n.a.	n.a.	n.a.	0.5
Nitrogen, Nitrate	8	0.01	0.125	0.012	0.01	n.a.	n.a.	n.a.	0.5
Chloride	8	1	1.000	15	14	14.5	1.45	0.037	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	0.000	2	2	n.a.	n.a.	n.a.	2
Organic Carbon, Total	8	0.5	1.000	2.1	1.6	1.71	0.18	0.11	n.a.
Phenolics, Total	8	0.01	0.000	0.01	0.005	n.a.	n.a.	n.a.	0.01

Background Statistics for Well OB-21

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	0.68	0.56	0.62	0.062	0.083	n.a.
Iron	8	0.02	1.000	1.6	1.4	1.49	0.15	0.043	n.a.
Lead	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Molybdenum	8	0.025	0.000	0.025	0.025	n.a.	n.a.	n.a.	0.1
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	1.5	1.3	1.38	0.14	0.051	n.a.
Sodium	8	1	1.000	15	14	14.63	1.46	0.035	n.a.
Alkalinity, Bicarbonate	8	10	1.000	270	260	267.5	26.75	0.017	n.a.
Alkalinity, Carbonate	8	10	0.000	10	5	n.a.	n.a.	n.a.	10
Nitrogen, Nitrite	8	0.01	0.500	0.036	0.01	0.019	0.011	0.56	n.a.
Nitrogen, Nitrate	8	0.01	0.125	0.01	0.01	n.a.	n.a.	n.a.	0.5
Chloride	8	1	1.000	23	18	20.13	2.031	0.1	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	1.000	41	33	38	3.8	0.072	n.a.
Organic Carbon, Total	8	0.5	1.000	1.7	1.1	1.23	0.21	0.17	n.a.
Phenolics, Total	8	0.01	0.125	0.0117	0.005	n.a.	n.a.	n.a.	0.0117

Background Statistics for Well OB-23AR

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	0.75	0.56	0.64	0.066	0.1	n.a.
Iron	8	0.02	1.000	0.94	0.73	0.82	0.082	0.095	n.a.
Lead	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Molybdenum	8	0.025	0.000	0.025	0.025	n.a.	n.a.	n.a.	0.1
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	1.5	1.3	1.36	0.14	0.067	n.a.
Sodium	8	1	1.000	21	17	18.38	1.84	0.096	n.a.
Alkalinity, Bicarbonate	8	10	1.000	290	280	281.25	28.13	0.013	n.a.
Alkalinity, Carbonate	8	10	0.000	10	5	n.a.	n.a.	n.a.	10
Nitrogen, Nitrite	8	0.01	0.250	0.011	0.01	n.a.	n.a.	n.a.	0.5
Nitrogen, Nitrate	8	0.01	0.250	0.014	0.01	n.a.	n.a.	n.a.	0.5
Chloride	8	1	1.000	32	29	30.25	3.025	0.039	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	1.000	11	8.5	9.48	0.95	0.082	n.a.
Organic Carbon, Total	8	0.5	1.000	1.3	1.1	1.15	0.11	0.066	n.a.
Phenolics, Total	8	0.01	0.000	0.01	0.005	n.a.	n.a.	n.a.	0.01

Background Statistics for Well OB-36

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	0.94	0.62	0.72	0.1	0.14	n.a.
Iron	8	0.02	1.000	0.51	0.45	0.47	0.047	0.046	n.a.
Lead	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Molybdenum	8	0.025	0.000	0.025	0.025	n.a.	n.a.	n.a.	0.1
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	1.7	1.4	1.55	0.16	0.06	n.a.
Sodium	8	1	1.000	19	16	16.75	1.67	0.07	n.a.
Alkalinity, Bicarbonate	8	10	1.000	270	260	262.5	26.25	0.018	n.a.
Alkalinity, Carbonate	8	10	0.000	10	5	n.a.	n.a.	n.a.	10
Nitrogen, Nitrite	8	0.01	0.125	0.019	0.01	n.a.	n.a.	n.a.	0.5
Nitrogen, Nitrate	8	0.01	0.125	0.015	0.01	n.a.	n.a.	n.a.	0.5
Chloride	8	1	1.000	14	11	12.63	1.26	0.084	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	0.000	2	2	n.a.	n.a.	n.a.	2
Organic Carbon, Total	8	0.5	1.000	1.3	0.62	0.82	0.21	0.25	n.a.
Phenolics, Total	8	0.01	0.250	0.021	0.005	n.a.	n.a.	n.a.	0.021

Background Statistics for Well OB-47

Parameter	# of Samples	Det Lim (mg/L)	Prop ADL	Max	Min	Mean	St Dev	Coeff of Var	NPPL
Arsenic	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Chromium	8	0.001	0.000	0.02	0.001	n.a.	n.a.	n.a.	0.02
Flouride	8	0.1	1.000	1	0.76	0.89	0.092	0.1	n.a.
Iron	8	0.02	1.000	0.39	0.14	0.3	0.083	0.28	n.a.
Lead	8	0.001	0.000	0.001	0.001	n.a.	n.a.	n.a.	0.001
Molybdenum	8	0.025	0.000	0.025	0.025	n.a.	n.a.	n.a.	0.1
Nickel	8	0.025	0.000	0.05	0.025	n.a.	n.a.	n.a.	0.05
Potassium	8	0.1	1.000	3.2	2.5	2.78	0.28	0.081	n.a.
Sodium	8	1	1.000	27	22	24.5	2.45	0.09	n.a.
Alkalinity, Bicarbonate	8	10	1.000	200	180	195	19.5	0.039	n.a.
Alkalinity, Carbonate	8	10	0.125	12	5	n.a.	n.a.	n.a.	12
Nitrogen, Nitrite	8	0.01	0.125	0.012	0.01	n.a.	n.a.	n.a.	0.5
Nitrogen, Nitrate	8	0.01	0.000	0.01	0.01	n.a.	n.a.	n.a.	0.5
Chloride	8	1	1.000	2.8	2.2	2.55	0.25	0.073	n.a.
Cyanide, Total	8	0.005	0.000	0.005	0.005	n.a.	n.a.	n.a.	0.01
Sulfate	8	2	1.000	5.4	2.9	3.91	0.81	0.21	n.a.
Organic Carbon, Total	8	0.5	1.000	1.7	1.4	1.5	0.15	0.087	n.a.
Phenolics, Total	8	0.01	0.000	0.01	0.005	n.a.	n.a.	n.a.	0.01

Summary of Background Statistics for Inorganic Monitoring Parameters - SECSA

Well I.D.	Parameter	Mean	Coefficient of Variation	Standard Deviation	Non-Parametric Prediction Limit
P-1	Alkalinity	398	0.037	15	n/a
	Chloride	86	0.203	18	n/a
	Sulfate	1057	0.175	184	n/a
	Barium	0.030	0.154	0.005	n/a
	Calcium	360	0.155	56	n/a
	Iron	5.5	0.313	1.7	n/a
	Magnesium	114.3	0.162	18.6	n/a
	Potassium	11.3	0.103	1.2	n/a
	Sodium	67.0	0.089	6.0	n/a
	Arsenic	0.0016	0.159	0.0003	n/a
	Cadmium	n/a	n/a	n/a	<0.0002
	Chromium	n/a	n/a	n/a	0.001
	Copper	0.0020	0.284	0.0006	n/a
	Lead	n/a	n/a	n/a	<0.001
	Nickel	0.010	0.429	0.004	n/a
	Selenium	0.0013	0.164	0.0002	0.0015
	Silver	n/a	n/a	n/a	<0.0002
	Hex Chrom	n/a	n/a	n/a	0.0221
	Mercury	n/a	n/a	n/a	<0.0002
	Cyanide	n/a	n/a	n/a	<0.005
P-2R	Alkalinity, Total	415	0.084	35	n/a
	Chloride	1034	0.250	258	n/a
	Sulfate	666	0.135	90	n/a
	Barium	0.127	0.243	0.031	n/a
	Calcium	391	0.148	58	n/a
	Iron	8.3	0.464	3.9	n/a
	Magnesium	76.4	0.149	11.4	n/a
	Potassium	13.3	0.181	2.4	n/a
	Sodium	543.0	0.248	134.7	n/a
	Arsenic	0.0090	0.440	0.0040	n/a
	Cadmium	0.0019	0.642	0.0012	n/a
	Chromium	n/a	n/a	n/a	0.0014
	Copper	0.0036	0.338	0.0012	0.0058
	Lead	n/a	n/a	n/a	<0.001
	Nickel	0.068	0.246	0.017	n/a
	Selenium	0.0035	0.486	0.0017	n/a
	Silver	n/a	n/a	n/a	<0.0002
	Hex Chrom	n/a	n/a	n/a	<0.005
	Mercury	n/a	n/a	n/a	<0.0002
	Cyanide	n/a	n/a	n/a	<0.005

Summary of Background Statistics for Inorganic Monitoring Parameters - SECSA

Well I.D.	Parameter	Mean	Coefficient of Variation	Standard Deviation	Non-Parametric Prediction Limit
P-3	Alkalinity, Total	358	0.067	24	n/a
	Chloride	1744	0.320	559	n/a
	Sulfate	157	0.403	63	n/a
	Barium	0.515	0.514	0.265	n/a
	Calcium	219	0.344	75	n/a
	Iron	2.6	0.547	1.4	n/a
	Magnesium	32.8	0.327	10.7	n/a
	Potassium	6.7	0.211	1.4	n/a
	Sodium	962.0	0.259	249.6	n/a
	Arsenic	0.0026	0.359	0.0009	n/a
	Cadmium	n/a	n/a	n/a	<0.0002
	Chromium	n/a	n/a	n/a	0.0012
	Copper	0.0025	0.884	0.0022	n/a
	Lead	n/a	n/a	n/a	<0.001
	Nickel	0.006	0.563	0.003	n/a
	Selenium	n/a	n/a	n/a	0.0011
	Silver	n/a	n/a	n/a	<0.0002
Hex Chrom	n/a	n/a	n/a	<0.005	
Mercury	n/a	n/a	n/a	<0.0002	
Cyanide	n/a	n/a	n/a	<0.005	
P-4R	Alkalinity, Total	377	0.059	22	n/a
	Chloride	494	0.401	198	n/a
	Sulfate	154	0.274	42	n/a
	Barium	0.179	0.329	0.059	n/a
	Calcium	155	0.156	24	n/a
	Iron	2.3	0.437	1.0	n/a
	Magnesium	27.8	0.185	5.1	n/a
	Potassium	2.9	0.162	0.5	n/a
	Sodium	316.0	0.307	97.0	n/a
	Arsenic	0.0019	0.206	0.0004	n/a
	Cadmium	n/a	n/a	n/a	<0.0002
	Chromium	n/a	n/a	n/a	0.0016
	Copper	0.0016	0.222	0.0004	n/a
	Lead	n/a	n/a	n/a	<0.001
	Nickel	0.019	0.161	0.003	n/a
	Selenium	n/a	n/a	n/a	<0.001
	Silver	n/a	n/a	n/a	<0.0002
Hex Chrom	n/a	n/a	n/a	<0.005	
Mercury	n/a	n/a	n/a	<0.0002	
Cyanide	n/a	n/a	n/a	<0.005	

Summary of Background Statistics for Inorganic Monitoring Parameters - SECSA

Well I.D.	Parameter	Mean	Coefficient of Variation	Standard Deviation	Non-Parametric Prediction Limit
P-7	Alkalinity, Total	445	0.163	73	n/a
	Chloride	274	0.138	38	n/a
	Sulfate	722	0.134	96	n/a
	Barium	0.036	0.091	0.003	n/a
	Calcium	374	0.101	38	n/a
	Iron	2.6	0.216	0.6	n/a
	Magnesium	103.8	0.104	10.8	n/a
	Potassium	4.2	0.076	0.3	n/a
	Sodium	58.9	0.277	16.3	n/a
	Arsenic	0.0041	0.262	0.0011	n/a
	Cadmium	n/a	n/a	n/a	<0.0002
	Chromium	n/a	n/a	n/a	<0.001
	Copper	0.0014	0.287	0.0004	n/a
	Lead	n/a	n/a	n/a	<0.001
	Nickel	0.012	0.214	0.002	n/a
	Selenium	0.0024	0.4802	0.0012	n/a
	Silver	n/a	n/a	n/a	<0.0002
	Hex Chrom	n/a	n/a	n/a	<0.005
	Mercury	n/a	n/a	n/a	<0.0002
	Cyanide	n/a	n/a	n/a	<0.005