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Joe Martens
Commissioner

May 18, 2012

Mr. Jeffrey Smith
Moench Tanning Company
465 Palmer Street
Gowanda, NY 14070

Dear Mr. Smith:

Comprehensive Groundwater Monitoring Evaluation Report
Site # 905004

Enclosed is a copy of the Comprehensive Monitoring Evaluation Report developed as part of inspections performed in March 2012. Although the inspection report makes two recommendations, the inspection indicates that Moench Tanning is in compliance with the groundwater sampling program.

If you have any questions, please call me at (716)851-7220.

Sincerely,

Stanley Radon
Senior Engineering Geologist

SR:dcg
radon\smith-may1.ltr

Attachments:
Attachment A – Narrative
Attachment B - CME Checklist

COMPREHENSIVE GROUNDWATER MONITORING

EVALUATION (CME)

MOENCH TANNING
PALMER STREET LANDFILL
Site # 905004

I.D.# NYS 002126910

May 2012

Prepared by:

Stanley F. Radon, CPG
Division of Environmental Remediation

Objective:

The objective of a Comprehensive Monitoring Evaluation (CME) is to determine whether, based upon site history and hydrogeology, the owner/operator of a TSD facility has, in place, a groundwater monitoring system which is adequately designed, operated and maintained to detect releases from RCRA regulated units.

Site History:

The Moench Tanning Facility is located in Gowanda, NY on Cattaraugus Creek in Cattaraugus County NY (see Figure 1, Appendix A). It was a chrome leather tannery that had been in operation for over 100 years, processing cattle hides into finished shoe leather. The facility ceased operations in late 1992.

The regulated unit at Moench Tanning subject to RCRA groundwater monitoring is the 20-acre Palmer Street landfill containing spray booth sludge, band cleaning sludge, sole leather extract, rendering waste, and leather straps. The site is also listed on the New York State Inactive Hazardous Waste Site listing (No. 905004) as a Class 4 site. A Class 4 site has undergone remediation and is subject to operation and maintenance. Physical closure of the landfill was completed in 1991. The cap consists of one foot of topsoil over two feet of low permeability soils.

Site Geology:

The geology associated with the Palmer Street landfill is a typical inter-fingering glacial/glaciolacustrine/glaciofluvial sequence. The description below is a summary based upon soil boring data from the site as presented in the Post Closure Investigation Report, Palmer Street landfill (Malcolm Pirnie, 1991). A complete description of all units can be found in this document. The geologic units beneath the site can be divided into three major groups:

- Upper Overburden deposits
  - Waste/fill
  - Alluvial silt, sand and gravel
  - Glaciolacustrine silt and sand

- Lower Overburden deposits
  - Galciolacustrine silt and clay
  - Glacial till
  - Glaciofluvial sand and gravel

- Bedrock Formations
  - Siltstone and shale

The upper overburden deposits are primarily glaciolacustrine silts and sands. A discontinuous alluvial silt, sand and gravel layer overlies the glaciolacustrine unit and the waste sits on top of this alluvial unit. The alluvial material is present along Cattaraugus Creek. The lower overburden deposits consist of a glaciolacustrine unit, a glaciofluvial sand unit, and three distinct glacial till units.

Top of rock contours have been mapped and indicate the presence of a deep, glacially scoured bedrock valley. The landfill site is located on the sloping sides of this buried valley. The valley deepens at least another 230 feet towards the Village of Gowanda. The bedrock near the creek is predominantly gray-brown shale with calcareous siltstone partings, which grades into a green-gray shale with lesser siltstone content.

Site Hydrology

The upper overburden water bearing zone is a shallow-leachate bearing zone consisting of the near surface waste/fill and underlying layer of undisturbed alluvial materials. The groundwater/leachate in this zone behaves like typical water table conditions, and recharge occurs primarily by infiltration of precipitation through the waste/fill and secondarily from upgradient groundwater flow. Discharge occurs to Cattaraugus Creek, off-site across the northern landfill boundary, and downward through the lower overburden to the regional aquifer by seepage through the lower overburden.

The lower overburden water bearing zone includes all saturated unconsolidated between the base of the upper overburden and the bedrock. The vertical hydraulic gradient between the lower overburden and the bedrock wells is downward across the site, and it appears that the two units are in hydraulic connection. The average hydraulic conductivity in the lower permeability

materials in this zone is 8.1 x 10^{-8} cm/s.

The bedrock underlying the site is in hydraulic connection with the regional the regional aquifer. The bedrock is recharged from the lower overburden zone. Hydraulic conductivities in the bedrock beneath the site average 1.8 x 10^{-5} cm/s, although the bedrock in the northern portion of the site has an average hydraulic conductivity of 1.4 x $^{-4}$ cm/s.

Groundwater Monitoring System

There are nine groundwater wells (see Figure 2, Appendix A) that are part of the long-term post-closure monitoring plan. These wells are:

MW-3 Down gradient well
MW -4SR Down gradient well
MW- 5 Down gradient well
MW – 6 Down gradient well
MW – 3D Down gradient well
MW - 4D Down gradient well
MW – 6D Down gradient well
MW – 7D & MW – 8D are up gradient wells

In addition to the monitoring wells above, Moench Tanning also samples three bank seeps, designated as BS-1, BS -2 and BS-3. However, due to intermittent flow, it is difficult to obtain samples from all three seeps.

Sampling Inspection

On March 28, 2011, Stanley Radon, Engineering Geologist II and Dennis Weiss, Regional Hazardous Waste Engineer, from the Region 9 office of the New York State Department of Environmental observed Mr. Jeff Smith of Moench Tanning perform sampling operations at the landfill.

The Comprehensive Groundwater Monitoring Evaluation worksheet forms were completed for this facility and are attached in Appendix B.

Groundwater Quality

The groundwater samples are analyzed for the following parameters:

- soluble arsenic
- soluble chromium
- soluble lead
- volatile organic compounds

Recommendations

1. To ensure sample integrity, the Department suggests that the any wells yielding turbid water be redeveloped to maximize the efficiency of the sand pack.

2. Prior to collecting groundwater elevation data, Moench should determine the depth to the bottom of the well and maintain records of the depth. If the well starts to accumulate sediment greater than one foot, the sediment should be removed.

Conclusions

1. The facility is following their approved sampling and analysis plan and is in compliance with 6NYCRR Part 373-3.6 groundwater regulations at this time. The sampler (Mr. Jeff Smith) is qualified and performed the sampling adequately.

2. The facility monitors the groundwater two times a year. The Department feels this program is adequate to monitor the groundwater conditions associated with the facility.

Mr. Smith attempting to obtain a bank seek sample along the edge of landfill and oxbow of Cattaraugus Creek.

Bailing to evacuate monitoring well 3D begins.

Field parameter sample container is filled via dedicated bailer.

40 ml VOA sample container is filled and checked to ensure no air bubbles are present.

Comprehensive Groundwater Monitoring Evaluation		Y/N
I.	**Office Evaluation Technical Evaluation of the Design of the Groundwater Monitoring System**	Y
A.	**Review of Relevant Documents**	
1.	What documents were obtained prior to conducting the inspection: ☐ RCRA Part A permit application ☐ RCRA Part B permit application X Correspondence between the owner/operator and appropriate agencies or citizen's groups X Previously conducted facility inspection reports X Facility's contractor reports X Regional hydrogeologic, geologic, or soil reports X The facility's Sampling and Analysis Plan X Groundwater Assessment Program Outline (or Plan, if the facility is in assessment monitoring) ☐ Other (specify):	
B.	**Evaluation of the Owner/Operator's Hydrogeologic Assessment**	Y
1.	Did the owner/operator use the following direct techniques in the hydrogeologic assessment: X Logs of the soil borings/rock corings (documented by a professional geologist, scientist, or geotechnical engineer) X Materials tests (e.g., grain size analyses, standard penetration tests, etc.) X Piezometer installation for water level measurements at different depths X Slug tests ☐ Pump tests X Geochemical analyses of soil samples ☐ Other (specify) (e.g., hydrochemical diagrams, wash analysis):	
2.	Did the owner/operator use the following indirect technique to supplement direct techniques data: ☐ Geophysical well logs ☐ Tracer studies ☐ Resistivity and/or electromagnetic conductance ☐ Seismic survey X Hydraulic conductivity measurements of cores X Aerial photography ☐ Ground penetrating radar ☐ Other (specify):	Y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
3.	Did the owner/operator document and present the raw data from the site hydrogeologic assessment?	y
4.	Did the owner/operator document methods (criteria) used to correlate and analyze the information?	y
5.	Did the owner/operator prepare the following: X Narrative description of geology X Geologic cross sections X Geologic and soil maps X Boring/coring logs X Structure contour maps of the differing water bearing zones and confining layer X Narrative description and calculation of groundwater flows X Water table/potentiometric map X Hydrologic cross sections	y
6.	Did the owner/operator obtain a regional map of the area and delineate the facility? X If yes, does the site map show: X Surficial geology features X Streams, rivers, lakes, or wetlands near the facility X Discharging or recharging wells near the facility	y
7.	Did the owner/operator obtain a regional hydrogeologic map? If yes, does this hydrogeologic map indicate: X Major areas of recharge/discharge X Regional groundwater flow direction X Potentiometric contours which are consistent with observed water level elevations	y
8.	Did the owner/operator prepare a facility site map? If yes, does the site map show: X Regulated units of the facility (e.g., landfill areas, impoundments) X Any seeps, springs, streams, ponds, or wetlands X Location of monitoring wells, soil borings, or test pits	y
9.	How many regulated units does the facility have? 1 If more an one regulated unit then, ☐ Does the waste management area encompass all regulated units? ☐ Is a waste management area delineated for each regulated unit?	N/A

Comprehensive Groundwater Monitoring Evaluation			Y/N
C.	**Characterization of Subsurface Geology of Site**		
1.	Soil boring/test pit program:		
	a.	Were the soil borings/test pits performed under the supervision of a qualified professional?	y
	b.	Did the owner/operator provide documentation for selecting the spacing for borings?	y
	c.	Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock?	y
	d.	Indicate the method(s) of drilling: X Auger (hollow or solid stem) ☐ Mud rotary ☐ Reverse rotary ☐ Cable tool ☐ Jetting ☐ Other (specify):	N/A
	e.	Were continuous sample cores taken?	y
	f.	How were the samples obtained (checked method(s)) X Split spoon X Shelby tube, or similar X Rock coring ☐ Ditch sampling ☐ Other (explain):	N/A
	g.	Were the continuous sample cores logged by a qualified professional in geology?	y

Comprehensive Groundwater Monitoring Evaluation		Y/N
h.	Does the field boring log include the following information: X Hole name/number X Date started and finished X Driller's name X Hole location (i.e., map and elevation) X Drill rig type and bit/auger size X Gross petrography (e.g., rock type) of each geologic unit X Gross mineralogy of each geologic unit X Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material) X Development of soil zones and vertical extent and description of soil type X Depth of water bearing unit(s) and vertical extent of each X Depth and reason for termination of borehole X Depth and location of any contaminant encountered in borehole X Sample location/number X Percent sample recovery Narrative descriptions of: X Geologic observations X Drilling observations	Y
i.	Were the following analytical tests performed on the core samples: ☐ Mineralogy (e.g., microscopic tests and x-ray diffraction) Petrographic analysis: ☐ Degree of crystallinity and cementation of matrix ☐ Degree of sorting, size fraction (i.e., sieving), textural variations ☐ Rock type(s) ☐ Soil type ☐ Approximate bulk geochemistry ☐ Existence of microstructures that may affect or indicate fluid flow ☐ Falling head tests ☐ Static head tests ☐ Settling measurements ☐ Centrifuge tests ☐ Column drawings	N

Comprehensive Groundwater Monitoring Evaluation		Y/N
D.	**Verification of Subsurface Geological Data**	
1.	Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations?	N
2.	Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically low water-bearing units?	Y
3.	Is the confining layer laterally continuous across the entire site?	N
4.	Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer?	N
5.	Did the geologic assessment address or provide means for resolution of any information gaps of geologic data?	Y
6.	Do the laboratory data corroborate the field data for petrography?	N/A
7.	Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry?	N/A
E.	**Presentation of Geologic Data**	
1.	Did the owner/operator present geologic cross sections of the site?	Y
2.	Do cross sections: X Identify the types and characteristics of the geologic materials present X Define the contact zones between different geologic materials X Note the zones of high permeability or fracture X Give detailed borehole information including: X Location of borehole X Depth of termination X Location of screen (if applicable) X Depth of zone(s) of saturation X Backfill procedure	Y
3.	Did the owner/operator provide a topographic map which was constructed by a licensed surveyor?	Y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
4.	Does the topographic map provide: X Contours at a maximum interval of two feet X Locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drain, pipelines, etc.) X Descriptions of nearby water bodies ☐ Descriptions of off-site wells X Site boundaries ☐ Individual RCRA units X Delineation of the waste management area(s) X Well and boring locations	Y
5.	Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features?	Y
6.	Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labeled?	Y
F.	**Identification of Groundwater Flow Paths**	
1.	Groundwater flow direction	
a.	Was the well casing height measured by a licensed surveyor to the nearest 0.01 feet?	Y
b.	Were the well water level measurements taken within a 24 hour period?	Y
c.	Were the well water level measurements taken to the nearest 0.01 feet?	Y
d.	Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements?	Y
e.	Was the water level information obtained from (check appropriate one): ☐ Multiple piezometers placed in single borehole X Vertically nested piezometers in closely spaced separate boreholes X Monitoring wells	Y
f.	Did the owner/operator provide construction details for the piezometers?	Y

Comprehensive Groundwater Monitoring Evaluation		Y/N
g.	How were the static water levels measured (check method(s)). X Electric water sounder ☐ Wetted tape ☐ Air line ☐ Other (explain):	y
h.	Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone?	y
i.	Has the owner/operator provided a site water table (potentiometric) contour map?	y
	• Do the potentiometric contours appear logical and accurate based on topography and presented data?	y
	• Are groundwater flow lines indicated?	y
	• Are static water levels shown?	y
	• Can hydraulic gradients be estimated?	y
j.	Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells?	y
k.	Do the owner/operator's flow nets include: X Piezometer locations X Depth of screening X Width of screening X Measurements of water levels from all wells and piezometers	y
2.	Seasonal and temporal fluctuations in groundwater:	

Comprehensive Groundwater Monitoring Evaluation		Y/N
a.	Do fluctuations in static water levels occur? If yes, are the fluctuations caused by any of the following: X Off-site well pumping ☐ Tidal processes or other intermittent natural variations (e.g., river stage, etc.) ☐ On-site well pumping X Off-site, on-site construction or changing land use patterns ☐ Deep well injection ☐ Seasonal variations ☐ Other (specify):	Y
b.	Has the owner/operator documented sources and patterns that contribute to or affect the groundwater patterns below the waste management?	N/A
c.	Do water level fluctuations alter the general groundwater gradients and flow directions?	N
d.	Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone?	Y
e.	Did the owner/operator implement means for gauging long-term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns?	Y
3.	Hydraulic conductivity:	
a.	How were hydraulic conductivities of the subsurface materials determined? X Single-well tests (slug tests) ☐ Multiple-well tests (pump tests) ☐ Other (specify):	Y
b.	If single-well tests were conducted, was it done by: X Adding or removing a known volume of water ☐ Pressurizing well casing	Y
c.	If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels?	Y

Comprehensive Groundwater Monitoring Evaluation		Y/N
d.	Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit?	y
e.	Is the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)?	y
f.	Were other hydraulic conductivity properties determined? If yes, provide any of the following data, if available: ☐ Transmissivity ☐ Storage coefficient ☐ Leakage ☐ Permeability ☐ Porosity ☐ Specific capacity ☐ Other (specify):	N
4.	Identification of the uppermost aquifer:	
a.	Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes,	y
	• Are soil boring/test pit logs included?	y
	• Are geologic cross-sections included?	y
b.	Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? If yes, • How was continuity demonstrated?	N
c.	What is hydraulic conductivity of the confining unit (if present)? How was it determined?	N
d.	Does potential for other hydraulic communication exist (e.g., lateral discontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachage? If yes or no, what is the rationale?	

Comprehensive Groundwater Monitoring Evaluation	Y/N
G. Office Evaluation of the Facility's Groundwater Monitoring System Monitoring Well Design and Construction: These questions should be answered for each different well design present at the facility. 1. Drilling Methods:	
a. What drilling method was used for the well? X Hollow-stem auger ☐ Solid-stem auger ☐ Mud rotary ☐ Air rotary ☐ Reverse rotary ☐ Cable tool ☐ Jetting ☐ Air drill w/ casing hammer ☐ Other (specify):	y
b. Were any cutting fluids (including water) or additives used during drilling? If yes, specify: • Type of drilling fluid Tap Water • Source of water used • Foam • Polymers • Other	y
c. Was the cutting fluid, or additive, identified?	y
d. Was the drilling equipment steam-cleaned prior to drilling the well? • Other methods	y
e. Was compressed air used during drilling? If yes, • Was the air filtered to remove oil?	n
f. Did the owner/operator document procedure for establishing the potentiometric surface? If yes, • How was the location established?	y

Comprehensive Groundwater Monitoring Evaluation				Y/N
g.	Formation samples			
	• Were formation samples collected initially during drilling?			y
	• Were any cores taken continuous?			y
	• If not, at what interval were samples taken?			n/a
	• How were the samples obtained? X Split spoon ☐ Shelby tube X Core drill ☐ Other (specify):			y
	• Identify if any physical and/or chemical tests were performed on the formation samples (specify):			n/a
2.	Monitoring Well Construction Materials			
a.	Identify construction materials (by number) and diameters (ID/OD)	Material	Diameter	
	• Primary Casing	PVC	2"	
	• Secondary or outside casing (double construction)	steel	6"	
	• Screen	PVC	2"	
b.	How are the sections of casing and screen connected? ☐ X Pipe sections threaded ☐ Couplings (friction) with adhesive or solvent ☐ Couplings (friction) with retainer screws ☐ Other (specify):			y
c.	Were the materials steam-cleaned prior to installation? • If no, how were the materials cleaned?_____			y
3.	Well Intake Design and Well Development			
a.	Was a well intake screen installed?			y
	• What is the length of the screen for the well?			5 and 10 ft.

Comprehensive Groundwater Monitoring Evaluation		Y/N
	• Is the screen manufactured?	Y
b.	Was a filter pack installed?	Y
	• What kind of filter pack was employed?	#2 Q-roc
	• Is the filter pack compatible with formation materials?	Y
	• How was the filter pack installed? tremie	Y
	• What are the dimensions of the filter pack? 4"	
	• Has a turbidity measurement of the well water ever been made?	Y
	• Have the filter pack and screen been designed for the in situ materials?	Y
c.	Well development	
	• Was the well developed?	Y
	• What technique was used for well development? ☐ Surge block X Bailer ☐ Air surging X Water pumping ☐ Other (specify):	Y
4.	Annular Space Seals	
a.	What is the annular space in the saturated zone directly above the filter pack filled with: X Sodium bentonite (pellets) ☐ Cement (specify neat or concrete) ☐ Other (specify):	Y
b.	Was the seal installed by: ☐ Dropping material down the hole and tamping ☐ Dropping material down the inside of hollow-stem auger X Tremie pipe method ☐ Other (specify):	Y

Comprehensive Groundwater Monitoring Evaluation		Y/N
c.	Was a different seal used in the unsaturated zone? If yes,	y
	• Was this seal made with X Sodium bentonite (specify type and grit) X Cement (concrete) ☐ Other (specify):	y
	• Was this seal installed by X Dropping material down the hole and tamping X ☐ Dropping material down the inside of hollow stem auger ☐ Other (specify):	y
d.	Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface?	y
e.	Is the well fitted with an above-ground protective device and bumper guards?	y
f.	Has the protective cover been installed with locks to prevent tampering?	y
H.	**Evaluation of the Facility's Detection Monitoring Program**	
1.	Placement of Downgradient Detection Monitoring Wells:	
a.	Are the groundwater monitoring wells or clusters located immediately adjacent to the waste management area?	y
b.	How far apart are the detection monitoring wells?	150-500 feet
c.	Does the owner/operator provide a rationale for the location of each monitoring well or cluster?	y
d.	Does the owner/operator identify the well screen lengths of each monitoring well or clusters?	y
e.	Does the owner/operator provide an explanation for the well screen lengths of each monitoring well or cluster?	y

Comprehensive Groundwater Monitoring Evaluation			Y/N
	f.	Do the actual locations of monitoring wells or clusters correspond to those identified by the owner/operator?	y
2.	Placement of Upgradient Monitoring Wells:		
	a.	Has the owner/operator documented the location of each upgradient monitoring well or cluster?	y
	b.	Does the owner/operator provide an explanation for the location(s) of the upgradient monitoring well(s)?	y
	c.	What length screen has the owner/operator employed in the background monitoring well(s)?	10 ft.
	d.	Does the owner/operator provide an explanation for the screen length(s) chosen?	y
	e.	Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator?	y
I.	**Office Evaluation of the Facility's Assessment Monitoring Program**		
1.	Does the assessment plan specify:		
	a.	The number, location, and depth of wells?	y
	b.	The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases?	y
2.	Does the list of monitoring parameters include all hazardous waste constituents from the facility?		y
	a.	Does the water quality parameter list include other important indicators not classified as hazardous waste constituents?	y
	b.	Does the owner/operator provide documentation for the listed wastes which are not included?	n/a
3.	Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the groundwater?		y

Comprehensive Groundwater Monitoring Evaluation			Y/N
4.	Has the owner/operator specified a schedule of implementation in the assessment plan?		y
5.	Have the assessment monitoring objectives been clearly defined in the assessment plan?		y
	a.	Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurred in any of the detection monitoring wells?	y
	b.	Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility?	y
	c.	Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituents in the ground water?	y
	d.	Does the plan employ a quarterly monitoring program? Semiannual	y
6.	Does the assessment plan identify the investigatory methods that will be used in the assessment phase?		y
	a.	Is the role of each method in the evaluation fully described?	y
	b.	Does the plan provide sufficient descriptions of the direct methods to be used?	y
	c.	Does the plan provide sufficient descriptions of the indirect methods to be used?	n/a
	d.	Will the method contribute to the further characterization of the contaminant movement?	y
7.	Are the investigatory techniques utilized in the assessment program based on direct methods?		y
	a.	Does the assessment approach incorporate indirect methods to further support direct methods?	n

Comprehensive Groundwater Monitoring Evaluation			Y/N
	b.	Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring?	Y
	c.	Are the procedures well defined?	Y
	d.	Does the approach provide for monitoring wells similar in design and construction as the detection monitoring wells?	Y
	e.	Does the approach employ taking samples during drilling or collecting core samples for further analysis?	Y
8.	Are the indirect methods to be used based on reliable and accepted geophysical techniques?		n/a
	a.	Are they capable of detecting subsurface changes resulting from contaminant migration at the site?	n/a
	b.	Is the measurement at an appropriate level of sensitivity to detect groundwater quality changes at the site?	n/a
	c.	Is the method appropriate considering the nature of the subsurface materials?	n/a
	d.	Does the approach consider the limitations of these methods?	n/a
	e.	Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods to further substantiate the findings.)	Y
9.	Does the assessment approach incorporate any mathematical modeling to predict contaminant movement?		n
	a.	Will site specific measurements be utilized to accurately portray the subsurface?	n/a
	b.	Will the derived data be reliable?	n/a
	c.	Have the assumptions been identified?	n/a
	d.	Have the physical and chemical properties of the site-specific wastes and hazardous waste constituents been identified?	Y

Comprehensive Groundwater Monitoring Evaluation			Y/N
J.	**Conclusions**		
1.	Subsurface geology		
	a.	Has sufficient data been collected to adequately define petrography and petrographic variation?	y
	b.	Has the subsurface geochemistry been adequately defined?	y
	c.	Was the boring/coring program adequate to define subsurface geologic variation?	y
	d.	Was the owner/operator's narrative description complete and accurate in its interpretation of the data?	y
	e.	Does the geologic assessment address or provide means to resolve any information gaps?	y
2.	Groundwater flow paths		
	a.	Did the owner/operator adequately establish the horizontal and vertical components of groundwater flow?	y
	b.	Were appropriate methods used to establish groundwater flow paths?	y
	c.	Did the owner/operator provide accurate documentation?	y
	d.	Are the potentiometric surface measurements valid?	y
	e.	Did the owner/operator adequately consider the seasonal and temporal effects on the groundwater?	y
	f.	Were sufficient hydraulic conductivity tests performed to document lateral and vertical variation in hydraulic conductivity in the entire hydrogeologic subsurface below the site?	y
3.	Uppermost Aquifer		
	a.	Did the owner/operator adequately define the uppermost aquifer?	y
4.	Monitoring Well Construction and Design		

Comprehensive Groundwater Monitoring Evaluation			Y/N
	a.	Do the design and construction of the owner/operator's groundwater monitoring wells permit depth discrete groundwater samples to be taken?	y
	b.	Are the samples representative of groundwater quality?	y
	c.	Are the groundwater monitoring wells structurally stable?	y
	d.	Does the groundwater monitoring well's design and construction permit an accurate assessment of aquifer characteristics?	y
5.	Detection Monitoring		
	a.	Downgradient Wells • Do the location, and screen lengths of the groundwater monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer?	y
	b.	Upgradient Wells • Do the locations and screen lengths of the upgradient (background) groundwater monitoring wells ensure the capability of collecting groundwater samples representative of upgradient (background) groundwater quality including any ambient heterogenous chemical characteristics?	y
6.	Assessment Monitoring		
	a.	Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration?	y
	b.	Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release?	y
	c.	Are the procedures used to make a first determination of contamination adequate?	y
	d.	Is the assessment plan adequate to detect, characterize, and track contaminant migration?	y

Comprehensive Groundwater Monitoring Evaluation			Y/N
	e.	Will the assessment monitoring wells, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes?	y
	f.	Are the assessment monitoring wells adequately designed and constructed?	y
	g.	Are the sampling and analysis procedures adequate to provide true measures of contamination?	y
	h.	Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume?	y
	i.	Are the data collected at sufficient frequency and duration to adequately determine the rate of migration?	y
	j.	Is the schedule of implementation adequate?	y
	k.	Is the owner/operator's assessment monitoring plan adequate?	y
	l.	If the owner/operator had to implement his assessment monitoring plan, was it implemented satisfactorily?	y
II.	**Field Evaluation**		
A.	**Groundwater Monitoring System**		y
1.	Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3.)		
B.	**Monitoring Well Construction**		
1.	Identify construction material and diameter		y
	a.	Primary casing: PVC	
	b.	Secondary or outside casing: Steel	

	Comprehensive Groundwater Monitoring Evaluation	Y/N
2.	Is the upper portion of the borehole sealed with concrete to prevent infiltration from the surface?	y
3.	Is the well fitted with an above-ground protective device?	y
4.	Is the protective cover fitted with locks to prevent tampering? If a facility utilizes more than a single well design, answer the above questions for each well design?	y
III.	**Review of Sample Collection Procedures**	
A.	**Measurement of Well Depths /Elevation**	
1.	Are measurements of both depth to standing water and depth to the bottom of the well made? Not to bottom of well	y/n
2.	Are measurements taken to the 0.01 feet?	y
3.	What device is used? Electronic tape	y
4.	Is there a reference point established by a licensed surveyor?	y
5.	Is the measuring equipment properly cleaned between well locations to prevent cross contamination?	y
B.	**Detection of Immiscible Layers**	
1.	Are procedures used which will detect light phase immiscible layers?	n/a
2.	Are procedures used which will detect heavy phase immiscible layers?	n/a
C.	**Sampling of Immiscible Layers**	
1.	Are the immiscible layers sampled separately prior to well evacuation?	n/a
2.	Do the procedures used minimize mixing with water soluble phases?	n/a
D.	**Well Evacuation**	
1.	Are low yielding wells evacuated to dryness?	y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
2.	Are high-yielding wells evacuated so that at least three casing volumes are removed?	y
3.	What device is used to evacuate the wells? Pump or bailer	y
4.	If any problems are encountered (e.g., equipment malfunction) are they noted in a field logbook?	y
E.	**Sample Withdrawal**	
1.	For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers?	y
2.	Are samples withdrawn with either fluorocarbon/resin or stainless steel (316, 304 or 2205) sampling devices?	y
3.	Are sampling devices either bottom-valve bailers or positive gas displacement bladder pumps?	y
4.	If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer?	y
5.	If bladder pumps are used, are they operated in continuous manner to prevent aeration of the sample?	n/a
6.	If bailers are used, are they lowered slowly to prevent degassing of the water?	y
7.	If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration?	y
8.	Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well?	y
9.	If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples?	y
10.	If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps: X Dilute acid rinse (HNO_3 or HC1) Nitric	y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
11.	If samples are for organic analysis, does the cleaning procedure include the following sequential steps: ☐ Nonphosphate detergent wash X ☐ Tap water rinse ☐ Distilled/deionized water rinse X ☐ Acetone rinse ☐ Pesticide-grade hexane rinse	y
12.	Is sampling equipment thoroughly dry before use?	n
13.	Are equipment blanks taken to ensure that sample cross-contamination has not occurred?	y
14.	If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min?	y
F.	**In-situ or Field Analyses**	
1.	Are the following labile (chemically unstable) parameters determined in the field: X pH X Temperature X Specific conductivity ☐ Redox potential ☐ Chlorine ☐ Dissolved oxygen X Turbidity ☐ Other (specify):	y
2.	For in-situ determinations, are they made after well evacuation and sample removal?	y
3.	If sample is withdrawn from the well, is parameter measured from a split portion?	y
4.	Is monitoring equipment calibrated according to manufacturers' specifications and consistent with SW-846?	y
5.	Are the date, procedure, and maintenance for equipment calibration documented in the field logbook?	y

Comprehensive Groundwater Monitoring Evaluation		Y/N
IV.	**Review of Sample Preservation and Handling Procedures**	
A.	**Sample Containers**	
1.	Are samples transferred from the sampling device directly to their compatible containers?	y
2.	Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps?	y
3.	Are sample containers for organics analysis glass bottles with fluorocarbon resin lined caps?	y
4.	If glass bottles are used for metals samples are the caps fluorocarbon resin-lined?	y
5.	Are the sample containers for metal analyses cleaned using these sequential steps: Laboratory cleaned ☐ Nonphosphate detergent wash ☐ 1:1 nitric acid rinse ☐ Tap water rinse ☐ 1:1 hydrochloric acid rinse ☐ Tap water rinse ☐ Distilled/deionized water rinse	y
6.	Are the sample containers for organic analyses cleaned using these sequential steps: Laboratory cleaned ☐ Nonphosphate detergent/hot water wash ☐ Tap water rinse ☐ Distilled/deionized water rinse ☐ Acetone rinse ☐ Pesticide-grade hexane rinse	y
7.	Are trip blanks used for each sample container type to verify cleanliness?	n

Comprehensive Groundwater Monitoring Evaluation		Y/N
B.	**Sample Preservation Procedures**	
1.	Are samples for the following analyses cooled to 4°C: ☐ TOC ☐ TOX ☐ Chloride ☐ Phenols ☐ Sulfate ☐ Nitrate ☐ Coliform bacteria ☐ Cyanide ☐ Oil and grease X Hazardous constituents (261, Appendix VIII)	y
2.	Are samples for the following analyses field acidified to pH<2 with HNO_3: ☐ Iron ☐ Manganese ☐ Sodium ☐ Total metals X Dissolved metals ☐ Fluoride ☐ Endrin ☐ Lindane ☐ Methoxychlor ☐ Toxaphene ☐ 2,4-D ☐ 2,4,5-TP Silvex ☐ Radium ☐ Gross alpha ☐ Gross beta	y
3.	Are samples for the following analyses field acidified to pH<2 with H_2S0_4: ☐ Phenols ☐ Oil and grease	n/a
4.	Is the sample for TOC analyses field acidified to pH <2 with HCl?	n/a
5.	Is the sample for TOX analysis preserved with 1 ml of 1.1 M sodium sulfite?	n/a

	Comprehensive Groundwater Monitoring Evaluation	Y/N
6.	Is the sample for cyanide analysis preserved with NaOH to pH >12?	n/a
C.	**Special Handling Considerations**	
1.	Are organic samples handled without filtering?	y
2.	Are samples for volatile organics transferred to the appropriate vials to eliminate headspace over the sample?	y
3.	Are samples for metal analysis split into two portions?	n
4.	Is the sample for dissolved metals filtered through a 0.45 micron filter?	y
5.	Is the second portion not filtered and analyzed for total metals?	n/a
6.	Is one equipment blank prepared each day of groundwater sampling?	y
V.	**Review of Chain-of-Custody Procedures**	
A.	**Sample Labels**	
1.	Are sample labels used?	y
2.	Do they provide the following information: X Sample identification number X Name of collector X Date and time of collection X Place of collection X Parameter(s) requested and preservatives used	y
3.	Do they remain legible even if wet?	y
B.	**Sample Seals**	
1.	Are sample seals placed on those containers to ensure samples are not altered?	n
C.	**Field Logbook**	
1.	Is a field logbook maintained?	y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
2.	Does it document the following: X Purpose of sampling (e.g., detection or assessment) X Location of well(s) X Total depth of each well X Static water level depth and measurement technique ☐ Presence of immiscible layers and detection method ☐ Collection method for immiscible layers and sample identification numbers X Well evacuation procedures X Sample withdrawal procedure X Date and time of collection ☐ Well sampling sequence X Types of sample containers and sample identification number(s) X Preservative(s) used X Parameters requested X Field analysis data and method(s) ☐ Sample distribution and transporter Field observations X Unusual well recharge rates ☐ Equipment malfunction(s) ☐ Possible sample contamination ☐ Sampling rate	y
D.	**Chain-of-Custody Record**	
1.	Is a chain-of-custody record included with each sample?	y
2.	Does it document the following: X Sample number X Signature of collector X Date and time of collection X Sample type X Station location X Number of containers X Parameters requested X Signatures of persons involved in chain-of-custody X Inclusive dates of custody	y
E.	**Sample Analysis Request Sheet**	
1.	Does a sample analysis request sheet accompany each sample?	y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
2.	Does the request sheet document the following: X Name of person receiving the sample X Date of sample receipt X Duplicates X Analysis to be performed	y
VI.	**Review of Quality Assurance/Quality Control**	
A.	Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program?	y
B.	Does the QA/QC program include:	
1.	Documentation of any deviation from approved procedures?	y
2.	Documentation of analytical results for: ☐ Blanks ☐ Standards X Duplicates ☐ Spiked samples ☐ Detectable limits for each parameter being analyzed	y
C.	Are approved statistical methods used?	n/a
D.	Are QC samples used to correct data?	n
E.	Are all data critically examined to ensure it has been properly calculated and reported?	y
VII.	**Surficial Well Inspection and Field Observation**	
A.	Are the wells adequately maintained?	y
B.	Are the monitoring wells protected and secure?	y
C.	Do the wells have surveyed casing elevations?	y
D.	Are the groundwater samples turbid? Some	y/n
E.	Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)?	y

	Comprehensive Groundwater Monitoring Evaluation	Y/N
F.	Has a site sketch been prepared by the field inspector with scale, north arrow, locations) of buildings, locations) of regulated units, locations of monitoring wells, and a rough depiction of the site drainage pattern?	y
VIII.	**Conclusions**	
A.	Is the facility currently operating under the correct monitoring program according to the statistical analyses performed by the current operator?	y
B.	Does the groundwater monitoring system, as designed and operated, allow for detection or assessment of any possible groundwater contamination caused by the facility?	y
C.	Do the sampling and analysis procedures permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility?	y