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Rev. 07/10/02

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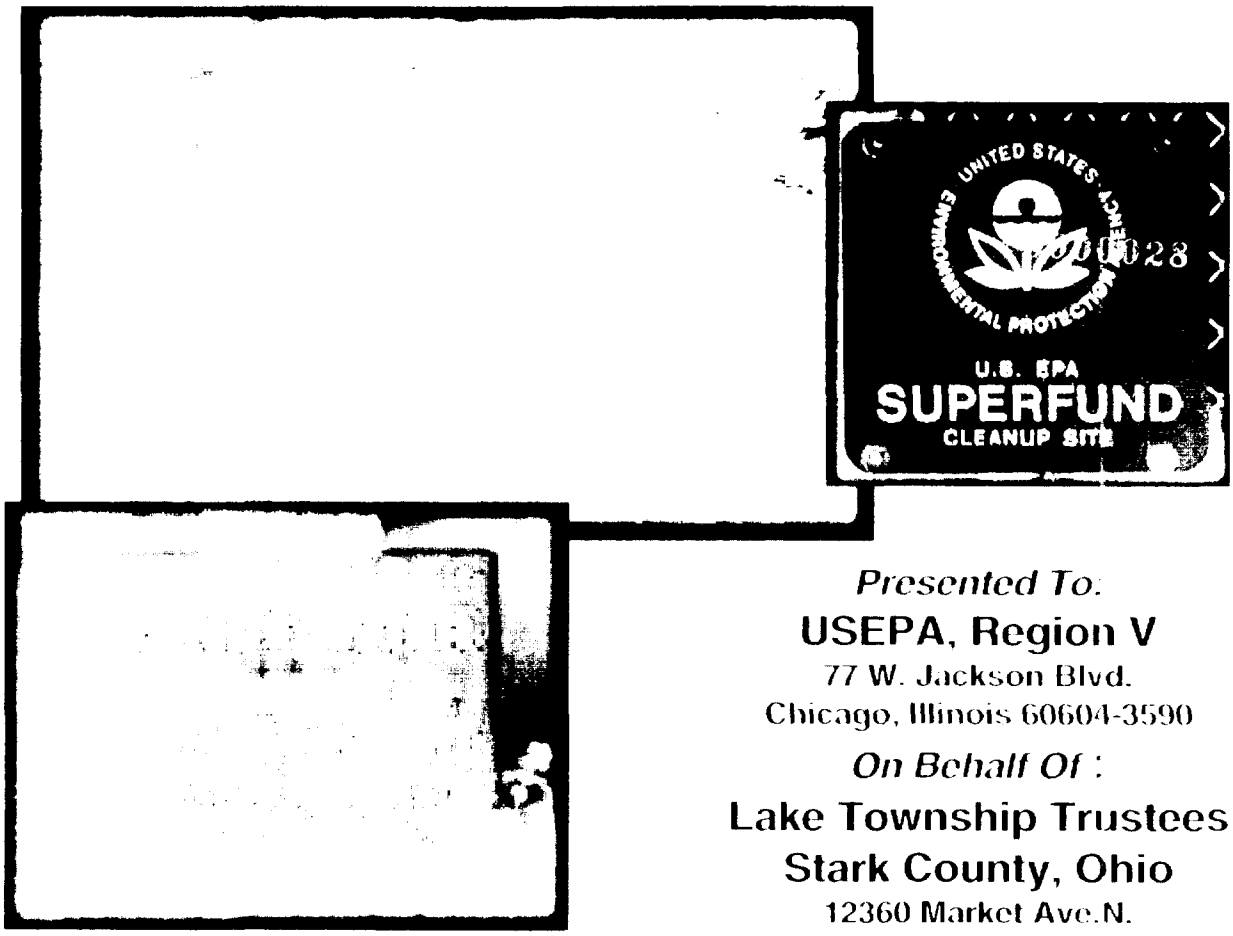
Comments on the Existing Public Record for the Industrial Excess Landfill for the Revision of the 1989 Existing Record of Decision



Presented To:

USEPA, Region V

77 W. Jackson Blvd.
Chicago, Illinois 60604-3590

On Behalf Of :

Lake Township Trustees
Stark County, Ohio

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April 12, 1999

RELIABILITY OF REPORT - DISCLAIMER

Conclusions reached in this report are based upon the objective data available to the CONSULTANTS at the time of forming their opinions and as presented in the report. The accuracy of the report depends upon the accuracy of these data. Every effort is made to evaluate the information by the methods that generally are recognized to constitute the state of the art at the time of rendering the report and conclusions, and the conclusions reached herein represent our opinions. Subsurface conditions are known to vary both in space and time, and there is inherent risk in the extrapolation of data.

THE CONSULTANTS are not responsible for actual conditions proved to be materially at variance with the data that were available to them and upon which they relied, as presented in the report.

The opinions, conclusions and recommendations shown in the report are put forth for a specific and proposed purpose and for the specific site discussed. The CONSULTANTS are not responsible for any other application, whether of purpose or location, of our opinions, conclusions and recommendations other than as specifically indicated in the report.

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LIST OF TABLES

Christman, R.L., Waters, D.D., and Bauder, J.R., 1971, Soil Survey of Stark County, Ohio: U.S. Department of Agriculture Soil Conservation Service.

DeLong, R.M., and White, G.W., 1963, Geology of Stark County: Ohio Geological Survey Bulletin 61.

Harker, D.H., and Bernhagen, R.J., 1943, Water Supply in Stark County: Report to Ohio Water Supply Board.

Schaefer, E.J., White, G.W., and Van Tuyl, D.W., 1946, the Groundwater Resources of the Glacial Deposits in the Vicinity of Canton, Ohio: Ohio Water Resources Board Bull. 3, 60 p.

Stark County Regional Planning Commission, 1969, Sanitary Landfill Location Study: 84 p.

(There is no indication that any of these documents besides Christman et al., and DeLong and White were reviewed for this Report of Investigation.)

6. Local Climatological Data: Annual Summary with Comparative Data, 1981, and National Oceanic Atmospheric Administration.

7. Sedam, A.C. 1973. Hydrogeology of the Pottsville Formation in Northeastern Ohio. U.S. Geological Survey Hydrologic Investigations Atlas HA-494, 2 sheets.

8. Statement under Oath of Kenny Catlette, May 31, 1984.

9. Stark County Regional Planning Commission, 1985. Report, 1985.

10. Techlaw, Inc., Draft Report: Industrial Excess Landfill, November 1, 1984.

11. Walker, A.C. 1979. Ground-water Resources of Stark County. Ohio Department of Natural Resources, Division of Water, (Map). (Reprinted 1988 but original was used).

12. White, G.W. 1984. Glacial Geology of Summit County, Ohio. Ohio Geological Survey Report of Investigations No. 123, 25 p., 1 map.

13. Weston – Spill Prevention and Emergency Response Technical Assistance Team, Region V, Emergency Action Plan for Industrial Excess Landfill; Uniontown, Ohio December, 1994.

In addition, the Report of Investigation references Logan and Miller, (1983), when they discuss the levels of metals in background soils but they do not list the full citation for the publication.

At the point in time that this Report of Investigation was being prepared, the additional following documents were also available for review but, apparently, were not reviewed since they were not listed in the bibliography:

1. Stark County Topographic Maps (2-foot contour), 1970, Stark County Engineer, Township, Range, Section, Township, especially T12 R8 Sec. 7 and T12 R8 Sec. 18.

2. Christman, R. L., Bauder, J. R., and D. D. Waters, 1968, An Inventory of Ohio Soils, Stark County, Ohio Dept. of Natural Resources, Div. of Lands and Soils, Progress Rept. No. 29, Columbus, Ohio, 29 pages and maps.

3. Achor, Wayne E., April, 1981, Ohio Supplement to Urban Hydrology for Small Watersheds; Technical Release No. 55, USDA Soil Conservation Service, Columbus, Ohio, 43 pages.

4. Soil Conservation Service, June 1986, Technical Release 55: Urban Hydrology for Small Watersheds, 2nd. Edit., USDA Soil Conservation Service, Washington, D.C., 91 pages, appendices and computer program.

5. U.S. Geological Survey, 1967, North Canton, Ohio 7 1/2-Minute Topographic Quad, Reston, Virginia, 40081-H4-TF-024, Map.

6. Jackson, Jim J., Bauder, James R., Hardy, James, and Mark S. Kennedy, April 19, 1988, North-Central GSA Meeting, Field Trip: Hardy Road Landfill and Industrial Excess Landfill, A Superfund Site, University of Akron, Akron, Ohio, 30+pages.

7. Botoman, George and David A. Stith, 1978, Analyses of Ohio Coals, Ohio Dept. of Natural Resources, Div. Geological Survey, Information Circular No. 47, Columbus, Ohio, 148 pages, tables.

8. Botoman, George and David A. Stith, 1981, Analyses of Ohio Coals, 1977-1978, Ohio Dept. of Natural Resources, Div. Geological Survey, Information Circular No. 50, Columbus, Ohio, 54 pages, tables.

9. Botoman, George and David A. Stith, 1986, Analyses of Ohio Coals, 1979-1980, Ohio Dept. of Natural Resources, Div. Geological Survey, Information Circular No. 52, Columbus, Ohio, 26 pages, tables

Important public documents that were developed after the Report of Investigation include the following:

1. Bair, E. Scott and S. E. Norris, 1989, Ground-Water Levels and Flow Near the Industrial Excess Landfill, Uniontown, Ohio, U.S. Geological Survey Open-File Report 89-272, Columbus, Ohio, 11 pages, map.

2. Dumouchelle, Denise H. and E. Scott Bair, 1994, Ground-Water Levels and Directions of Flow near the Industrial Excess Landfill, Uniontown, Ohio, March 1994, U.S. Geological Survey, Water-Resources Investigations Report 94-4136, Columbus, Ohio, 17 pages, maps.

3. Jackson, Jim L., Bauder, James R., Hardy, James and Mark S. Kennedy, 1989, "Field Studies: Hardy Road Landfill and Industrial Excess Landfill, A Superfund Site" in Ohio Journal of Science, Vol. 89, Pt. 3, pp. 45-55.

4. Muller, Albert J., 1992, Groundwater Contamination in and Around the Industrial Excess Landfill, A. Superfund Site, Uniontown, Ohio, University of Akron, Unpublished MS. Thesis, Akron, Ohio, 242+ pages.

5. Williams, Steven, 1991, Ground Water Pollution Potential of Stark County, Ohio; Ground Water Pollution Potential Report No. 6, Ohio Dept. of Natural Resources, Div. of Water, Columbus, Ohio, 75 pages, map.

6. Woods, Alan J., Omernik, James M., Brockman, C. Scott, Gerber, Timothy D., Hosteter, William D. and Sandra H. Azevedo, 1998, Ecoregions of Indiana and Ohio, U.S. Geological Survey, Denver, Colorado, Map.

7. Botoman, George and David A. Stith, 1988, Analyses of Ohio Coals,1982-1984, Ohio Dept. of Natural Resources, Div. Geological Survey, Information Circular No. 55, Columbus, Ohio, 17 pages, tables.

8. Harrell, James A., McKenna, John P., and Ashok Kumar, 1993, Geological Controls on Indoor Radon in Ohio, Ohio Dept. of Natural Resources, Div. Geological Survey, Report of Investigations No. 144, Columbus, Ohio, 36 pages.

In addition, the following individuals were not interviewed for the preparation of this report, even though they were locally known to be expert independent sources of information on the site: (or, in the case of Dr. Logan, on metals in soils in Ohio)

1. James Bauder, principal, James R. Bauder, Inc., Canton, Ohio, certified soil scientist and geologist in Stark County, still in practice.

2. Dr. Jim J. Jackson, Center for Environmental Studies, (Chair, Geological Sciences), University of Akron, now retired.

3. Dr. Terry Logan, Soils Chemistry, School of Natural Resources, Ohio State University, retires in June, 1999.

The Natural Setting at Uniontown

Bedrock

Lake Township, Stark County is located in an area of Pennsylvanian-aged bedrock overlain by Illinoian and Late Wisconsinan-aged glacial deposits (DeLong and White, 1963). The bedrock in this portion of the county is mostly Pottsville Group with a few, small sections of basal Allegheny Group existing as high remnants in the area. The Pottsville Group is, for the most part, a series of sandstones and conglomerates. The formations are, in order of oldest to youngest:

1. Basal Pennsylvanian Sharon Conglomerate
   " In this area of about 2,400 square miles the Sharon is dominantly an orthoquartzite. Average grain size is 0.25-0.5 mm. A few scattered pebbles and pebble lenses are common and grit layers are rare. Sand grains characteristically flash light from many crystal faces of secondary quartz. Normally the Sharon is a clean, white, friable orthoquartzite with a silicon dioxide content of over 96 percent; near the surface and along joint planes it is limonite-stained and more solidly cemented. Next to limonite the chief impurities are clay and feldspar (quoting Fuller, 1955, p. 160)" (pp. 18-19).

   The Sharon contains two coals, the Sharon (No. 1) Coal and the Quakertown (No. 2) Coal, but mines in these units were further west in the county around Canal Fulton, west of Massillon and near Brewster closer to the Wayne County line.

2. Massillon Sandstone
   "In general the Massillon Sandstone is medium to coarse grained, although locally, as in sec. 27, Lawrence Township, it is a conglomerate. There an unsuccessful attempt was made to develop it as a source of gravel. The sandstone facies is porous and quickly becomes casehardened on the surface. The rock has a high silica content and has been used in the past as building stone as well as glass and molding sand. In color, the fresh surface is very light, although impurities locally give it a tan to buff hue. The major impurities are hematite and clay minerals" (p. 26).

   The Massillon outcrops, where exposed, are found in the western six townships of Stark County.

   Burdick et al., (1997), Evaluation of Groundwater Chemistry and Natural Attenuation Processes at the Industrial Excess Landfill fail to recognize the extreme purity of both the Sharon Conglomerate and the Massillon sandstone when they write "Both the Massilon (sic) and Sharon Members contain hematite (iron oxide) and clay minerals, which *may* (emphasis added)contribute to naturally elevated concentrations of some metals (such as iron, aluminum, manganese, nickel, and other) in the groundwater (DeLong and White 1963)" (page 3-3). Because these two formations are among the cleanest sandstones in Ohio, it is doubtful that they contribute significantly to the elevated concentrations of metals. Some metals are possible from the Mercer, above the two clean sandstones, but

since most or all of the Mercer is missing in the area of the landfill, it is doubtful that the Mercer is a source of significant metals (see below).

3. Mercer Formation

The Mercer Formation is a very complex series of coal beds separated by soft shales, thin sandstones and several marine limestones that are used as marker beds. DeLong and White separates the units into two sections. The "Interval from the base of the Bear Run Coal to the top of the Flint Ridge Coal" which they show as outcropping in the western six townships and Lake and Plain to the east, includes the Lower Mercer (No. 3) Coal. The "Interval from the base of the Middle Mercer Clay to the top of the Brookville Clay" which they show as having outcrops in all but the eastern six townships includes the Upper Mercer (No. 3a) Coal and the Tionesta (No. 3b) Coal.

The most recognizably resistant unit in the Mercer Formation is the Homewood Sandstone, which is found between the Tionesta (No. 3b) Coal and the Brookville (No. 4) Coal. "The channel-fill sandstone of the Homewood is massive and crossbedded at the base, and becomes medium to thin bedded upward. The rock is light gray, medium to fine grained, micaceous, and argillaceous. Normally the interval from the Tionesta Coal to the Brookville Coal is filled with either light- to medium-gray, thin-bedded shale and fine-grained sandstone, or siltstone that is light gray, micaceous, and argillaceous" (p. 40).

It is probable that the lower sandstones underlying the Uniontown area are the Massillon and the Sharon Conglomerate. The sandstone forming the ridge beneath the landfill may be the Massillon or one of the more resistant sandstones in the Mercer, possibly the Homewood. The Brookville (No. 4) was mined in the southern half of Lake Township.

Burdick et al., (1997), note that the pH readings for ground water wells located in the bedrock ranged between 6 and 10, speculating that the range may be due to different lithologies encountered during drilling. The issue of pH will be discussed at length later in this report, but it is important to state at this point that, given the nature of rock formations in the area of Uniontown, a natural ground water pH reading above 7.0 would be quite difficult to achieve as most of the rocks in the area are acidic in nature (except for a few very thin limestones in the Mercer that have not been reported in wells at the site).

Pre-Glacial Drainage Patterns

After the end of the Paleozoic, this portion of Ohio became dry land on a continual basis and was subjected to extensive patterns of weathering and erosion. A series of drainage patterns were carved into the sedimentary bedrock. These patterns persisted until the beginning of the Pleistocene, when continental ice sheets began to cover portions of Ohio. The bedrock topography for the region was mapped in DeLong and White, 1963 as Plate 1. A more detailed and localized top of rock map can be found in Bair and Norris, 1989, as Figure 4. The Bair and Norris map shows a westward trending valley running through the center of the landfill. This

valley has over 80 feet of relief from it's head, just east of the landfill at the sod farm to where it is measured in wells on Islandview Ave. This bedrock map is here reproduced Exhibit 1. The actual location and depth of this bedrock valley is important in determining the potential pathways for contaminant migration from the landfill site.

Ecoregion

With the advent of the Pleistocene, continental ice sheets moved into Ohio. At the present time, the total number of ice sheets that visited Ohio is unknown, but it is known that at least two periods of glaciation occurred in Stark County, the Illinoian and the Late Wisconsinan. White (in DeLong and White, 1963) considers the Mogadore Till to be an "Early Wisconsinan" deposit, but that age assignment has been changed with the realization by Canadian geologists that there was no Early Wisconsinan in Canada, therefore, there could be no Early Wisconsinan in Ohio. The ODNR Geological Survey has reassigned the Early Wisconsinan to either the Illinoian (possibly a Late Illinoian) or to the Late Wisconsinan, as appropriate.

Lake Township, assigned by White to the Grand River Lobe on the Wisconsinan ice advances, is now considered part of the Summit Interlobate Area (Woods et al., 1998). A general description of this area, fully 536 square miles in size, extending from south of Canton in Stark County through most of Summit and the western half of Portage County into the southern half of Geauga County is as follows:

"Physiography:

Glaciated plain. Numerous kames, kettles, lakes, bogs, deranged stream networks, and sluggish streams.

"Elevation(amsl)/Local Relief (feet):

900 – 1300 / 50 –150

"Geology:

Sandy late-Wisconsinan glacial outwash and glacial till overlie Pennsylvanian sandstone and shale of the Pottsville and Allegheny Groups.

"Common Soil Series:

On glacial outwash: Chili. On kames: Chili, Wooster. On bogs-kettles: Carlisle. On glacial till: Canfield, Ravanna, Wooster.

"Precipitation (mean annual inches):

36-41

"Potential Natural Vegetation:

Mostly mixed oak forests (on sandy soils); also mixed mesophytic forest, oak-sugar maple forest (on soils derived from glacial till), extensive sphagnum peat bogs."

Pleistocene Glacial Deposits and Physical Properties

Overlying the bedrock and underlying the IEL site and Uniontown is an extensive Illinoian sand and gravel deposit. This core represents a kame field of significant size, most of which is buried by the later Late Wisconsinan ice sheets that covered Lake Township. This extremely clean sand and gravel deposit can be seen in the gravel pits at the southwest corner of the I-77 and Portage Street intersection, less than seven miles almost due south of Uniontown. Here the Illinoian-aged gravel has a cemented surface horizon that formed when the Illinoian materials were exposed as the surface of the earth. No glacial till is present at this location; the Late Wisconsinan-aged kames and outwash sands and gravels directly overlie the Illinoian materials. The entire deposit is very free of silts and clays (Weatherington-Rice, 1993).

Bauder, in Jackson et al., (1988), identifies this lower sand and gravel formation. The major source of materials for this unit is the weathered Pennsylvanian sandstones and conglomerates described above. Almost all of the fines have been removed as part of the high energy glacio-fluvial transport mechanism responsible for deposition. Household wells in the area and monitoring wells for the landfill that are located above bedrock and below the glacial till/lacustrine zone, are screened in this formation. There is every reason to expect that both horizontal and vertical flow through this unit are rapid and that there is very little clay mineral material or organic materials in the deposit that provide an environment conducive to natural attenuation by adsorption or ion exchange processes. In the region of the landfill, this unit appears to be saturated with water at all times. The local extent of this unit can be seen on the Lake Township Ground Water Resources Map (colored in light yellow), March 1999 (Exhibit 2).

Above the lower sand and gravel, over the northern portion of the site and north into Uniontown, there is a separating unit, variously described as till, clay, lacustrine and silts in the well logs in the area and in the literature. While this horizon may include lacustrine units that date to kettle and bog infilling in the underlying Illinoian sands and gravels, for the most part, this unit is expected to be the Mogadore Till. White (DeLong and White, 1963) describes the Mogadore as "a sandy, pebbly till in which cobbles and boulders are common. The sand content of three samples from Stark County ranges from 52 to 57 percent. The clay minerals of the till matrix are mainly illite and chlorite, but kaolinite is always present in small amounts" (p. 129). Because only 10 percent clay sized material supports fracture formation and retention (Tornes, 1999), it is assumed that the Mogadore Till contains relic fracturing that was formed when the unit was the surface of the earth in Lake Township. There may also be a soil profile on the top of the formation. In addition, the clay minerals that are present, illite, chlorite and kaolinite, are the least reactive of the clay minerals (Bigham, 1996).

Given this setting, it is expected that the till unit will provide little protection to prevent migration of contamination from the landfill flowing from the upper sands and gravels to the lower sands and gravels. Hydraulic conductivities through the fractures will be perhaps one to two orders of magnitude more rapid than that found between the fractures. Only the high sand content prevents the range from being even higher (Fausey, 1998). In addition, not all the clay minerals present are available for cation exchange. Because the preferential flow paths are through fractures, clays located between fractures never come into contact with contaminants, thereby limiting still further the cation exchange capacity of this till layer. It is also significant to

note that the southern portion of the landfill and the area south is missing most, if not all, of this glacial till separation.

The surfacial deposits in the Uniontown area are White's (DeLong and White, 1963) Late Wisconsinan Kent End Moraine. On page 134, White writes, "In the western part of the Kent moraine" (*including Lake Township,*), "much of the drift is aggregated in knolls and hills of gravel which are as high as 100 feet so that the term kame moraine is appropriate. The hills are irregular in shape and are not oriented in any preferred direction. Undrained depressions, kettle holes, are common and are particularly conspicuous in northern Lake and northwestern Marlboro townships. In the vicinity of Hartville the depressions have been drained, and the peat and mucky soils are used extensively for vegetable growing."

The Kent Till, like the Mogadore, is a low lime till with an average of only 19 percent clay sized materials in Stark County. The clay minerals are mainly illite, chlorite and a small amount of kaolinite. For the most part, the fines have been removed from the sand and gravel kame field that forms the uplands of Uniontown and the sides and bottom of the IEL landfill. What clay minerals that have remained behind during the glacio-fluvial process that deposited the kames, are collected in the kettles and peat bogs of the area. Most of the clay minerals have been flushed away during Pleistoncene to modern times (Holocene).

Burdick et. al., (1997), fail to differentiate between clay sized materials and actual clay minerals and the difference between glacial till and the materials typically found in kames. First they state, in quoting DeLong and White, 1963, "Moraines composed primarily of sand and gravel are present as hills and are termed kames. Kames also contain variable amounts of till. The tills are generally very thin, relatively coarse deposits that contain cobbles, boulders, silt, and clay. In the vicinity of the site, the Kent Till is thin or missing at the surface or is contained within the sand and gravel kame deposits" (Page 3-1).

It should be noted that by definition, a kame is free of till because a kame is a sand and gravel deposit. There is no evidence that Kent Till is present in the area of the landfill. There are reports of perhaps two separate fine-grained units in some of the deeper wells but, while there is a very high probability that the Mogadore Till is present, it is not confirmed that the Kent Till is present.

Later Burdick et all, (1997) state "Both the Mogadore and Kent Tills contain approximately 20 percent clay minerals on average, namely illite, chlorite, and kaolinite. All three of these clay minerals are aluminosilicates that vary in degrees of sorption capabilities" (Page 3-1). A review of the DeLong and White quote above regarding the Mogadore (page 129) shows that White gives no percentage of clay sized materials in the till, neither does he state the percentage of actual clay minerals in the till. A review of Table 4 – Composition of Kent Till of Grand River Lobe (DeLong and White, 1963) shows that the 95 percent confidence limit on mean percentage of the till sheet is 16.9 to 20.3 percent clay sized material in the till sheet. The percentage of actual clay minerals is somewhat lower. So even if the Kent Till was present at the IEL site, which has not been confirmed, the volume of actual clay minerals available for sorption from that till is considerably less than the 20 percent implied in the 1997 report. It should be recognized and acknowledged that "rock flour" is a common constituent of the clay size fraction

in this depositional environment. Rock flour is of a clay size fraction, is not a clay mineral, and can be expected to have a very low exchange capacity and low sorptive capacity.

As in the underlying sand and gravel, most of the remaining sand and gravel in the upper kame deposit comes from the Pennsylvanian sandstones and conglomerates, known for their high quartz content. Quartz (SiO_2) is an inert mineral that provides no medium on which other organic or inorganic materials can be sorbed. Therefore, while the sand and gravel can act as a filter, it provides little or no opportunity for adsorption or ion exchange forms of natural attenuation.

This kame and kettle, gravel hill and wetland setting is clearly represented in the 1970 Stark County Engineer's two-foot topographic contour maps. The maps show not only the elevations of the hills which are mostly free of ground water (vadose zones) but also the elevations of the water (the water table conditions) in the ponds, based on the conditions that existed when the County was flown.

Soil and Bog Formations

Once the Late Wisconsinan glaciers retreated for the last time, the kames and kettles began to mature and weather. Pedogenic processes came into play and soils were formed. On the uplands, mineral soils dominated. The minor amount of carbonate material that existed was leached. Clays that either were present or that were formed by pedogenic processes in the upper A horizon, were translocated to the B horizon, retarding slightly the infiltration rate for water moving from the surface into the ground-water system. The uplands formed into the "Chili-Wheeling-Shoals association: deep, nearly level to steep, well-drained and somewhat poorly drained soils that have a loamy subsoil; formed mainly in glacial outwash (Christman et al., 1971)".

The kettles filled with water, representing the regional water table, and began to fill with fines washed off the uplands. These fines formed a substrate in the bottoms that supported vegetative growth. Eventually many of these kettles filled, becoming peat bogs on which the Carlisle-Willette-Linwood association developed. This soil association is "very poorly drained organic soils that are mainly in depressions" (Christman et al., 1971)". The locations of these soils associations are shown on the Lake Township General Soils Map, December 1998 (Exhibit 3).

Once the soils have been mapped, (information that was available as early as 1968 in published forms [Christman et al., 1968] and before from field sheets), basic properties of those soils are available. From this information, several very critical relationships can be established. Most of the uplands at Uniontown, including the area where the gravel pit was located, are mapped as Chili loam, Chili gravelly loam, Chili-Urban land complex and Conotton gravelly loam (Christman et al., 1971, map sheet 12). A review of Achor, (1981), shows that both the Chili and the Conotton soils are in the B Hydrologic Soils Group, a classification used to determine runoff Curve Number (CN) characteristics when calculating either USDA's TR # 55 Urban Hydrology for Small Watersheds (Soil Conservation Service, June 1986, 2nd Edit) or determining the input for HELP or ground-water flow models such as Modflow.

A review of Table 5 (Christman, et al., 1971) shows that once the A and B horizons have been removed, the remaining parent materials are classified as loamy coarse sand, stratified coarse sand and gravel or sand and gravel. These soil types are assigned to the A Hydrologic Soils Group. The materials are rated as having a permeability of >12.0 inches/hour (the highest rating assigned by USDA in Ohio) and an available moisture capacity of 0.02 to 0.04 inches per inches of soil (one of the lowest ratings found in Ohio). The available moisture capacity is the number used to determine the evapotranspiration potential for any soil. This factor is important when determining a water budget for an area, especially when calculating the throughput of precipitation into the landfill over time.

Soil pH (also on table 5) for the A and B horizons are in the range of 4.5 to 5.5 for the Chili soils and 5.6 to 6.0 for the Conotton soils. The C horizon or unweathered sand and gravel in both soils show a pH range of 5.1 to 6.0. This simple analysis from published materials that significantly predate the 1988 Report of Investigations show that the natural materials used to surround the waste at the Uniontown IEL site are extremely permeable, are droughty, have very little material needed to support good vegetative growth and are acidic.

Dumouchelle and Bair, (1994), agree with this rapid permeability. They calculate horizontal flow velocities (feet per day) ranging from 0.43 feet/day to 6.3 ft/day, reported on Table 4. Using those figures, it is possible to calculate that contaminants reported in monitoring wells in the 1988 Report of Investigation may have moved between 0.327 miles (1726.5 feet) and 4.791 miles (25,294.5 feet) since that report was developed, assuming no other receptors arrested or stopped their migration.

Finally, a review of Table 7 (Christman et al., 1971) shows that under the category of Sanitary landfills, these soils are rated as "Severe: very rapid permeability in subsoil and substratum" with a footnote 2. Footnote 2 reads "There is a hazard of environmental pollution if this soil is developed for this use. Some of these soils are porous, particularly in the substratum, and commonly do not provide adequate filtration".

Contrasting to the hills of sand and gravel, are the kettle bogs that are predominantly Carlisle muck with some sections of Linwood muck and Willette muck (Christman et al., 1971, map 12). Achor, (1981), rates these soils as A/D Hydrologic Soil Groups. The D rating reflects their naturally saturated conditions and denotes that the regional water table is usually located at or near the surface of these soils. When drained, however, these soils are extremely permeable, as reflected by their A rating. These soils are classified as hydric soils, which support wetlands as their native vegetative pattern.

Table 5 (Christman et al., 1971) shows a variation between the three soils in the substratum. All of the soils are acidic through the vegetative peat zones with pH values as low as 5.1. These are acidic bogs, not to be confused with alkaline fens. The majority soil in the group, the Carlisle muck, which includes the bottom lands (sod farm) to the east and most of the wetlands to the west, has a variable mineral soil material in the substratum, resulting in a variable pH from 7.4 (near neutral) to 8.4 which can be a reflection of freshwater marl (limestone) that formed in the kettle lakes before they filled. The Linwood muck is floored on sandy loam and

The Curve Numbers for the wetlands did not change. Those wetlands that were not drained still collected the surface runoff and direct precipitation that fell on them. The tiled wetlands also continued to collect the precipitation, but transferred a significant portion of it to the surface water system.

The current cap on the IEL landfill increased the infiltration rate from pre-development to post-development. Before development, the Curve Number was 55 for good forest on B Soils. Once the sand and gravel pit was open, the Curve Number approached zero, because precipitation that fell into the pit transferred directly into the ground water. Now that the landfill is capped with local materials (A Soils) (Jackson et. al., 1988) and is covered with grass, the Curve Number is 30. This number is just less than half the previous natural runoff number.

Various reports developed for USEPA show the average annual precipitation to be slightly less than 36 inches a year (Report of Investigation, 1988, Exhibit 8). While that total precipitation budget is important, the type of that precipitation (snow, spring soaking rains, summer thunderstorm) and the rate is more important when determining a total water budget. Achor (1981) lists the following rainfall frequencies for Stark County:

Table 1
Rainfall Volumes for Predicted Storm Events

Frequency in years	Rainfall in inches (24 hours)
1 year	2.2 inches
2 years	2.3 inches
5 years	3.2 inches
10 years	3.6 inches
25 years	4.0 inches
50 years	4.5 inches
100 years	4.5 inches

Even though Metzger's Ditch is a manmade drainage ditch, it does have a Federal Emergency Management Agency 100 year flood boundary. This boundary is shown on the Lake Township Flood Plains Map, February 1999 (Exhibit 9). When this map is compared with the Lake Township Wetlands Map (Exhibit 6), it can be seen that there are jurisdictional wetlands and/or jurisdictional flood plains along the entire length of Metzger's Ditch from the east side of the IEL site to the Summit County Line (and beyond into Summit County). These wetlands and flood plains act as potential deposition points for any materials being carried through surface flow from the landfill.

While it would take a 25 year rainfall event to create any significant surface runoff from the current landfill cap (full discussion in next section), there have been at least two 100(+) year storms since the sand and gravel quarry and landfill was first in operation. These were in winter 1959, and the September 1979 rains from Hurricane Frederick which resulted in as much as 500-year storms in part of Ohio. Stark County and the Tuscarawas River watershed experienced at least a 100-year rainfall event in 1979. The Tuscarawas River was out of its banks and beyond the 100-year boundary in Canal Fulton, just southwest of Uniontown. (Photographic

documentation and FEMA flood insurance documentation preparation by Bennett & Williams staff, Fall 1979).

Airshed

Uniontown is fortunate to be located just five miles north-northeast from the Akron-Canton Airport, which has a first order weather station. Documentation on the direction and average wind speed are found in the 1988 Report of Investigation. The wind direction and speed table is here reproduced at Exhibit 10 and the wind rose (figure 2-4) is reproduced as Exhibit 11.

Summary

This section summarizes the natural conditions existing in the area of Uniontown where the Uniontown Industrial Excess Landfill is located. Almost all of the information presented existed in published form, either as here presented or in an earlier source, before the Report of Investigation was completed in 1988.

The current conditions within the landfill and the fate and transport of contaminants leaving the landfill are directly controlled by these regional conditions. It is a known fact that contaminated materials were placed in the landfill and it is also a known fact that some of those contaminants have migrated beyond the landfill boundary. This section includes a discussion of potential routes of migration and possible sites for natural attenuation and/or bioremediation.

While there have been some vague discussions by the PRPs on possible natural remediation (see following section), USEPA has not adequately determined how contaminants are leaving the landfill, or more importantly, where they are going. In his February 17, 1999 letter to Edda Post (Exhibit 12), William E. Muno, Director, Superfund Division, US EPA Region V states on pages 1 and 2:

> "As for the complexity of the issues, I believe the proposed changes are fairly straightforward. As noted in the Proposed Plan, the main reason we are proposing to eliminate the pump-and-treat component of the IEL remedy is that we found no significant ground water contamination beyond the boundary of the landfill. A pump-and-treat system would therefore be extracting water that, for the most part, already meets drinking water standards.
>
> "Surely, there is no public health reason to do that. With respect to the change in the landfill cap, we have proposed a design incorporating standard containment technology that has proven its worth at a large number of sites.
>
> "When you suggest that the issues are complex, I assume you are referring to natural attenuation. As I said before, the Agency is proposing to eliminate the pump-and-treat component of the remedy because it appears there is nothing to treat. One plausible explanation for this is that natural attenuation has operated to reduce contaminant levels. Another possible explanation is that a plume of contamination moved outward from the landfill many years ago, but has long

since dispersed. Yet whatever the explanation, there is clearly no groundwater problem" [*based on the 1997 round of monitoring well data*] that would justify implementation of a pump-and-treat system. Nor is there likely to be one in the future, given the construction of a new cap over the landfill that will reduce water infiltration to near zero. Ground water will be regularly monitored in the future to confirm that contamination is under control. In sum, while the cause of the reduction in contamination outside the landfill may be complex, the fact of the reduction is not. And it is this fact that underlies our proposal to change the IEL remedy."

While the pump-and-treat system as proposed and recommended in the 1989 Record of Decision is flawed, it has not been adequately demonstrated that the only route of contamination is the ground water. Further, vague reference to two plausible explanations for the reduction of contaminants in the 1997 round of ground-water samples does not adequately constitute closure on the issue of where the contaminants went. USEPA determined in 1984 that there was sufficient cause to put IEL on the National Priority List (NPL), also known as "Superfund". Simply stating that the contaminants are gone is not protective of the health and welfare of the people of Lake Township. This section contains some of the important local information necessary for Ohio and USEPA to trace the routes of escape for that contamination. It is the responsibility of the Agencies, as administrators of the Superfund program, to determine the current locations and states of those contaminants and to determine that the contaminants currently are not posing a health treat to either the people or the biota of Lake Township. If the contaminants are simply transported, immobilized, and in a state that once again may be mobilzed in the future, then the community must be assured that these contaminants will not again become mobilized and become a source of future problems. If they have been diluted and washed from the area or blown away by the wind, that also must be documented.

The Uniontown Industrial Excess Landfill and Its Impact on the Area

Landfill History

The actual early history of the sand and gravel pit-turned-landfill is not completely clear. The Report of Investigation, 1988, identifies the original site as the Summit Sand and Gravel Company and indicates that active mining of the site occurred until some time in 1961 when the water table over much of the site was reached and it was no longer possible to continue a dry mining operation. A check of the Annual Coal and Nonmetallic Mineral Report; with Directories for Reporting Firms for 1961, (State of Ohio, Department of Industrial Relations, no date) does not show that the quarry was in operation that year. While the Mineral Industry Map for that year indicates the location of the quarry site and assigns it a number (Stark County sand and gravel SK640), there is no report of any active mining that year. Therefore, the quarry ceased operations some time before 1961. Further researching of this date becomes important because there is also a disagreement in the literature as to the date that the site first started accepting waste.

The quarry just to the south, SK 610, Uniontown Sand & Gravel Supply, Inc. report mining a Pleistocene kame glacial deposit for building sand, and building and paving gravel. These designated uses require that the materials produced be free of shales and siltstones in the gravel fraction (spalling) and free of silts and clays in the sand fraction. It is reasonable to assume that the Summit Sand and Gravel was producing similar quality materials, since it has a similar provenance and depositional history.

While the Report of Investigation (1988) states that the site first began receiving fly ash wastes in 1966, under the ownership of Charles Kittenger, Bauder remembers a much earlier activity (Jackson, et al, 1988). Bauder states that:

> "The site of the Uniontown Industrial Excess Landfill was an active sand and gravel pit before 1955. Waste disposal began at this site in 1959. From 1959 into 1964 the site was known as the Kittenger Landfill. The materials approved for inclusion in the Kittenger Landfill by the Ohio Department of Health included fly ash, masonry rubble, paper, scrap lumber, and other non-toxic materials (Dopler, 1987).
>
> "The ownership of the site changes and the Uniontown Sanitary Dump opened in 1966. It was not until 1969 that the site was approved by the Ohio Department of Health and subsequently licensed by the Stark County Health Department. Records of the Stark County Health Department indicate that there were few complaints about the site until 1971 when residents near the IEL began to complain of fire hazard. About 1971, the Ohio Department of Health approved a procedure for the landfilling of liquid wastes in which the liquids were to be lagooned at the site, mixed with soil and the resultant mix was to be buried.
>
> "Mr. Joseph Dopler, chief Sanitarian for the Stark County Health Department stated that before the soil was mixed with the liquid wastes, the lagoon caught fire with an apparent total loss of the liquid wastes. The plan to mix the liquid wastes with soil was abandoned (Dopler 1987)," (Page 19).

Bauder was working as a soils scientist and geologist in Stark County during those years, first as a member of the Stark County soil survey mapping team and, then later, for Stark County. He had reason to travel throughout Stark County on a regular basis and was in contact with a number of the local and county departments that would have had responsibility for the landfill. He is still active in the area today.

Muller, in his 1992 thesis Ground Water Contamination In and Around the Industrial Excess Landfill, a Superfund Site, Uniontown, Ohio, relies on both Bauder's version (Jackson et al., 1989) and a version from C. C. Johnson, Inc., (1988). As part of this review, a copy of the C. C. Johnson, 1988 document was not located. It is possible that the document may simply be the Report of Investigation, 1988, referred to earlier. The firm of C.C. Johnson & Malhotra, P.C. were involved in the original site review.

Mr. Donald Day was Northeast District engineer for solid waste with the Ohio Department of Health (ODH) in the mid 1960's and later Chief, Division of Solid Waste with Ohio EPA from 1972 when the Department was formed until the mid 1980's. He remembers the history of the Uniontown IEL site yet differently. During the years that the Stark County Board of Health was considering licensing the facility, the Ohio Department of Health was recommending against a number of uses that were later licensed by the County. However, because ODH did not have regulatory powers over the separate county health districts, their concerns about the site, and others throughout the state, could not be enforced. It was because of the lack of uniform implementation of Ohio's solid waste laws, in part, that the solid waste program was moved out of ODH and placed into the newly-formed Ohio EPA with permitting powers that override the licensing powers of the local health departments (Day, 1996).

Evaluation of the Waste Stream – Fly Ash as an Example

While it may seem like semantics to try to determine the accurate history of the landfill and associated practices, it is not. Two critical parts of the site analysis missing from the Report of Investigation, 1988, and not completed by anyone involved with this site, are a total water budget since waste was first deposited and a total contaminant budget, part of which would have moved with the water.

Another critical issue is whether any of the wastes are within the saturated zone. All sources reviewed agreed that when the landfill was first opened, the first wastes accepted included fly ash. The source of the fly ash was reportedly the boilers at the Firestone Tire and Rubber factory in Akron. Apparently these boilers were coal fired. While there is no record as to the source of the coal for those boilers, coal most likely was not shipped any further than is necessary in order to minimize costs. Stark County has a coal mining economy. In 1961 (Dept. Industrial Relations, no date) there were 17 coal mines in Stark County. Portage County still had one mine; Mahoning County had 22 mines; and Tuscarawas County had 49 mines. With coal so readily available, it is most likely that the coal burned at the Firestone factory, with its ash disposed of at the landfill, was locally mined. As such, it is possible to estimate the contents of materials in the resulting ash.

Coal forms when the remains of vegetation are buried under sediments in an anaerobic setting. Then, through time and pressure, the remaining vegetative materials are metamorphosed into coal. In Ohio, bituminous coal is formed with significant assorted impurities. While some of those impurities turn into gases when the coal is burned, a number of them, including most of the metals, remain behind. Furthermore, because a separation is not provided, it is assumed that the ash in the landfill includes bottom ash, which has an even higher concentration of toxic materials, including heavy metals.

No analyses of the ash are presented in the materials reviewed to date. These types of analyses are necessary in order to determine contaminant loading from the landfill. However, estimates have placed the waste volume in the landfill to as much as 50 percent fly ash by volume. Given that the landfill covers 30 acres and may be as thick as 50 feet in some sections, this represents a significant volume of approximately 450 acre feet (30 acres x 15 feet thickness) or even more that may be accounted for by ash.

While the most common components of coal are carbon, oxygen, hydrogen, sulfur and nitrogen in that order, coal also contains a number of trace metals that are measured in parts per million (ppm). Botoman and Stith (various) measure the following list of compounds and report their values in percent: silicon dioxide, aluminum oxides, calcium oxides, magnesium oxides, sodium oxides, potassium oxides, iron oxides, titanium oxides, lead oxides and sulfur oxides. Metals, reported in ppm, include the following: silver, boron, barium, beryllium, cadmium, cerium, cobalt, chromium, cesium, copper, dysprosium, erbium, europium, gallium, gadolinium, germanium, hafnium, holmium, lanthanum, lithium, lutetium, manganese, molybdenum, niobium, neodymium, nickel, lead, palladium, praseodymium, rubidium, scandium, samarium, tin, strontium, tantalum, terbium, thorium, thallium, uranium, vanadium, wolfram, yttrium, ytterbium, zinc, and zirconium. This list is generally referred to in the literature as being heavy metals.

Excellent research into the mobilization of metals from fly ash and mine spoil has been conducted for a number of years at the Ohio State University. Under the direction of Drs. Jerry Bigham and Sam Traina, Soils Chemists in the School of Natural Resources, this team has worked extensively in eastern Ohio, developing methods to immobilize the heavy metals released in the byproducts of coal mining and burning. Their experience and laboratory facilities represent a local source for analyses of expected contaminants in the fly ash. This type of analysis is necessary in order to determine contaminant loading now that the ash has weathered and leached for as few as 19 and as many as 40 years.

Ground-Water Contaminant Migration as Controlled by pH

Most of the fly ash in the landfill is only periodically saturated and is, therefore, weathering in vadose zone conditions for most of the year. The landfill is, however, surrounded by silica sands and gravels. Water will be acidic to neutral when entering the system, unless impacted by the characteristics of other wastes in the landfill (refer to later discussion on pH). The pH in the monitoring wells should be acidic and, therefore, the metals contained in the fly ash should be mobile. In fact, that is what is seen in a number of the shallower wells (Sharp & Assoc., 1998).

There are, however, some unexplained pH anomalies that have been observed in the March 1997 and September 1998 water-sampling rounds. PH data for other sampling rounds could not be located for this review, so it was not possible to determine whether these anomalies existed prior to March 1997. The issue of the fluctuating pH levels is addressed later in this report.

As part of this review, no documentation was found that addresses the significant variations in pH (except the Burdick et. al., 1997 report that attributed it to variations in the naturally occurring bedrock). Sampling data are simply reported with comments demonstrating the change in VOCs and metals concentrations, but with no attempt to try to explain the mechanisms at work that control the situation.

Contaminant Migration by Wind

Exhibits 10 and 11 indicate that the average yearly wind direction is to the north-northeast. Winds blow in a westerly direction only 72 days a year on average. In addition, the average wind speed is 10.2 miles per hour (MPH). This velocity exceeds the velocity necessary to transport fine-grained contaminants such as those that might be deposited in the landfill. A review of the contaminants on Exhibit 13 show that at least two, fly ash and lamp-black, have properties that could easily allow them to be transported by wind in an up-gradient ground-water direction, the north-northeast.

In fact, in 1971, there were several complaints about lamp-black blowing into homes as a black dust (Report of Investigation, 1988). In spite of this known record of complaints and the knowledge that fly ash, also mobile in air and containing heavy metals, among other contaminants, could have been blown to the east and settled out on the surface soils in the bog to the east, almost all of the background soil and sediment locations chosen for sampling are directly down wind from the landfill. Exhibit 14; Report of Investigations figure 4-14 show the sampling sites. Once the locations of these sites are compared to Exhibit 11, it becomes clear that the locations of all the background soil and sediment locations, with the exception of those collected at the Rubber City Sand and Gravel Co., may be compromised by the potential deposition of airborne particulates blowing from the open landfill over a 20 year period of time. In addition, since the current cap contains contamination and the current vegetation on the cap is somewhat sparse and subject to drought conditions, it is possible that particulate contaminants are still being transported from the landfill. This avenue of contaminant transport has not been adequately explored especially when areas that are potentially contaminated by one pathway are considered suitable for background sampling for another pathway.

An additional serious problem with the soil and sediment sampling program is that soils and sediments that are predominately organic in nature (the muck soils and sediments in the kettle ponds, bogs and Metzger's Ditch) are mixed with soils and sediments that are predominately mineral in nature (on the kame uplands). It was assumed that the values could be grouped together for background, on-site and down-gradient analyses. In fact, two separate sets of samples should have been collected, one for mineral materials and one for organic materials.

Contaminant Migration by Gas

Gas generation was one of the earliest concerns noted for the site. While gas was originally considered to be methane only, a number of other chemical compounds were identified in a gaseous state by the completion of the Report of Investigation in 1988. The Report of Investigations, Table 6-1 (here included as Exhibit 15) identifies a series of volatile organic compounds that were found when the gas stream was sampled. From these sample collections, a target compound list was set for destruction in the gas collection system (Exhibit 16).

The installation of a gas collection system is one of the few remedial activities that has actually occurred at the site. Per information gathered in meeting with staff of Ohio EPA NEDO on March 17, 1999, it was learned that the existing gas collection system was installed 12 years ago as an emergency action. Because of the critical methane migration problem at the site, the

gas extraction and flare system was installed without the typically required air permitting process. However, during the last 12 years that the system has been in operation (under the control and management of Ohio EPA NEDO), no attempt has been made to normalize the situation and bring the gas extraction and burn system into regulatory compliance.

The current system extracts gas from a total of 15 wells, 12 on the west, north and southwest boundaries of the site (Exhibits 17 and 18) with, later, three internal wells also tied into the system. Exhibit 19, PCE Soil Gas Results, distributed by ATSDR at the March 30, 1999 public meeting, show the general location of the gas extraction wells. Of special note on that map, however is the indication of soil gas levels above non-detect outside of the boundaries of the gas extraction system, especially in the northeast, southwest and northwest direction. Exhibits 20 and 21 list the gases that are coming out of the landfill as of the March 31, 1986 test.

Given the permeable nature of the kame surrounding the landfill, landfill gas will volatilize, move up through the soils (warm weather) and become part of the airshed to be blown downwind. It may also continue to migrate (frozen ground/snow cover/saturated soils) through the sand and gravel until it finds an outlet (i.e. basement) or migration route (i.e. storm sewer or utility line backfill trench). Because existing conditions can change rapidly over the course of a year, one round of gas testing of some of the basements in the area is not sufficient. Gas is clearly moving beyond the edges of the extraction system, into the environment at large, and ongoing monitoring of confined spaces must be as much a part of that program as quarterly sampling of ground-water wells until it is demonstrated that the capture of the gases is complete.

Ohio EPA's current regulation requires an explosive gas plan be written for each site, identifying any and all structures within 1000 feet of the perimeter of the landfill. As part of the gas monitoring plan, all structures have to be monitored quarterly for a minimum of three (3) years. A 1000 foot parameter from the existing boundaries extends as far as Polly Drive to the north and most of the way to Island Ave. to the west. If the landfill boundaries are extended to Cleveland Ave. on the west, the western line would still be a few hundred east of Island Ave.

Perhaps even more importantly, only part of the site has a gas extraction system in place. The rest of the landfill is simply venting untreated gases into the airshed to mix downwind. While a small study was presented in the Report of Investigation that indicated that these gases dissipated, this is an additional loading to the airshed and must be stopped. The USEPA New Source Performance Standards (NSPS) states that the surface of each landfill be monitored by taking OVA readings at ground level. If gas readings exceed 500 ppm above the cap level, remedial action must be taken. If for no other reason than the control of the venting gases, the landfill must be capped and an adequate collection system that captures all of the gas must be installed.

Radon is a separate issue. While radon is a gas, it is an inert gas and does not react with either the VOCs venting into the air or with ground water. It simply shares a route. Radon is emitted through the gas collection and treatment system. It is also venting through the cap. Radon may also be traveling through ground water. However, the radon being released has been determined to be naturally occurring and so has not become part of the monitoring system. In fact, the one radon reading collected from the gas venting system was 516 pCi/L. If Radon

collects in a similar concentration in a basement, it is considered very dangerous. Current USEPA limits consider 100 pCi/L an emergency level. In addition, there is no published information that indicates that this is a natural reading. Significant published information indicates that this reading is high for this part of the State (discussed further in the section on radioactivity). Because of the readings, a testing program for radon must be instituted as part of the gas control system for the landfill. It appears that the homes in the immediate vicinity of the landfill have not been tested for radon as a part of the Superfund process. This process must begin at once and become part of the regular sampling procedure.

Water Budget

While it is beyond the scope of these comments to create a full water budget for the area, it is possible to calculate an approximate volume of water that has moved through the landfill since it began accepting waste. Various starting dates have been given for the beginning of waste acceptance but all sources agree that the landfill began accepting fly ash between 1959 and 1966. All of the sources seem to agree that the current cap was applied in 1980. Between the time that the first fly ash was brought to the facility and the cap was applied, all of the annual precipitation moved through the open landfill. There are at least three different annual precipitation rates in the literature cited; from less than 36 inches per year to just over 36 inches per year. For purposes of calculation, 36 inches per year are used.

Therefore:

36 inches/year = 3 feet
1980 - 1959 = 21 years x 3 feet = 63 feet
1980 - 1966 = 14 years x 3 feet = 42 feet

Based on these calculations, during the period of operations of the landfill between 42 and 63 feet of precipitation fell on the wastes.

In 1980, a cap was applied. According to Chaudhry, Majid A. (1998), "Comparison of Storm Water Infiltration and Runoff for Three Types of Landfill Caps Industrial Excess Landfill Uniontown, Ohio" Technical Memorandum, Tetra Tech EM Inc, Chicago, Ill, Appendix Help Model, the current cap on the site consists of the following:

Poor grass cover
Curve Number 70,
Therefore creating
0.21 inches of runoff a year,
26.62 inches of evapotranspiration and
10.00 inches of infiltration.

This calculation, however, is not believable. Ohio EPA, in an earlier memo, (Larry Antonelli, December 24, 1997) indicated that a cap should be based on meadow conditions, continuous grass, protected from grazing and generally mowed for hay (Soil Conservation Service, June 1986 2nd Edit.) When this classification on Table 2-2c is checked (page 2-7), no ranking is given for hydrologic conditions from poor to fair. It is possible that the modeler at

Tetra Tech read the wrong cover type. Be that as it may, Table 2-2c gives the following Curve Numbers for Meadow Cover Type:

Soil Group:	A	B	C	D
Curve Number	30	58	71	78

When reviewed against this information, it would appear that Tetra Tech has chosen a C Soils Group for the cap. A C Soils Group is typical of a glacial soil, well developed with good tilth. This type of a soil will support a healthy stand of vegetation and provide ample field capacity of moisture and nutrients. But this is NOT the type of material with which the site is capped.

Bauder in Jackson et al., 1989 reports that:

> "In 1978, after lengthy controversies, IEL ceased operation. Residents continued to complain that dumping of materials was occurring at night. The SCHD "[*Stark County Health Department*]" attempted to close the landfill per requirements of the Ohio Department of Health, which included a final cover of clayey materials "[*similar to the CN 70 offered by Tetra Tech*]. "Litigation resulted in a court ruling that the final cover of this landfill could be soil materials obtained at or near the site "(p. 51).
>
> "Most of the soil materials used in final cover material for IEL came from an area adjacent to the southwest corner of the site. These aggregate materials generally contained less than 20% fines and were apparently similar to the aggregate materials sold from the prior sand and gravel pit operations at IEL. Earth-moving activities caused the aggregate cover material to become much more compacted and less porous. In 1986, J. Bauder observed depression areas on top of the cover material that held surface water for significant periods of time" (p. 53).
>
> "The heightened free water mound associated with the landfilled materials is augmented by the increased water infiltration into the site caused by the extensive areas of nearly level and depressionary areas occurring in the western third of the Uniontown Industrial Excess Landfill site" (p. 54).

By definition, a soil made up of only 20 percent silts and clay sized materials would fall into an A Soils Group. This would produce a Curve Number of 30, not 70 for the site. In addition, because the raw materials for this cap are mostly sand and gravels, the resulting cap will have a low field capacity for holding water and would therefore be quite droughty. Given that condition, the assigned Tetra Tech evapotranspiration rate of 26.62 inches/year is significantly higher than can be supported at the site. A much more realistic figure would be in the 10 to 12 inches/year range.

Even the runoff rate of 0.21 inches/year rate offered by Tetra Tech is too high. A TR # 55 run for the site A Soils Group and Curve Number of 40 (the lowest figure accepted by the computer program) required a 25 year storm of 4.0 inches in a 24 hour period before surface

runoff from the site occurred. Using this calculation, approximately 24 to 26 inches of precipitation have entered the landfill every year since 1980.

1999-1980 = 19 years x 24 inches/year = 38 feet.
38 feet + 42 feet to 63 feet = 80 to 101 total feet
80 feet x 30 acres = 2,400 acre feet of water
101 feet x 30 acres = 3,030 acre feet of water
(325,851.43 gal/acre foot)
2,400 acre feet = 782,040,000 gallons
3,030 acre feet = 987,330,000 gallons (almost 1 billion gallons)

Given this volume of water through the system, it would be doubtful if any free liquid that had been added to the landfill that had the ability to mix with water would still be in the landfill. Only solid materials and liquids that have been incorporated within the solids, do not move with water, or are still in barrels, would be expected to remain in the landfill. Furthermore, those solid materials in the landfill have been subjected to significant leaching over the years. With a mechanism that allows such a significant volume of contaminant transport out of the landfill, it is critical in this heavily populated community to determine the ultimate fate of these contaminants.

Waste in Water/Off-Site Movement

There has been speculation through the reports and in the letters and memos about the saturated conditions at the base of the landfill. While USEPA maintains that there may be less than two feet of separation between the bottom of the landfill and the water table, (Linda Kern memo, July 18, 1995), other sources (Burdick et al., 1997) states on page 2-1 that "Flyash wastes are reportedly present in 80 to 85 percent of the 30-acre site [Johnson and Mulhatra,1988]. Flyash was one of the first wastes disposed at the site and was placed in topographic depressions to reclaim flooded areas of the site, such as the area in the northwestern portion of the landfill." While most of the information gathered appears to have been from local reports, there is a reasonable basis to determine that the base of the landfill is saturated.

A review of the 1970 Stark County Engineer's two-foot topographic maps show hummocky topography in the bottom of the landfill. When this map was completed, the landfill had been in operation for between four and 11 years. In the southeast section of the site, just a short distance north of Monitoring Well nest 7, there is a large depression with a water level of 1124.1 feet above mean sea level (AMSL). From this map, it is impossible to determine whether this water impoundment is in waste or is in the old sand and gravel section of the landfill.

There is another way to evaluate this condition. The Office of Real Estate and Land Management, ODNR, keeps a listing of all available aerial photographs for the State of Ohio. Often sets are kept at the local soil and water conservation district, the local planning commission or the local engineer's office. For many years, USDA Agricultural Stabilization and Conservation Service (now Farm Services Agency) took aerial photographs of portions of each county for crop reporting documentation. Both local offices and ODNR should be contacted to locate aerials of the same vintage as the 1970 topographic map. The Stark County Engineer's

office may still have a set of the prints used to make the maps. By reviewing the photographs, it may be possible to determine if the southeast section of the landfill was covered in waste when the topographic maps were made. If it was, then any monitoring well measurement that would place water in that location near 1124.1 feet AMSL, would indicate wastes in water.

Review of older photographs may also prove to be useful when tracing the development of waste placement in the landfill. Such an analysis should be undertaken at once since it appears that it has not been done. This separation issue needs to be fully understood before the new cap is installed.

Once the contaminants are leached out of the landfill, they can be found in any setting from gas to lighter than water (floaters) to miscible in water to denser than water (sinkers) at normal ambient temperature and pressure. It is essential to know the properties of each of the contaminants to understand how their mobility, phase and most probable migration pathway. Table 3-2 from the Report of Investigation, 1988, has been modified and included herein as Table 2 for that purpose.

The Unanswered pH Question

Given the natural conditions in the region, pH readings in the monitoring wells are expected to be acidic (below 7.0). Nothing in the natural environment supports the existence of alkaline pH ground-water conditions. In addition, as most of the materials added to the landfill are acidic in nature, that acidic pH condition is expected to continue. The ground-water chemistry review as part of these comments shows only two sampling events, March 1997 and September 1998 that report pH values for the monitoring wells. If those measurements were taken for other years, they are not in the literature available as part of this review. Levels of pH in ground water are necessary because pH controls the mobility of many metals, and reflects the respiration of soil microorganisms that may be active in breaking down some of the waste stream. In addition, where pH varies from the expected, it is a useful indicator of contaminant migration. Table 3 shows the pH measured in the monitoring wells for the March 1997 and September 1998 sampling events:

Table 2
Properties of Solvents and Other Materials as They Migrate out of the Landfill

Contaminant	Gas	LNAPL	Miscible	DNAPL
Acetone			X	
Benzene		X		
n-Butanol			X	
n-Butyl acetate		X		
Ethanol			X	
2-Ethoxyethl acetate		X	X	
Ethyl acetate		X		
Gasoline		X		
Hexane		X		
n-Heptane		X		
Isopropyl alcohol			X	
Isopropyl acetate		X		
Methanol			X	
2-Methoxyethanol			X	
1,1,1,-Trichloroethane				X
Methyl ethyl ketone		X	X	
Methyl isobutyl ketone		X		
Methylene chloride				X
Chlorobenzene				X
Naptha		X		
Naptha (aliphatic)		X		
Sulfuric acid			X	X
Tetrahydrofuran			X	
Toluene		X		
Xylene		X		
Daughter Products				X
1,2 DCA		X		
Ethyl benzene				
Vinyl Chlorine	X			

Note: Chemicals that have more than one significant property are listed in all relevant columns.
Source: NIOSH, June 1994, Pocket Guide to Chemical Hazards, US Dept. of Health and Human Services, Washington, D.C., 398 pages.

Table 3 pH Variations in Monitoring Wells			
Monitoring Well #	**March 1997**	**September 1998**	**Change**
MW-1S	6.48	7.54	+1.06
MW-1i	7.06	7.79	+0.73
MW-1D	7.5	7.79	+0.29
MW-2D	9.93	8.05	-1.88
MW-3S	6.55	n/a	
MW-3I	7.47	6.75	-0.72
MW-3D	7.8	8.03	+0.23
MW-4S	6.9	6.22	-0.68
MW-5S	6.45	7.1	+0.65
MW-6S	6.4	6.4	same
MW-7S	6.45	6.16	-0.29
MW-7I	7.91	7.29	-0.62
MW-7D	7.99	7.28	-0.71
MW-9S	6.49	6.99	+0.5
MW-9I	9.35	7.57	-1.78
MW-9D	6.75	11.43	+4.68
MW-10S	7.19	8.04	+0.85
MW10I	7.12	n/a	
MW10D	7.3	7.9	+0.6
MW-11S	6.87	9.44	+3.57
MW-11I	6.99	7.29	+0.3
MW-11D	7.51	11.97	+4.46
MW-12D	n/a	6.9	
MW-12D (resample)	n/a	7.18	
MW-12I	n/a	7.1	
MW-12I (bailed)	n/a	7.22	
MW-12I (resample)	n/a	6.9	
MW-13I	6.89	6.73	-0.16
MW-14S	6.48	6.28	-0.2
MW-14I	7.04	6.94	-0.1
MW-15S	7.43	7.03	-0.4
MW-15I	7.43	n/a	
MW-16I	6.5	8.08	+1.58
MW-17S	6.74	6.01	-0.73
MW-17D	6.23	7.13	+0.8
MW-18S	6.37	7.37	+1.0
MW-18I	6.78	7.91	+1.13
MW-18I (bailed)	n/a	7.91	
MW-19S	6.87	7.01	

Table 3- Continued pH Variations in Monitoring Wells			
Monitoring Well #	**March 1997**	**September 1998**	**Change**
MW-20S	7.36	7.16	-0.2
MW-20I	7.31	7.39	+0.08
MW-20D	7.64	7.24	-0.4
MW-21S	6.62	7.38	+0.76
MW-21I	7.22	7.72	+0.5
MW-22I	7.68	7.49	-0.19
MW-23S	6.8	7.08	+0.28
MW-23I	10.13	7.6	-2.53
MW-23D	6.96	7.65	+0.69
MW-24S	6.74	7.05	+0.31
MW-24S (bailed)	n/a	7.38	
MW-24I	6.96	7.09	+0.13
MW-25S	7.37	7.48	+0.11
MW-25I	7.15	7.33	+0.18
MW-26S	7.29	7.34	+0.05
MW-26i	7.03	7.31	+0.28
MW-27S	7.25	7.21	-0.04
MW-27S(bailed)	n/a	7.29	
MW-27I	7.46	6.93	-0.57
MW-27D	7.44	7.35	-0.09
MW-28D	7.29	7.23	-0.06

A review of the pH information in Table 2 reveals several interesting patterns. In March 1997, out of 52 samples being reported, 49 (94.23 percent) of the samples had a pH below 8.0 and 42 (80.77 percent) had a pH below 7.5 which is within the normal range of a landfill in this setting. No samples were below 6.0 and only three samples were anomalously high (9.93 for MW-2D, 9.35 for MW-9i, and 10.13 for MW-23i).

When the same analysis is performed on the September 1998 data, the results are different. Out of 57 samples being reported, only 50 (87.72 percent) were below a pH of 8.0 for a drop of 6.51 percent of the samples. Only 41 (71.93 percent) were in the less than 7.5 pH range for another reduction of 8.84 percent. Again, no samples were below a pH of 6.0. The following wells were above a pH of 8.0: MW-2D at 8.05, MW-3D at 8.03, MW-9D at 11.43, MW-10S at 8.04, MW-11S at 9.44, MW-11D at 11.97, and MW-16I at 8.08. Only MW-2D remained above 8.0 each time, but even that well demonstrated a decrease in pH from 9.93 to 8.05.

Monitoring well groups MW-2, MW-3, MW-9, MW-10, MW-11, MW-16 and MW-23 all reported at least one well in each group with a pH above 8.0 at least once in the two events. Interestingly, there is no data for MW-8. This well nest is downgradient from the buried east to

west valley under the site and might provide valuable information about off-site migration if it was sampled.

When the total amount of change is studied, whether it be up or down, of the 49 wells with data for each sampling event, fully 24 or 48.98 percent changed at least 0.5 in the 18-month period. Ten wells or 20.41 percent showed a 1.0 change, and seven wells showed a 1.5 change in pH. Four wells showed a 2.0 or higher change in pH. They were as follows: MW-9D with a 4.68 increase to 11.43, MW-11S with a 3.57 increase to 9.44, MW-11D with a 4.46 rise in pH to 11.97 and MW-23I with a 2.53 fall in pH from 10.13. These are significant changes in pH and demonstrate an instability in the ground water in, under and near the landfill. One explanation is that the landfill is influencing the ground water quality and fate and transport of contaminants in the ground water.

In all, there are sets of monitoring wells that show the downward migration of high pH ground water over time or the general acidification of the well nest from one sampling round to the next. The monitoring well nests that appear to be the most affected are MW-2, MW-3, MW-9, MW-10, MW-11, MW-16, and MW-23. Three of these nests, MW-10, MW-11 and MW-23 are beyond the boundaries of the landfill and MW-10 and MW-23 are beyond the property boundaries. No comments in the reviewed materials address this pH issue except for Burdick et al., (1997). They attribute the range in pH to natural conditions in the bedrock. Based on the assessment of the geologic materials (see previous section), this explanation is not plausible. Indigenous ground water conditions tend to be stable. Fluctuations of pH of orders of magnitude cannot be attributed to natural conditions without "unnatural" or "extraordinary" circumstances.

Section Summary

It is apparent that the landfill has had and continues to have a significant impact on the ground and surface waters and air around the landfill. The site investigation has been less than rigorous. For the health and safety of the community at large, the questions, still unanswered from the 1988 Report of Investigation, must be answered and incorporated into the remediation and closure of this uncontrolled hazardous waste dump.

Analyses of the Ground Water Models

Discussion of Review

A review of the Earth Science Consultants (ESC) November 6, 1997 Modflow ground-water model titled Groundwater Modeling Report, Industrial Excess Landfill, Uniontown, Ohio was performed. The following comments address limitations in the model and concerns about its application.

1. The first paragraph of the executive summary, states that "...there is no discernable plume of landfill constituents of concern emanating from the IEL site, such that offsite groundwater quality is not adversely impacted."

   An historical ground-water contamination plume exists beyond the boundary of the site. This contamination plume was divided into a smaller Volatile Organic Chemical

(VOC) plume and an outer heavy metals plume, (multiple sources including the Report of Investigation, 1988). It is possible that the VOCs added as simple free liquids to the site, have been flushed with the perhaps as much as one billion gallons of water that has moved through the site since 1959. The recent September 1998 sampling event shows increasing VOC levels within the site. This is possibly due to VOCs deposited originally as solids or in drums as opposed to free liquids.

A concentration of 8300 µg/L for benzene was recorded for Monitoring Well MW-14S (up from 1900 µg/L in March, 1997) and 1100 µg/l of 2(3H)-Benzothiazolone was measured in ground water at MW-14I. These VOC concentrations indicate that a new source of contaminants may have been exposed in the landfill. One possible source is leaking barrels that were placed in the landfill and are deteriorating over time. Because the contents and conditions of these barrels are not well documented, it is reasonable to assume that VOC concentrations will continue to show significant fluctuations over time, thereby creating new VOC plumes of contamination moving out through the neighborhood.

2. The Modflow model appears to have had a specific and limited purpose, which was to reproduce site solute transport conditions to assess potential receptors west of the site. As such, this model is not a comprehensive ground-water model of the site.

3. The receptor boundary used in this study was not the site boundary, but instead was the Stark-Summit County line. This is an extremely important point. Any projections made by this model cannot not be interpreted as being protective to the health and welfare of the citizens in Lake Township. The projections are geared specifically for concentrations that will move beyond the County Line. The last paragraph of the executive summary states that "The groundwater model demonstrates that constituent concentrations under the most conservative scenario are decreased by a factor of at least fourteen between the site property boundary and the receptor boundary (*Stark/Summit County line*). The modeling of more realistic site conditions demonstrates that groundwater constituents from the former IEL liquid waste disposal area will never reach the receptor boundary." These statements are based upon the initial assumptions of a source concentration of 100 micrograms per liter and a limited source area within the landfill. See item 12, below.

4. While ESC gives some detail regarding the construction of the model, only brief descriptions of the model layers are given, with no explanation as to what hydrogeologic strata each layer represents. In addition, the variable thickness of the layers are not shown. Because of this, it is difficult to address any issues that concern the construction of the model, and the parameters that may be associated with the layers.

5. Boundary conditions are shown on Figures 2A and 2B. The originals of these figures are in color while the copy reviewed, provided by Ohio EPA NEDO, is in black and white. As such, differentiating between the boundary conditions used is difficult.

6. Values for hydraulic conductivity are listed in the text and are shown on figures, but, as above, the original figures were in color and the copy reviewed is in black and white. As

such, it is difficult to differentiate the areas where different values for hydraulic conductivity were used. In addition, the report does not provide information regarding the sources of the values used for hydraulic conductivity.

There is particular concern with regard to specific model input. For instance, the vertical hydraulic conductivity varied over the top of the landfill. There was also a variation over the surrounding neighborhood. While no explanations for this variation was offered, given the B Soils Group for the upland sand and gravel soils, the A Soils Group for the landfill cap and the A/D Soils Group for the organic soils of the sod farm, it would not be expected to see the same vertical hydraulic conductivity assigned across all three settings. Nor would it be expected to see significant variations over a single land use (i.e. the cover of the landfill) unless there were other factors, here unexplained, built into the vertical hydraulic conductivity rates. The lack of that information makes it difficult to independently validate the conclusions drawn by the model.

7. An effective porosity value of 0.25 was used for the top four layers of the model. This value appears arbitrary. There was no discussion regarding sensitivity analysis of the impact of this parameter on plume length, concentrations or time-of-travel.

8. According to the ground-water potentiometric surface of the shallow aquifer constructed from data collected in March 1997 (Figure 1 here reproduced as Exhibit 22), there is a radial flow component to ground-water flow beneath the landfill. There is very little hydraulic information to the east of the landfill. There are two similar conflicts in this potentiometric surface shown on this figure, and they are treated differently. At the western edge of the site, MW-11S has a ground-water elevation of 1120.04 ft AMSL and MW-21S has a ground-water elevation of 1118.39- ft AMSL. Monitoring well 11S is shown to be outside the 1120 contour line, with MW-21S between the 1120 contour line and MW-11S. On the eastern boundary of the site, monitoring well MW-4S has a ground-water elevation of 1116.34 ft AMSL while MW-20S has a ground-water elevation of 1118.22 ft AMSL. On the western boundary, the value for MW-11S appears to have been ignored. On the eastern boundary, two contour lines, elevations 1117 and 1118, were placed between monitoring wells MW-4S and MW-20S, indicating a westward flow direction at that point, whereas all other indications are that flow is to the east.

This same confusion as to the placement of contour lines on the east side is also seen in the September 1998 ground-water sampling report (Sharp & Assoc., 1999). The potentiometric surface map for the intermediate sand and gravel aquifer places the water level elevation of 1117.02 AMSL for MW-20I below the 1117 contour line (Exhibit 23). In addition, the potentiometric surface map for the shallow sand and gravel aquifer map shows an unexplained "sink" at MW-9S, more than one and one-half feet lower than the monitoring wells on either side (Exhibit 24). While the issue is not addressed by either ESC or Sharp and Associates, one of the irrigation wells at the adjacent sod farm had been pumped almost 13 million gallons by that point in time in the summer. The water levels of several wells may have been a reflection of that activity.

Burdick et al., (1997), the Geraghty and Miller report, using the same March 1997 data, draw different contours on the eastern side of the landfill. Their Figure 3-2 (here reproduced as Exhibit 25) show MW-20S within the mound of the landfill, and down gradient from sources of contamination. They repeat that assignment in their figure 3-3 (here reproduced as Exhibit 26). Finally, they clearly place the supposed up gradient monitoring network well set of MW-20 within both the 1988 and the March 1997 plume representing concentrations of dissolved metals above the MCL. MW-20 represents a contaminated well in their figure 5-2 (here reproduced as Exhibit 27).

While not addressed in the model, there have been significant volumes of water withdrawn from three irrigation wells at the sod farm to the east. The location map, water withdrawal registrations and well logs for those wells, were obtained from the records of ODNR, Division of Water. Exhibit 28 is the location map for the three wells. Exhibits 29 through 34 are the State of Ohio Water Withdrawal Facility Registration for the years 1990,1994, 1996, 1997, 1998 and 1999, respectively. Exhibits 35 through 37 are the well logs for the three wells. Had the Modflow model been undertaken to demonstrate current conditions at the landfill and in the surrounding neighborhood, those data would have been critical to understanding the ground-water flow directions on the eastern side of the landfill. The understanding of ground-water flow to the east is an area of significant debate not only between the consultants but also between Ohio EPA, that has questioned that the MW-20 nest is upgradient (March 17, 1999 interview, NEDO), and USEPA who continue to claim that it is upgradient (David A. Ullrich to CCLT, March 11, 1999). Based upon the data, it is the opinion of Bennett & Williams that the MW-20 well nest is compromised at least during the irrigation season at the sod farm, if not throughout the entire year.

9. The hydraulic gradients to the west of the landfill that were produced by the model do not match the measured/plotted gradient shown on Figure 1 (here reproduced as Exhibit 22). A better match of the gradient, especially combined with a smaller value for effective porosity will likely affect the model results significantly (i.e. allow the plume to migrate further to the west).

10. In addition, the potentiometric surface produced by the model does not match that shown in Figure 1 (Exhibit 22) in the northern portion of the modeled area. An indication of this is that the model does not respect the ground-water elevation at PZ-16 of 1143.18-ft MSL. The well PZ-16 lies between the 1125 and 1130 ft contours produced by the model, resulting in a difference of approximately 16 feet between measured and calculated head values.

11. The only model results that show any migration of contaminants to the east are those of Run 16B, as shown on Figures 4 and 4A. This run is implied to be unrealistic because all the grids that represent the landfill site were used as source nodes. However, this is the only run that indicates that there is a potential radial transport of constituents of concern.

In fact, this assumption of all the grids at the landfill site potentially contributing contaminants is perfectly appropriate. Records indicate that wastes were placed over the

entire surface of the landfill. There are indications (Burdick et al., 1997) that 80 to 85 percent of the site has fly ash, a significant source of heavy metals. Therefore, a model that assigns contaminants to all of the nodes at the site is realistic.

12. The first sentence in Section 2.6, **Numerical Parameters,** states, "A concentration of the source cells of 100 micrograms per liter was selected as the source concentration in order to more directly compare the effects of solute transport across the model as a direct comparison of magnitude or as a percentage if desired." It has been reported that concentrations of volatile organic compounds in ground water at the site have been as large as 8300 µg/L (Benzene, MW-14S) as recently as September 1998. Because this is a fact, then the concentration of the source cells of 100 µg/L is not conservative, and the results should be discussed in terms of percentages rather than of magnitude. Unfortunately, the discussion of model results uses only magnitude, and conclusions are based on the assumption that "concentrations above 1 microgram per liter do not reach the western edge of the model", the Stark/Summit County Line. If one uses the percentage comparison as stated in Section 2.6, then 1 percent of the initial 8300 µg/L (Benzene, MW-14S, 1998) is 83 µg/l, and 5 percent is 415 µg/L at the County Line. As such, the statement in the last paragraph of Section 4.0 which states "...that concentrations above 1 microgram per liter do not reach the western edge of the model," and the statement in the last paragraph of Section 5 that states "... the model indicates that contaminants released to groundwater from the former liquid disposal area are unlikely to reach potential downgradient receptors west of the IEL site at concentrations of concern," are incorrect. In addition, since the MCL for Benzene is 5 µg/l, then all receptors between the landfill and some significant distance west into Summit County will be potentially exposed to levels of known carcinogens far above the MCLs, and therefore will be placed at risk from the exposure.

13. While there were river cells used in the model, there is apparently no interaction between the ground-water and surface water built into the model. This is surprising considering that Metzger's Ditch was installed to drain water from the boggy areas of the valley floor, and that there are numerous lakes and ponds in the area. There was no information regarding the head values and leakage values that were assigned to the river cells.

Summary and Conclusions

The model appears to be of limited scope, and was not designed to be a comprehensive model of the entire flow system. Nevertheless, conclusions were made that appear to be in error, e.g. that ground-water concentrations of chemicals of concern would never exceed 1 µg/L at the western boundary of the model. It is important to note that the receptor boundary is the county line rather than Cleveland Avenue, which is apparently the current property boundary. This is surprising because there are many homes between the site and the county line. In addition, there are preferential pathways of anthropogenic origin, such as sand and gravel backfill along water and storm water pipes in the area.

In the recommendations section of the report that address ground-water monitoring (Section 6.1), the assumption is stated "that ground-water migration continues to be primarily to the west of the IEL site", even though radial flow from the landfill is indicated on Figure 1 (Exhibit 22), the potentiometric surface during March 1997.

This model should not be regarded as a comprehensive, inclusive ground-water model. It contains flaws that prevent it from functioning in that capacity. It is not representative of observed ground water conditions. Should it become desirable to construct a comprehensive model, all of the above comments should be incorporated. Understanding of the ground water flow in the region demands recognition of the impact of the irrigation wells at the sod farms and the radial migration of contaminants outward from the site. A model should not be attempted until the parameters that go into the model are understood. A model would then be useful if some attempt were going to be made to contain and remove the contaminants from the local environment, as first proposed in the 1989 Record of Decision but not undertaken by any of the parties since.

An Evaluation of Radiation Issues

Introduction

Radiation questions have long been an issue surrounding the IEL landfill. In the late 1980's and early 1990's, there were a series of ground-water samples taken for radiological indicators. Some of the numbers that were reported for the samples were quite alarming. However, for a number of reasons, US and Ohio EPA systematically invalidated virtually all of the data that was collected. In addition, there was also one gas stack reading for radiological parameters that was reported in the 1988 Report of Investigation (Exhibit 21). This one sampling event, reporting a radon level of 516 pCi/l was dismissed as naturally occurring with no review of the value in terms of natural radon levels in the community and the region at large.

While the data was dismissed by the Agencies, in 1994, the Scientific Advisory Board reviewed all the data and issued a set of findings. Their findings basically assured USEPA and were meant to assure the community that, with the advent of a cap and a pump and treat system, radiation should not be a problem. However, they did suggest that, just to be sure, USEPA should undertake another round of radiation sampling, following proper lab protocol for sampling and lab analysis. The report was issued in 1994. To date, US and Ohio EPA have not followed up on the recommendations. Neither has the site been capped nor a pump and treat system installed. In fact, the radiation issue is just as open-ended almost six years later as it was when the report was issued.

Radiological Sampling Results

A review of the radiochemical data and documents regarding the site history associated with the sampling and analysis of radiological parameters from the IEL site was conducted. The data reviewed were in the form of results reporting sheets from analytical laboratories. On these results reporting sheets, there were no indications as to whether or not the data had undergone

validation and/or assessment following validation. Additionally, there were no statistical analyses results, no indication of background activities or concentrations, no trend analyses, and no interpretation of the results. Because radiochemical analysis is a set of complex procedures, all radiochemical results should undergo data validation prior to use in the interpretation of results.

The analytical results reviewed were for both suspended solids (filter) and ground-water samples. As would be expected, suspended solid (filter) samples had generally higher readings than those for ground water. However, as presented, the raw data on the laboratory sheets are incomplete and cannot be used for interpretation. It should be noted that there were data missing from the filter data; no dry weight of the sample, no indication of the amount of water that had been filtered, no indication of the turbidity of the ground-water sample, and no indication of the activity of the filter paper prior to use were included. Additionally, the size of the filter pores was not listed. The size of the filter pores is important so that it can be determined if the analytical results are for metals contained in suspended solids or total mobile metals (for filter samples); and colloidal and dissolved metals or dissolved metals (for ground-water samples).

There must be supporting documentation for these tests somewhere in the records of either US or Ohio EPA. It is our understanding that all of the sampling was undertaken by one of the agencies and/or their own contractors and that the laboratory chosen were labs that US and/or Ohio EPA had used with confidence before. Yet somehow, the very documentation and data analysis that would normally be required to be submitted is not in the public record.

Information regarding background activities for the radiological parameters has not been determined for the site. Without this information, any interpretation of the results is impossible. The Science Advisory Board (SAB) (September 1994) emphasized the need to establish background values for radiological parameters of concern, and recommended the installation of 5 to 10 background wells. In order for the establishment of background values to be statistically valid, multiple rounds of sampling and analysis are required. They assumed, in 1994, that their recommendations would be followed.

Recommendations/Decision Tree

After the SAB released their report wherein they discussed issues related to the sampling and analyses of environmental media (e.g. temporal and spatial sampling and analyses, radiological parameters, criteria for data validation, etc.) the USEPA, the Nuclear Regulatory Commission, the Department of Energy, and the Department of Defense developed a Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM, December 1997). This document provides detailed guidance for planning, implementing and evaluating environmental and facility radiological surveys. Included in this manual are discussions regarding the development of Data Quality Objectives (DQOs) to ensure that the survey results are of sufficient quality and quantity to support the decision-making process; selecting appropriate measurement methods; assessing the survey results as part of the Data Quality Assessment (DQA) process, which includes the interpretation of the survey results; and Quality Assurance and Quality Control procedures.

Because this document is both formally recognized by the Federal government and also reflects the most current thinking, it is recommended that this document be used as guidance in developing a comprehensive approach to the radiological sampling and analyses for the IEL site. The document is available through the Superintendent of Documents (US Government Printing Office), the National Technical Information Service (NTIS), Federal agency information resource centers, and at the Nuclear Regulatory Commission's internet site.

Attached are the Table of Contents, Roadmap, Section 1, and flowcharts/decision trees from Section 2 of this document (here listed as Exhibit 38).

It is recommended that this process be evaluated for its use at the IEL site. It may be that some of the previous data developed for the site will fit into the framework and processes contained in this manual, assuming the supporting validation information can be located. If the data are adaptable to the processes, then the entire Data Life Cycle process may be shortened. It is believed, however, that validation of the data, by experienced radiological data validators must be performed. In addition, background values and statistical analysis will still be necessary. The interpretation of the results, and the determination of risk to human health and the environment, if any, should be done by, or under the direct supervision of, a health physicist who is experienced with such interpretations and determinations regarding radiological contamination of environmental media at similar sites.

Possible Sources of Radionuclides in the Landfill

There is only one confirmed source of radionuclide enrichment in the landfill; the fly ash. There have been additional discussions in the record of Cobalt-60 being used in the tire manufacturing process. There have also been statements about possible waste streams from the US Army. To date, it is our understanding, that none of the other sources have been confirmed. The fly ash, alone, is enough to create significant increases in radionuclide levels in the ground and surface waters, and produce increased concentrations of radon.

Because of the naturally occurring radionuclides contained in coal, disposal or dumping of other radioactive wastes at IEL is unnecessary in order to have elevated activities or concentrations of radiological parameters, mainly uranium and thorium, in ground water at the site, because these elements are contained in the fly ash (from combustion of coal) that was disposed of at IEL. In an article entitled *Coal Combustion: Nuclear Resource or Danger* by Alex Gabbard (Oak Ridge National Laboratory Web Page), uranium and thorium in coal and coal ash is discussed. Mr. Gabbard states that trace quantities of uranium in coal range from less than 1ppm in some samples to approximately 10 ppm in others. He also states that the amount of thorium contained in coal is about 2.5 times higher that the amount of uranium. He states:

> "During combustion, the volume of coal is reduced by over 85%, which increases the concentration of the metals originally in the coal. Although significant quantities of ash are retained by precipitators, heavy metals such as uranium tend to concentrate on the tiny glass spheres that make up the bulk of fly ash. This uranium is released to the atmosphere with the escaping fly ash, at about 1.0 % of the original amount, according to NCRP data. The retained ash is enriched in

uranium several times over the original uranium concentration in the coal because the uranium, and thorium, content is not decreased as the volume of coal is reduced."

In his conclusions section, he states:

> "...large quantities of uranium and thorium and other radioactive species in coal ash are not being treated as radioactive waste. These products emit low-level radiation, but because of regulatory difference, coal-fired power plants are allowed to release quantities of radioactive material that would provoke enormous public outcry if such amounts were released from nuclear facilities. Nuclear waste products from coal combustion are allowed to be dispersed throughout the biosphere in an unregulated manner. Collected nuclear wastes that accumulate on electric utility sites are not protected from weathering, thus exposing people to increasing quantities of radioactive isotopes through air and water movement and the food chain."

Because of the significant relevance of this paper to the large volume of fly ash buried at the IEL site, this entire paper is here included as Exhibit 39.

Coal is a natural substance, and as such, varies in chemical content from place to place. Information for Table 4 has been taken from Botoman and Stith, (1986 and 1988). This data reflects ODNR's data for coal mined in Stark County, Ohio. While there is no guarantee that the fly ash in the IEL landfill comes from Stark County coal, this coal supply is physically the closest supply to the Firestone facility in Akron where the coal was burned.

Table 4
Ash Content, Thorium and Uranium Contents (ppm)*of Stark County, Ohio Coal

Coal Seam	Ash Content	Whole Coal		Fired Ash Residue	
		Th	U	Th	U
Lower Mercer (No.3)					
Average	22.74	6.2	2.33	35	7.9
No. Samples	4	2	2	1	1
Range	38.4-7.9			35	7.9
Bedford					
Average	25.45	7.1	3.7	25	13
No. Samples	2	1	1	1	1
Range	26.2-24.7			25	13
Tionesta (No. 3B)					
Average	22.85	2.45	2.15	11.5	7.1
No. Samples	4	2	2	2	2
Range	33.1-12.7			14-9	7.2-7.0
Brookville No. 4					
Average	8.54	3.2	4.28	22.5	48.25
No. Samples	10	8	8	8	8
Range	15.8-4.2			33-14	110-10
Lower Kittanning No. 5					
Average	8.18	1.01	<1.11	11.68	<12.45
No. Samples	4	6	6	6	6
Range	8.7-7.7			23-5.2	18-<1.9
Strasburg (No. 5A)					
Average	10.85	1.3	0.8	11	7.2
No. Samples	2	1	1	1	1
Range	11.0-10.7			11	7.2
Middle Kittanning (No. 6)					
Average	9.43	1.93	2.69	21.86	31.26
No. Samples	8	7	7	7	7
Range	10.9-7.5			30-16	70-9.8
Lower Freeport (No. 6A)					
Average	18.3	4.7	2.6	24	13
No. Samples	2	1	1	1	1
Range	18.8			24	13
Upper Freeport (No. 7)					
Average	14.85	3.1	0.83	19.5	5.8
No. Samples	4	2	2	2	2
Range	17.9-11.6			25-14	7.1-4.5
Combined Coal Values Stark Cnty.					
Average	13.61	2.73	2.58	19.31	25.74
No. Samples	40	30	30	29	29
Range	38.4-4.2			35-5.2	110-<1.9

Note: Metal Measurements are in ppm.

Radon as By-Product

Radon is a natural by-product of the uranium decay chain. However, unlike the other metal products in the decay chain, radon is a gas. Furthermore, it is an inert gas that may share pathways with other gases (i.e. methane) and water, but it does not react. Harrell et al., in their 1993 ODNR publication Geological Control on Indoor Radon in Ohio state on page 1:

> "There are several isotopes of radon, but only one, radon-222, is abundant enough in Ohio to be hazardous. This isotope is a by-product of the radioactive decay series that begins with uranium-238 and proceeds through isotopes of several elements, ending with lead-210. The immediate precursor to radon-222 is radium-226. Radon is the only gaseous element in the decay series and so is highly mobile in the subsurface. The uranium-238 isotope accounts for about 99 percent of all uranium in the Earth's crust (Dyck, 1978), and uranium occurs in at least trace amounts in all earth materials. It has been estimated that, on average, rocks making up the continental crust contain from 2 to 3 parts per million (ppm) of uranium (Dyck, 1978). In areas where average crustal rocks are exposed at the surface, the concentrations of radon gas is on the order of 0.1 to 0.5 picocuries per liter (pCi/L) of air outdoors and 1.0 to 1.5 pCi/L indoors (Dyck, 1978; Gesell, 1983; Nero, 1988). These background levels are well below the 4.0 pCi/l "action threshold" recommended by the US EPA for house remediation."
>
> "Of particular concern in evaluating radon hazards are those areas underlain by earth materials containing amounts of uranium significantly above the crustal average. Although it is true that the amount of radon coming out of the ground is most directly related to the concentration of radium, this later element is almost always in secular equilibrium with uranium or close to it. For this reason and because the concentration of uranium is much easier to measure than that of radium, radon source materials are most appropriately characterized by their uranium content."

From Table 3, it can be established that mined coal from Stark County, when burned will have a range of uranium content from <1.0 to 110 pCi/L with an average around 25 to 26 pCi/L. If Harrell et al., (1993) is correct, then radon levels in basements near the IEL landfill could be in the range of 20 to 30 pCi/L, far in excess of the USEPA action level of 4 pCi/L. Table 5 presents data from Harrell et al, (1993) for Stark County as a whole; the Uniontown Zip Code of 44685; and the Hartville Zip Code of 44632. The geology of the Hartville Zip Code area is very similar to the geology of the Uniontown Zip Code area except that Hartville does not have the Uniontown IEL landfill with approximately 450 acre feet of fly ash.

Table 5
Radon Levels in Homes: Stark County, Ohio

Location	No.	Md	GM	AM	Q1	Q3	Min	Max	SD	CV
Stark Co.	773	3.5	3.4	5.6	1.8	6.6	0.1	68.7	6.7	120.4
Uniontown	53	4.6	5.1	9.1	2.1	10.2	0.6	61.1	12.3	135.1
Hartville	35	1.5	1.6	2.3	0.9	3.1	0.1	11.5	2.4	101.3

Abbreviations Used:

No.	Number of indoor radon measurements.
Md	Median radon concentrations.
GM	Geometric mean radon concentrations.
AM	Arithmetic mean radon concentrations.
Q1	First quartile (25^{th} percentile) of the radon concentration distribution.
Q3	Third quartile (75^{th} percentile) of the radon concentration distribution.
Min.	Minimum radon concentration.
Max.	Maximum radon concentration.
SD	Standard deviation of the radon concentration.
CV	Coefficient of variation for the radon concentration (i.e., SD/Amx100)

Note: All concentrations are in picocuries of radiation per radiation per liter of air

While these values represent random samples throughout the zip code areas, patterns are evident. There is substantially more radon in the Uniontown zip code area than in the Hartville zip code. The median level is above the USEPA action level. In all the categories, Uniontown citizens have a greater exposure than their neighbors to the immediate east. Yet, to date, there has been no radon investigation undertaken of any of the basements in the area of the landfill as part of the Superfund process. Furthermore, the high radon level at the landfill has been dismissed as "natural" background. Given what's in that landfill, Hartville is a better "natural" background for comparisons.

In light of these statements, the sampling and analysis of wastes contained in the landfill for the presence of radionuclides and radiological parameters (such as gross alpha, gross beta and radon), may, contrary to EPA findings of low-probability of detection, prove that a significant amount of radioactive material may be present in the landfill. Such a study, based on the Multi-Agency Radiation Survey and Site Investigation Manual should begin immediately and not be postponed until the revised Record of Decision is completed.

An Evaluation of "Low-Flow" Sampling

Ground-water monitoring at the site has historically included the collection of both filtered and unfiltered samples for the analysis of metals. The most recent sampling event, conducted and reported by Sharp & Associates, Inc. (December 1998), included the collection of "low-flow" samples. Low-flow sampling involves the careful monitoring and control of purge water, purge rate, water level, and water-quality characteristics to obtain analytical results representative of actual site conditions. Instead of the traditional purging of three to five well volumes from a monitoring well prior to sampling, the low-flow method is not reliant on the volume of water removed, relying instead on the stabilization of ground-water quality parameters. Rather than complete removal of the standing water in the well column, which allows aquifer water to subsequently enter the well, the method pulls water into the well through a discrete section of the screen at low flow rates. This approach allows the standing water to be bypassed.

Although individual applications may vary somewhat, there are several necessary components involved in low-flow sampling, and all are well-documented in the scientific literature (e.g., USEPA, 1994; Powell and Puls, 1993; Kearl et al., 1992; Puls, et al., 1992). One such component is careful monitoring and control of the water level in the well during purging. When pumping at low rates, the maximum change in water level in the well is held at one (1) foot or less. Adherence to this criterion is a good indication that the standing water is being bypassed and the sample is being drawn from a discrete screen zone. Another, closely related, criterion is the maintenance of a flow rate generally less than 300 mL/min. In general, the faster the pumping rate, the greater the possibility of suspending and mobilizing colloids in the ground water. Where the static water level is sufficiently shallow (<~15 to 20 feet), this criterion is best met using a peristaltic pump for metals sampling/analysis. At greater depths-to-water and where volatile compounds are concerned, bladder pumps or submersible pumps are more appropriate.

Of principal importance to successful low-flow sampling is the monitoring and stabilization of ground-water chemical parameters including pH, specific conductance, temperature, Eh (redox potential), dissolved oxygen, and turbidity. Purging continues until these field parameters reach steady-state, at which time sampling occurs. Steady state is typically defined as three or four consecutive readings in which: 1) Eh, specific conductance, turbidity, and dissolved oxygen do not change by more than ten (10) percent; and 2) temperature and pH do not change by more than one tenth of a unit. The goal for turbidity, because it is by definition a measure of suspended matter, is for readings less than 5 nephalometric turbidity units (NTUs).

Since low flow samples are representative of specific elevations, discrete samples, at different elevations are required for VOC's, DNPL's, etc.

Review of the Sharp report, however, indicates that many of these criteria were not satisfied during the September, 1998 sampling event. For example, review of the "Groundwater Sampling Forms" in Appendix A indicate that just two of the wells (MW-7S and MW-7I) were purged long enough to obtain turbidity values less than 5 NTU. In fact, many of the wells (i.e., 25I,16I, 12D, 17D, 20I) were sampled with turbidity readings greater than 1,000 NTU, and some wells exhibited rising turbidity readings throughout the purging (e.g., MW-26S, MW-25I, etc.).

An additional curiosity regarding turbidity is on the MW-12I field sheets. According to the sheets, MW-12I was sampled on September 15, 1998 at 1515 hrs. at a turbidity level of 25.0 NTU using a "low-flow bladder" pump; then, at 1625 hrs. the well was sampled at a turbidity level of 174.6 NTU using a bailer. The following day, the well was resampled (MW-12IRS) using the bladder pump. This time, however, the turbidity started at 109.4 NTU, but increased to 1,719.5 when the sample was collected 19 minutes later. No explanation for these changes is offered in the report or the log sheets.

Because the field sheets only occasionally include depth-to-water data during the purging process and do not include a flow rate (although one can be estimated in some instances from the volume data and the time) it is not possible to discern the cause of these high turbidity values. That is, it cannot be determined whether the cause is an excessively high pumping rate, poor well development, or actual aquifer effects in which colloids are naturally mobilized in the aquifer. In the case of MW-12IRS, it appears that most of the criteria were met (the water level was held constant and the flow rate is estimated to be one liter per minute, and the other parameters were stable), but the turbidity is excessively high. This situation may indicate either a poorly developed well, a problem with the pump, or a mobilization of colloids in the aquifer.

The issue of potential mobilization of colloids at the site is a serious issue for consideration. It is only with the advent of low-flow sampling that this issue has surfaced as an issue for IEL. Sampling data taken earlier than March 1997, did not contain basic information such as pH, temperature or turbidity. These sampling parameters are vital to the understanding of ground-water chemistry at a given location. Now, a subset of this information is available. A literature review indicates that turbidity in the form of colloids have been noted at other fly ash disposal sites. Gschwend et al., (1990), discuss the same type of experiences in monitoring ground water around a coal fly ash disposal site in the US southwest. Their abstract reads as follows:

> "We investigated groundwaters in the vicinity of a coal ash site near an electric generating station in the western USA. The purpose of the study was to ascertain why fine particles or colloids appear in some subsurface water samples there. If such fine particles are merely introduced during bailing or pumping operations which suspend otherwise immobile soil colloids, we should exclude these particulate materials from the water samples before analysis intended to quantify what is moving through the aquifer. However if the colloids were truly suspended and moving with the groundwater flow in situ, then we should include their contribution to our assessment of the mobile loads."

> "Applications of very careful sampling techniques (slow pumping rates, no atmospheric exposure) did not cause the large quantities of colloids observed previously to disappear from well water in which they occurred. Additionally, the same sampling procedures did not cause similar abundances of colloids to appear in waters collected from neighboring wells installed and developed in the same manner and in the same geologic strata. Thus we believe sampling artifacts do not explain the colloids' presence in the groundwater samples."

"On the other hand, the groundwater chemistry and the nature of the suspended colloids (size composition) strongly suggest these fine particles were suspended and therefore moving with the groundwater flow. At wells exhibiting large amounts of suspended colloids (~10 – 100 mg/L^{-1}), the water was enriched in CO_2 and depleted in O_2 relative to nearby locations. The colloids were typically between 0.1 and 2 μm in size and were primarily silicates. These results suggest to us that where infiltrating water is percolating through a site that has been mixed with coal ash, the secondary carbonate materials in the soils are dissolved; removal of the cementing carbonate phase may consequently release soil silicate colloids to be carried in the flowing water."

"Such processes may enhance contaminant transport in groundwater by augmenting the pollution load moving in the groundwater, and increasing the permeability of the porous medium to pollution infiltration with waste water and/or rainwater" (p 307).

While the Uniontown IEL site has a different geological setting, the presence of fly ash is similar. Also similar are the presence of cementing agents in the glacial kame moraine, here typically silica and iron oxides. Furthermore, because of the coarse nature of the glacial kame moraine setting, colloid material flowing with ground water is less likely to be filtered by the sand and gravel and may travel as part of the regional ground-water flow system. Given this understanding of the setting, the last paragraph of the paper is significant. It reads as follows:

"Further estimates of contaminant transport from the site should include consideration of colloid-associated movement. This case appears to illustrate a phenomenon likely to occur widely: that is, wherever the groundwater geochemistry has been "adjusted" by the activities of man to cause decementation (e.g., loss of carbonate or other phases like Fe-oxides which are important to other regions), soil colloids may be mobilized. If the solution and surface chemistries are suitable, these microparticles may be poorly filtered as they are carried through the porous medium, and thereby they may contribute to the subsurface transport of sorbed pollutants" (pp. 319-320).

Given the volume of heavy metals in the fly ash that must find some resting place, however temporarily, and the major debate about correct measurements for metals in a filtered vs. an unfiltered setting, this paper raises serious issues and suggests lines of exploration that should be undertaken if the contaminant transport mechanisms at this site are to be understood. While the sum effect of the observations on the September 1998 of low-flow sampling indicates that the ground-water regime at this site is not adequately understood, perhaps with the continued use of low flow sampling, especially on a quarterly basis as called for in the 1989 Record of Decision, the mechanics of the site and regional ground-water chemistry can be better evaluated.

An initial issue raised was the compatibility between the pre-low flow sampling and the current sampling results. One of the critical considerations in determining the compatibility of

the two sets of sample data is the level of turbidity in the samples. Given that the older samples did not include reported turbidity and given the fluctuation in this 1998 round of sampling, it is not possible to definitively answer that question. However, given the broad range in turbidity levels between the wells in just the September 1998 sampling, it may not be possible to compare even this round from well to well. With those considerations, including the detection limits on VOCs that this sampling round has, all comparisons made must be general in nature.

One major benefit from the low flow sampling method, when properly applied, is the assurance that the pH reading being reported is a stabilized aquifer value for that point in time at the general location of the monitoring well being sampled. Given the range of pH values reported during the March 1997 and September 1998 sampling events, pH values need to be carefully followed and charted to try to understand the source of the extreme variability in the acidity/alkalinity of the ground waters at the site. Assuming the low flow monitoring requirements are properly followed, it may be possible to sort out the pH "problem" and better understand the transport of heavy metals through the system.

Since so many firms have been involved in the sampling collection and analyses over the years and since results have been so inconsistent, it is imperative that US and Ohio EPA establish a clear, detailed procedure for sample collection at the site. This procedure should be based on the USEPA 1994 document and should be strictly followed by any team sent to sample the site and surrounding monitoring wells. Furthermore, when the results of the sampling are reported, each report should clearly note each point in which there were deviations from the approved sampling plan, with full explanations as to why those deviation occurred. In addition, where anomalous results exist, those anomalies should be fully explained as they relate to the general regional geochemistry and as they relate to the waste on site.

A Discussion on Historical Sampling and Laboratory Practices –

Of special note and concern are the laboratory detection limits. Although little laboratory documentation is provided with the three sets of ground-water sampling data reviewed for this report, there was a significant memorandum authored by Linda Kern, USEPA (July 18, 1995). In this memo, she lists, on Tables 2 and 3, summaries of each concentration of a contaminant over the MCL. These tables, (Exhibits40 and 41), show numerous "J" values. Of special significance is that several "J" values are orders of magnitude higher than the MCLs for those same contaminants.

This makes the rest of the data suspect as well. Proper laboratory procedures mandate that sample thresholds (minimum detection limits) clearly be lower than the USEPA Maximum Contaminant Level for the specific parameter being measured. A further review of more current sampling data indicates that this situation has not changed.

A second issue of concern is the treatment of detected VOC s in the last two sampling events. Review of the March 1997 and September 1998 data indicates that all VOCs detected in the monitoring wells outside the perimeter of the landfill were attributed to laboratory errors. While a number of these readings were not significantly elevated, the VOCs detected had previously been identified as being derived from the landfill. Furthermore, in spite of the

documentation that assures all readers that the site has been cleaned up, levels of Benzene have reached their all time high of 8,300 µg/L at MW-14S. Therefore, present contaminant levels cannot be explained by artifacts of sample or laboratory errors alone.

A Discussion on Bioremediation and/or Natural Attenuation

Bioremediation and natural attenuation have been well documented for petroleum hydrocarbon fuel contaminated sites (Cookson, 1995). The issue usually comes down to comparing the rate of degradation to the time required for the contamination to reach the nearest receptor. For a site having distant receptors, relatively slow transport rates, and an environmental setting shown to be conducive to bioremediation, a natural attenuation plan may be the best choice, along with the enhanced monitoring program that should always accompany such a plan. However, if the degradation rates are slow, receptors are nearby, and the rate of transport is fast, active remediation is usually to be preferred (Brady et al.,1998). At the IEL site, degradation rates have not yet been determined, either through field or laboratory studies, however it is clear that both human and ecological receptors are very near, and ground-water flow rates are very fast.

The protocol developed by the Air Force Center for Environmental Excellence and USEPA's Kerr Environmental Research Center is a good framework for making decisions about natural attenuation. The eight-step protocol is as follows (Wiedemeier et al., 1995):

1. Site characterization,
2. Develop preliminary conceptual model,
3. Perform site characterization in support of natural attenuation,
4. Document indicators of natural attenuation and refine conceptual model,
5. Numerically simulate geochemical fate and transport of contamination including biodegradation rate values,
6. Analyze and identify receptors' exposure pathways,
7. Develop long term monitoring plan,
8. Obtain necessary permits.

Burdick et al., (1997), in Evaluation of Groundwater Chemistry and Natural Attenuation Processes at the Industrial Excess Landfill cite Wiedemeier et al., (1995), but do not follow this protocol in their evaluation of IEL. The third and fourth steps of the protocol are critical: site characterization and documentation of attenuation indicators. The factors affecting biotransformations in the subsurface include: pH, temperature, water content, carbon content, clay content, availability of oxygen or other electron acceptors, oxidation-reduction potential, nutrient availability, types of microorganisms present, acclimation of the microbial consortia, and microbial toxicity of the contaminants. Measurements of these factors are needed over a period of time and over the full site, including downgradient and truly upgradient areas. It is necessary to determine the geochemistry of the subsurface materials (e.g., mineralogy, grain size, organic matter, texture, biological activity, cation exchange capacity) and the ground water (e.g., temperature, pH, Eh, alkalinity, total dissolved solids, dissolved oxygen, iron, manganese, major cations and anions: Ca, Mg, Na, K, Cl, HCO3, SO4, NO3) at the site.

The limited information that has been gathered at IEL does not indicate optimal conditions for bioremediation. For example, biotransformations are most effective at near-neutral pH conditions. The pHs measured in ground water at IEL during the 1997 and 1998 sampling events show highly variable and, in some cases, extremely basic pH conditions (e.g., 11.97 at MW-11D). High clay content can enhance sorption, but the IEL site is low in clay content as described earlier in this report.

Lines of evidence must be established to prove that attenuation is occurring. Different classes of contaminants must be approached differently when assessing the feasibility of natural attenuation. For simplicity, three broad classes: petroleum hydrocarbons (benzene, toluene, etc.), chlorinated hydrocarbons (PCE, TCE, etc.), and metals are discussed. Compounds representing all three classes have been documented present in ground water at IEL through the most recent September 1998 sampling event.

For petroleum hydrocarbons, the lines of evidence include (Brady et al.,1998; Cookson, 1995):

- Disappearance or reduced concentrations of the compound downgradient along the flow path, especially in comparison with non-reactive tracer compounds,
- Appearance of metabolic degradation by-products (e.g., carbon dioxide, hydrogen sulfide, methane), lowered alkalinity, lowered pH, and mobilized iron and manganese ions,
- Loss of electron acceptors such as oxygen, nitrate, sulfate, and carbon dioxide (usually depleted in that order) in comparison to background levels,
- Loss of electron donors such as native total organic carbon (TOC), and
- Oxidative environment downgradient of the plume (high dissolved oxygen, high nitrate, low ferrous iron, high Eh or redox potential),

For chlorinated aliphatic hydrocarbons, the lines of evidence also include (Brady et al.,1998):

- Appearance of daughter compounds (for example DCE, vinyl chloride, and chloride ions),
- Microbiological laboratory data which document the presence of organisms capable of degrading chlorinated compounds, and
- Reductive (anaerobic) environment alternating with oxidizing (aerobic) environment.

The sequential metabolism required to degrade chlorinated aliphatics can be aerobic to anaerobic, anaerobic to aerobic, or anaerobic to aerobic to anaerobic to aerobic (Baker and Herson, 1994). The specific pathway required is usually specific to the compound being degraded, the microbial consortia present in the subsurface, and the redox conditions in the aquifer. Because of this complexity, complete degradation of the parent compound may not occur, and intermediate daughter compounds having greater toxicity than the parent compound may accumulate. It is therefore very important to show that complete degradation is taking place. The high and, in most cases, increasing concentrations of vinyl chloride, chloroethane, 1,1-dichloroethane, and 1,2- dichloroethane in monitoring wells at IEL suggest that incomplete

dechlorination is in fact occurring, thereby releasing these more toxic and more mobile daughter compounds.

Establishing lines of evidence for natural attenuation of metals and radionuclides is more problematic. Metals and radioactive materials are not biodegradable (Baker and Herson, 1994). Because metals cannot be broken down or degraded, the goal becomes transforming them into less bioavailable forms or immobilizing them through sorption or precipitation. These reactions are usually very dependent on pH and Eh levels, and these conditions must be maintained in perpetuity, or the metals will again be released.

Chromium, nickel, and lead, all of which are documented as present at IEL, are capable of being adsorbed to iron hydroxides. Nickel and lead are also sorbed to carbonate minerals. However, low pH will destabilize iron hydroxides and carbonates. Low Eh dissolves iron hydroxides. Lead can also be sorbed to organic material; the other two do not. Lead can also bind with sulfide to form insoluble precipitates; low Eh favors sulfide precipitate formation (but dissolves the iron hydroxides that may be sorbing the other two metals). It is important to consult metal speciation diagrams of Eh versus pH to determine if a metal precipitate is going to be in its stable phase given the subsurface geochemistry of the site. The presence of organic acids (a metabolic by-product of anaerobic biodegradation of organic compounds) or chelating agents, such as EDTA, reduce the ability of the metals to sorb to other materials. Laboratory testing of the sorptive ability of the subsurface materials and subsequent leachability of the sorbed metals will be required to establish if there is a potential for metals immobilization at IEL.

Each metal is different in its attenuation pathway as shown in Exhibit 42 reproduced from Brady et al., (1998). Exhibit 43 summarizes the data needed to determine potential attenuation mechanisms on a metal-by-metal basis. In any sorption or precipitation process, it must be remembered that a change in site geochemistry can cause contaminant sinks to become future sources of re-released contamination. There have not been enough geochemical data collected at IEL to establish whether the ground water beneath the site has reached geochemical equilibrium, let alone what must be done to maintain that equilibrium in the future. The variation shown in pH actually indicates that the opposite, or non-equilibrium, is the prevailing condition.

The report by Burdick et al. (1997), while providing good generic background information on natural attenuation processes, fails to make a strong case that anything other than dilution is occurring at the IEL site. The paucity of geochemical and microbial data collected at the site makes the report's statements of natural attenuation mechanisms present at IEL hypothetical at best. Several of the mechanisms described, such as sorption to clays, are not even applicable to this site. Under CERCLA, the statutory preference is for remedies which permanently and significantly reduce the volume, toxicity, or mobility of hazardous substances (CERCLA Sections 118 and 121(b)(1), 42 USC § 9618 and 9624 (b)(1)). Dilution, one of the primary mechanisms of natural attenuation at IEL as reported by Burdick et al. (1997), does not accomplish CERCLA's stated goals. Decreases in concentrations, especially of non-biodegradable and often bioaccumulated contaminants such as metals and radionuclides, do not constitute a decrease in contaminant mass, nor a decrease in volume or toxicity. Given the increases in concentrations of volatile organics (benzene, chloroethane, 1,1-dichloroethane, and

1,2- dichloroethane) noted during the 1997 and 1998 sampling events, even the dilution due to almost one billion gallons of water flushing through the Industrial Excess Landfill is inadequate to maintain contaminant concentrations below MCLs.

Landfill Cap Design

The Final Remedial Design has not yet been released. Therefore, our comments on the proposed landfill cap design are based upon the general information given in the January 1999 Fact Sheet entitled "USEPA proposes changes to the cleanup plan for the Industrial Excess Landfill Superfund site". The 1989 Record of Decision calls for a multi-layer RCRA Subtitle C compliant cap to be installed over the entire surface of the landfill. The bottom barrier of the cover was to have been a 24-inch compacted clay layer. The 1999 proposed change is to replace this clay liner with a synthetic liner. This is presented by the USEPA as a change in methodology, not a change in the design goal for the cap itself. The proposed multiple layer cap will purportedly meet the same impermeability design goal as the previously proposed RCRA Subtitle C cap. Therefore the revised cap will, if constructed in accordance to the specifications, provide equal or better protection.

USEPA's 1991 seminar publication "Design and Construction of RCRA/CERCLA Final Covers" recommends the following design including a gas venting option:

1. 60 cm (24 in) vegetation/soil top layer including 6 in topsoil,
2. geosynthetic filter layer,
3. 30 cm (12 in) drainage layer of granular material or equivalent geosynthetic,
4. 60 cm (24 in) low hydraulic conductivity geomembrane / clay layer,
5. geosynthetic filter,
6. 30 cm (12 in) gas vent layer,
7. waste.

Both geosynthetic filter layers in this standard generic RCRA cap serve to prevent fine grained soil materials from clogging the more porous drainage / gas venting layer directly below. In general, CERCLA regulations refer to RCRA Subtitle C regulations. However, the generic RCRA cap design may be modified using innovative or site-specific information as long as "these alternative designs [are] demonstrated to be equivalent in performance to the generic design proposed by EPA (USEPA, 1991). The proposed new cap design for IEL consists of the following (USEPA, 1999):

1. 6 in topsoil,
2. 18 in top fill,
3. drainage layer using geonet / geotextile having a minimum hydraulic conductivity of 10^{-2} cm/sec,
4. geosynthetic liner at least 30 mil thick,
5. 12 in sub-base and gas collection layer,
6. recompacted existing soil cover, augmented as needed, and
7. waste.

The significant differences between the two cap designs are:

- Substitution of geonet for 12-in drainage layer with geofilter.
- Substitution of 30 mil geosynthetic liner for 24-in low hydraulic conductivity geomembrane / clay layer with geofilter.

The first substitution is consistent with current practice and is listed as an acceptable alternative in the EPA (1991) document. The second substitution deserves closer examination. Tchobanoglous et al. (1993) recommends use of one or more geomembranes as the barrier layer, citing a number of problems inherent with the use of clay barrier layers including compaction difficulties, desiccation cracking, freeze-thaw damage, rupture by burrowing animals, and cracking due to differential settling. Bagchi (1994) recommends that if a synthetic membrane is used as a barrier layer, it should be a minimum of 40 mil thick and preferably 60 to 80 mil. McBean et al. (1995) emphasizes that stringent QA/QC programs, although costly (7 percent to 12 percent of the total cost of the cap materials and installation), must be adhered to during the installation of geomembrane liners to assure integrity of the finished barrier system.

It should be noted that the Fact Sheet (USEPA, 1999) cites two reasons for proposing to substitute a geosynthetic liner for the clay layer: (1) Agency experience with using synthetics since 1989 and (2) lack of a nearby borrow source. The second reason confirms the lack of clay materials in the Uniontown area soils. The same well-washed sand and gravels that characterize the IEL site, providing little native material for a clay cap, also cause site hydraulic conductivities to be very high and contaminant adsorption potentials to be very low.

A concern has been voiced about the weight of the final cap forcing leachate out of the landfill. The weight of the future cap must be compared with the present weight of infiltrating water which fills and flows through the landfill in the cap's absence. Beyond this, the question of cap weight demonstrates a lack of understanding of the mechanisms of cap support and construction.

Other issues that must be addressed in the final cap design are the current lack of low-permeability sidewalls on the landfill and the surface water drainage control system. Stormwater runoff quantities must be calculated, and perimeter channel locations and sizes properly designed to collect runoff and prevent runon from offsite areas. The runoff must be conveyed far enough away from the landfill via lined channels or storm sewer lines so that the stormwater will not infiltrate through the permeable kame materials and re-enter the landfill through the permeable sides. If a subsurface stormwater collection system is to be used, the gravel-packed utility trench that will hold the storm sewer pipe must be designed to not provide an additional route for gas migration to nearby residences.

Missing and/or Incomplete Items from the 1989 Record of Decision

In July 1989, USEPA issued its Industrial Excess Landfill Superfund Site Record of Decision & Responsiveness Summary. Hearings had been held, facts collected, a final Report of Investigation (1988) released and a Feasibility Study (1988) completed. While the Record of

Decision noted a number of unanswered questions from the investigation period, and questions that needed to be addressed during the design phase of the project, a plan was in place and the movement was forward.

Some emergency conditions had been addressed; water was piped to a number of homes in the area and a partly operational gas collection and destruction system was installed and operating. The Record of Decision outlined a final solution to the site's management. It included several basic efforts. They were:

1. The installation of a design that would both prevent the infiltration of water through the cap and would also serve as part of the gas collection and destruction system;
2. The expansion of the gas collection and destruction system;
3. The installation of a pump and treat system that would collect the contaminated ground water off site and treat it to MCL levels before releasing it to Metzger's Ditch. The pump and treat system was also designed to lower the water table under the landfill so that the waste would not be in the saturated zone. There were several subsets of the pump and treat system that had to be completed before it was designed and installed.
   a. Pumping tests had to be conducted to determine more accurately the hydraulic conductivity of the sand and gravel aquifer that houses the landfill.
   b. An accurate and supportable ground-water model had to be constructed so that various design scenarios could be "field tested" before the final pump and treat design was installed;
4. Organized and ongoing monitoring of the area was to be conducted. For the first four years, all sampling was to be completed on a quarterly basis. After that, sampling was required on a semi-annual basis for the life of the oversight of the landfill. No cutoff date was determined;
5. Surface water and sediment cleanup was to be undertaken. Surface water was to be treated in the ground-water treatment system. Sediment from the on-site surface ponds and from the contaminated portions of Metzger's Ditch were to be dredged and disposed of properly;
6. Organized and ongoing monitoring of Metzger's Ditch and other surface water points around the landfill was to continue during the remediation process and remedial actions were to be employed when necessary; and
7. Land acquisition was to occur to allow for the expansion of capped areas, working areas, and to limit ongoing human exposure to the site.

In addition, the Record of Decision identified a list of "data gaps" that needed to be addressed while the design phase moved forward. Those gaps included the following list taken from pages 7 and 8 of the 1989 Record of Decision:

"1) Determine the full extent and nature of groundwater contamination;
2) Define hydrogeological conditions within, beneath, and around the landfill;
3) Determine if light or dense NAPLs are present;

4) Characterize the chemical nature of on-site landfill gas, generation rate, migration potential, and pathways at different depths within the landfill;
5) Characterize the nature, extent, and off-site migration potential of soil gases;
6) Confirm results of the Remedial Investigation regarding off-site soil and sediment analyses; and
7) Evaluate factors affecting RCRA cap design such as settling, erosion potential, water balance, and permeability."

Most importantly, all of the remediation on site was to meet the criteria set forth in the Applicable Relevant Appropriate Regulations, the "ARARs". This issue is discussed on pages 28 through 32 of the report, here submitted as Exhibit 44 and discussed later in this text.

For several years, the effort moved forward. From the beginning, the PRPs were not particularly responsive in implementing the action items. As is typical in these situations, they questioned the need for each step of the clean-up effort, holding up the process at each decision point with series of comments, many of which were determined to be irrelevant by the agencies who were part of the review process. Nowhere is this disagreement of fact between the regulators and the PRPs more clearly demonstrated than in the July 18, 1995 memorandum from Linda Kern, USEPA to the Industrial Excess Landfill Technical Information Committee, RE: Transmittal of US EPA Responses to Comments Received on the 60% Remedial Design for the Industrial Excess Landfill. On page 2 and 3 of this memorandum Ms. Kern states:

> "On December 12, 1994, EPA received a position paper and technical comments on the 60% design, submitted by Burlington Environment, Inc. on behalf of several rubber companies that are PRPs (BF Goodrich Company, Bridgestone/Firestone, Inc., GenCorp, Inc., and The Goodyear Tire and Rubber Company [the rubber companies] footnote 1) for the IEL site. On the same day, EPA received a letter from Louis E. Tosi, counsel to some of the rubber companies, requesting that EPA include the rubber companies' paper in the administrative record and that EPA consider the comments before proceeding any further with the remedy. The rubber companies' position paper reiterates comments they made in 1989 when the IEL remedy was proposed, questioning the necessity for any additional remedial action at the landfill. The rubber companies allege that data collected during the remedial design phase reinforce their conclusion that the remedy EPA selected is unwarranted.
>
> "What follows is EPA's response. It is based upon EPA's evaluation of: (1) the technical validity of the rubber companies' comments; (2) consistency with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601-9675, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300; (3) consistency with the IEL record of decision (ROD) issued in July 1989; and (4) consistency with EPA guidance and policy."
>
> "EPA's responses are organized to address each specific section of the rubber companies' position paper and technical comments. EPA responses to Appendix

A of the position paper (groundwater modeling results) are presented in Attachment 1. The rubber companies' position paper and comments together with Mr. Tosi's letter are appended as Attachment 2."

What follows are 29 pages of comments and another 19 pages of maps and tables that document in very specific detail just why the PRPs position is without merit. Her topic headings include the following:

1. Response to Section 1.0: The Rubber Companies mischaracterize the nature of the Site and discount the long-term risks it poses;
2. Response to Section 2.0:
   a. 2.1: Neither the removal actions conducted at the Site nor the data collected during remedial design invalidate the remedy selected in the existing Record of Decision,
   b. 2.2: Groundwater remediation is warranted,
   c. 2.3: Capping the Site is warranted, and
   d. 2.4: EPA Guidance on closure does not support a "no-action" remedy at IEL.
3. Response to Section 3.0, Technical Comments on 60 Percent Remedial Design Report and Related Documents:
   a. 3.1: Response to Comments on "Revised Responses to Comments on Draft Preliminary Design Report for Industrial Excess Landfill Site, Uniontown, Ohio, Addendum Report" (June 1994),
   b. 3.2: Responses to Comments on 60 Percent Design of Phase 1, Landfill Cap and Landfill Gas Extraction and Treatment System,
   c. 3.3: Response to Comments on the "Assessment of Air Emissions for Landfill Gas Extraction and Treatment System, Industrial Excess Landfill Site, Uniontown, Ohio, Revised Draft Report", and
   d. 3.4: Response to Comments on "Geosynthetic Clay Liner Proposal for Industrial Excess Landfill".
4. Draft Response to Appendix A, Results of Groundwater Modeling Conducted by Burlington Environmental, Inc. for the Industrial Excess Landfill Site Uniontown, Ohio (review of the first simple groundwater model, not the model reviewed in this document).

US and Ohio EPA were not adequately responsive during the years following the ROD. Sampling undertaken by the two agencies and/or their contractors were often less than adequately collected or analyzed. For one reason or another, virtually all of the radiological sampling undertaken at the facility was invalidated. That sampling was not the responsibility of the PRPs , but the responsibility of the agencies in control of the regulatory enforcement. When the Scientific Advisory Board called for resampling for radionuclides in 1994, that advice was ignored and the radiation issue was left unresolved.

Somehow, over the years, the process that started so positively in 1989 got bogged down in bureaucracy and legal maneuvering. Now, ten (10) years later instead of having a site contained and monitored, the community finds themselves back to where they were in the 1980's, creating yet another Record of Decision with yet a new list of objectives to be

completed. However, during those ten (10) years, another 20 feet of rain water has infiltrated the landfill from the surface, flowed through the wastes and entered the ground water system, trailing another ten (10) years worth of contaminants with it. In addition, ten (10) more years of gas have migrated out through the surface of the landfill into the airshed. Ten (10) more years of radon gas have moved away from the site. For ten (10) more years, the contaminated sediments in Metzger's Ditch have remained in place to be leached and carried down stream into the backyards of a heavily residential community.

To date, from the information provided to us for review, it appears that the following list of items identified in the 1989 Record of Decision have not been completed. Where we have been able to identify reasons for non-completion, they are listed.

1. No cap has been installed. Water is still infiltrating through the waste and gas is still escaping. Furthermore, the document generated by Tetra Tech for USEPA in 1998 to determine the current level of site infiltration is incorrect. It appears that the report and model were developed with no site-specific information.
2. With the exception of a few wells tied into the existing system, the gas collection and destruction system has not been expanded, certainly not enough to cover the whole site. In addition, the current system is still operating under emergency status, 12 years after installation. The system has not been permitted to meet local air quality requirements.
3. No pump and treat system has been installed. While the agencies are now arguing that the levels in the ground water monitoring wells appear to be cleaned up, therefore the pump and treat system is not needed, they are ignoring two critical factors. Originally the system was designed to serve three purposes: 1) the clean-up of the contaminated ground water; 2) the lowering of the water table that is currently either in the waste or very near the waste, and 3) the clean-up of contaminated surface water, both on site and collections from off site.

   While it is debated as to whether the ground water has been cleaned up, through whatever mechanism, clearly the issues of waste in the water and remediation of contaminated surface water have been lost in the ongoing dialogue. Those two critical issues should be returned to the discussion. In addition,

   a. No pumping tests have been conducted. The reasoning behind not conducting such a test was because there was no way to manage all of the contaminated water that would be generated (Ohio EPA, March 17, 1999). This is not a valid reason for not acquiring field data. If, in fact, the levels of contamination are now judged to be low, the cost of treating this water before discharge will be minimal. OEPA should not be permitted to avoid the discharge issue. These tests should be used to generate necessary information needed to accurately understand the disposition of contamination moving from the site.
   b. To date, no one has run an "accurate and supportable" ground-water model. Three have been conducted: 1) a simple one by Burlington Environmental; 2) a Modflow model by Earth Sciences, here reviewed, and 3) another simple one by Ohio EPA. None of these are accurate.

Further, it is not possible to design an adequate dewatering system that is needed to lower the water table to below the waste, nor to evaluate the mechanism for disposing /treating this water. Even if it is finally determined that the surrounding ground water has sufficiently diluted the contaminants leaching from the landfill, and even if a proper cap is installed, there is still an expectation that the bottom of the waste will be in ground water and contamination will continue to be leached out of the site. The only realistic remedy to this situation is a dewatering and treatment system.

4. There has been no organized or ongoing monitoring of the area. Ground-water sampling has been sporadic and incomplete. Surface water and sediment sampling has been deficient. Gas monitoring has been inconsistent and incomplete.
5. Surface water and sediment cleanup has not been undertaken.
6. There has been no organized and ongoing monitoring of Metzger's Ditch and other surface water points. To date, no data had been reviewed that indicates that any monitoring of those sites has taken place since the 1988 Report of Investigation was completed.
7. Some land was acquired. It appears that this portion of the Record of Decision was completed.
8. There has been no "determin(ation of) the full extent and nature of groundwater contamination" as identified as a data gap.
9. There has been no "defin(ation of the) hydrogeological conditions within, beneath and around the landfill" as identified as a data gap.
10. There has been no "determin(ation) if light or dense NAPLs are present" as identified as a data gap.
11. There has been no full attempt to "characterize the chemical nature of on-site landfill gas, generation rate, migration potential, and pathways at different depths within the landfill" as identified as a data gap.
12. There has been no full attempt to "characterize the nature, extent, and off-site migration potential of soil gases" as identified as a data gap.
13. There has been no full attempt to "confirm results of the Remedial Investigation regarding off-site soil and sediment analyses" as identified as a data gap.
14. There has been no apparent attempt to "evaluate factors affecting RCRA cap design such as settling, erosion potential, water balance, and permeability" as identified as a data gap unless the Tetra Tech 1998 HELP model is meant to address a portion of this assignment.

There exists the possibility that some of these above listed deficiencies have been begun or completed in other documentation that has not been reviewed as part of this report. If those documents have adequately addressed these missing factors, then this list can be shortened.

A Discussion on the Applicable Relevant Appropriate Regulations

As part of the final Record of Decision, USEPA discussed at length the necessity that any and all actions on the landfill site had to also be in compliance with all other relevant US and Ohio laws governing the handling of hazardous wastes. Pages 28 to 32 of the Record of Decision have been included here as Exhibit 44.

Since 1989, many of Ohio's regulations have been modified. In addition, new regulations have been implemented. In Exhibit 45, Ohio Universal ARARs has been modified to list only applicable relevant appropriate regulations that may pertain to this site. Each regulation listed should be reviewed for applicability. Assuming applicability is appropriate, final closure and ongoing monitoring of the IEL landfill must also meet these Ohio regulations.

Summary Points and Recommendations for an Ongoing Testing Program

The following items are recommended in response to the proposed changes and the ongoing status of the IEL:

Recommendations Regarding Natural Attenuation

In response to the proposed natural attenuation plan, an expanded monitoring and sampling program is recommended. New background monitoring wells must be installed. Current "background" wells (MW-12 and MW-20) are suspect. MW-20 is within the radial zone of influence of the hydraulic mound beneath the landfill. MW-12 is of questionable integrity due to using flush mounted construction in an area that makes the well a likely collector for runoff of road salts and oils. In addition, MW-12 is side gradient to the landfill with a low trough in between (Dumouchelle and Bair, 1994). If water levels rise in the landfill, especially during the late spring and early summer when ground water-recharge has ended for the area around MW-12, MW-12 will become a downgradient well, and therefore may become contaminated from leachate from the landfill.

It is recommended that geochemical analyses of ground water in monitoring wells be performed to determine mechanisms for natural attenuation and establish lines of evidence that bioremediation is or is not occurring at IEL. Sampling four to six wells per strata (shallow, intermediate, bedrock) per setting (source area, downgradient plume area, and background) is necessary. Sampling should be repeated over a period of time to allow investigators to account for seasonal variations and to see development of trends over time. The following analyses should be performed, at the minimum, on the collected ground-water samples:

1. Contaminants identified at IEL and their daughter products (e.g., one degradation sequence for PCE is: tetrachloroethylene, PCE → trichloroethylene, TCE → 1,2-dichloroethylene, DCE → vinyl chloride, VC → ethylene);

2. Inorganic cations (both field-filtered and unfiltered samples): Calcium (Ca), Iron (Fe), Magnesium (Mg), Manganese (Mn), Potassium (K), Sodium (Na) and radionuclides;

3. Inorganic anions (unfiltered): Alkalinity, Chloride (Cl), Nitrate (NO_3), Sulfide (S), and Sulfate (SO_4);

4. Other analyses: dissolved methane, dissolved carbon dioxide (CO_2), total suspended solids (TSS) unfiltered, microbiological concentration (direct counts or agar plate counts) and total organic carbon (TOC) both field-filtered and unfiltered; and

5. Field measurements: Turbidity, temperature, pH, dissolved oxygen (DO), methane, Oxidation-reduction potential (Eh), and specific conductance.

It is also recommended that shallow soil gas samples be taken in the three settings (source area, down gradient plume area, and background). These samples should be analyzed for methane, hydrogen sulfide, and carbon dioxide. Again, four to six locations per setting are recommended.

It is recommended that subsurface soil samples be collected and analyzed for total organic carbon (TOC), sieve analysis plus hydrometer (clay content), cation exchange capacity, iron hydroxide, manganese oxide, calcium carbonate, and microbiological concentration (direct counts or agar plate counts).

It is recommended that precipitation records be maintained in conjunction with ground-water sampling dates, so that correlations may be drawn between changing contaminant concentrations and changing infiltration rates.

Finally, it is recommended that more careful QA/QC be performed on all laboratory analyses (e.g., no more "J" values above MCLs).

Recommendations about Fate of Released Contaminants

A separate investigation should be undertaken to determine the fate of the contaminants that have been released from the site over the past three plus decades. This investigation should include both sampling and modeling efforts. A numerical model that includes the ground water / surface water interactions prevalent in kame and kettle settings should be developed to guide the sampling planning. A model should also be developed to predict the impact of the cap on water table beneath the waste. A model(s) will also be effective to evaluate the dewatering program, evaluating the quantity and determining the cost of treating the removed water to MCLs before release.

In support of the modeling effort, good hydraulic data must be developed. A definitive, and relatively inexpensive, program for making meaningful hydraulic determinations includes the following:

a) develop a detailed stratigraphic model of the site, based on existing wells;

b) conduct a few (four to six) small-scale pumping tests in specific zones, minimizing the quantity of discharge water that must be treated and discharged;
c) conduct a few tracer tests;
d) collect sufficient reliable samples, with gradation analyses, to permit vertical profiling and calculation of transmissivities. This will require additional drilling;
e) utilize existing wells, and access others if necessary, and monitor the pumping cycles of the adjacent irrigation wells;
f) develop continuous records of precipitation events, runoff, and ground-water fluctuations;
g) develop a water balance for the site; and
h) re-evaluate the stratigraphic model.

When all or mopst of these data are available, a meaningful model of flow in both the vadose and saturated zones can be developed. This, in turn, will provide both method and meaning to sampling, plume delineation, and predictive planning. The basic data can all be acquired within six months, if there is a desire to do so.

Sampling should be undertaken of shallow and deep sediments in the down gradient bogs, wetlands, and small ponds. These samples should be analyzed for IEL contaminants and their daughter compounds and for geochemical and bioremediation indicators. Bogs and lakes to the east, south and west that serve as ground-water discharge points should be first priority. For locations of these higher priority wetlands, see Exhibit 46.

Biological surveys should be completed for the downgradient receptor surface water bodies. These surveys should include macroinvertebrates, fish populations and tissue samples, plant tissue samples, algae communities and organic materials in the muck soil peat bogs.

Utility trenches along Cleveland Avenue and Carl Street should be investigated as potential pathways for gas contaminant migration. Gas samples collected from the gravel bedding within the trenches should be analyzed for methane, radon, and volatile organic hydrocarbons.

Basements of local residences within a minimum of a thousand feet of the landfill perimeter and along preferential migration routes (e.g., utility trenches) should have air sampling programs. The collected air samples should be analyzed for methane, radon, and volatile organic hydrocarbons.

Surface soil downgradient of prevailing winds should be sampled and analyzed for known IEL metal contaminants.

Recommendations in Support of the Proposed Conceptual Remedial Design

It is recommended that the IEL site be capped with the proposed modified RCRA Subtitle C multiple layer cap. In conjunction with the cap installation, the active gas collection system should be expanded to ensure that all gas from the entire landfill is collected. This needs to be supported by demonstration of overlapping cones of influence and permanent gas monitoring

probes on the property that demonstrate complete capture. The gas flare system should be designed and permitted to maximize contaminant destruction and minimize air pollution. A permit for this system should be obtained.

Recommendations for Health Survey

It is recommended that an appropriate health survey be performed in the Uniontown area that either allays or confirms residents' fears. This will provide scientific evidence that background expected cancer rates have or have not been exceeded in the IEL area.

Recommendations for Radionuclide Survey

It is recommended that USEPA follow the recommendations of the Science Advisory Board (1994) in undertaking quarterly radionuclide sampling of ground water. The report noted problems in the inadequacy of the background wells and technical flaws in studies supporting EPA's sampling program, but stated:

> "Despite these problems, we believe that EPA has looked hard for signs of radioactive contamination and has not found clear evidence to support a claim of past radioactive dumping. That does not imply that such dumping did not occur, only that presently there is little or no evidence for it. We see no basis for substantial additional radiation testing at the IEL site; however it would be prudent after remediation to test a sample of the pump and treat water flow for radiation at least each calendar quarter until the successive quarterly samples have produced a constant level of near-basal gross alpha and beta activity" (p. 3).

Because a pump-and-treat system is no longer being recommended by EPA in the proposed Record of Decision revision, it is important to carry out the prudent advice of the Science Advisory Board report by performing quarterly gross alpha and beta sampling. It should be noted again that radiation could be the result of naturally occurring uranium in Ohio coals being concentrated through combustion to high levels in the fly ash. It is not necessary to prove that past dumping of radioactive materials occurred, only that the fly ash itself was a sufficient source of radioactivity.

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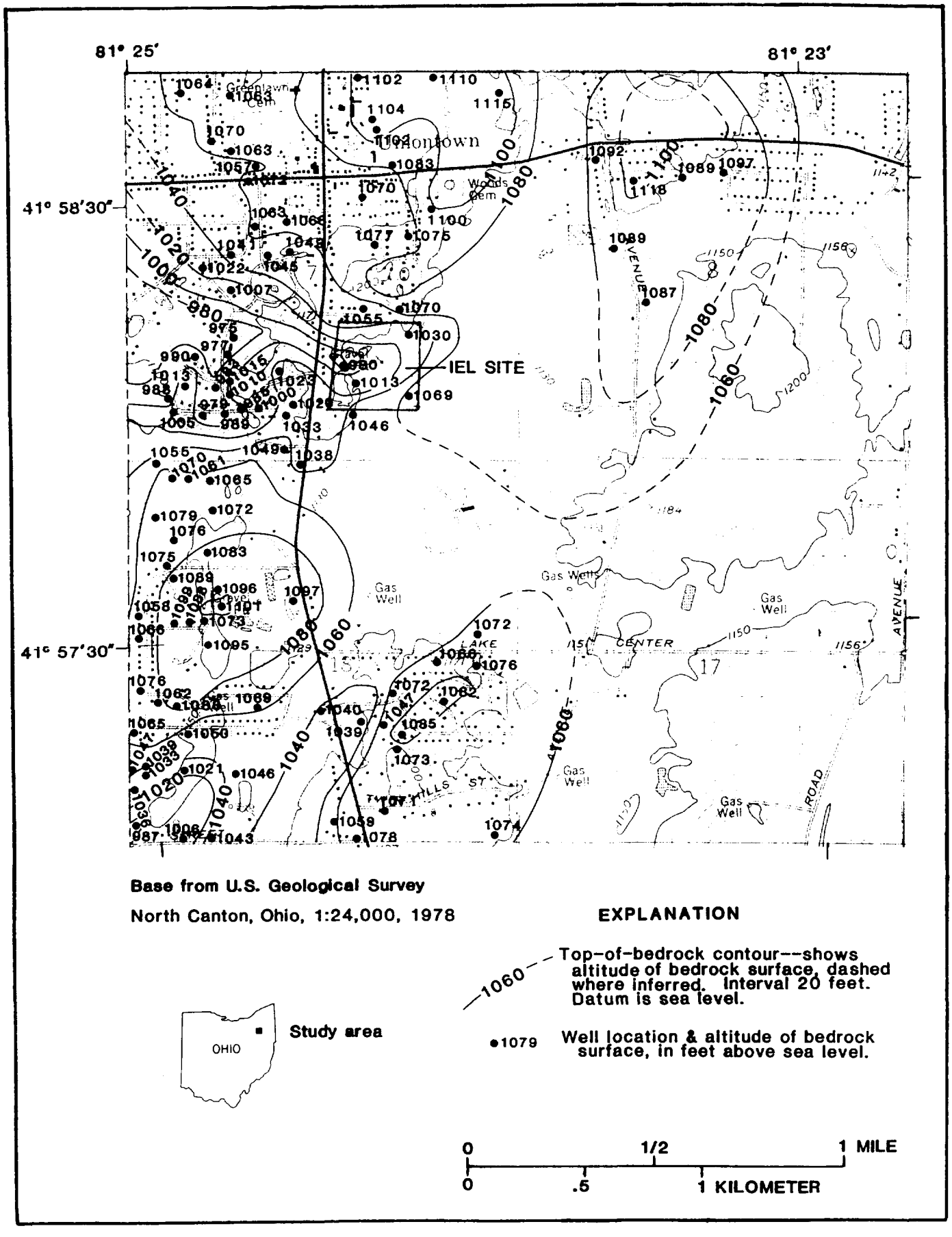


Figure 4.--Top-of-bedrock map based on drillers' logs.

Exhibit 1

Lake Township

Ground Water Resources

Basemap

- State Roads
- County Roads
- Township Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Village of Hartville
- Municipal-Industrial Well
- Well Site

Well Yields

100 to 500 Gallons per Minute

Good ground-water areas. Permeable sand and gravel deposits not traversed by major streams. May supply sustained yields of several hundred gallons per minute. Suitable for industrial and municipal well field development.

25 to 100 Gallons per Minute

Interbedded and interlensing sand, gravel, silt, and clay. Farm and small industrial supplies available from wells ranging to 150 feet deep. Wells may yield 100 gallons, or more, per minute. Yields from underlying sandstones are described below.

Ground water obtained from sandstones of the Pottsville group. Principal aquifers are the Massillon sandstone (upper) and Sharon conglomerate (below). Wells will produce sustained yields of as much as 50 gallons per minute. Up to 100 gallons per minute may be available for short periods of intermittent pumping. Sharon may be from 150 feet to 300 feet below land surface. With few exceptions, the bedrock is covered with less than 75 feet of glacial material.

Less than 30 Gallons per Minute

Ground water obtained from sandstones and sandy shales. Although larger yields have been reported, the maximum reliable yield is about 25 gallons per minute. Bedrock is covered with from 20 to 80 feet of unconsolidated deposits which may supply domestic yields in the glaciated portion of Stark County.

Note: The ground-water characteristics of Stark County have been mapped regionally, based upon interpretations of more than 20,000 water well records and the area's geology and hydrology. Well log data which are indicated on the map were selected as typical for the areas shown.

In some instances exploratory drilling may be necessaryt to locate the best well site within various yield areas shown on the map.

Source: Ground Water Resources of Stark County
Ohio Department of Natural Resources
Division of Water
1988

N W E S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

prepared by
MS consultants, inc.
engineers, architects, planners

Exhibit 2
March1999

sla cartoné c:\arcgis\waterwp.apr (Ground Water Resources)
22 MAR 98 10:40

Lake Township
General Soils

Basemap

- State Roads
- County Roads
- Township Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Village of Hartville

Soil Types

- Fitchville-Sebring - *nearly level, light colored, poorly to somewhat poorly drained soils*
- Chili-Wheeling-Shoals - *nearly level to steep, light colored, somewhat poorly to well drained soils*
- Ravenna-Canfield - *nearly level to sloping, light colored, somewhat poorly to moderately well drained soils*
- Canfield-Wooster - *sloping to steep, light colored, moderately well to well drained soils*
- Carlisle-Willette-Linwood - *level, dark colored, very poorly drained soils*

Source: General Soil Map of Stark County
Ohio Department of Natural Resources
Division of Lands and Soil
1968

N W E S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

prepared by
ms consultants, inc.
engineers, architects, planners

Exhibit 3
December 1998

29 DEC 98 09:15

Lake Township

National Wetlands Inventory
U.S. Department of the Interior
Fish and Wildlife Service
1995

Basemap

- State Roads
- County Roads
- Township Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Lakes and Streams
- Lakes and Ponds
- Village of Hartville

Wetland Classes

- PFO - *Forested*
- PSS - *Shrub / Scrub*
- PEM - *Emergent*
- POW - *Open Water*
- PAB - *Aquatic Bed*

NOTE: The wetlands shown on this map are as shown on the National Wetland Inventory (NWI) and have not been field checked. As such, this map should only be used for planning purposes.

N W E S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

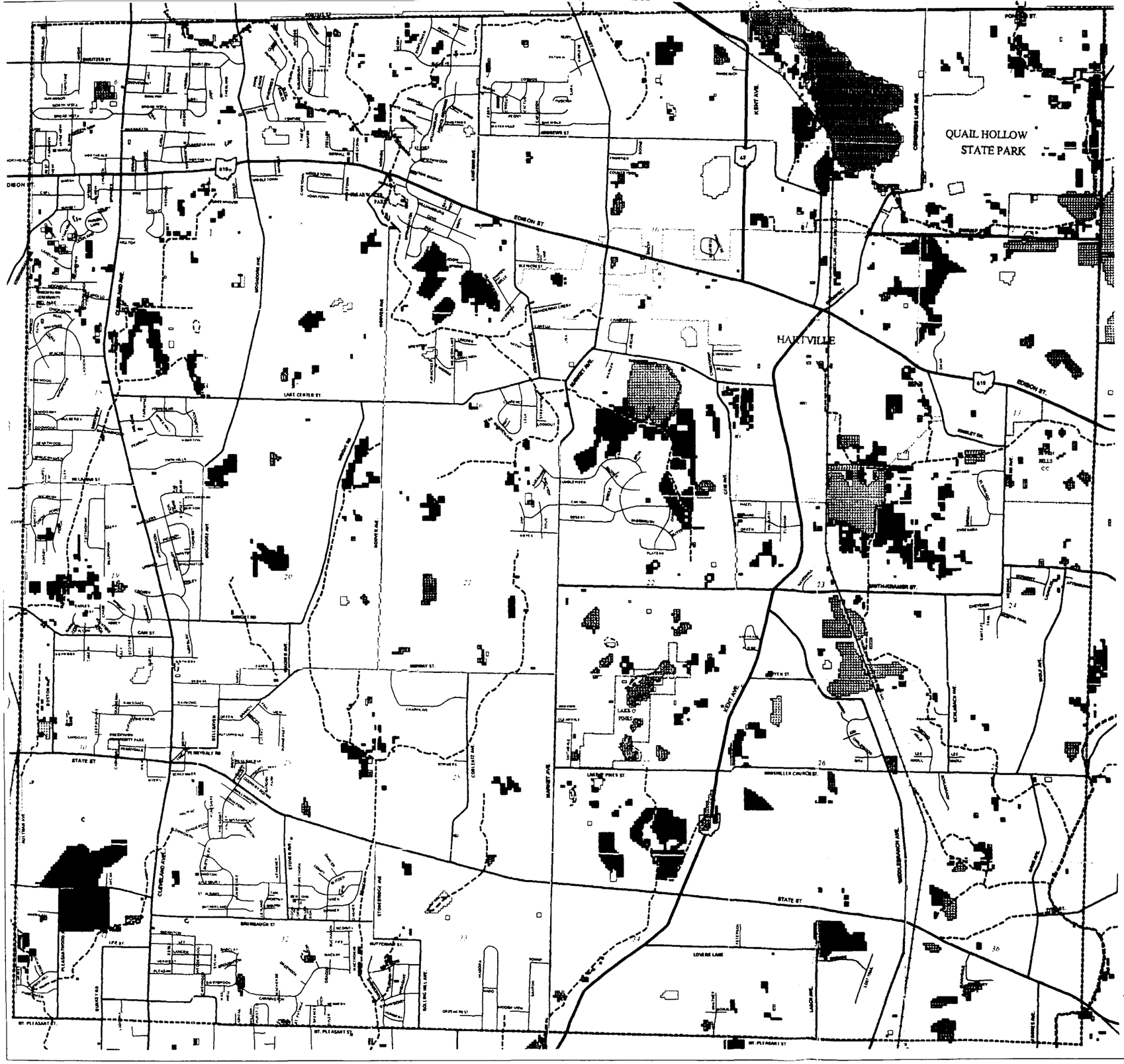
prepared by
ms consultants, inc.
engineers, architects, planners

Exhibit 4
December 1998

23 DEC 98 13:23

Lake Township

Ohio Wetlands Inventory
State of Ohio
Department of Natural Resources



Basemap

- State Roads
- County Roads
- Township Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Lakes and Streams
- Village of Hartville

Wetland Classes

- *upland*
- *woods on hydric soils*
- *open water*
- *shallow marsh (emergent vegetation in water < 3 feet)*
- *shrub/scrub (emergent woody vegetation in water < 3 feet)*
- *wet meadow (grassy vegetation in water < 6 inches)*
- *farmed wetland (wet meadow in agricultural areas)*

NOTE: The Ohio Wetlands Inventory is based on analysis of satellite data and is intended solely as an indicator of wetland sites for which field review should be conducted. The satellite data reflect conditions during the specific year and season the data was acquired and all wetlands may not be indicated. Statistics generated from the inventory are intended solely as an approximation.

The Ohio Department of Natural Resources produced the Ohio Wetlands Inventory for Stark County from May 1987 Landsat Thematic Mapper data using ERDAS image processing software. The woods on hydric soils category was produced by overlaying digital soils data provided by the Ohio Capabilities Analysis Program. The data has not been field checked.

N W E S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

prepared by
ms consultants, inc.
engineers, architects, planners

Exhibit 5
January 1999

Lake Township
Wetlands

Basemap

- State Roads
- County Roads
- Township Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Lakes and Streams
- Village of Hartville

National Wetland Inventory (NWI)
U.S. Fish and Wildlife Service

Ohio Wetland Inventory (OWI)
Ohio Department of Natural Resources

NOTE: This map contains a simplified composite of wetland information. It is intended for planning purposes only. The data on this map has not been field checked.

N
W E
S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

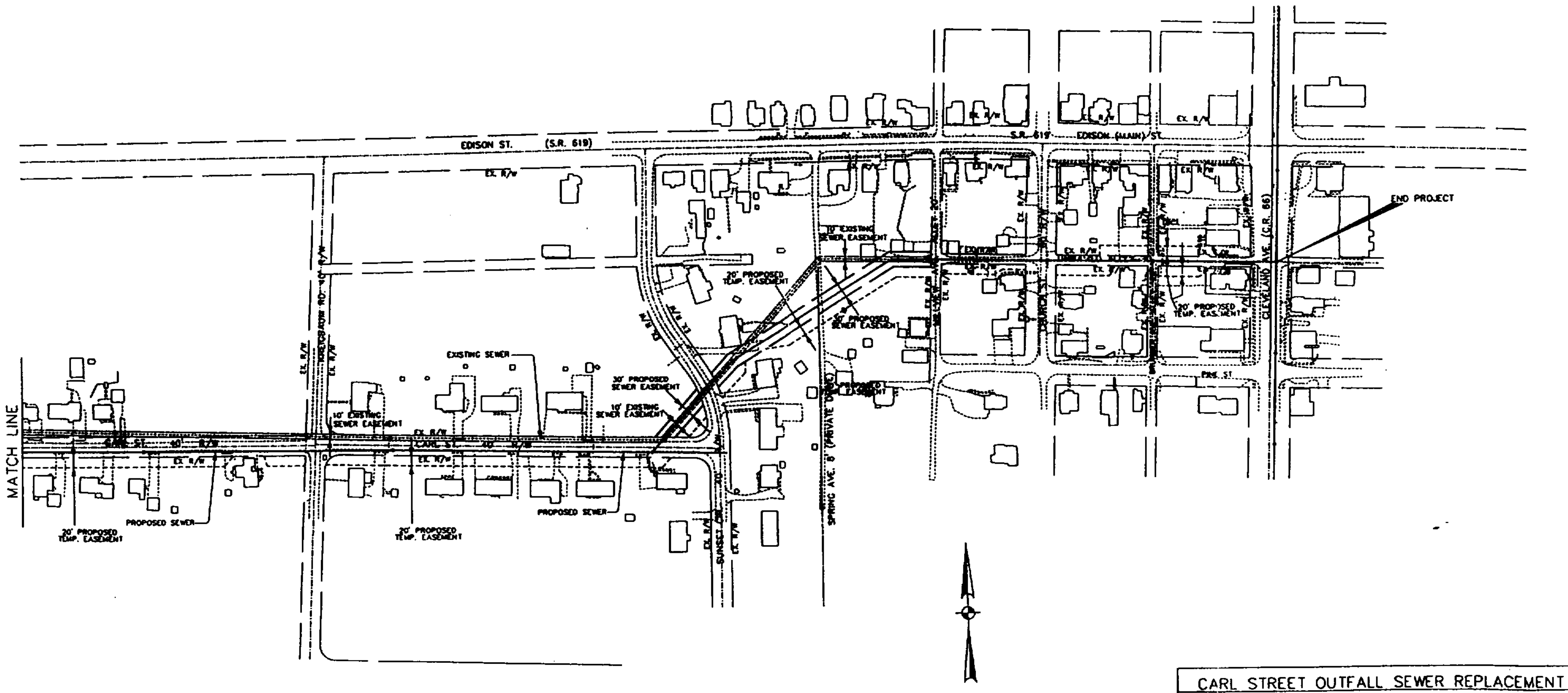
Trustees
Norman Martin
Don Myers
Sue Ruley

Clerk / Treasurer
Jane Feller

prepared by
mis consultants, inc.
engineers, architects, planners

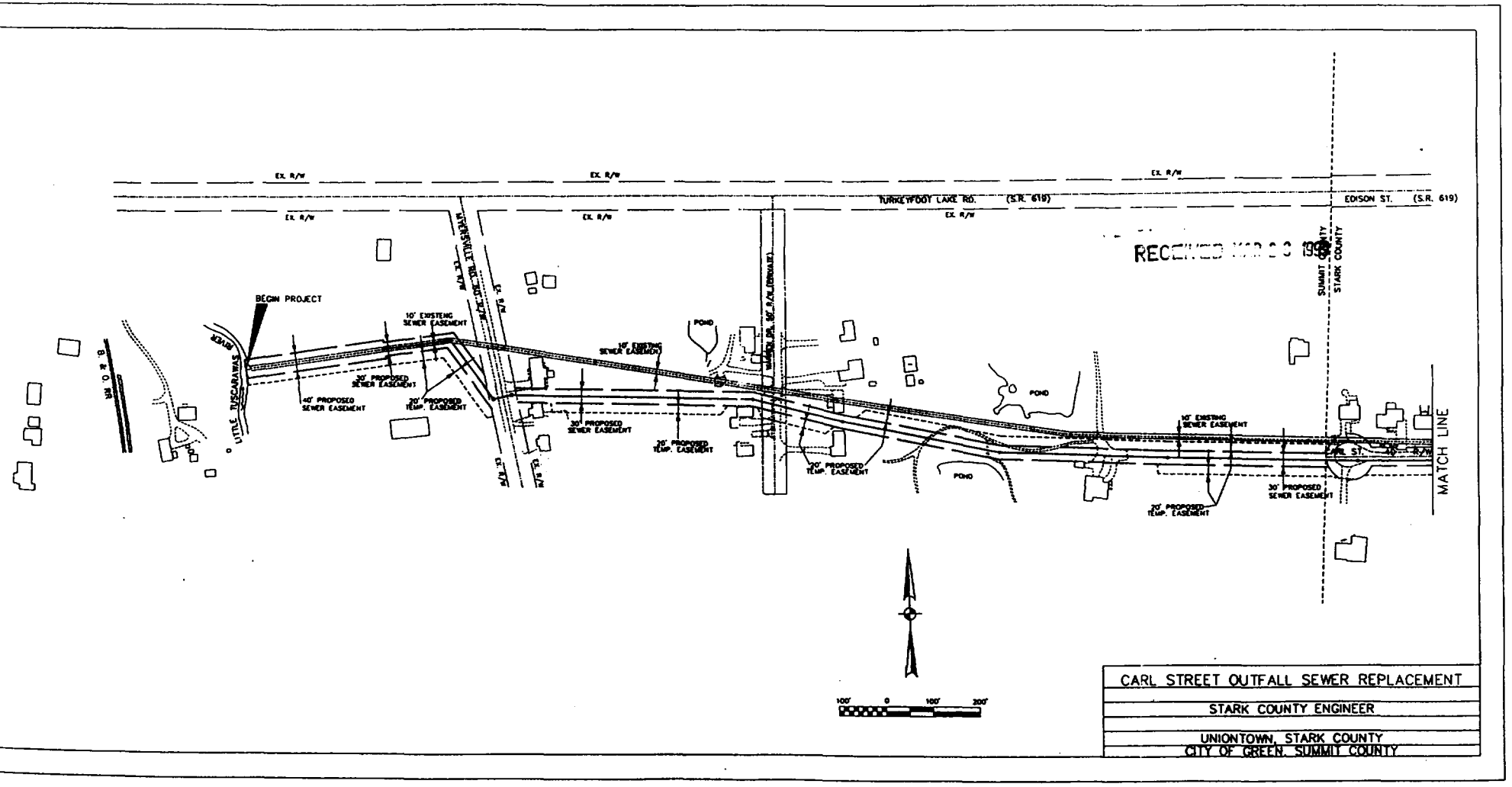
Exhibit 6
January 1999

c:\arcproj\laketwsp.apr (NWI/OWI (11x17))
05 JAN 99 14:49



CARL STREET OUTFALL SEWER REPLACEMENT
STARK COUNTY ENGINEER
UNIONTOWN, STARK COUNTY
CITY OF GREEN, SUMMIT COUNTY

Exhibit 7


EX. R/W
TURKEYFOOT LAKE RD. (S.R. 619)
EDISON ST. (S.R. 619)
RECEIVED
SUMMIT COUNTY
STARK COUNTY
BEGIN PROJECT
10" EXISTING SEWER EASEMENT
40' PROPOSED SEWER EASEMENT
30' PROPOSED SEWER EASEMENT
20' PROPOSED TEMP. EASEMENT
POND
MATCH LINE
100' 0 100' 200'
CARL STREET OUTFALL SEWER REPLACEMENT
STARK COUNTY ENGINEER
UNIONTOWN, STARK COUNTY
CITY OF GREEN, SUMMIT COUNTY

Drilling records from the Ohio Department of Natural Resources indicate that about a dozen oil and natural gas exploration and production wells have been drilled within a mile of IEL. The target production zone for these wells is the Lower Silurian Clinton Sandstone that lies about 4,500 feet below the surface in this area. Production records from these wells indicate gas production ranging from 50 to 2000 thousand cubic feet per day and oil production from 0 to 97 barrels per day. The majority of these wells continue to produce at the time of this writing.

2.4 Climatology

(Note: The Akron/Canton Airport, located about 5 miles south-southwest of IEL has a first-order weather station from which records were used to help compile this section.)

The climate of the IEL area is mostly typical of the mid-continent of the United States. However, nearby Lake Erie has some moderating effect on cold air masses during late fall and early winter, and it also is partly responsible for heavy snow squalls until the lake freezes over. Monthly average temperatures and precipitation are shown below:

	Average Temperature	Average Precipitation
January	25.1°F	2.56"
February	27.2°F	2.18"
March	36.7°F	3.37"
April	48.6°F	3.26"
May	58.8°F	3.55"
June	67.8°F	3.27"
July	71.6°F	4.01"
August	70.4°F	3.31"
September	63.8°F	2.96"
October	52.5°F	2.24"
November	41.0°F	2.54"
December	30.3°F	2.65"
Yearly Average:	49.5°F	35.90"

Exhibit 8

Lake Township

Flood Plains

100 Year (FEMA)

- State Roads
- County Roads
- Township Boundaries
- Park Boundaries
- Railroads
- Reference Grid
- Lakes and Streams
- Lakes and Ponds
- Village of Hartville

Note: This map is a composite of Federal Emergency Management Agency, Flood Insurance Rate Maps for Stark County, 1983. This map depicts the 100 Year Flood Boundary (Zone A). This map is intended for planning purposes only and does not necessarily show all areas subject to flooding.

N W E S

0 2000 4000 6000 8000 Feet

0 0.25 0.5 0.75 1 1.25 Miles

prepared by
ms consultants, inc.
engineers, architects, planners

Exhibit 9

February 1999

The coldest month is January when temperatures can plunge into the -20's^{o}F. The warmest month is July with highs in the 90's^{o}F not uncommon and low 100's^{o}F occurring rarely. Precipitation is fairly uniformly distributed throughout the year.

Monthly average resultant wind direction, average resultant wind speed, and average wind speed are shown below:

	Resultant Wind Direction	Resultant Wind Speed	Average Wind Speed
January	250^{o}	8.3 M.P.H.	13.8 M.P.H.
February	240^{o}	5.7 M.P.H.	11.1 M.P.H.
March	240^{o}	3.9 M.P.H.	12.5 M.P.H.
April	240^{o}	5.4 M.P.H.	10.8 M.P.H.
May	230^{o}	1.9 M.P.H.	9.7 M.P.H.
June	270^{o}	2.4 M.P.H.	8.9 M.P.H.
July	230^{o}	2.2 M.P.H.	8.4 M.P.H.
August	260^{o}	1.6 M.P.H.	6.6 M.P.H.
September	220^{o}	2.7 M.P.H.	7.8 M.P.H.
October	170^{o}	1.9 M.P.H.	9.7 M.P.H.
November	160^{o}	1.8 M.P.H.	10.8 M.P.H.
December	230^{o}	9.4 M.P.H.	12.5 M.P.H.
Yearly Average:	228^{o}	--------	10.2 M.P.H.

* Direction wind is from, where north is 360^{o}, east is 90^{o}, south is 180^{o}, and west is 270^{o}.

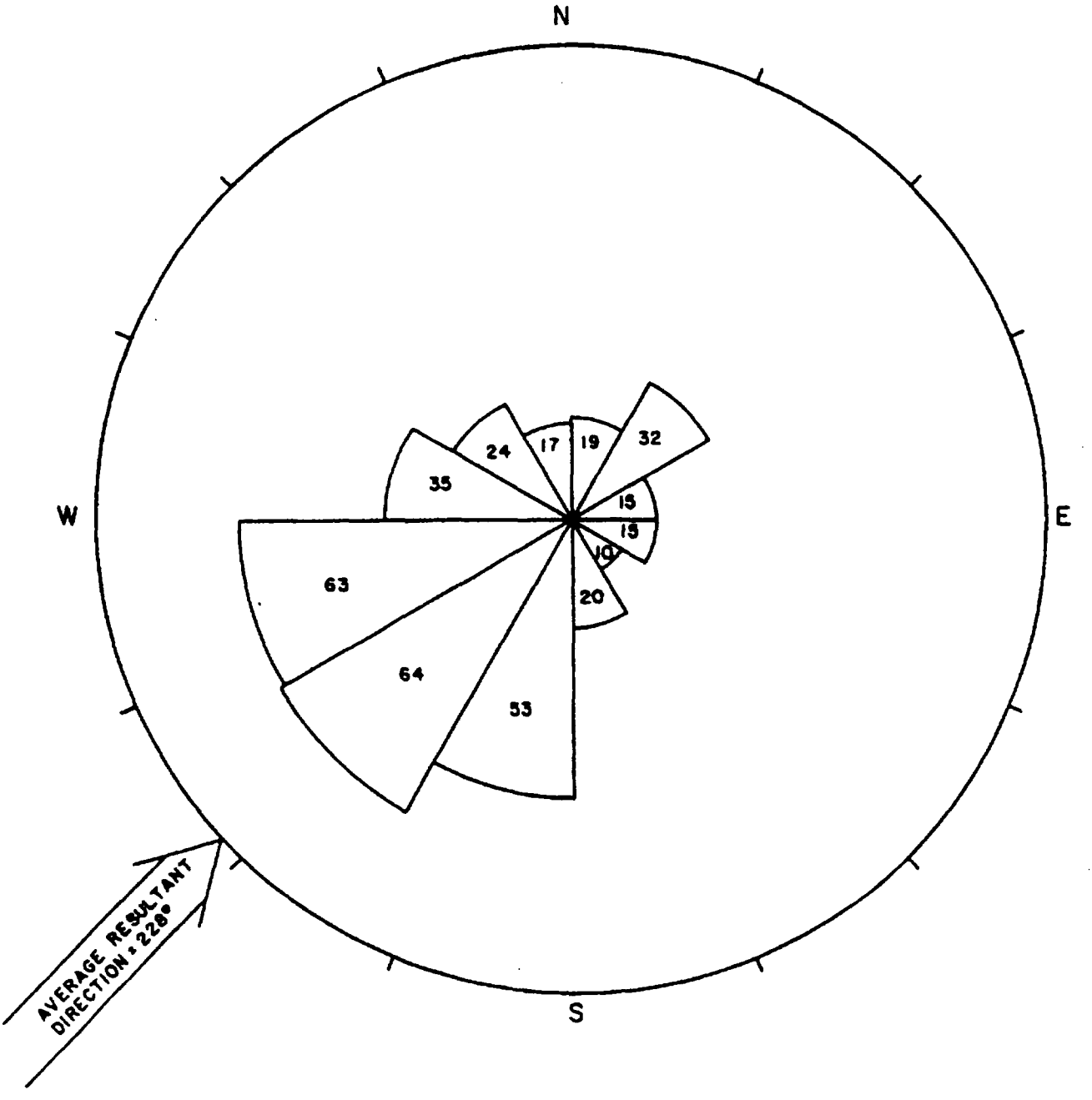
Figure 2-4 illustrates the frequency of daily average resultant wind directions. (Available wind data for 1985 did not include information for August. Therefore, information for August 1984 was used in its place.)

The windiest month at IEL is January while the summer months are relatively calm. As in much of the mid-continent area, the wind blows predominantly from the southwest (Figure 2-4).

Exhibit 10

FIGURE 2-4

RESULTANT WIND DIRECTIONS FOR AKRON-CANTON AIRPORT, 1985



NUMBERS INDICATE FREQUENCY (DAYS OUT OF THE YEAR) THAT THE DIRECTION WAS THE AVERAGE DIRECTION FROM WHICH THE WIND BLEW.

Exhibit 11

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

FEB 17 1999

REPLY TO THE ATTENTION OF:

S-6J

Edda Sara Post, Esquire
Kaufman & Cumberland Counselors at Law
1500 Republic Building
25 Prospect Avenue West
Cleveland OH 44115

Subject: Industrial Excess Landfill Superfund Site

Dear Ms. Post:

This is in response to your January 20, 1999 letter requesting, on behalf of the Lake Township Board of Trustees, an extension of the public comment period on the United States Environmental Protection Agency's (U.S. EPA) proposed changes in the cleanup plan for the Industrial Excess Landfill. You have asked for an extension until June 30, 1999, or sixty days after the release of the Ombudsman's report, whichever occurs later. U.S. EPA hereby extends the current 60-day comment period by an additional thirty days, or until April 11, 1999.

In seeking a longer extension, you cite a number of considerations. First, you allude to the long history of investigation at this site and suggest that the complexity of the issues requires a longer comment period. I do agree that U.S. EPA has been studying IEL for a long time. However, I do not view that as an argument for taking yet more time before proceeding with a remedy to protect human health and the environment. In response to public concern, the Agency placed implementation of the remedy at IEL on hold for several years. During this time, the Science Advisory Board ("SAB") examined the radiation questions that had been raised. When it issued its final report nearly five years ago, the SAB declared that "the issue of radioactive contamination should not be pursued further and the confirmed issue of chemical hazards and remediation thereof should proceed expeditiously." U.S. EPA is attempting to follow through on this recommendation.

As for the complexity of the issues, I believe the proposed changes are fairly straightforward. As noted in the Proposed Plan, the main reason we are proposing to eliminate the pump-and-treat component of the IEL remedy is that we found no significant ground water contamination beyond the boundary of the landfill. A pump-and-treat system would therefore be extracting water that, for the most part, already meets drinking water standards.

Exhibit 12

Surely, there is no public health reason to do that. With respect to the change in the landfill cap, we have proposed a design incorporating standard containment technology that has proven its worth at a large number of sites.

When you suggest that the issues are complex, I assume you are referring to natural attenuation. As I said before, the Agency is proposing to eliminate the pump-and-treat component of the remedy because it appears there is nothing to treat. One plausible explanation for this is that natural attenuation has operated to reduce contaminant levels. Another possible explanation is that a plume of contamination moved outward from the landfill many years ago, but has long since dispersed. Yet whatever the explanation, there is clearly no groundwater problem that would justify implementation of a pump-and-treat system. Nor is there likely to be one in the future, given the construction of a new cap over the landfill that will reduce water infiltration to near zero. Ground water will be regularly monitored in the future to confirm that contamination is under control. In sum, while the cause of the reduction in contamination outside the landfill may be complex, the fact of the reduction is not. And it is this fact that underlies our proposal to change the IEL remedy.

You assert that the proposed remedy changes are controversial, apparently basing your conclusion on newspaper reports alleging that the Ohio EPA and the Agency for Toxic Substances and Disease Registry (ATSDR) may not be in agreement with them. This is simply false. Ohio EPA has been an active partner throughout the consideration of changes to the remedy, and fully supports the proposal. ATSDR has not had the same kind of day-to-day involvement that Ohio EPA has had, and so has not issued any statements either agreeing or disagreeing with the proposed changes. I might add that ATSDR does not have a formal concurrence role in Superfund remedy selection. Nevertheless, we have consulted with ATSDR on the proposed changes to the IEL remedy and we will continue to do so.

Finally, you suggest that a decision on the proposed remedy changes should be postponed, pending the outcome of the EPA Ombudsman's recent inquiries. I disagree. I view the Ombudsman's work as necessarily separate and distinct from our decision-making responsibilities in Region 5. After a long and painstaking process, we are poised to go forward with a remedy for IEL. I do not think a decision should be delayed on the chance that the Ombudsman might suggest further changes in the IEL remedy. In any case, the remedial process under the National Contingency Plan is flexible enough to accommodate additional remedy changes later, if they are determined to be necessary.

In conclusion, I believe that a 90-day comment period will allow

the public adequate time to review the documents supporting the change in remedy and to comment upon our remedy proposal. Many pertinent documents, including most of the groundwater monitoring results, have long been available for review in the Uniontown repositories. In upcoming availability sessions and meetings in Uniontown, our staff will explain the technical issues and answer questions. These meetings will occur well before the end of the public comment period, giving the public time to consider our explanation of the proposed changes and to formulate meaningful comments.

If you have any questions in the meantime, please feel free to contact me or Ross del Rosario, the site manager, at (312) 886-6195.

Sincerely yours,

Wm. E. Muno

William E. Muno, Director
Superfund Division

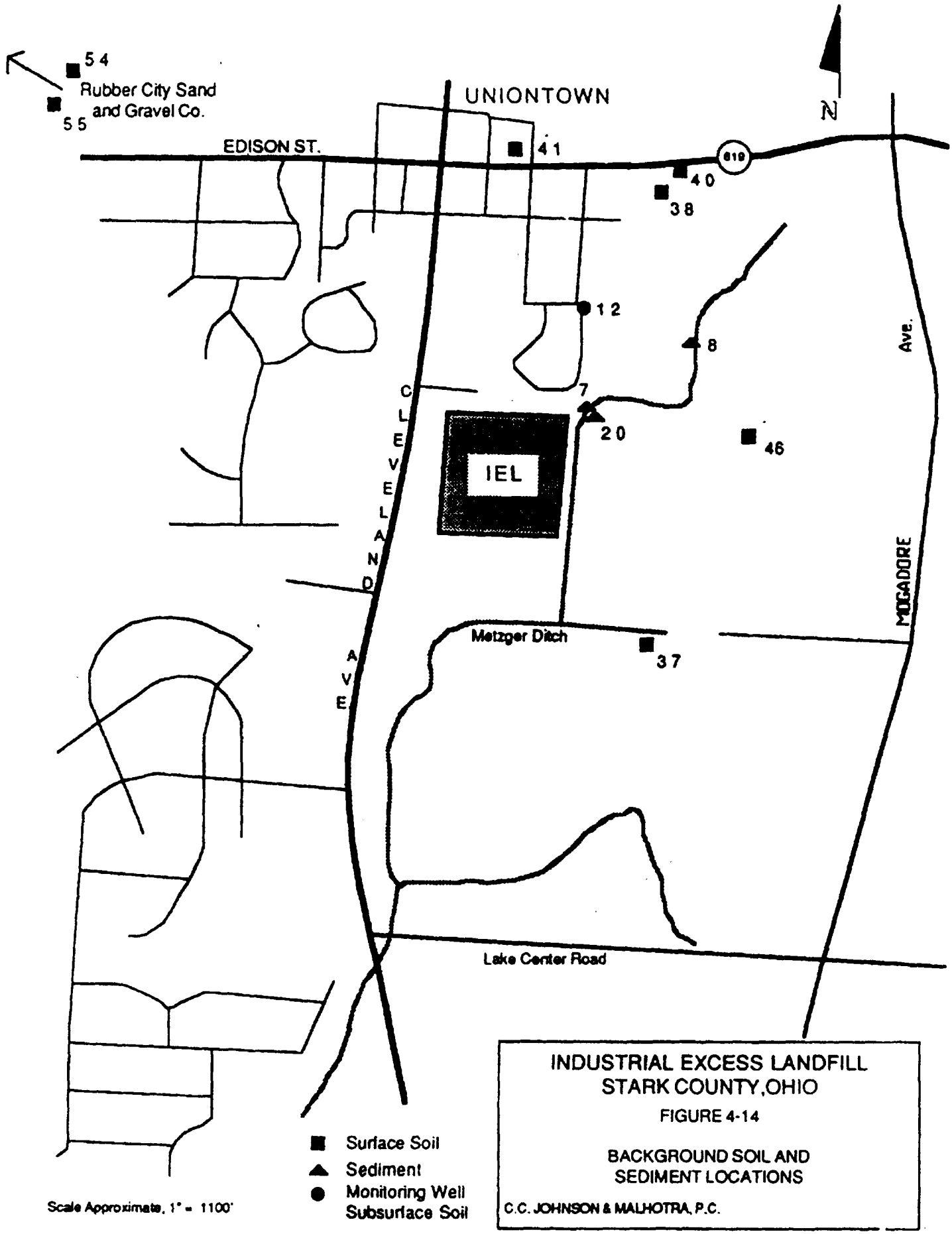
TABLE 3-1

LISTING OF SUSPECTED MATERIALS
DISPOSED AT THE INDUSTRIAL EXCESS LANDFILL

Permitted Wastes and Wastes Observed by Knowledgeable Persons and Residents

Fly ash
Garbage and household trash
Latex (solid and semi-solid)
"Sulfur liquid"; drummed wastes with odor of rotten eggs
Floor sweepings and other solid industrial wastes in drums
Large salt blocks (from an aluminum foundry)
Paper scrap with "sticky stuff"
Lab chemical wastes
Liquids wastes (described as being capable of causing burn lesions)
Masonry rubble
Paper scrap (solid or liquid)
Lumber scrap
Plastic scraps, rejects and shavings
Rubber
Non-organic oils (slightly acid) and greases
Metallic and glass refuse
Flammable liquids
Sewage (Possibly from septic tanks)
Lamp-black
Hard rubber
"Solid waste from licensed vehicles", (circa 1972)
Liquid solvents

Exhibit 13



INDUSTRIAL EXCESS LANDFILL
STARK COUNTY, OHIO

FIGURE 4-14

BACKGROUND SOIL AND
SEDIMENT LOCATIONS

C.C. JOHNSON & MALHOTRA, P.C.

Exhibit 14

TABLE 6-1

TARGET COMPOUND LEVELS IN EXTRACTION SYSTEM GAS SAMPLES FROM THE INDUSTRIAL EXCESS METHANE VENTING SYSTEM

Compound	Anal. 1	Anal. 2	Anal. 3
Vinyl Chloride	ND [1/]	6.7 ppm	
1,1-Dichloroethylene	>14 ppb [1/]		
trans 1,2-Dichloroethene	ND		
1,1-Dichloroethane	630 ppb [2/]		
1,2-Dichloroethane	ND		
Benzene	2200 ppb [2/]		
Trichloroethylene	280 ppb [2/]		
Toluene	1500 ppb [2/]		
Tetrachloroethylene	300 ppb [2/]		
Ethyl Benzene	1200 ppb [2/]		
Xylenes	1860 ppb [2/]		
Styrene	65 ppb		
m-Ethyl toluene	73 ppb [3/]		
C3 Alkyl Benzene	400 ppb [3/]		
Methylene Chloride	Det.		
1,1,1-Trichloroethane	Det.		
Chlorobenzene	Det.		
C5 Hydrocarbons	310 ppb [3/]		
C6 Hydrocarbons	14 ppm [3/]		
C7 Hydrocarbons	8.9 ppm [3/]		
C8 Hydrocarbons	8.0 ppm [3/]		
C9 Hydrocarbons	3.3 ppm [3/]		
C10 Hydrocarbons	1.9 ppm [3/]		

Exhibit 15

TABLE 6-1 (Continued)

TARGET COMPOUND LEVELS IN EXTRACTION SYSTEM GAS SAMPLES FROM THE INDUSTRIAL EXCESS METHANE VENTING SYSTEM

Compound	Anal. 1	Anal. 2	Anal. 3
Methane		20%	
Ethane		60 ppm	
Propane		4.4 ppm	
Propylene		10 ppm	
Carbon Monoxide		ND (DL = 4 ppm)	
Nitrogen		58%	
Oxygen		2.8%	
Argon		0.63%	
Carbon Dioxide		18.3%	
Hydrogen		ND (DL = 0.005%)	
Phosgene			ND (DL = 100 ppb)
Hydrogen Sulfide			ND (DL = 1 ppm)

Notes: Anal. 1 - GC/MS Analysis of Tenax Portion of collected tubes.
Anal. 2 - Analyses of Summa Canister.
Anal. 3 - Onsite Analyses w/Portable Monitox Sensors.

1/ Either not detected in analysis or reported concentration biased low due to breakthrough of target compound to non-analyzed CMS portion of tube.

2/ Compound signal greater than the range of the instrument calibration.

3/ Reported values are sums of the measured concentrations of individual compounds belonging to the specified.

Det. - Compound detected but not quanitated because of either interferences in its spectra or no calibration curve for the compound.

TABLE 6-2

TARGET COMPOUND LIST FOR THE STUDY
OF IEL'S METHANE VENTING SYSTEM

Vinyl chloride,
1,1-Dichloroethylene,
1,1,1-Trichloroethane,
Tetrachloroethylene,
Toluene,
C2 Alkyl Aromatics
(Ethyl benzene & xylenes),
C3 Alkyl Aromatics
Chlorobenzene
Methylene chloride,
1,1-Dichloroethane,
Trichloroethylene,
Methane,
Benzene
Hexanes

Exhibit 16

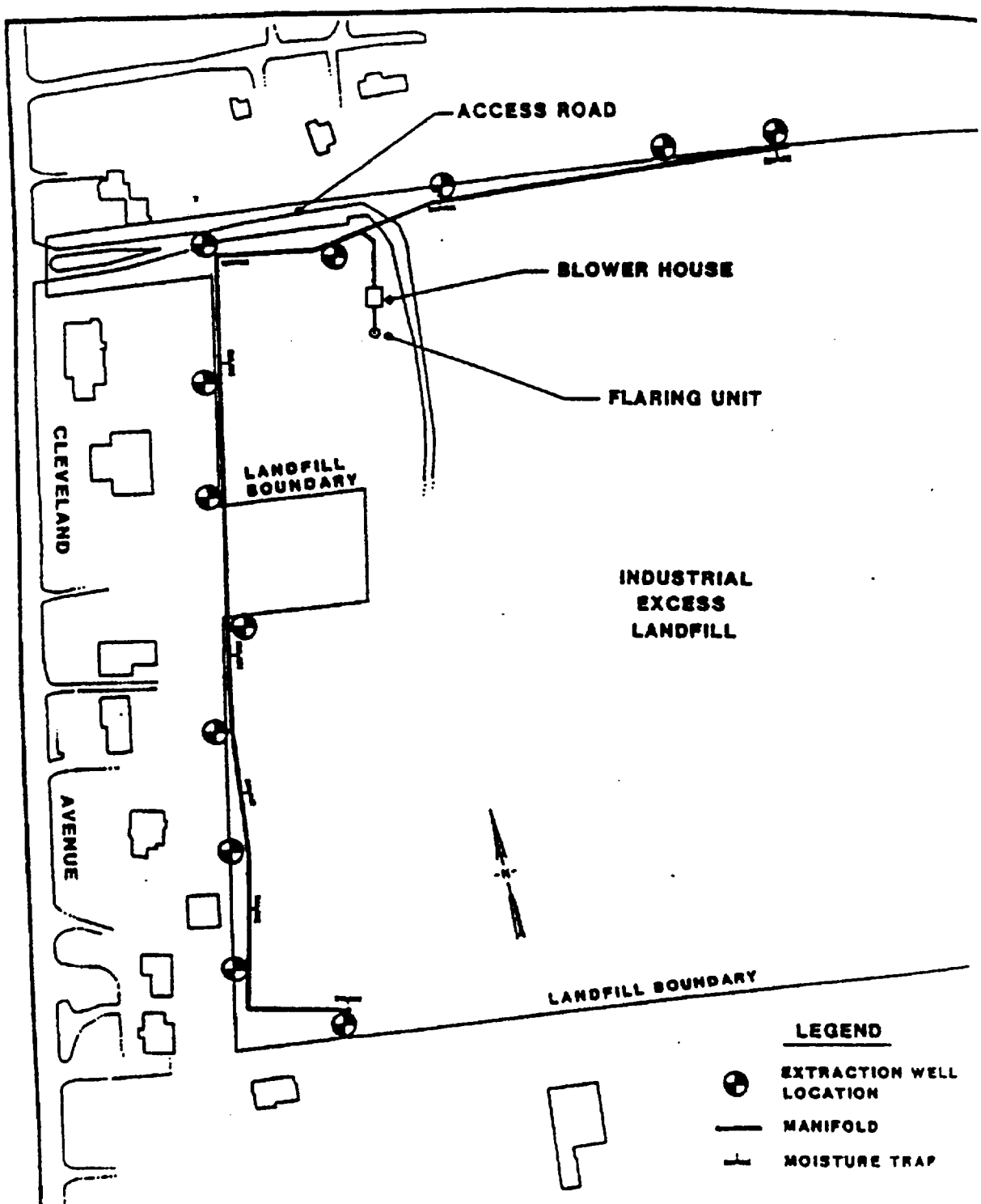


FIGURE 6-1

ACTIVE METHANE VENTING SYSTEM
INDUSTRIAL EXCESS LANDFILL
UNIONTOWN, OHIO

Exhibit 17

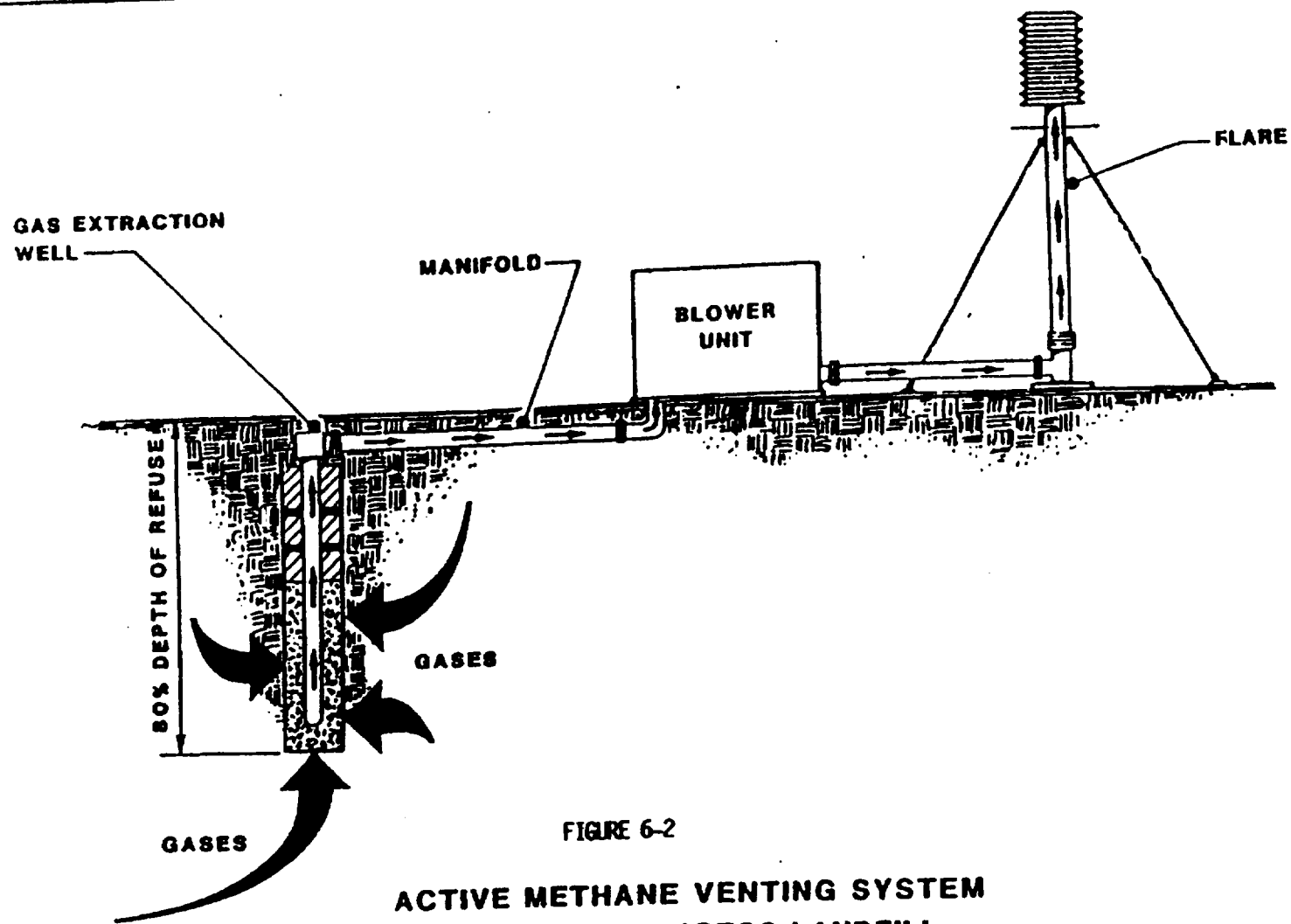


FIGURE 6-2

ACTIVE METHANE VENTING SYSTEM
INDUSTRIAL EXCESS LANDFILL
UNIONTOWN, OHIO

Exhibit 18

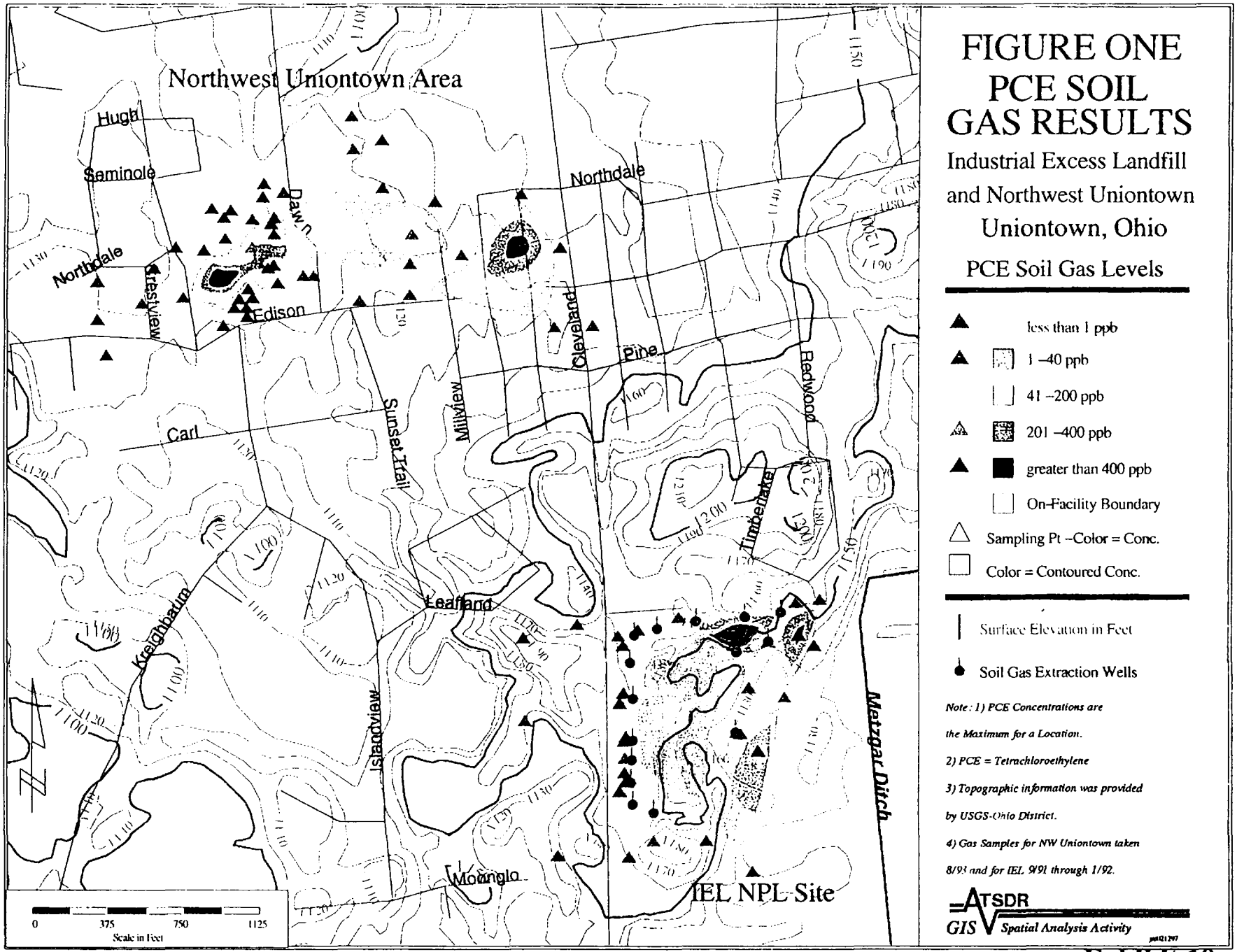


FIGURE ONE
PCE SOIL GAS RESULTS

Industrial Excess Landfill
and Northwest Uniontown
Uniontown, Ohio

PCE Soil Gas Levels

- less than 1 ppb
- 1 –40 ppb
- 41 –200 ppb
- 201 –400 ppb
- greater than 400 ppb
- On-Facility Boundary
- Sampling Pt –Color = Conc.
- Color = Contoured Conc.
- Surface Elevation in Feet
- Soil Gas Extraction Wells

Note: 1) PCE Concentrations are the Maximum for a Location.

2) PCE = Tetrachloroethylene

3) Topographic information was provided by USGS-Ohio District.

4) Gas Samples for NW Uniontown taken 8/93 and for IEL 9/91 through 1/92.

ATSDR
GIS Spatial Analysis Activity

Exhibit 19

TABLE 6-4

LANDFILL STACK* GAS ANALYSES 3/31/86

(Downwind, Gases On, Flare Off)

Uniontown, Ohio

PARAMETER	CONCENTRATION (PPB) I
BENZENE	236
TOLUENE	15
TRICHLOROETHENE	264
METHYL ETHYL KETONE	75
1,1 DICHLOROETHENE 1,2 DICHLOROETHENE 1,1,1, TRICHLOROETHANE	141
1,1 DICHLOROETHANE 1,2 DICHLOROETHANE VINYL CHLORIDE	2254
ETHYL BENZENE	367
CHLOROFORM METHYLENE CHLORIDE	111
TETRACHLOROETHENE	10
PHOSGENE	12
HYDROCARBONS	P

P - Mass spectra scan shows the presence of Hydrocarbons.

I - Air Monitoring at Landfill Site 5' Downwind from Stack 18' High, Gases on, Flare off.

* - Candle flare.

15704A/32

Exhibit 20

TABLE 6-3

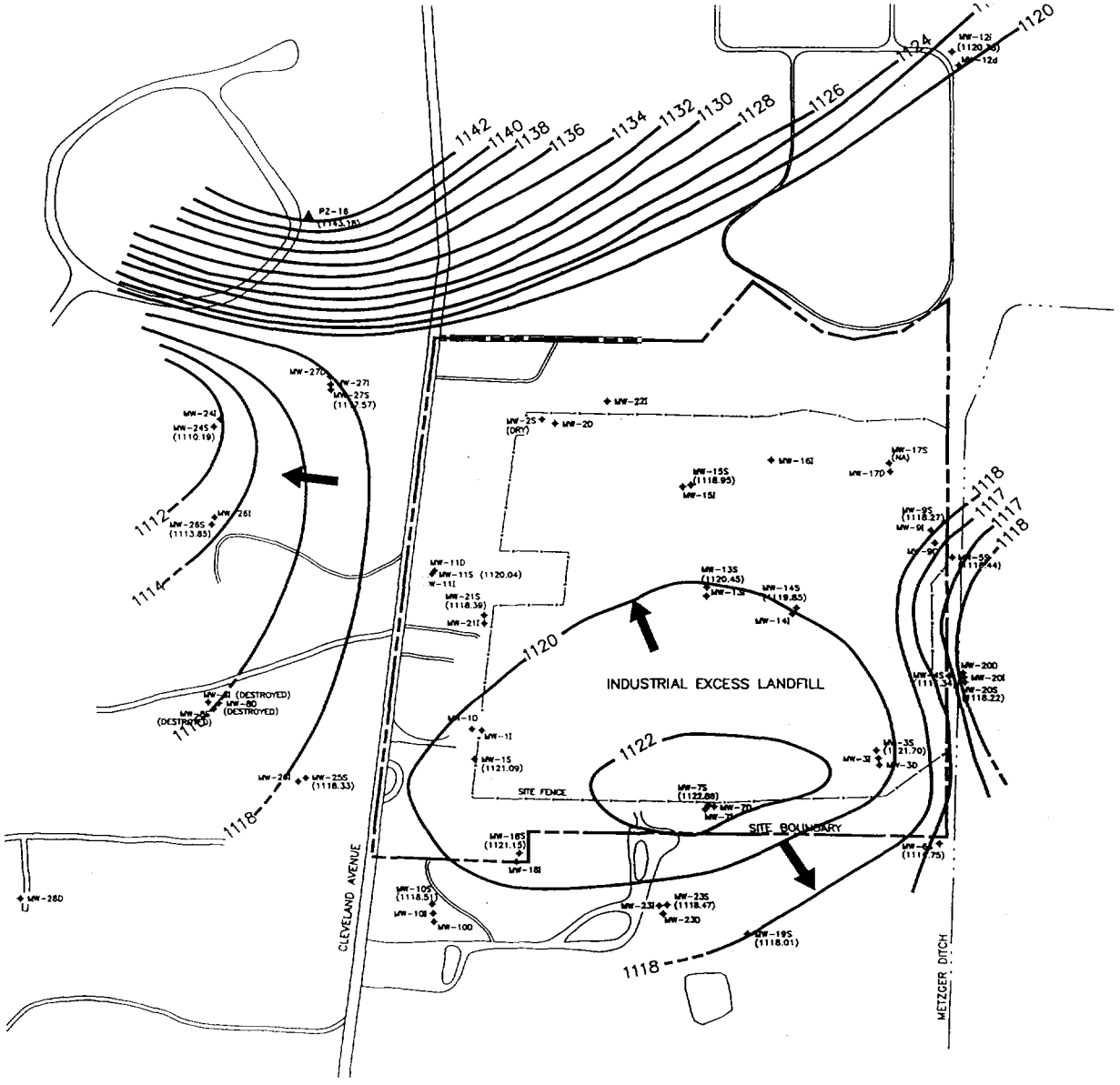
RESULTS FROM VARIOUS RADIATION ANALYSES

Parameter	Level
Total Radioactivity [1/]	ND (DL = <.03 mRad/hour)
C-13 Radiation	ND
Tritium Radiation	ND
Iodine-131 Radiation	ND
Radon	516 picocuries/liter

[1/] Orsite analysis performed using Victoreen G: Meter, Model No. 493-50 (with open probe).

Exhibit 21

Exhibit 22



SCALE – FEET

0 300 600

LEGEND

- MW-14S — MONITORING WELL AND NUMBER
  S = SHALLOW WELL
  I = INTERMEDIATE WELL
  D = DEEP WELL
- SITE BOUNDARY
- FENCE
- PZ-16 — PIEZOMETER
- 1111 — GROUNDWATER ELEVATION CONTOURS
- GROUNDWATER FLOW DIRECTION

REVISION	DATE	DESCRIPTION

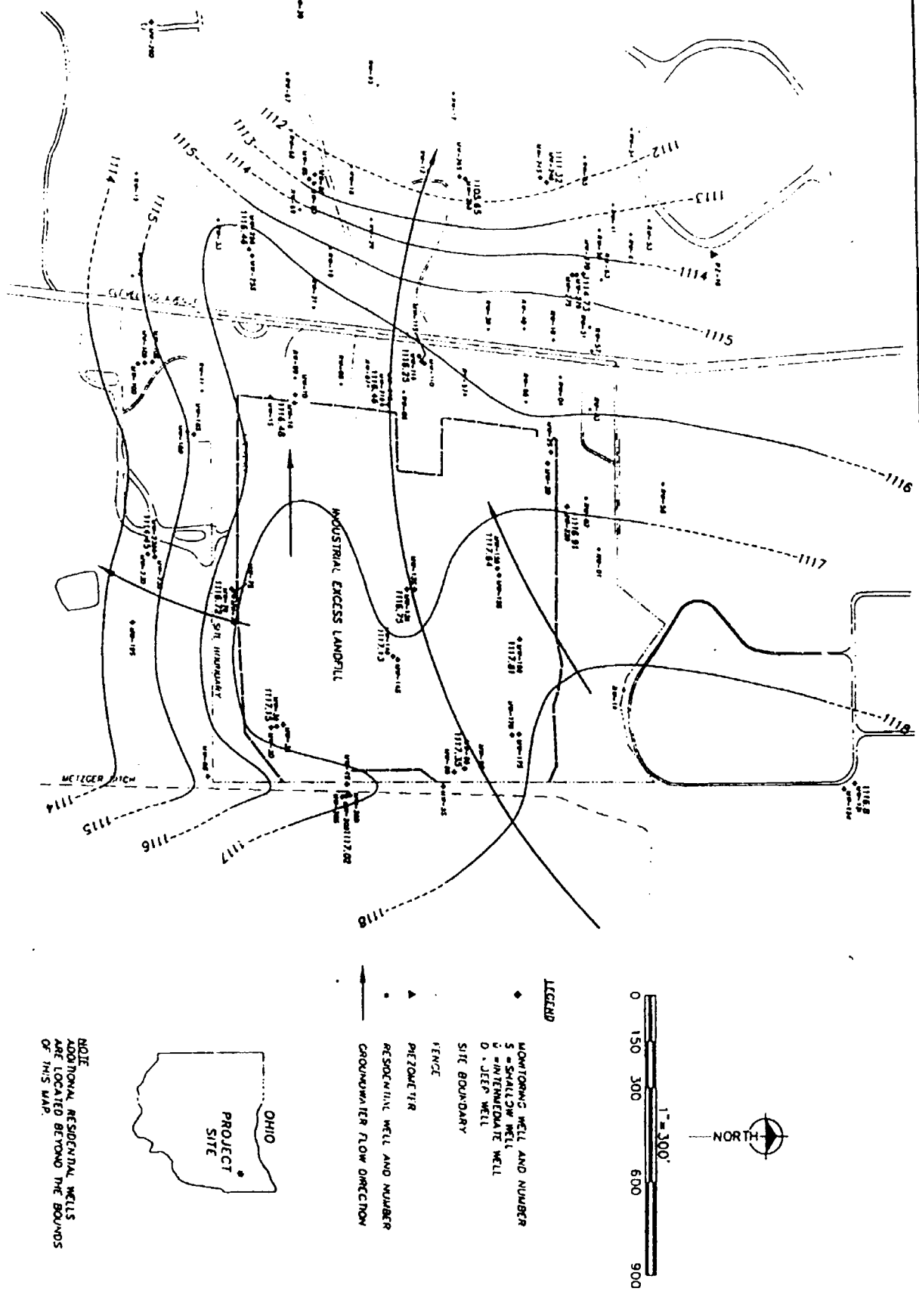
FIGURE 1
GROUNDWATER POTENTIOMETRIC SURFACE
SHALLOW AQUIFER MARCH 1997
INDUSTRIAL EXCESS LANDFILL SITE
UNIONTOWN, OHIO

PREPARED FOR
FULLER AND HENRY
TOLEDO, OHIO

APPROVED	5/97
CHECKED	5/97
DRAWN	05/06/1997
DRAWING NUMBER	3818218

Earth Sciences Consultants, Inc

Exhibit 23



Project Reference: #7203
INDUSTRIAL EXCESS LANDFILL (IEL)
UNIONTOWN, OHIO

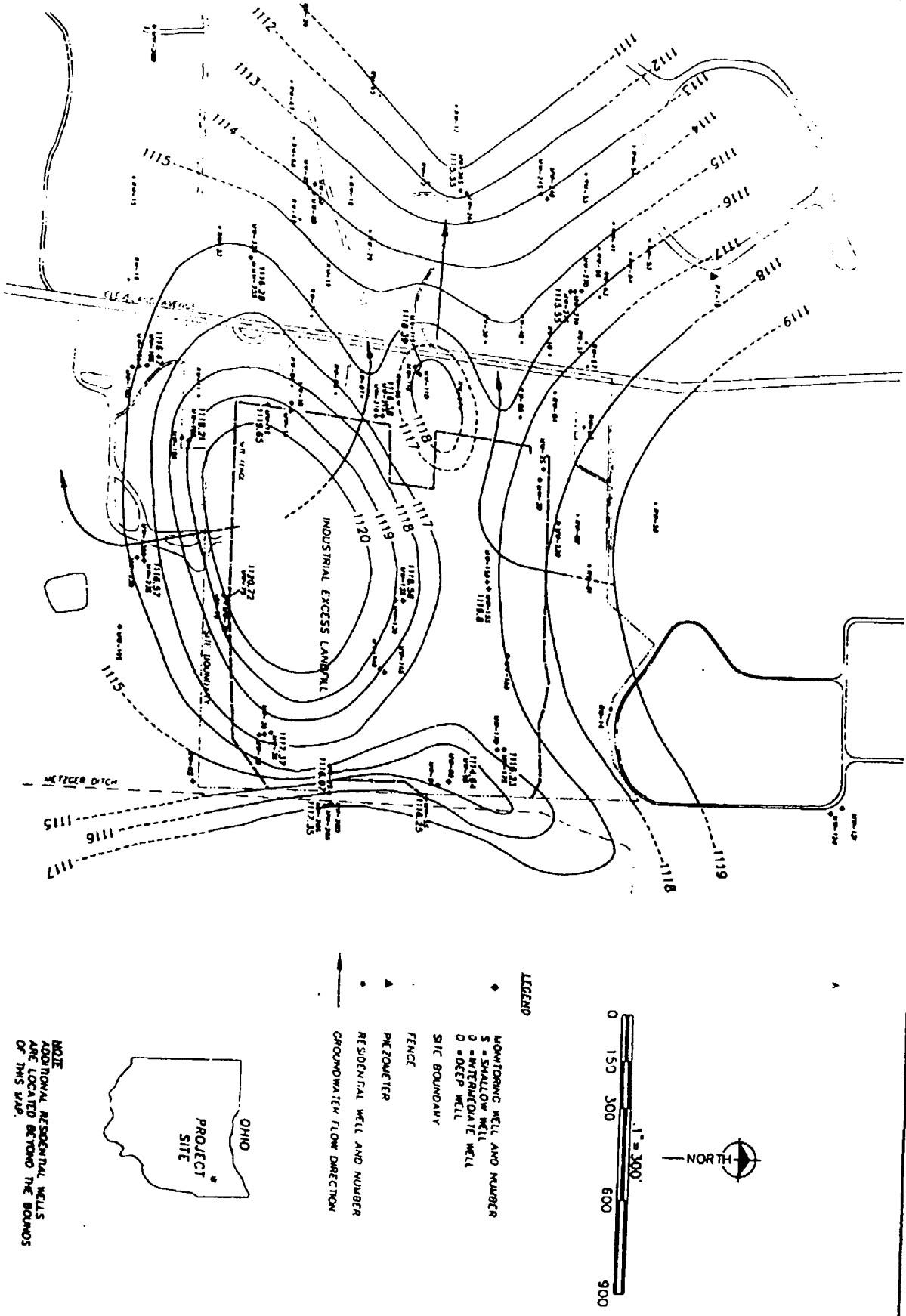
POTENTIOMETRIC SURFACE MAP
9/14 - 9/16 DATA
INTERMEDIATE SAND
AND GRAVEL AQUIFER

Client: IEL PRP GROUP

SHARP
AND ASSOCIATES, INC.

4

Exhibit 24



Project Reference: #7203

POTENTIOMETRIC SURFACE MAP
9/14 - 9/16 DATA
SHALLOW SAND
AND GRAVEL AQUIFER

INDUSTRIAL EXCESS LANDFILL (IEL)
UNIONTOWN, OHIO

Client: IEL PRP GROUP

SHARP
AND ASSOCIATES, INC.

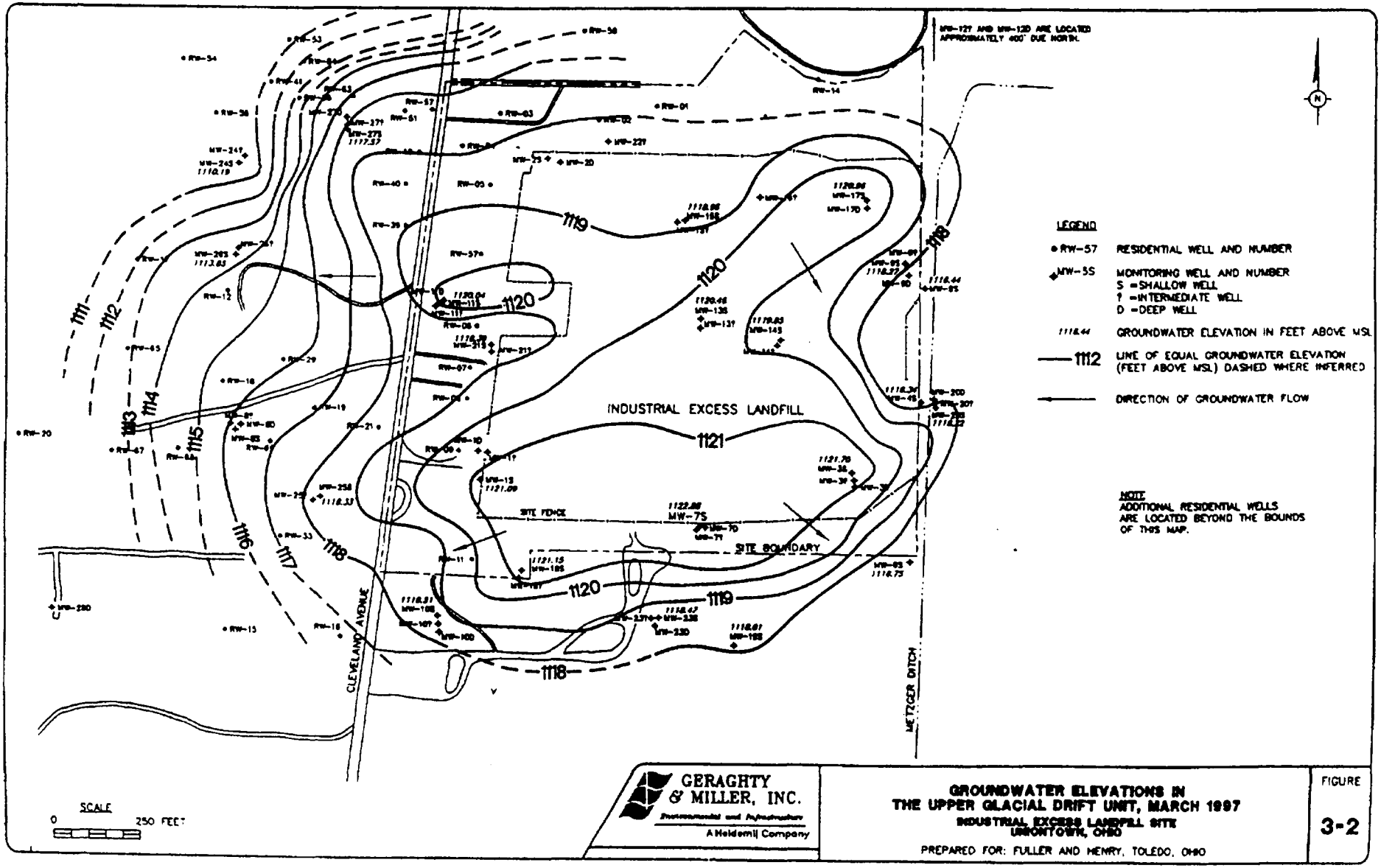

MW-127 AND MW-128 ARE LOCATED APPROXIMATELY 400' DUE NORTH.
INDUSTRIAL EXCESS LANDFILL
SITE FENCE
SITE BOUNDARY
MW-7S
CLEVELAND AVENUE
METZGER DITCH
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
LEGEND
RW-57 RESIDENTIAL WELL AND NUMBER
MW-3S MONITORING WELL AND NUMBER
S = SHALLOW WELL
? = INTERMEDIATE WELL
D = DEEP WELL
1118.44 GROUNDWATER ELEVATION IN FEET ABOVE MSL
1112 LINE OF EQUAL GROUNDWATER ELEVATION (FEET ABOVE MSL) DASHED WHERE INFERRED
DIRECTION OF GROUNDWATER FLOW
NOTE
ADDITIONAL RESIDENTIAL WELLS ARE LOCATED BEYOND THE BOUNDS OF THIS MAP.
SCALE
0 250 FEET
GERAGHTY & MILLER, INC.
Environmental and Hydrodynamics
A Halliburton Company
GROUNDWATER ELEVATIONS IN THE UPPER GLACIAL DRIFT UNIT, MARCH 1997
INDUSTRIAL EXCESS LANDFILL SITE
UNIONTOWN, OHIO
PREPARED FOR: FULLER AND HENRY, TOLEDO, OHIO
FIGURE
3-2

Exhibit 25

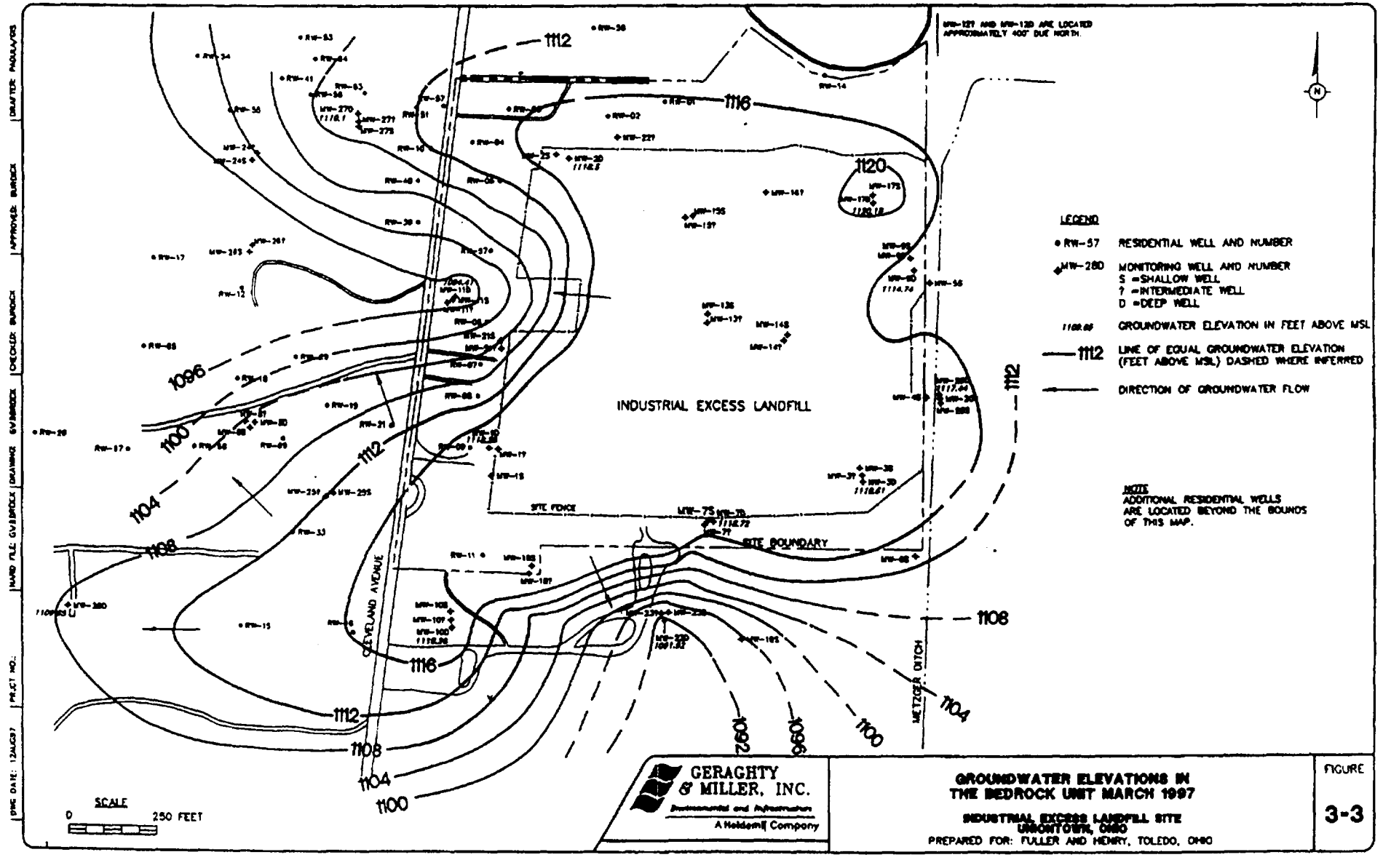
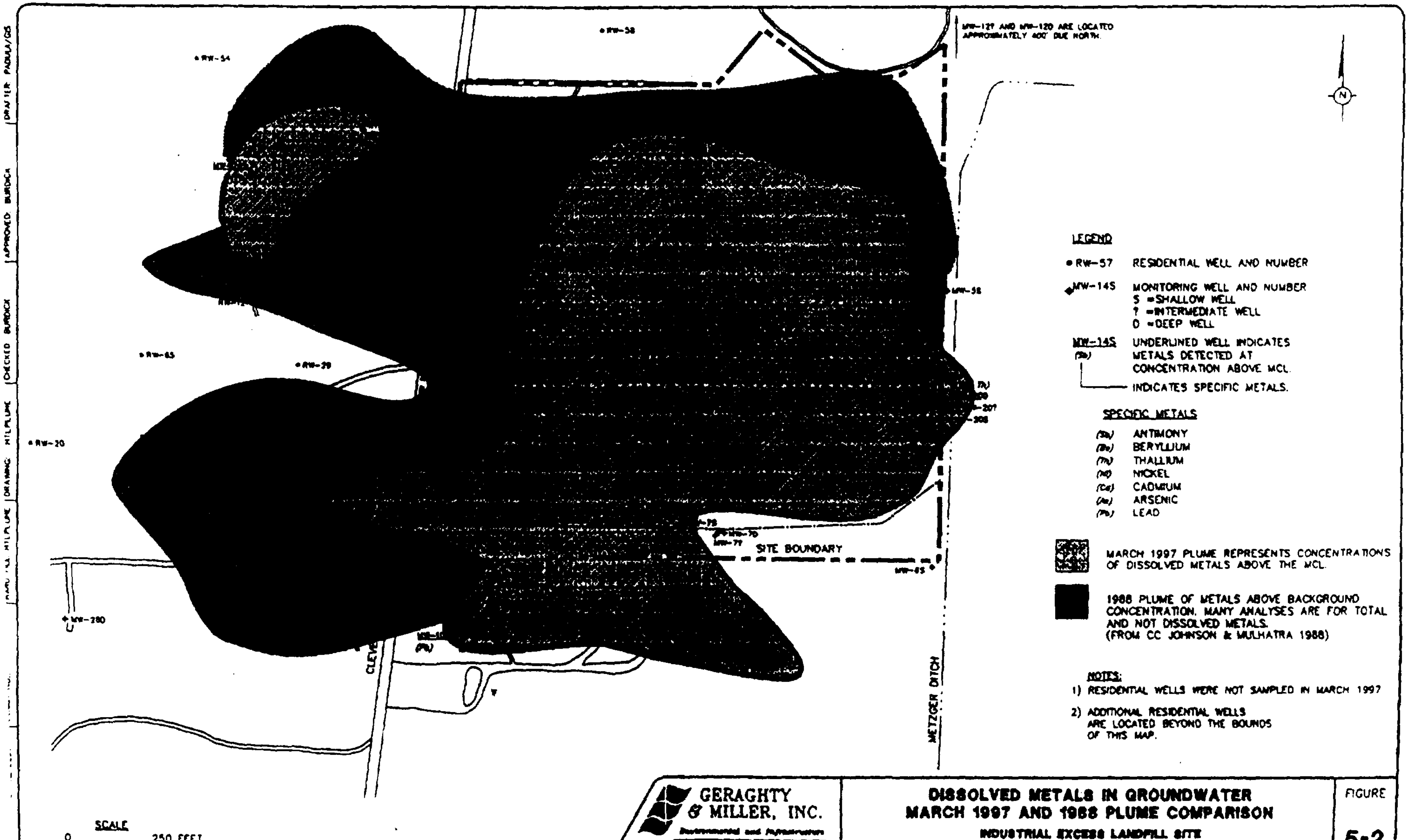

INDUSTRIAL EXCESS LANDFILL
CLEVELAND AVENUE
METZGER DITCH
SITE FENCE
SITE BOUNDARY
MW-127 AND MW-128 ARE LOCATED APPROXIMATELY 400' DUE NORTH.
NOTE
ADDITIONAL RESIDENTIAL WELLS ARE LOCATED BEYOND THE BOUNDS OF THIS MAP.
LEGEND
RW-57 RESIDENTIAL WELL AND NUMBER
MW-28D MONITORING WELL AND NUMBER
S =SHALLOW WELL
? =INTERMEDIATE WELL
D =DEEP WELL
1100.00 GROUNDWATER ELEVATION IN FEET ABOVE MSL
1112 LINE OF EQUAL GROUNDWATER ELEVATION (FEET ABOVE MSL) DASHED WHERE INFERRED
DIRECTION OF GROUNDWATER FLOW
SCALE
0 250 FEET
GERAGHTY & MILLER, INC.
Environmental and Information
A Halliburton Company
GROUNDWATER ELEVATIONS IN THE BEDROCK UNIT MARCH 1997
INDUSTRIAL EXCESS LANDFILL SITE
UNIONTOWN, OHIO
PREPARED FOR: FULLER AND HENRY, TOLEDO, OHIO
FIGURE
3-3

Exhibit 26



GERAGHTY & MILLER, INC.
A Heidemij Company

DISSOLVED METALS IN GROUNDWATER
MARCH 1997 AND 1988 PLUME COMPARISON
INDUSTRIAL EXCESS LANDFILL SITE
UNIONTOWN, OHIO
PREPARED FOR: FULLER AND HENRY, TOLEDO, OHIO

FIGURE 5-2

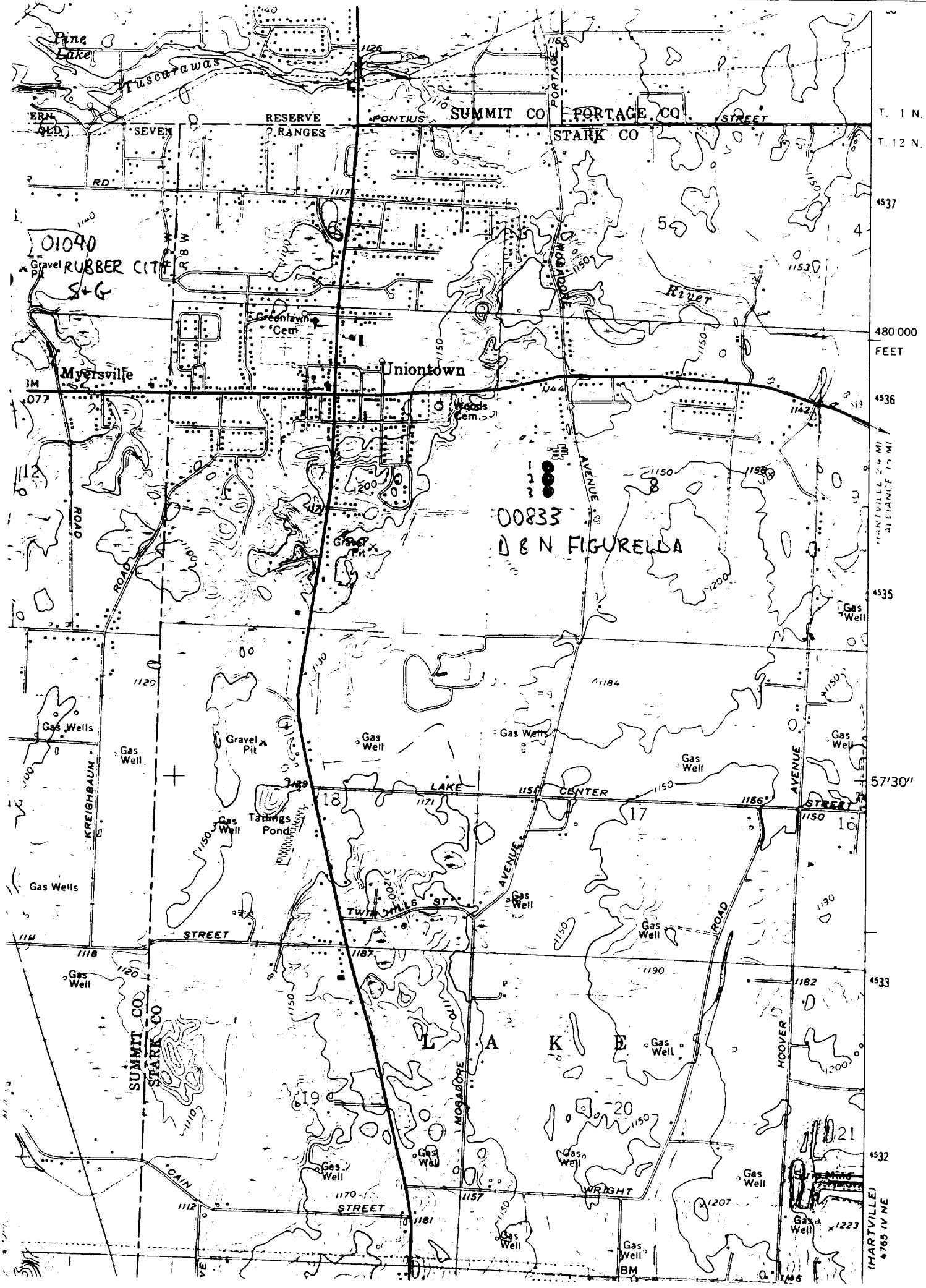

Pine Lake
Tuscarawas
RESERVE
SEVEN RANGES
PONTIUS
SUMMIT CO
PORTAGE CO
STARK CO
PORTAGE STREET
T. 1 N.
T. 12 N.
01040
RUBBER CITY
S+G
Gravel Pit
R 8 W
Greenlawn Cem
Myersville
Uniontown
Woods Cem
Gravel Pit
00833
D & N FIGURELLA
ROAD
AVENUE
MOGADORE
River
480 000 FEET
4537
4536
4535
4533
4532
57'30"
Gas Well
Gas Wells
Tailings Pond
LAKE CENTER STREET
TWIN HILLS ST
STREET
KREIGHBAUM
CAIN
WRIGHT
HOOVER
L A K E
SUMMIT CO
STARK CO
BM
(HARTVILLE) 4765 IV NE

Exhibit 28

KAB

RECEIVED

DEC 05 1990

OW837

STATE OF OHIO WATER WITHDRAWAL FACILITY REGISTRATION

DEPT. OF WATER

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES DEVELOPMENT SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-3
COLUMBUS, OHIO 43224-1336
(614) 265-6750

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more than 100,000 gallons of water daily, register such facilities with the Ohio Department of Natural Resources, Division of Water.

100,000 Gallons Per Day (GPD) = 0.1 Million Gallons Per Day (MGD) = 4200 Gallons Per Hour (GPH) = 70 Gallons Per Minute (GPM)

Detailed directions are on a separate instruction sheet. Please type or print the following information:

1. OWNER OF WATER WITHDRAWAL FACILITY

Owner's Name: D+N Figurella	Contact Person (If other than owner)
Company Name	Company Name
Mailing Address: 2092 Mt. Pleasant NW	Mailing Address
City, State, Zip: No. Canton OH 44720	City, State, Zip
SIC (Standard Industrial Classification)-4 digit: 0191 / Phone: (216) 494-2105	Phone ( )

The annual withdrawal report form should be sent to : ☐ Owner ☐ Contact person (Check one)

2. WATER USE

Estimate percentage of the total water use from all sources for each type of use for both ground water and surface water. Total water use for both ground and surface water = 100%; GW = Ground water; SW = Surface water

WATER USE	GW%	SW%
Public Water Supply		
Community		
Non-community		
(OEPA # _____)		
Agricultural		
Livestock Watering		
Crop Irrigation		
Nursery/Turf/Landscaping	100	
Industrial		
Process Water		
Cooling Water		
Power Generation		
Nuclear		
Thermoelectric		
Hydroelectric		

WATER USE	GW%	SW%
Mineral Extraction		
Coal		
Oil		
Salt		
Sand and Gravel		
Limestone		
Other _____ (Please specify)		
Miscellaneous		
Recreation/Amusement		
Water Quality Remediation		
Heating/Cooling		
Domestic		
Fish Hatchery		
Dewatering		
Golf Course Irrigation		
Other _____ (Please specify)		

3. WATER WITHDRAWAL FACILITY CAPACITY

Total withdrawal capacity of the facility: 1 GPD or (MGD) (Circle one)

NOTE: Total withdrawal capacity is the sum of the withdrawal capacity for all wells and surface water intakes combined.

Was construction of this facility completed before January 1, 1990? ✓ Yes ____ No

Name of facility Mogadore Ave. N.W. (AV)

4. SUPPLY SOURCES

GROUND-WATER SOURCES	SURFACE-WATER SOURCES
Total number of wells 3	Total number of surface-water intakes _____
Total withdrawal capacity of all wells 2.5	Total withdrawal capacity of all intakes _____
GPD or (MGD) (Circle one)	GPD or MGD (Circle one)

DNR 7804 (01/90)

Exhibit 29

FOR EACH WELL
PROVIDE THE FOLLOWING:

A. Owner's well number 1
Well capacity 1 GPD or MGD (Circle one)
Well log number (or copy of well log) ?
Well depth ? (ft) Well diameter 10" (in)

AQUIFER UTILIZED (Check one)

- ☐ Sand
- ☐ Sandstone (SS)
- ☐ Sand and gravel
- ☐ Limestone (LS) /Dolomite
- ☐ Shale (Sh)
- ☐ Interbedded SS, LS, Sh
- ☐ Underground mine
- ☐ Other

LOCATION OF WELL

County Stark
Township Lake Section 7
Nearest City or Town Uniontown
Provide written description of well location.
12155 Mogadore Ave

B. Owner's well number 2
Well capacity 1 GPD or MGD (Circle one)
Well log number (or copy of well log) ?
Well depth ? (ft) Well diameter 10" (in)

AQUIFER UTILIZED (Check one)

- ☐ Sand
- ☐ Sandstone (SS)
- ☐ Sand and gravel
- ☐ Limestone (LS) /Dolomite
- ☐ Shale (Sh)
- ☐ Interbedded SS, LS, Sh
- ☐ Underground mine
- ☐ Other

LOCATION OF WELL

County Stark
Township Lake Section 7
Nearest City or Town Uniontown
Provide written description of well location.
12155 Mogadore Ave N.W.

C. Owner's well number 3
Well capacity .5 GPD or MGD (Circle one)
Well log number (or copy of well log)
Well depth ? (ft) Well diameter 8" (in)

AQUIFER UTILIZED (Check one)

- ☐ Sand
- ☐ Sandstone (SS)
- ☐ Sand and gravel
- ☐ Limestone (LS) /Dolomite
- ☐ Shale (Sh)
- ☐ Interbedded SS, LS, Sh
- ☐ Underground mine
- ☐ Other

LOCATION OF WELL

County Stark
Township Lake Section 7
Nearest City or Town Uniontown
Provide written description of well location.
12155 Mogadore Ave. N.W.

(Note: Use additional sheets if necessary)

FOR EACH SURFACE-WATER INTAKE
PROVIDE THE FOLLOWING:

A. Owner's intake number
Intake capacity GPD or MGD (Circle one)
Name of body of water

SOURCE UTILIZED (Check one)

- ☐ River, stream, or drainage ditch
- ☐ Lake, pond, quarry, or reservoir
- ☐ Other

LOCATION OF INTAKE

County
Township Section
Nearest City or Town
Provide written description of intake location.

B. Owner's intake number
Intake capacity GPD or MGD (Circle one)
Name of body of water

SOURCE UTILIZED (Check one)

- ☐ River, stream, or drainage ditch
- ☐ Lake, pond, quarry, or reservoir
- ☐ Other

LOCATION OF INTAKE

County
Township Section
Nearest City or Town
Provide written description of intake location.

C. Owner's intake number
Intake capacity GPD or MGD (Circle one)
Name of body of water

SOURCE UTILIZED (Check one)

- ☐ River, stream, or drainage ditch
- ☐ Lake, pond, quarry, or reservoir
- ☐ Other

LOCATION OF INTAKE

County
Township Section
Nearest City or Town
Provide written description of intake location.

(Note: Use additional sheets if necessary)

Supply Sources Continued:

D. Owner's well number _____
Well capacity _____ GPD or MGD (Circle one)
Well log number (or copy of well log) _____
Well depth _____ (ft) Well diameter _____ (in)

AQUIFER UTILIZED (Check one)

- ☐ Sand
- ☐ Sandstone (SS)
- ☐ Sand and gravel
- ☐ Limestone (LS) /Dolomite
- ☐ Shale (Sh)
- ☐ Interbedded SS, LS, Sh
- ☐ Underground mine
- ☐ Other _____

LOCATION OF WELL

County _____
Township _____ Section _____
Nearest City or Town _____
Provide written description of well location.

D. Owner's intake number _____
Intake capacity _____ GPD or MGD (Circle one)
Name of body of water _____

SOURCE UTILIZED (Check one)

- ☐ River, stream, or drainage ditch
- ☐ Lake, pond, quarry, or reservoir
- ☐ Other _____

LOCATION OF INTAKE

County _____
Township _____ Section _____
Nearest City or Town _____
Provide written description of intake location.

5. LOCATION OF WATER USE

State Ohio County Stark Township Lake Section 7

Provide written description of location of water use. If more than one water use location exists, attach separate sheets providing the above information for each.

6. TYPE AND LOCATION OF DISCHARGE POINTS

Estimate percentage of water discharged to the following: 0

- ___ Recharge Well
- ___ On Site Sewage Disposal
- ___ Ground-water Recharge Basin
- ___ Land Application
- ___ Recycling Basin
- ___ Wetland
- ___ Pond, Lake, or Reservoir Name _____
- ___ River, Stream, or Drainage Ditch Name _____
- ___ Other _____ (Please specify)

Location of Discharge Facility

State _____ County _____ Township _____ Section _____

Provide written description of location of discharge facility. If more than one point of discharge exists, attach separate sheets providing the above information for each.

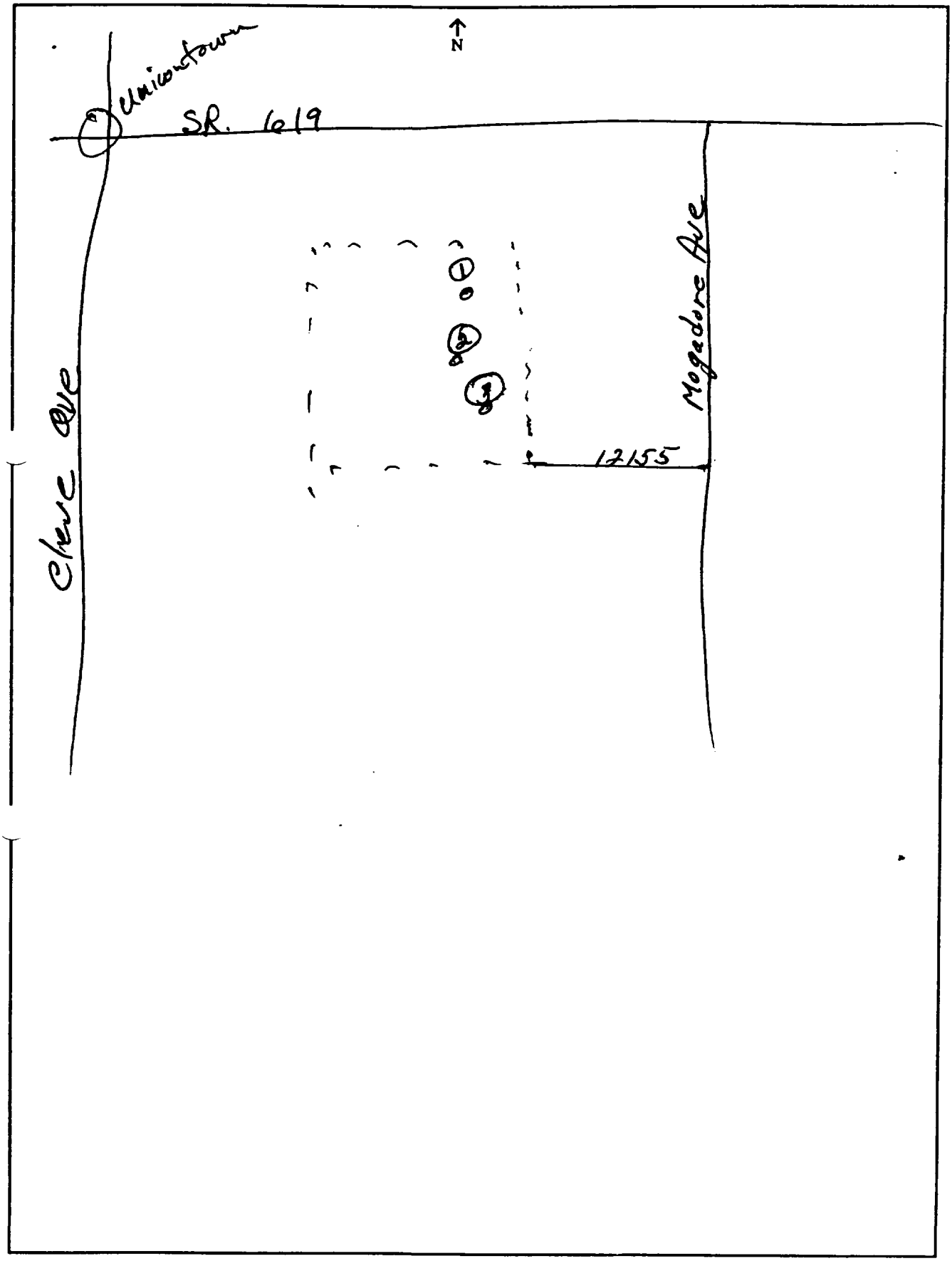
Please complete a water withdrawal facility location sketch on page 4.

7. STATEMENT OF AFFIRMATION

I hereby certify that to the best of my knowledge the information submitted herein, is true, accurate and complete.

Owner or authorized representative's signature	Date
Donald J. Esquilla	11/30/90

WATER WITHDRAWAL FACILITY LOCATION SKETCH: Locate all wells, intake pipes, places of use, and discharge points with references to water sources, named roads, highways, buildings, or other distinctive landmarks. This section may be divided for additional maps or separate maps may be attached.



NORTH CANTON U-28

FOR OFFICE USE ONLY:

Date of Registration _____ Basin 05040001 Registration Number U0833 Latitude 40° 58' 20" Longitude 81° 23' 40"

STATE OF OHIO
WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES DEVELOPMENT SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-3
COLUMBUS, OHIO 43224-1336
(614) 265-6750

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more than 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

RECEIVED
DEC 2 1994
DIVISION OF WATER
GROUND WATER RESOURCES

INSTRUCTIONS

WATER WITHDRAWAL FACILITY

Provide the name of the owner of the facility. In the case of a public water supply system or other government operated facility, furnish the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the registration number of the facility as found on the facility registration confirmation. Please record the facility registration number at the top of page two of this form, also. If you do not know the number, contact the Division of Water at

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS

Report the amounts withdrawn in units of millions of gallons. Round the number to three decimal places. For example, 15,980,999 gallons per day would round to 15.981 million gallons per day (MGD). NOTE: The second page of this form may be photocopied if additional space is needed. If you use additional sheets, sign and date each one.

GROUND WATER

Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the maximum and minumum amounts withdrawn daily for each month under "Maximum" and "Minimum." Report the number of days per month the facility wells were in ration and enter that figure under "Days in Operation." For example, if your facility pumps water one hour per day, than the number of days per month facility is in use equals the number of days in the month. Sum each month's number of days in operation and enter the amount under "Total Operation Days." NOTE: If you do not have meters on your wells, estimate to the best of your ability!

SURFACE WATER

Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the maximum and minimum amounts withdrawn daily for each month under "Maximum" and "Minimum." Report the number of days per month the facility intakes are in operation and enter that amount under "Days in Operation." For example, if your facility pumps water one hour per day, than the number of days per month the facility is in use equals the number of days in the month. Sum each month's number of days in operation and enter the amount under "Total Operation Days." NOTE: If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface-water or ground-water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determined. Attach a separate sheet if necessary.

RETURN FLOW

Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and enter that amount under "Total." NOTE: If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined. Attach a separate sheet, if necessary.

Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

NOTE: Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit the annual report will not be met until the completed form is received by the Division of Water. The annual report must be submitted even if no water was withdrawn. Reports should be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6750.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	Phone no.	Contact Person (If other than owner)	Phone no.
Donald S Figurella	216 494 2105		
Company Name		Company Name	
Mailing Address: 2092 Mt. Pleasant NW		Mailing Address	
City, State, Zip: North Canton, OH. 44720		City, State, Zip	
Facility Registration Number: 00833 Stark		Water Withdrawal Report for Year Ending December 31, 199 3	

DNR 7804 (01/90)

Exhibit 30

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

(in Units of Millions of Gallons) REGISTRATION NUMBER 08233

GROUND WATER

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
WELL NO. 1	0	0	0	0	0	1.5	2	1.5	.5	0	0	0	5.5
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL	0	0	0	0	0	1.5	2	1.5	.5	0	0	0	GRAND TOTAL 5.5
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

SURFACE WATER

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAY

Are surfacewater and groundwater withdrawal amounts based on metered readings? yes no (circle one)
If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary)

RETURN FLOW (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
FLOW													
FLOW													
FLOW													
FLOW													
TOTAL													GRAND TOTAL

Are return flow amounts based on metered readings? yes no (circle one)
If "no," how were the reported return flow amounts determined?
(Attach separate sheet, if necessary)

Estimated

Is the information originally supplied on your registration form still correct? yes no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature: Donald J. Trogstad

Date: 11/25/94

STATE OF OHIO
WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-1
COLUMBUS, OHIO 43224-1336
(614) 265-6735

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more than 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

INSTRUCTIONS

WATER WITHDRAWAL FACILITY

Provide the name of the owner of the facility. In the case of a public water supply system or other government operated facility, furnish the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the REGISTRATION NUMBER of the facility as found on the facility registration confirmation. If you do not know the number, contact the Division of Water at 614/265-6735.

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS

Report the amounts withdrawn in units of millions of gallons. Round the number to two decimal places. For example, 7,635,730 gallons per day would round to 7.64 million gallons per day (MGD). **NOTE**: The second page of this form may be photocopied if additional space is needed. If you use additional sheets, sign and date each one.

GROUND WATER

Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the daily maximum and the daily minumum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during any of the month. Report the number of days per month the facility wells were in operation and enter that figure under "Days in Operation." Sum each th's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your wells, estimate to the best of your ability!

SURFACE WATER

Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during any day of the month. Report the number of days per month the facility intakes were in operation and enter that amount under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface water or ground water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determined.

RETURN FLOW

Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop and golf course irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and r that amount under "Total." If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined.

NOTE: Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit the annual report will not be met until the completed form is received by the Division of Water. The annual report MUST be submitted even if no water was withdrawn. Reports MUST be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6735.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	*Phone no.*	Contact Person (If other than owner)	*Phone no.*
Company Name		Company Name	
Mailing Address		Mailing Address	
City, State, Zip		City, State, Zip	
Facility Registration Number 00833		Water Withdrawal Report for Year Ending December 31, 199 4	

DNR 7804 (09/94)

Stark

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

WITHDRAWALS

Registration Number 00833

GROUND WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
WELL NO. 1	0	0	5	0	0	2	3.5	1	.5	0	0	0	7
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL													GRAND TOTAL 7
MAXIMUM													
MINIMUM													
DAYS IN OPERATION						5	18	3	2				TOTAL OPERATION DAYS 28

SURFACE WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

Are surface water and ground water withdrawal amounts based on metered readings? yes no (circle one) If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary)

RETURN FLOW (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
FLOW													
FLOW													
TOTAL													GRAND TOTAL

Are return flow amounts based on metered readings? yes no (circle one) If "no," how were the reported return flow amounts determined? (Attach separate sheet, if necessary)

NOTE: Is the information originally supplied on your registration form still correct? yes no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature: Wanda A. Fuquette

Date: Dec 10, 1994

Exhibit 31

STATE OF OHIO WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-1
COLUMBUS, OHIO 43224-1336
(614) 265-6735

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more than 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

INSTRUCTIONS

WATER WITHDRAWAL FACILITY
Provide the name of the owner of the facility. In the case of a public water supply system or other governmentally operated facility, the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the REGISTRATION NUMBER of the facility as found on the facility registration confirmation. If you do not know the number, contact the Division of Water at 614/265-6735.

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS
Report the amounts withdrawn in units of millions of gallons. Round the number to two decimal places. For example, 7,635,730 gallons per day would round to 7.64 million gallons per day (MGD). **NOTE**: The second page of this form may be photocopied if additional space is needed. If you use additional sheets, sign and date each one.

GROUND WATER
Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during any day of the month. Report the number of days per month the facility wells were in operation and enter that figure under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your wells, estimate to the best of your ability!

SURFACE WATER
Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during any day of the month. Report the number of days per month the facility intakes were in operation and enter that amount under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface water or ground water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determined.

RETURN FLOW
Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop and golf course irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and enter that amount under "Total." If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined.

NOTE: Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit the annual report will not be met until the completed form is received by the Division of Water. The annual report MUST be submitted even if no water was withdrawn. Reports MUST be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6735.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	*Phone no.*	Contact Person (If other than owner)	*Phone no.*
Donald Figurella			
Company Name		Company Name	
Mailing Address: 2692 Mt. Pleasant N.W.		Mailing Address	
City, State, Zip: No. Canton OH 44720		City, State, Zip	
Facility Registration Number: 00833		Water Withdrawal Report for Year Ending December 31, 1995	

DNR 7804 (09/94)

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

WITHDRAWALS

Registration Number 00833

GROUND WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
WELL NO. 1	0	0	0	0	0	0	.4	.4	.2	0	0	0	1
WELL NO. 2	0	0	0	0	0	0	.4	.4	.2	0	0	0	1
WELL NO. 3	0	0	0	0	0	0	.4	.4	.2	0	0	0	1
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL							1.2	1.2	.6				GRAND TOTAL 3
MAXIMUM													
MINIMUM													
DAYS IN OPERATION							24	24	12				TOTAL OPERATION DAYS 60

SURFACE WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL 0
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAY

Are surface water and ground water withdrawal amounts based on metered readings? yes (no) (circle one) If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary) G.P.M. x Hrs + Days

RETURN FLOW (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
FLOW													
FLOW													
TOTAL													GRAND TOTAL 0

Are return flow amounts based on metered readings? yes no (circle one) If "no," how were the reported return flow amounts determined? (Attach separate sheet, if necessary)

NOTE: Is the information originally supplied on your registration form still correct? yes no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature Donald Fuguella | Date 1/5/96

EXHIBIT 32

STATE OF OHIO WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-1
COLUMBUS, OHIO 43224-1336
(614) 265-6735

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more tha 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

RECEIVED
JUN 13 1997
ODNR/DIVISION OF WATER
WATER RESOURCES SECTION

INSTRUCTIONS

WATER WITHDRAWAL FACILITY

Provide the name of the owner of the facility. In the case of a public water supply system or other government operated facility, furnish the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the REGISTRATION NUMBER of the facility as found on the facility registration permit. If you do not know the number, contact the Division of Water at 614/265-6735.

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS

Report the amounts withdrawn in units of millions of gallons. Round the number to two decimal places. For example, 7,635,730 gallons per day would round to 7.64 million gallons per day (MGD). **NOTE**: The second page of this form may be photocopied if additional space is needed. If you use additional sheets, sign and date each one.

GROUND WATER

Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amoun and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the daily maximum and the daily ninumum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during ar day of the month. Report the number of days per month the facility wells were in operation and enter that figure under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your wells, estimate to the best of your ability!

SURFACE WATER

Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during any day of the month. Report the number of days per month the facility intakes were in operation and enter that amount under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface water or ground water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determined.

RETURN FLOW

Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop and golf course irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and enter that amount under "Total." If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined.

NOTE: Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit th annual report will not be met until the completed form is received by the Division of Water. The annual report MUST be submitted even if no water was withdrawn. Reports MUST be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6735.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	*Phone no.*	Contact Person (If other than owner)	*Phone no.*
Company Name		Company Name	
Mailing Address		Mailing Address	Same
City, State, Zip		City, State, Zip	
Facility Registration Number 00833		Water Withdrawal Report for Year Ending December 31, 1996	

DNR 7804 (09/94)

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

WITHDRAWALS

Registration Number 00893

GROUND WATER (in Units of Millions of Gallons)

SOURCE DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.		TOTAL PER YEAR
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL													GRAND TOTAL 0
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS 0

SURFACE WATER (in Units of Millions of Gallons)

SOURCE DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.		TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL
XIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

Are surface water and ground water withdrawal amounts based on metered readings? yes no (circle one) If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary)

RETURN FLOW (in Units of Millions of Gallons)

SOURCE DEC.	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.		TOTAL PER YEAR
FLOW													
FLOW													
TOTAL													GRAND TOTAL

Are return flow amounts based on metered readings? yes no (circle one) If "no," how were the reported return flow amounts determined? (Attach separate sheet, if necessary)

NOTE: Is the information originally supplied on your registration form still correct? yes no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature Donald L. Fiscarella

Date 6/6/97

EXHIBIT 33

STATE OF OHIO WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-1
COLUMBUS, OHIO 43224-1336
(614) 265-6735

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more th 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

RECEIVED
AUG 17 1998
OHIO DIVISION OF WATER
WATER RESOURCES SECTION

INSTRUCTIONS

WATER WITHDRAWAL FACILITY

Provide the name of the owner of the facility. In the case of a public water supply system or other government operated facility, furnish the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the REGISTRATION NUMBER of the facility as found on the facility registration confirmation. If you do not know the number, contact the Division of Water at 614/265-6735.

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS

Report the amounts withdrawn in units of millions of gallons. Round the number to two decimal places. For example, 7,635,730 gallons per day would rou to 7.64 million gallons per day (MGD). **NOTE:** The second page of this form may be photocopied if additional space is needed. If you use additional shee sign and date each one.

GROUND WATER

Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amoun and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the daily maximum and the daily minumum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during an ay of the month. Report the number of days per month the facility wells were in operation and enter that figure under "Days in Operation." Sum each mont number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your wells, estimate to the best of your abilit

SURFACE WATER

Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn duri any day of the month. Report the number of days per month the facility intakes were in operation and enter that amount under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface water or ground water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determine

RETURN FLOW

Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop and golf course irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter hat amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and enter hat amount under "Total." If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined.

NOTE: Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit the annual report will not be met until the completed form is received by the Division of Water. The annual report MUST be submitted even if no water was withdrawn. Reports MUST be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6735.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	*Phone no.*	Contact Person (If other than owner)	*Phone no.*
Donald Figurella			
Company Name		Company Name	
Mailing Address		Mailing Address	
2092 Mt. Pleasant NW.			
City, State, Zip		City, State, Zip	
No Canton OH 44720			
Facility Registration Number		Water Withdrawal Report for Year Ending December 31, 1997	
00833 Lake 7 Stark			

DNR 7804 (10/97)

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

WITHDRAWALS

Registration Number 00833

GROUND WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
WELL NO. 1	0	0	0	0	0	2	25	25	.5	0	0	0	7.5
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL													GRAND TOTAL 7.5
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

SURFACE WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAY

Are surface water and ground water withdrawal amounts based on metered readings? yes no (circle one) If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary)

RETURN FLOW (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
FLOW													
FLOW													
TOTAL													GRAND TOTAL

Are return flow amounts based on metered readings? yes no (circle one) If "no," how were the reported return flow amounts determined? (Attach separate sheet, if necessary)

NOTE: Is the information originally supplied on your registration form still correct? yes no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature Donald Figurella

Date 8/10/98

STATE OF OHIO WATER WITHDRAWAL FACILITY REGISTRATION ANNUAL REPORT FORM

SEND TO: OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER
WATER RESOURCES SECTION
1939 FOUNTAIN SQUARE COURT, BLDG. E-1
COLUMBUS, OHIO 43224-1336
(614) 265-6735

RECEIVED
JAN 27 1999
DIVISION OF WATER
WATER RESOURCES SECTION

AUTHORITY: Ohio Revised Code Section 1521.16 requires that any owner of a facility, or combination of facilities, with the capacity to withdraw more tha 100,000 gallons of water daily, register such facilities and file an annual report with the Ohio Department of Natural Resources, Division of Water.

INSTRUCTIONS

WATER WITHDRAWAL FACILITY
Provide the name of the owner of the facility. In the case of a public water supply system or other government operated facility, furnish the name of the municipality or agency. If there is an employee or representative of the owner who should be contacted regarding the information on the registration form, his or her name, address, and phone number should be furnished in the space marked "Contact Person."

Facility Registration Number: Record the REGISTRATION NUMBER of the facility as found on the facility registration confirmation. If you do not know the number, contact the Division of Water at 614/265-6735.

Indicate the appropriate calendar year which corresponds with the information you provide on the back of this form.

WITHDRAWALS
Report the amounts withdrawn in units of millions of gallons. Round the number to two decimal places. For example, 7,635,730 gallons per day would roun to 7.64 million gallons per day (MGD). **NOTE:** The second page of this form may be photocopied if additional space is needed. If you use additional sheet sign and date each one.

GROUND WATER
Report the well identification number. This is the number that you assign to a well.

Report the monthly withdrawals for each well. Sum all values for each well and enter that amount under "Total Per Year." Sum all "Total Per Year" amount and enter that amount under "Grand Total." Sum each month's withdrawal and enter that amount under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn during an of the month. Report the number of days per month the facility wells were in operation and enter that figure under "Days in Operation." Sum each month number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your wells, estimate to the best of your abilit

SURFACE WATER
Report the intake identification number. This is the number that you assign to an intake.

Report the monthly withdrawals for each intake. Sum all months for each intake and enter that amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's withdrawal and enter that figure under "Total." Enter the daily maximum and the daily minimum amounts withdrawn for each month under "Maximum" and "Minimum." For the "Minimum" enter zero (0) if no water was withdrawn durin any day of the month. Report the number of days per month the facility intakes were in operation and enter that amount under "Days in Operation." Sum each month's number of days in operation and enter the amount under "Total Operation Days." If you do not have meters on your intakes, estimate to the best of your ability!

Indicate whether surface water or ground water withdrawal amounts are based on metered readings. If not, explain how withdrawal amounts were determine

15000/Hr 45000/Day

RETURN FLOW
Return flow is that portion of withdrawn water which is not consumed or lost to evapotranspiration during use and is returned to some source. Water used for crop and golf course irrigation is presumed to be 100% consumed. It is not considered to involve a discharge or return of water to some source.

Report the amounts of return flow in units of millions of gallons. Report the monthly flow returns for each source. Sum all return flow values and enter it amount under "Total Per Year." Sum all "Total Per Year" amounts and enter that amount under "Grand Total." Sum each month's return flow and enter hat amount under "Total." If you do not have meters on your return flows, estimate to the best of your ability!

Indicate whether return flow amounts are based on metered readings. If not, explain how return flow amounts were determined.

NOTE: Indicate whether the information originally supplied on the registration form is still correct. If not, attach a separate sheet indicating the nature of any changes. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Please be sure to sign and date the annual report form. If you use additional sheets, sign and date each one. All the information should be accurate to the best of your knowledge. If the form is not complete, staff from the Division of Water will contact you for more information. The requirement to submit the annual report will not be met until the completed form is received by the Division of Water. The annual report MUST be submitted even if no water was withdrawn. Reports MUST be received by March 1 of the next calendar year. If you have any questions, contact the Division of Water at 614/265-6735.

Please type or print the following information:

WATER WITHDRAWAL FACILITY

Owner's Name	Phone no.	Contact Person (If other than owner)	Phone no.
P. Figurella			
Company Name		Company Name	
Mailing Address: 2092 Mt. Pleasant N.W.		Mailing Address	
City, State, Zip: No. Canton OH 44720		City, State, Zip	
Facility Registration Number: 00833		Water Withdrawal Report for Year Ending December 31, 1998	

DNR 7804 (10/97) Frank

NOTE: This page may be photocopied if additional space is required. Please be sure to sign and date each copy.

WITHDRAWALS

Registration Number 00833

GROUND WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
WELL NO.					2.5	2	3	4	2	3			16.5
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
WELL NO.													
TOTAL													GRAND TOTAL 16.5
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

SURFACE WATER (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
INTAKE													
INTAKE													
INTAKE													
INTAKE													
INTAKE													
TOTAL													GRAND TOTAL
MAXIMUM													
MINIMUM													
DAYS IN OPERATION													TOTAL OPERATION DAYS

Are surface water and ground water withdrawal amounts based on metered readings? yes (no) (circle one) If "no," how were the reported withdrawal amounts determined? (Attach separate sheet, if necessary)

RETURN FLOW (in Units of Millions of Gallons)

SOURCE	JAN.	FEB.	MARCH	APRIL	MAY	J UNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTAL PER YEAR
FLOW													
FLOW													
TOTAL													GRAND TOTAL

Are return flow amounts based on metered readings? yes no (circle one) If "no," how were the reported return flow amounts determined? (Attach separate sheet, if necessary)

NOTE: Is the information originally supplied on your registration form still correct? (yes) no (circle one)
If "no," please attach a separate sheet indicating the nature of the change. If needed, a new registration form will be forwarded to you so that you may provide this office with the necessary revisions.

Owner or authorized representative's signature: Donald Figurella

Date: Jan 25, 1999

WELL LOG AND DRILLING REPORT

ORIGINAL

PLEASE USE PENCIL OR TYPEWRITER DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus 12, Ohio

№ 301340

County Stark Township Lake Section of Township 8

Owner Keyser Bros. Address 5626 Pinedale N.E. Hartville, O

Location of property Mogadore ~~Rt~~ Ave

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 20

Type of screen Pref Length of screen 21

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate 500 G.P.M. Duration of test 5 hrs.

Drawdown 10 ft. Date

Static level-depth to water 3 ft.

Quality (clear, cloudy, taste, odor)

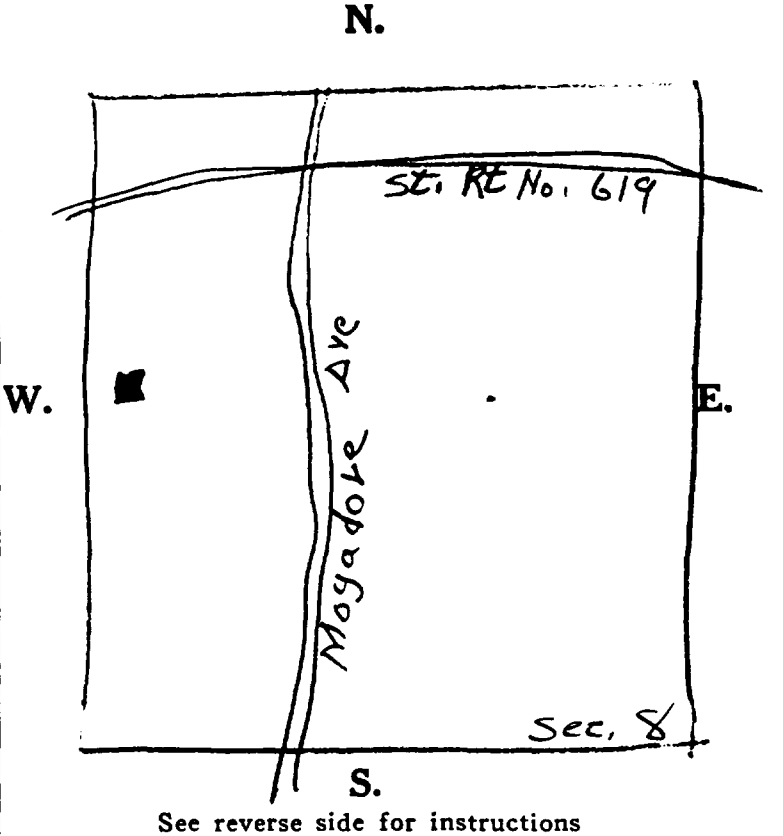
Pump installed by

WELL LOG

Formations Sandstone, shale, limestone, gravel and clay	From	To
	0 Feet	Ft.
Clay		6
Gravel Clay + Stones	6	18
Sand + Gravel	18	40

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm Geo. E. Martin + Son Date 14 Sept. 1964

Address 3103 Martindale Rd Canton, O Signed Geo E Martin

Exhibit 35

WELL LOG AND DRILLING REPORT

ORIGINAL

Exhibit 36
№ 356953

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

County Stark Township Lake Section of Township 8

Owner Keyser Bros. Address 5626 Pinedale N.E.

Location of property Mogadore Ave Hartville, O

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 33½
Type of screen Perf. Length of screen 12
Type of pump
Capacity of pump
Depth of pump setting
Date of completion

BAILING OR PUMPING TEST

Pumping Rate 400 G.P.M. Duration of test hrs.
Drawdown 20 ft. Date
Static level-depth to water 3 ft.
Quality (clear, cloudy, taste, odor)

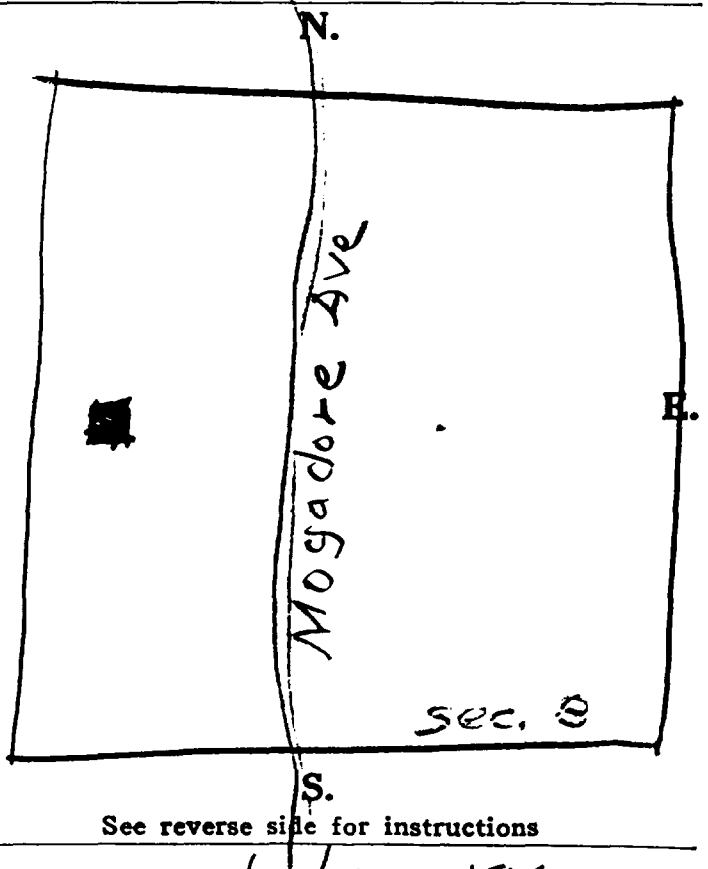
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay	0 Feet	6 Ft.
Gravel clay	6	18
Sand + Grave	18	23
Clay + Stones	23	30
Sand + Gravel	30	43

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

Drilling Firm Geo. E. Martin + Son Date 7 July 1965
Address 3103 Martindale Rd Canton, Signed Geo E Martin

*If additional space is needed to complete well log, use next consecutive numbered form.

b

WELL LOG AND DRILLING REPORT

ORIGINAL

Exhibit 37
No 356954

PLEASE USE PENCIL OR TYPEWRITER
DO NOT USE INK.

State of Ohio
DEPARTMENT OF NATURAL RESOURCES
Division of Water
1562 W. First Avenue
Columbus, Ohio 43212

County Stark Township Lake Section of Township 8

Owner Keyser Bros. Address 5626 Pindale N.E.

Location of property Mogadore Ave Hartville, O

CONSTRUCTION DETAILS

Casing diameter 8 Length of casing 43

Type of screen Pref Length of screen 22

Type of pump

Capacity of pump

Depth of pump setting

Date of completion

BAILING OR PUMPING TEST

Pumping Rate 1000 G.P.M. Duration of test hrs.

Drawdown 10 ft. Date

Static level-depth to water 4 ft.

Quality (clear, cloudy, taste, odor)

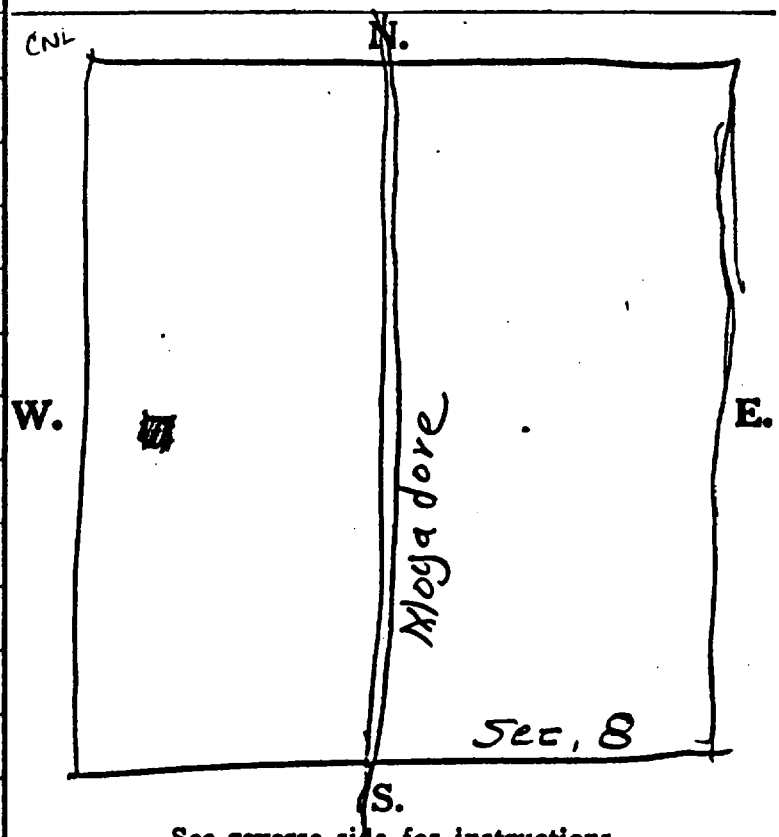
Pump installed by

WELL LOG*

Formations Sandstone, shale, limestone, gravel and clay	From	To
Clay + Stones	0 Feet	20 Ft.
Sand + Gravel	20	45

SKETCH SHOWING LOCATION

Locate in reference to numbered State Highways, St. Intersections, County roads, etc.



See reverse side for instructions

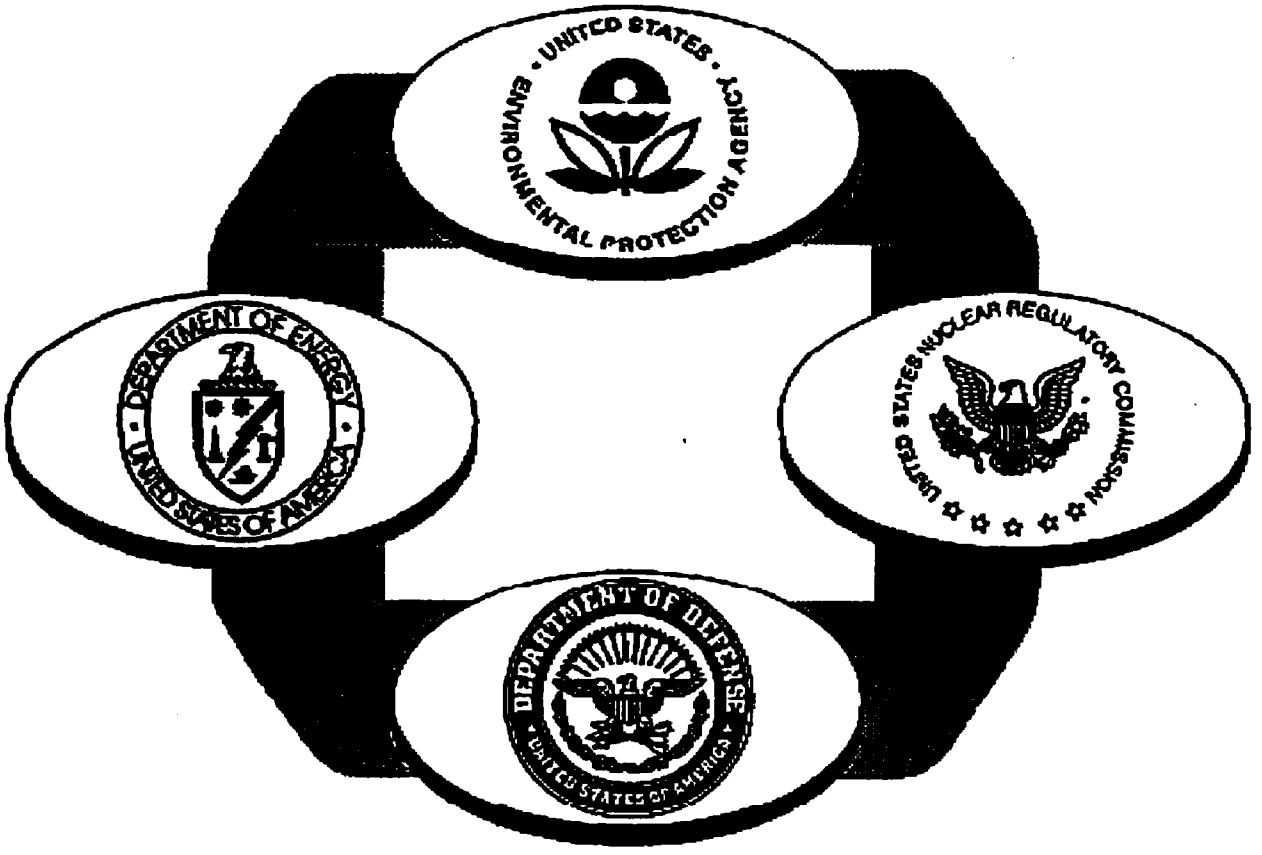
Drilling Firm Geo. E. Martin + Son Date 9 July 1965

Address 308 Martindale Rd Canton, O Signed E. M. Martin

*If additional space is needed to complete well log, use next consecutive numbered form.

NUREG-1575
EPA 402-R-97-016

MULTI-AGENCY RADIATION SURVEY AND SITE INVESTIGATION MANUAL (MARSSIM)



Final

December 1997

Exhibit 38

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ROADMAP

Introduction to MARSSIM

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation. The MARSSIM guidance focuses on the demonstration of compliance during the final status survey following scoping, characterization, and any necessary remedial actions.

The process of planning the survey, implementing the survey plan, and assessing the survey results prior to making a decision is called the Data Life Cycle. MARSSIM Chapter 2 and Appendix D provide detailed guidance on developing appropriate survey designs using the Data Quality Objectives (DQO) Process to ensure that the survey results are of sufficient quality and quantity to support the final decision. The survey design process is described in MARSSIM Chapters 3, 4, and 5. Guidance on selecting appropriate measurement methods (*i.e.*, scan surveys, direct measurements, samples) and measurement systems (*i.e.*, detectors, instruments, analytical methods) is provided in MARSSIM Chapters 6 and 7 and Appendix H. Data Quality Assessment (DQA) is the process of assessing the survey results, determining that the quality of the data satisfies the objectives of the survey, and interpreting the survey results as they apply to the decision being made. The DQA process is described in MARSSIM Chapter 2 and Appendix E and is applied in MARSSIM Chapter 8. Quality Assurance and Quality Control (QA/QC) procedures are developed and recorded in survey planning documents, such as a Quality Assurance Project Plan (QAPP) which is described in MARSSIM Chapter 9

MARSSIM does not provide guidance for translating the release criterion into derived concentration guideline levels (DCGLs). MARSSIM discusses contamination of surface soil and building surfaces in detail. If other media (*e.g.*, ground water, surface water, subsurface soil, equipment, vicinity properties) are potentially contaminated at the time of the final status survey, modifications to the MARSSIM survey design guidance and examples may be required.

The Goal of the Roadmap

The goal of the roadmap is to present a summary of the major steps in the design, implementation, and assessment of a final status survey and to identify where guidance on these steps is located in MARSSIM. A brief description of each step is included in the roadmap along with references to the sections of MARSSIM that provide more detailed guidance.

This roadmap provides the user with basic guidance from MARSSIM combined with "rules of thumb" (indicated by ☞) for performing compliance demonstration surveys. The roadmap is not designed to be a stand-alone document, but to be used as a quick reference to MARSSIM for

users already familiar with the process of planning and performing surveys. Roadmap users will also find flow charts summarizing the major steps in the Radiation Survey and Site Investigation Process, combined with references to sections in MARSSIM where detailed guidance may be found. In addition, the roadmap serves as an overview and example for applying MARSSIM guidance at sites with radioactive contamination of surface soil and building surfaces. The roadmap assumes a working knowledge of MARSSIM terminology. If such knowledge is lacking, the user may refer to Section 2.2 of MARSSIM for definitions of key terms. In addition, a complete set of definitions is provided in the Glossary.

Data Life Cycle

Compliance demonstration is simply a decision as to whether or not a survey unit meets the release criterion. For most sites, this decision is supported by statistical tests based on the results of one or more surveys. The initial assumption used in MARSSIM is that each survey unit is contaminated above the release criterion until proven otherwise. The surveys are designed to provide the information needed to reject this initial assumption. MARSSIM recommends using the Data Life Cycle as a framework for planning, implementing, and evaluating survey results prior to making a decision. Figure 1 summarizes the major activities associated with each phase of the Data Life Cycle.

Planning Stage

The survey design is developed and documented using the Data Quality Objectives (DQO) Process (Section 2.3.1, Appendix D). The DQOs for the project are established and preliminary surveys (*e.g.*, scoping, characterization) are performed to provide information necessary to design the final status survey for compliance demonstration. The DQOs for the project are re-evaluated for each of the preliminary surveys. The preliminary surveys may provide information for purposes other than compliance demonstration that are not discussed in MARSSIM. For example, a characterization survey may provide information to support evaluation of remedial alternatives. In addition, any of the preliminary surveys may be designed to demonstrate compliance with the release criterion as one of the survey objectives. These alternate survey designs are developed based on site-specific considerations (Section 2.6). The planning phase of the Data Life Cycle produces a final status survey design that is used for demonstrating compliance with the release criterion. This design is recorded in planning documents, such as a Quality Assurance Project Plan (QAPP) described in Section 9.2.

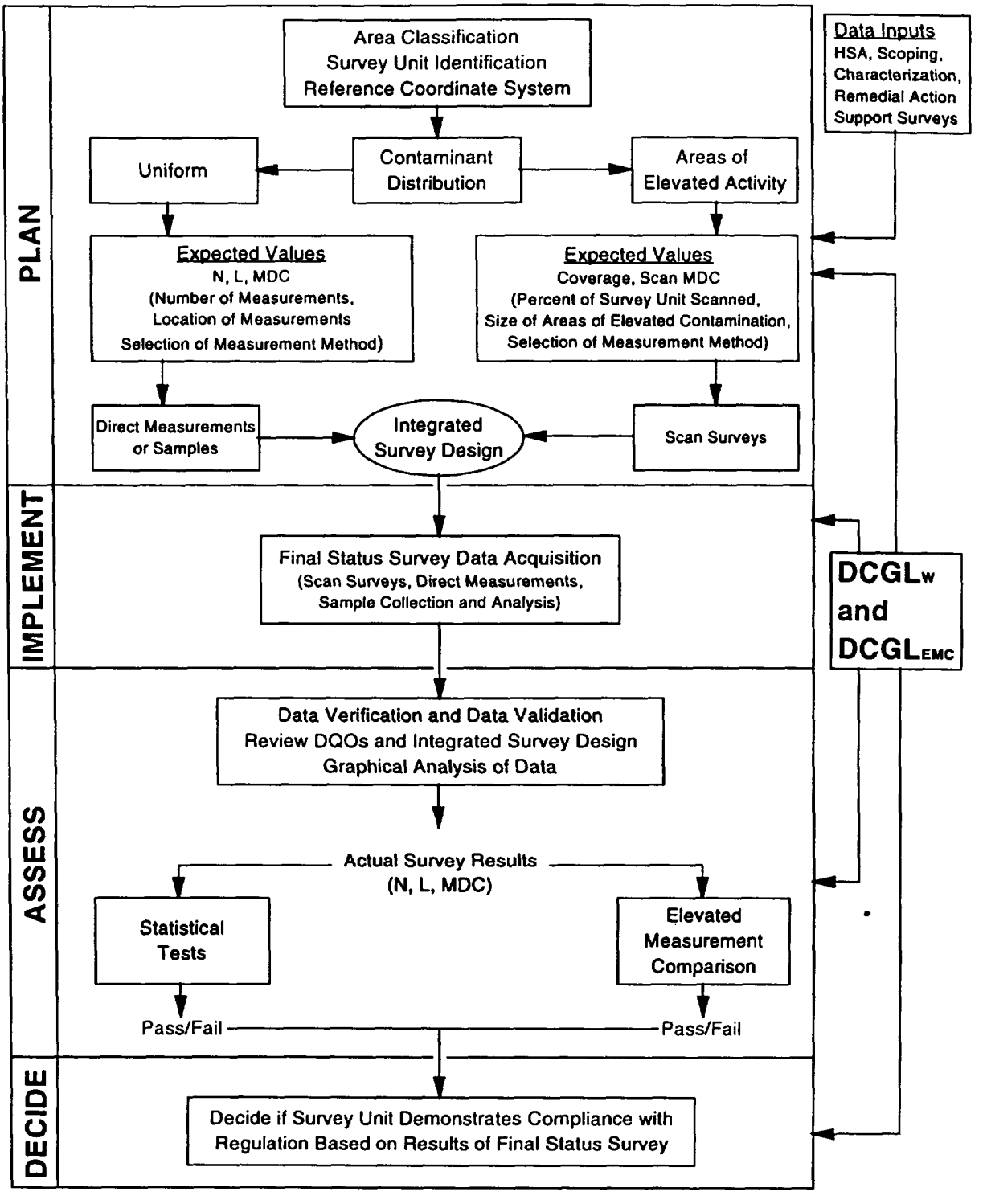


Figure 1 The Data Life Cycle Applied to a Final Status Survey

A minimum amount of information is needed from the preliminary surveys to develop an effective final status survey design. This includes

- sufficient information to justify classification and specification of boundaries for survey units (the default is Class 1 which results in the highest level of survey effort)
- an estimate of the variability of the contaminant concentration in the survey unit (σ_s) and the reference area (σ_r) if necessary

After the preliminary surveys are completed, the final status survey design can be developed. Figure 2 presents the major steps in the development of a survey design that integrates scanning surveys with direct measurements and sampling. Most of the steps are easy to understand and references to appropriate sections of MARSSIM are included in the flowchart. Several of these steps are important enough to justify additional discussion in this guide. These steps are

- Classify Areas by Contamination Potential
- Group/Separate Areas into Survey Units
- Determine Number of Data Points
- Select Instrumentation
- Develop an Integrated Survey Design

Classify Areas by Contamination Potential (Section 4.4)

Classification is a critical step in survey design because it determines the level of survey effort based on the potential for contamination. Overestimating the potential for contamination results in an unnecessary increase in the level of survey effort. Underestimating the potential for contamination greatly increases the probability of failing to demonstrate compliance based on the survey results. There are two key decisions made when classifying areas: 1) is the average activity in the area likely to exceed the $DCGL_W$, and 2) is the contamination present in small areas of elevated activity or is the contamination distributed relatively homogeneously across the area. Each of these decisions is considered separately when designing the survey and then combined into an integrated survey design. Class 1 areas, prior to remediation, are impacted areas with concentrations of residual radioactivity that exceed the $DCGL_W$. Class 2 areas are impacted areas concentrations of residual activity that exceed the $DCGL_W$ are not expected. Class 3 areas are impacted areas that have a low probability of containing areas with residual radioactivity. The information obtained from the preliminary surveys is crucial for classifying areas (see Figure 2.4).

☞ Area classification considers both the level of contamination relative to the $DCGL_W$ and the distribution of the contamination. The contamination may be uniformly distributed or present as small areas of elevated activity.

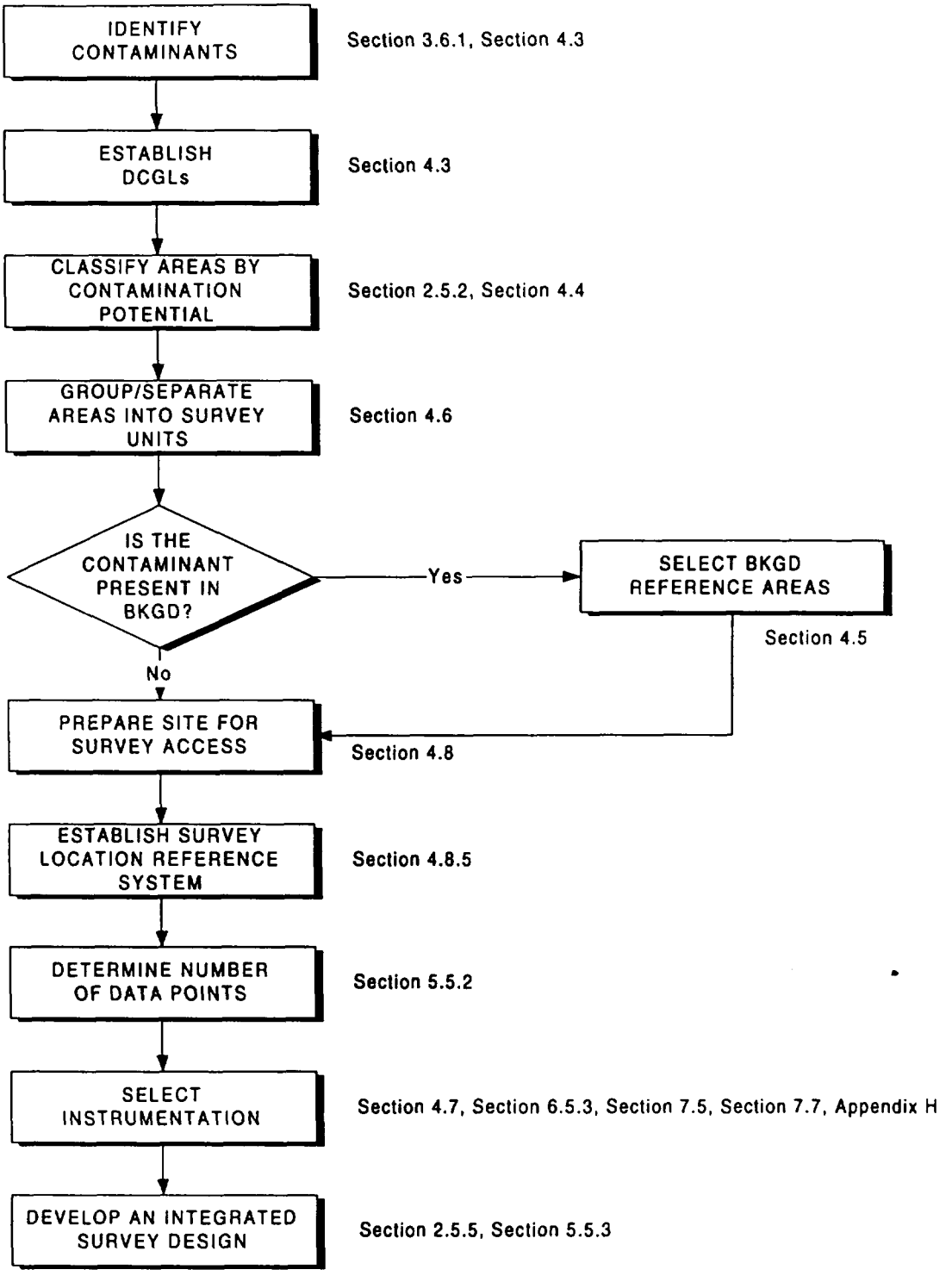


Figure 2 Flow Diagram for Designing a Final Status Survey

Group/Separate Areas into Survey Units (Section 4.6)

Survey units are limited in size based on classification, exposure pathway modeling assumptions, and site-specific conditions. Table 1 provides suggested survey unit areas based on area classification. The rationale for selecting a larger survey unit area should be developed using the DQO Process and fully documented.

Table 1 Suggested Survey Unit Areas

Classification	Suggested Area
Class 1	
Structures	up to 100 m^2
Land Areas	up to 2,000 m^2
Class 2	
Structures	100 to 1,000 m^2
Land Areas	2,000 to 10,000 m^2
Class 3	
Structures	no limit
Land Areas	no limit

☞ Survey unit areas should be consistent with exposure pathway modeling assumptions used to develop DCGLs.

Determine Number of Data Points (Section 5.5.2)

The number of data points is determined based on the selection of a statistical test, which in turn is based on whether or not the contaminant is present in background. Figure 3 presents a flow chart for determining the number of data points.

The first step in determining the number of data points is to specify the acceptable decision error rates, α and β. Decision error rates are site-specific and selected using the DQO Process. Changes in the values of α and β may result from successive iterations of the DQO Process.

☞ Values for α and β are site-specific and selected using the DQO Process.

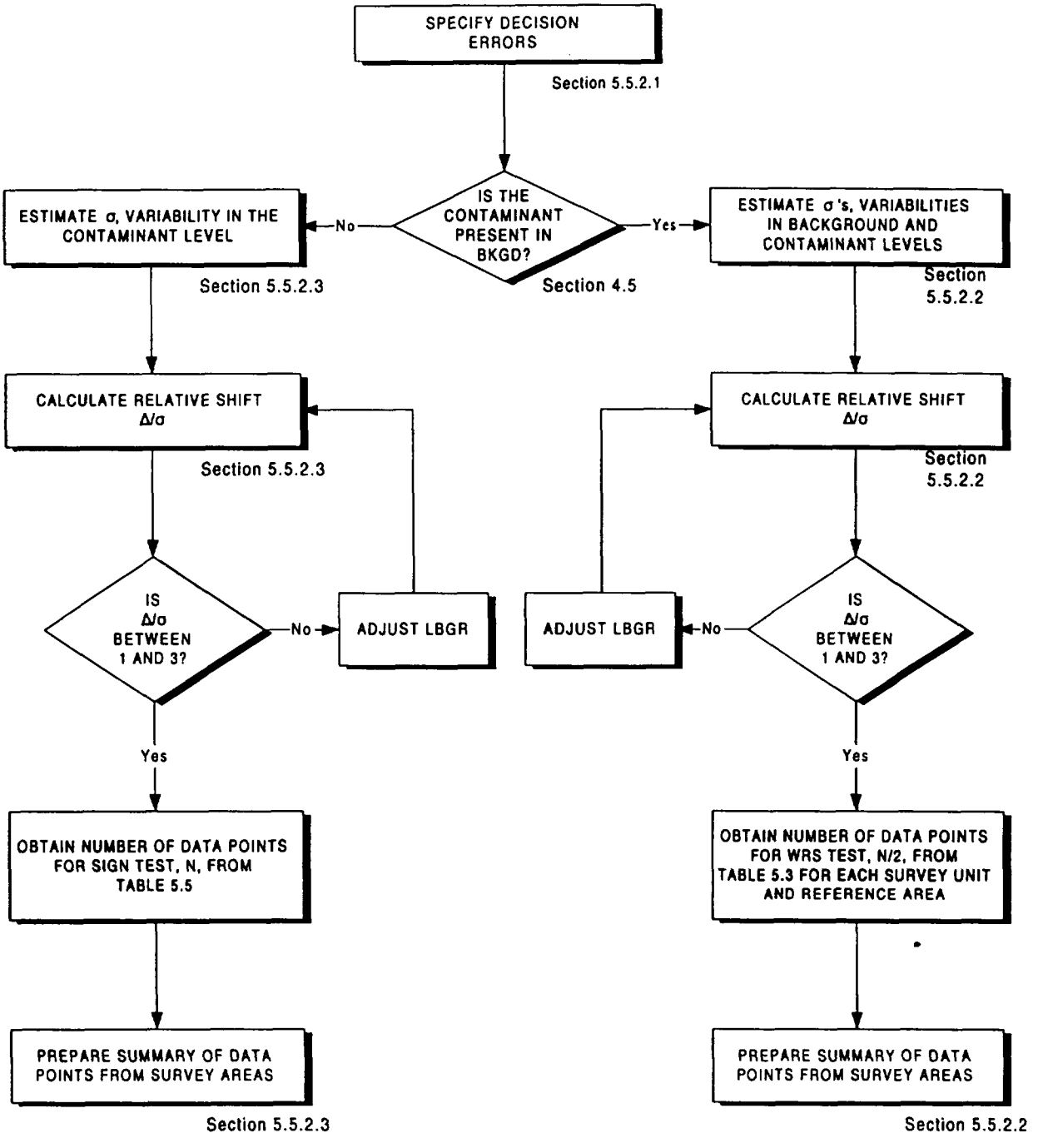


Figure 3 Flow Diagram for Determining the Number of Data Points

The next step, after determining whether or not the contaminant is present in background, is to estimate the variability of the contaminant concentration, σ. The standard deviation of the contaminant concentration determined from the preliminary survey results should provide an appropriate estimate of σ. If the contaminant is present in background, the variability in the survey unit (σ_s) and the variability in the reference area (σ_r) should both be estimated. The larger of the two values should be selected for determining the number of data points. Underestimating σ can underestimate the number of measurements needed to demonstrate compliance with the regulation, which increases the probability the survey unit will fail the statistical test. Overestimating σ can result in collecting more data than is necessary to demonstrate compliance.

☞ It is better to overestimate values of σ_s and σ_r.

☞ When σ_s and σ_r are different, select the larger of the two values.

The third step is to calculate the relative shift, Δ/σ. The variability of the contaminant concentration, σ, was determined in the previous step. The shift, Δ, is equal to the width of the gray region. The upper bound of the gray region is defined as the $DCGL_W$. The lower bound of the gray region (LBGR) is a site-specific parameter, adjusted to provide a value for Δ/σ between one and three. Δ/σ can be adjusted using the following steps:

- Initially select LBGR to equal one half the $DCGL_W$. This means Δ ($DCGL_W$ - LBGR) also equals one half the $DCGL_W$. Calculate Δ/σ.
- If Δ/σ is between one and three, obtain the appropriate number of data points from Table 5.3 or Table 5.5.
- If Δ/σ is less than one, select a lower value for LBGR. Continue to select lower values for LBGR until Δ/σ is greater than or equal to one, or until LBGR equals zero.
- If Δ/σ is greater than three, select a higher value for LBGR. Continue to select higher values for LBGR until Δ/σ is less than or equal to three.

Alternatively, Δ/σ can be adjusted by solving the following equation and calculating Δ/σ:

$$LBGR = DCGL_W - \sigma$$

If LBGR is less than zero, Δ/σ can be calculated as $DCGL_W/\sigma$.

☞ Adjust the LBGR to provide a value for Δ/σ between one and three.

The final step in determining the number of data points is to obtain the appropriate value from Table 5.3 or Table 5.5. Table 5.3 provides the number of data points for each survey unit and each reference area when the contaminant is present in background (N/2). Table 5.5 provides the number of data points for each survey unit when the contaminant is not present in background (N).

Select Instrumentation (Section 4.7, Section 6.5.3, Section 7.5, Section 7.7, Appendix H)

Instrumentation or measurement techniques should be selected based on detection sensitivity to provide technically defensible results that meet the objectives of the survey. Because of the uncertainty associated with interpreting scanning results, the detection sensitivity of the selected instruments should be as far below the DCGL as possible. For direct measurements and sample analyses, minimum detectable concentrations (MDCs) less than 10% of the DCGL are preferable while MDCs up to 50% of the DCGL are acceptable.

☞ Estimates of the MDC that minimize potential decision errors should be used for planning surveys.

Develop an Integrated Survey Design (Section 5.5.3)

The integrated survey design combines scanning surveys with direct measurements and sampling. The level of survey effort is determined by the potential for contamination as indicated by the survey unit classification. This is illustrated in Figure 4. Class 3 survey units receive judgmental scanning and randomly located measurements. Class 2 survey units receive scanning over a portion of the survey unit based on the potential for contamination combined with direct measurements and sampling performed on a systematic grid. Class 1 survey units receive scanning over 100% of the survey unit combined with direct measurements and sampling performed on a systematic grid. The grid spacing is adjusted to account for the scan MDC (Section 5.5.2.4).

Table 2 provides a summary of the recommended survey coverage for structures and land areas. Modifications to the example survey designs may be required to account for other contaminated media (*e.g.*, ground water, subsurface soil).

Implementation Phase

The objectives outlined in the QAPP are incorporated into Standard Operating Procedures (SOPs). The final status survey design is carried out in accordance with the SOPs and the QAPP resulting in the generation of raw data. Chapter 6, Chapter 7, and Appendix H provide information on measurement techniques.

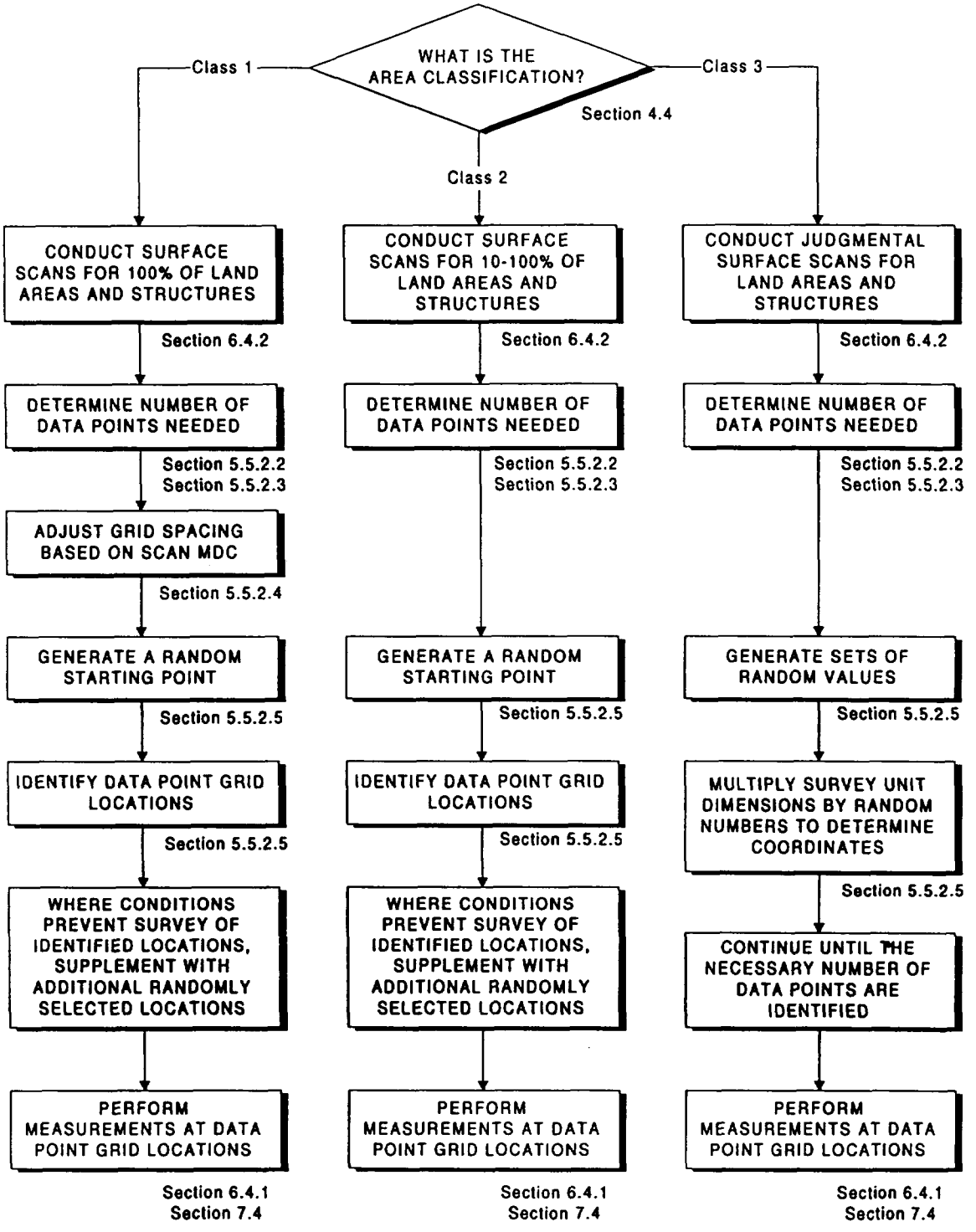


Figure 4 Flow Diagram for Developing an Integrated Survey Design

Table 2 Recommended Survey Coverage for Structures and Land Areas

Area Classification	Structures		Land Areas	
	Surface Scans	Surface Activity Measurements	Surface Scans	Surface Soil Measurements
Class 1	100%	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3); additional direct measurements and samples may be necessary for small areas of elevated activity (Section 5.5.2.4)	100%	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3); additional direct measurements and samples may be necessary for small areas of elevated activity (Section 5.5.2.4)
Class 2	10 to 100% (10 to 50% for upper walls and ceilings) Systematic and Judgmental	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3)	10 to 100% Systematic and Judgmental	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3)
Class 3	Judgmental	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3)	Judgmental	Number of data points from statistical tests (Sections 5.5.2.2 and 5.5.2.3)

Assessment Phase

The assessment phase of the Data Life Cycle includes verification and validation of the survey results combined with an assessment of the quantity and quality of the data. As previously stated, both the average level of contamination in the survey unit and the distribution of the contamination within the survey unit are considered during area classification. For this reason, the assessment phase includes a graphical review of the data to provide a visual representation of the radionuclide distribution, an appropriate statistical test to demonstrate compliance for the average concentration of a uniformly distributed radionuclide, and the elevated measurement comparison (EMC) to demonstrate compliance for small areas of elevated activity.

The survey data are verified to ensure that SOPs specified in the survey design were followed and that the measurement systems were performed in accordance with the criteria specified in the QAPP (Section 9.3.1). The data are validated to ensure that the results support the objectives of the survey, as documented in the QAPP, or permit a determination that these objectives should

be modified (Section 9.3.2). The Data Quality Assessment (DQA) process is then applied using the verified and validated data to determine if the quality of the data satisfies the data user's needs. DQA is described in Appendix E and is applied in Chapter 8.

The first step in DQA is to review the DQOs and survey design to ensure that they are still applicable. For example, if the data suggest that a survey unit is misclassified, the DQOs and survey design would be modified for the new classification.

The next step is to conduct a preliminary data review to learn about the structure of the data and to identify patterns, relationships, or potential anomalies. This review should include calculating basic statistical quantities (*i.e.*, mean, standard deviation, median) and graphically presenting the data using at least a histogram and a posting plot. The results of the preliminary data review are also used to verify the assumptions of the tests. Some of the assumptions and possible methods for assessing them are summarized in Table 3. Information on diagnostic tests is provided in Section 8.2 and Appendix I.

Table 3 Methods for Checking the Assumptions of Statistical Tests

Assumption	Diagnostic
Spatial Independence	Posting Plot (Figure 8.1)
Symmetry	Histogram (Figure 8.2) Quantile Plot (Figure I.2)
Data Variance	Sample Standard Deviation (Section 8.2)
Power is Adequate	Retrospective Power Chart (Sign Test, Figure I.5) (WRS Test, Figure I.6)

The final step in interpreting the data is to draw conclusions from the data. Table 4 summarizes the statistical tests recommended in MARSSIM. Section 8.3 provides guidance on performing the Sign test when the contaminant is not present in background. Section 8.4 provides guidance on performing the Wilcoxon Rank Sum (WRS) test when the contaminant is present in background.

Table 4 Summary of Statistical Tests

Radionuclide not in background and radionuclide-specific measurements made:

Survey Result	Conclusion
All measurements less than $DCGL_W$	Survey unit meets release criterion
Average greater than $DCGL_W$	Survey unit does not meet release criterion
Any measurement greater than $DCGL_W$ and the average less than $DCGL_W$	Conduct Sign test and elevated measurement comparison

Radionuclide in background or radionuclide non-specific (gross) measurements made:

Survey Result	Conclusion
Difference between maximum survey unit measurement and minimum reference area measurements is less than $DCGL_W$	Survey unit meets release criterion
Difference of survey unit average and reference area average is greater than $DCGL_W$	Survey unit does not meet release criterion
Difference between any survey unit measurement and any reference area measurement greater than $DCGL_W$ and the difference of survey unit average and reference area average is less than $DCGL_W$	Conduct WRS test and elevated measurement comparison

Table 5 provides examples of final status survey investigation levels for each survey unit classification and type of measurement. For a Class 1 survey unit, measurements above the $DCGL_W$ are not necessarily unexpected. However, a measurement above the $DCGL_W$ at one of the discrete measurement locations might be considered unusual if it were much higher than all of the other discrete measurements. Thus, any discrete measurement that is above both the $DCGL_W$ and the statistical-based parameter for the measurements should be investigated further. Any measurement, either at a discrete location or from a scan, that is above the $DCGL_{EMC}$ should be flagged for further investigation.

In Class 2 or Class 3 areas, neither measurements above the $DCGL_W$ nor areas of elevated activity are expected. Any measurement at a discrete location exceeding the $DCGL_W$ in these areas should be flagged for further investigation. Because the survey design for Class 2 and Class 3 survey units is not driven by the EMC, the scanning MDC might exceed the $DCGL_W$. In this case, any indication of residual radioactivity during the scan would warrant further investigation.

Table 5 Summary of Investigation Levels

Survey Unit Classification	Flag Direct Measurement or Sample Result When:	Flag Scanning Measurement Result When:
Class 1	> $DCGL_{EMC}$ or > $DCGL_W$ and > a statistical-based parameter value	> $DCGL_{EMC}$
Class 2	> $DCGL_W$	> $DCGL_W$ or > MDC
Class 3	> fraction of $DCGL_W$	> $DCGL_W$ or > MDC

Because there is a low expectation for residual radioactivity in a Class 3 area, it may be prudent to investigate any measurement exceeding even a fraction of the $DCGL_W$. The level one chooses here depends on the site, the radionuclides of concern, and the measurement and scanning methods chosen. This level should be set using the DQO Process during the survey design phase of the Data Life Cycle. In some cases, the user may also decide to follow this procedure for Class 2 and even Class 1 survey units.

Both the measurements at discrete locations and the scans are subject to the EMC. The result of the EMC does not in itself lead to a conclusion as to whether the survey unit meets or exceeds the release criterion, but is a flag or trigger for further investigation. The investigation may involve taking further measurements in order to determine that the area and level of the elevated residual radioactivity are such that the resulting dose or risk meets the release criterion.[1] The investigation should also provide adequate assurance that there are no other undiscovered areas of elevated residual radioactivity in the survey unit that might result in a dose exceeding the release criterion. This could lead to a re-classification of all or part of a survey unit—that is, unless the results of the investigation indicate that reclassification is not necessary.

Decision Making Phase

A decision is made, in coordination with the responsible regulatory agency, based on the conclusions drawn from the assessment phase. The results of the EMC are used to demonstrate compliance with the dose- or risk-based regulation for small areas of elevated activity, while the nonparametric statistical tests are used to demonstrate that the average radionuclide concentration in the survey unit complies with the release criterion. The objective is to make technically defensible decisions with a specified level of confidence.

---

[1] Rather than, or in addition to, taking further measurements, the investigation may involve assessing the adequacy of the exposure pathway model used to obtain the DCGLs and area factors, and the consistency of the results obtained with the Historical Site Assessment and the scoping, characterization, and remedial action support surveys.

The EMC consists of comparing each measurement from the survey unit with the investigation levels in Table 5. The EMC is performed for measurements obtained from the systematic or random sample locations as well as locations flagged by scanning surveys. Any measurement from the survey unit that is equal to or greater than the investigation level indicates an area of relatively higher concentration and is investigated, regardless of the outcome of the nonparametric statistical tests.

> ☞ Any measurement from the survey unit that is equal to or greater than the investigation level indicates an area of relatively higher concentration and is investigated, regardless of the outcome of the nonparametric statistical tests.

The result of the Sign test or the WRS test is the decision to reject or not to reject the null hypothesis that the survey unit is contaminated above the $DCGL_W$. Provided that the results of any investigations triggered by the EMC have been resolved, a rejection of the null hypothesis leads to the decision that the survey unit meets the release criterion. If necessary, the amount of residual radioactivity in the survey unit can be estimated so that dose or risk calculations can be made. In most cases, the average concentration is the best estimate for the amount of residual radioactivity.

Summary

The roadmap presents a summary of the planning, implementation, assessment, and decision making phases for a final status survey and identifies where guidance on these phases is located in MARSSIM. Each step in the process is described briefly along with references to the sections of MARSSIM to which the user may refer for more detailed guidance. Flow charts are provided to summarize the major steps in the Radiation Survey and Site Investigation Process, again citing appropriate sections of MARSSIM. In addition to providing the user with basic guidance from MARSSIM, the roadmap also includes "rules of thumb" for performing compliance demonstration surveys.

1 INTRODUCTION

1.1 Purpose and Scope of MARSSIM

Radioactive materials have been produced, processed, used, and stored at thousands of sites throughout the United States. Many of these sites—ranging in size from Federal weapons-production facilities covering hundreds of square kilometers to the nuclear medicine departments of small hospitals—were at one time or are now radioactively contaminated.

The owners and managers of a number of sites would like to determine if these sites are contaminated, clean them up if contaminated, and release them for restricted use or for unrestricted public use. The Environmental Protection Agency (EPA), the Nuclear Regulatory Commission (NRC), and the Department of Energy (DOE) are responsible for the release of sites following cleanup. These responsibilities apply to facilities under the control of Federal agencies, such as the DOE and Department of Defense (DOD), and to sites licensed by the NRC and its Agreement States. Some States have responsibilities for similar sites under their control.

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) provides a nationally consistent consensus approach to conducting radiation surveys and investigations at potentially contaminated sites. This approach should be both scientifically rigorous and flexible enough to be applied to a diversity of site cleanup conditions. MARSSIM's title includes the term "survey" because it provides information on planning and conducting surveys, and includes the term "site investigation" because the process outlined in the manual allows one to begin by investigating any site (*i.e.*, by gathering data or information) that may involve radioactive contamination.

The decommissioning that follows remediation will normally require a demonstration to the responsible Federal or State agency that the cleanup effort was successful and that the release criterion (a specific regulatory limit) was met. In MARSSIM, this demonstration is given the name "final status survey." This manual assists site personnel or others in performing or assessing such a demonstration. (Generally, MARSSIM may serve to guide or monitor remediation efforts whether or not a release criterion is applied.)

As illustrated in Figure 1.1, the demonstration of compliance with respect to conducting surveys is comprised of three interrelated parts:

I. Translate: Translating the cleanup/release criterion (*e.g.*, mSv/y, mrem/y, specific risk) into a corresponding derived contaminant concentration level (*e.g.*, Bq/kg or pCi/g in soil) through the use of environmental pathway modeling.

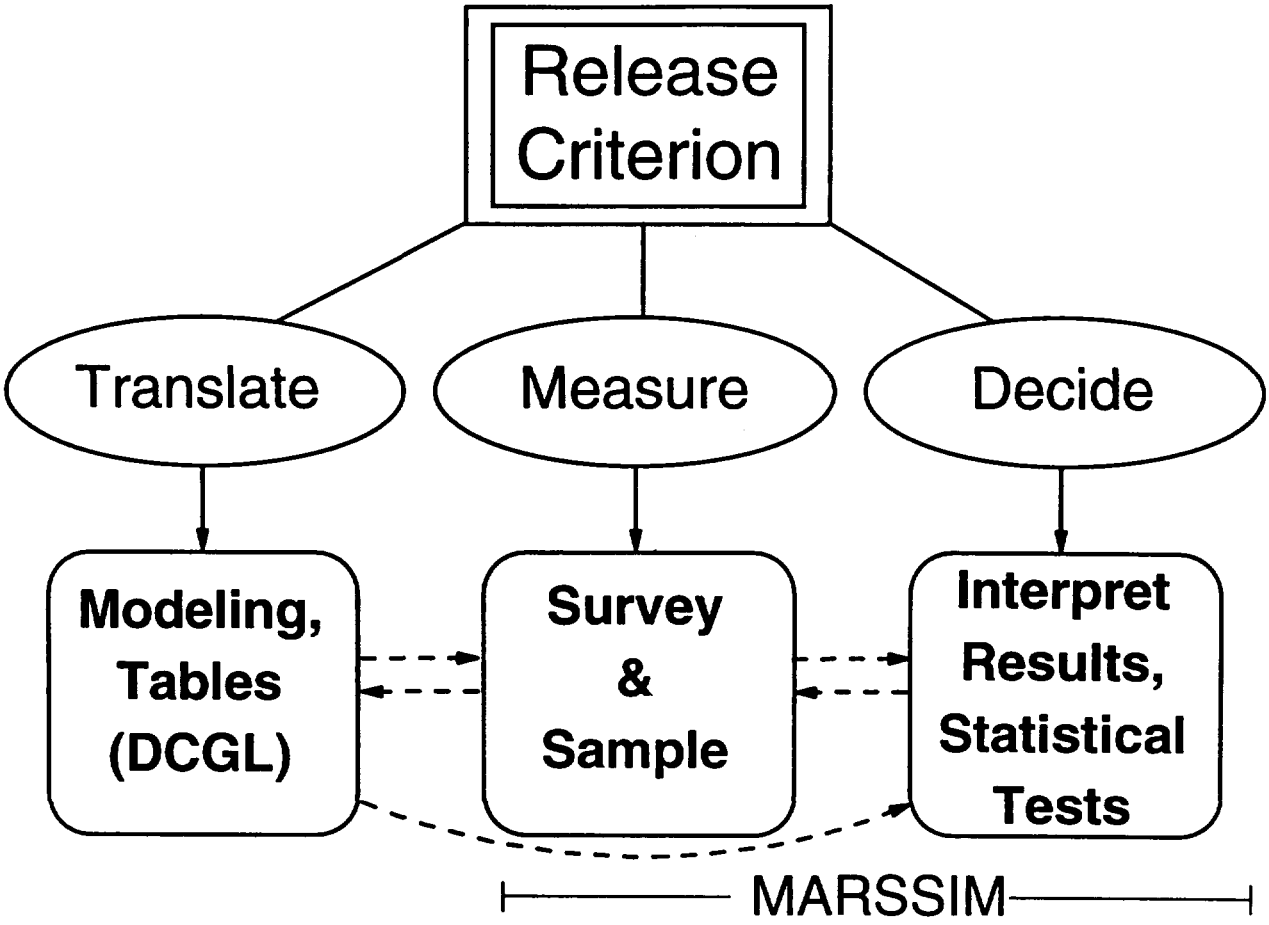


Figure 1.1 Compliance Demonstration

II. Measure: Acquiring scientifically sound and defensible site-specific data on the levels and distribution of residual contamination, as well as levels and distribution of radionuclides present as background, by employing suitable field and/or laboratory measurement techniques.[1]

III. Decide: Determining that the data obtained from sampling does support the assertion that the site meets the release criterion, within an acceptable degree of uncertainty, through application of a statistically based decision rule.

[1] Measurements include field and laboratory analyses, however, MARSSIM leaves detailed discussions of laboratory sample analyses to another manual (*i.e.*, a companion document, the Multi-Agency Radiation Laboratory Analytical Protocols (MARLAP) manual that is currently under development).

MARSSIM presents comprehensive guidance—specifically for II and III above—for contaminated soil and buildings. This guidance describes a performance-based approach for demonstrating compliance with a dose- or risk-based regulation. This approach includes processes that identify data quality needs and may reveal limitations that enter into conducting a survey. The data quality needs stated as Data Quality Objectives (DQOs) include performance measures and goals in relation to a specific intended use of the data (EPA 1997).

DQOs must be developed on a site-specific basis. However, because of the large variability in the types of radiation sites, it is impossible to provide criteria that apply to every situation. As an example, MARSSIM presents a method for planning, implementing, assessing, and making decisions about regulatory compliance at sites with radioactive contaminants in surface soil and on building surfaces. In particular, MARSSIM describes generally acceptable approaches for:

- planning and designing scoping, characterization, remediation-support, and final status surveys for sites with surface soil and building surface contamination
- Historical Site Assessment (HSA)
- QA/QC in data acquisition and analysis
- conducting surveys
- field and laboratory methods and instrumentation, and interfacing with radiation laboratories
- statistical hypothesis testing, and the interpretation of statistical data
- documentation

Thus, MARSSIM provides standardized and consistent approaches for planning, conducting, evaluating, and documenting environmental radiological surveys, with a specific focus on the final status surveys that are carried out to demonstrate compliance with cleanup regulations. These approaches may not meet the DQOs at every site, so other methods may be used to meet site-specific DQOs, as long as an equivalent level of performance can be demonstrated.

Table 1.1, at the end of Chapter 1, summarizes the scope of MARSSIM. Several issues related to releasing sites are beyond the scope of MARSSIM. These include translation of dose or risk standards into radionuclide specific concentrations, or demonstrating compliance with ground water or surface water regulations. MARSSIM can be applied to surveys performed at vicinity properties—those not under government or licensee control—but the decision to apply the MARSSIM at vicinity properties is outside the scope of MARSSIM. Other contaminated media (*e.g.*, sub-surface soil, building materials, ground water) and the release of contaminated components and equipment are also not addressed by MARSSIM. With MARSSIM's main focus on final status surveys, this manual continues a process of following remediation activities that are intended to remove below-surface contaminants. Therefore, some of the reasons for limiting the scope of the guidance to contaminated surface soils and building surfaces include: 1) contamination is limited to these media for many sites following remediation, 2) since many

sites have surface soil and building surface contamination as the leading source of contamination, existing computer models used for calculating the concentrations based on dose or risk generally consider only surface soils or building surfaces as a source term, and 3) MARSSIM was written in support of cleanup rulemaking efforts for which supporting data are mostly limited to contaminated surface soil and building surfaces.

MARSSIM also recognizes that there may be other factors, such as cost or stakeholder concerns, that have an impact on designing surveys. Guidance on how to address these specific concerns is outside the scope of MARSSIM. Unique site-specific cases may arise that require a modified approach beyond what is presently described in MARSSIM. This includes examples such as: 1) the release of sites contaminated with naturally occurring radionuclides in which the concentrations corresponding to the release criteria are close to the variability of the background and 2) sites where a reference background cannot be established. However, the process of planning, implementing, assessing, and making decisions about a site described in MARSSIM is applicable to all sites, even if the examples in this manual do not meet a site's specific objectives.

Of MARSSIM's many topics, the Data Quality Objective (DQO) approach to data acquisition and analysis and the Data Quality Assessment (DQA) for determining that data meet stated objectives are two elements that are a consistent theme throughout the manual. The DQO Process and DQA approach, described in Chapter 2, present a method for building common sense and the scientific method into all aspects of designing and conducting surveys, and making best use of the obtainable information. This becomes a formal framework for systematizing the planning of data acquisition surveys so that the data sought yield the kind of information actually needed for making important decisions—such as whether or not to release a particular site following remediation.

1.2 Structure of the Manual

MARSSIM begins with the overview of the Radiation Survey and Site Investigation Process in Chapter 2—Figures 2.4 through 2.8 are flowcharts that summarize the steps and decisions taken in the process. Chapter 3 provides instructions for performing an Historical Site Assessment (HSA)—a detailed investigation to collect existing information on the site or facility and to develop a conceptual site model. The results of the HSA are used to plan surveys, perform measurements, and collect additional information at the site. Chapter 4 covers issues that arise in all types of surveys. Detailed information on performing specific types of surveys is included in Chapter 5. Guidance on selecting the appropriate instruments and measurement techniques for each type of measurement is in Chapters 6 and 7. Chapter 6 discusses direct measurements and scanning surveys, and Chapter 7 discusses sampling and sample preparation for laboratory measurements. The interpretation of survey results is described in Chapter 8. Chapter 9 provides guidance on data management, quality assurance (QA), and quality control (QC). Information on specific subjects related to radiation site investigation can be found in the appendices.

MARSSIM contains several appendices to provide additional guidance on specific topics. Appendix A presents an example of how to apply the MARSSIM guidance to a specific site. Appendix B describes a simplified procedure for compliance demonstration that may be applicable at certain types of sites. Appendix C summarizes the regulations and requirements associated with radiation surveys and site investigations for each of the agencies involved in the development of MARSSIM. Detailed guidance on the DQO Process is in Appendix D, and Appendix E has guidance on DQA. Appendix F describes the relationships among MARSSIM, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Resource Conservation and Recovery Act (RCRA). Sources of information used during site assessment are listed in Appendix G. Appendix H describes field survey and laboratory analysis equipment that may be used for radiation surveys and site investigations. Appendix I offers tables of statistical data and supporting information for interpreting survey results described in Chapter 8. The derivation of the alpha scanning detection limit calculations used in Chapter 6 is described in Appendix J. Comparison tables for QA documents are in Appendix K. Appendix L lists the regional radiation program managers for each of the agencies participating in the development of MARSSIM. Appendix M lists publications that serve as resources describing sampling methods. Information on data validation is provided in Appendix N.

MARSSIM is presented in a modular format, with each module containing guidance on conducting specific aspects of, or activities related to, the survey process. Followed in order, each module leads to the generation and implementation of a complete survey plan. Although this approach may involve some overlap and redundancy in information, it also allows many users to concentrate only on those portions of the manual that apply to their own particular needs or responsibilities. The procedures within each module are listed in order of performance and options are provided to guide a user past portions of the manual that may not be specifically applicable to the user's area of interest. Where appropriate, checklists condense and summarize major points in the process. The checklists may be used to verify that every suggested step is followed or to flag a condition in which specific documentation should explain why a step was not needed.

Also included in the manual is a section titled Roadmap. The roadmap is designed to be used with MARSSIM as a quick reference for users already familiar with the process of planning and performing radiation surveys. The roadmap gives the user basic guidance, rules of thumb, and references to sections in the manual containing detailed guidance.

MARSSIM, which is based on a graded approach, also contains a simplified procedure (see Appendix B) that many users of radioactive materials may—with the approval of the responsible regulatory agency—be able to employ to demonstrate compliance with the release criterion. Sites that may qualify for simplified release procedures are those in which the radioactive materials used were 1) of relatively short half-life (*e.g.*, $t_{1/2} \leq 120$ days) and have since decayed to insignificant quantities, 2) kept only in small enough quantities so as to be exempted or not

requiring a specific license from a regulatory authority, 3) used or stored only in the form of non-leaking sealed sources, or 4) combinations of the above.

1.3 Use of the Manual

Potential users of this manual are Federal, State, and local government agencies having authority for control of radioactive environmental contamination; their contractors; and other parties, such as organizations with licensed authority to possess and use radioactive materials. The manual is intended for a technical audience having knowledge of radiation health physics and an understanding of statistics as well as experience with the practical applications of radiation protection. An understanding of instrumentation and methodologies and expertise in planning, approving, and implementing surveys of environmental levels of radioactive material is assumed. This manual has been written so that individuals responsible for planning, approving, and implementing radiological surveys will be able to understand and apply the guidance provided here. Certain situations and sites may require consultation with more experienced personnel.

MARSSIM provides guidance for conducting radiation surveys and site investigations. MARSSIM uses the word "should" as a recommendation, that ought not be interpreted as a requirement. The reader need not expect that every recommendation in this manual will be taken literally and applied at every site. Rather, it is expected that the survey planning documentation will address how the guidance will be applied on a site-specific basis.

As previously stated, MARSSIM supports implementation of dose- or risk-based regulations. The translation of the regulatory dose limit to a corresponding concentration level is not addressed in MARSSIM, so the guidance in this manual is applicable to a broad range of regulations, including risk- or concentration-based regulations. The terms dose and dose-based regulation are used throughout the manual, but these terms are not intended to limit the use of the manual.

Note that Federal or State agencies that can approve a demonstration of compliance may support requirements that differ from what is presented in this version of MARSSIM . *It is essential, therefore, that the persons carrying out the surveys*, whether they are conducting surveys in accordance with the simplified approach of Appendix B or the full MARSSIM process, *remain in close communication with the proper Federal or State authorities throughout the compliance demonstration process.*

1.4 Missions of the Federal Agencies Producing MARSSIM

MARSSIM is the product of a multi-agency workgroup with representatives from EPA, NRC, DOE, and DOD. This section briefly describes the missions of the participating agencies. Regulations and requirements governing site investigations for each of the agencies associated with radiation surveys and site investigations are presented in Appendix C.

1.4.1 Environmental Protection Agency

The mission of the U.S. Environmental Protection Agency (EPA) is to improve and preserve the quality of the environment, on both national and global levels. The EPA's scope of responsibility includes implementing and enforcing environmental laws, setting guidelines, monitoring pollution, performing research, and promoting pollution prevention. EPA Headquarters maintains overall planning, coordination, and control of EPA programs, and EPA's ten regional offices are responsible for executing EPA's programs within the boundaries of each region. EPA also coordinates with, and supports research and development of, pollution control activities carried out by State and local governments.

1.4.2 Nuclear Regulatory Commission

The mission of the U.S. Nuclear Regulatory Commission (NRC) is to ensure adequate protection of public health and safety, the common defense and security, and the environment in the use of certain radioactive materials in the United States. The NRC's scope of responsibility includes regulation of commercial nuclear power reactors; non-power research, test, and training reactors; fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and waste. The Energy Reorganization Act of 1974 and the Atomic Energy Act of 1954, as amended, provide the foundation for regulation of the Nation's commercial use of radioactive materials.

1.4.3 Department of Energy

The mission of the Department of Energy (DOE) is to develop and implement a coordinated national energy policy to ensure the availability of adequate energy supplies and to develop new energy sources for domestic and commercial use. In addition, DOE is responsible for the development, construction and testing of nuclear weapons for the U.S. Military. DOE is also responsible for managing the low- and high-level radioactive wastes generated by past nuclear weapons and research programs and for constructing and maintaining a repository for civilian radioactive wastes generated by the commercial nuclear reactors. DOE has the lead in decontaminating facilities and sites previously used in atomic energy programs.

1.4.4 Department of Defense

The global mission of the Department of Defense (DOD) is to provide for the defense of the United States. In doing this, DOD is committed to protecting the environment. Each military service has specific regulations addressing the use of radioactive sources and the development of occupational health programs and radiation protection programs. The documents describing these regulations are used as guidance in developing environmental radiological surveys within DOD and are discussed in Appendix C.

Table 1.1 Scope of MARSSIM

Within Scope of MARSSIM		Beyond Scope of MARSSIM	
Guidance	MARSSIM provides technical guidance on conducting radiation surveys and site investigations.	*Regulation*	MARSSIM does not set new regulations or non-technical issues (*e.g.*, legal or policy) for site cleanup. Release criterion will be provided rather than calculated using MARSSIM.
Tool Box	MARSSIM can be thought of as an extensive tool box with many components—some within the text of MARSSIM, others by reference.	*Tool Box*	Many topics are beyond the scope of MARSSIM, for example: -a public participation program -packaging and transportation of wastes for disposal -decontamination and stabilization techniques -training
Measurement	The guidance given in MARSSIM is performance-based and directed towards acquiring site-specific data.	*Procedure*	The approaches suggested in MARSSIM vary depending on the various site data needs—there are no set procedures for sample collection, measurement techniques, storage and disposal established in MARSSIM.
Modeling	The interface between environmental pathway modeling and MARSSIM is an important survey design consideration addressed in MARSSIM.	*Modeling*	Environmental pathway modeling and ecological endpoints in modeling are beyond the scope of MARSSIM.

Table 1.1 Scope of MARSSIM (continued)

Within Scope of MARSSIM		Beyond Scope of MARSSIM	
Soil and Buildings	The two main media of interest in MARSSIM are contaminated surface soil and building surfaces.	*Other Media*	MARSSIM does not cover other media, including construction materials, equipment, subsurface soil, surface or subsurface water, biota, air, sewers, sediments or volumetric contamination.
Final Status Survey	The focus of MARSSIM is on the final status survey as this is the deciding factor in judging if the site meets the release criterion.	*Materials or Equipment*	MARSSIM does not recommend the use of any specific materials or equipment—there is too much variability in the types of radiation sites—this information will be in other documents.
Radiation	MARSSIM only considers radiation-derived hazards.	*Chemicals*	MARSSIM does not deal with any hazards posed by chemical contamination.
Remediation Method	MARSSIM assists users in determining when sites are ready for a final status survey and provides guidance on how to determine if remediation was successful.	*Remediation Method*	MARSSIM does not discuss selection and evaluation of remedial alternatives, public involvement, legal considerations, policy decisions related to planning
DQO Process	MARSSIM presents a systemized approach for designing surveys to collect data needed for making decisions such as whether or not to release a site.	*DQO Process*	MARSSIM does not provide prescriptive or default values of DQOs.
DQA	MARSSIM provides a set of statistical tests for evaluating data and lists alternate tests that may be applicable at specific sites.	*DQA*	MARSSIM does not prescribe a statistical test for use at all sites.

data will support that decision with satisfactory confidence. Usually a decision maker will make a correct decision after evaluating the data. However, since uncertainty in the survey results is unavoidable, the possibility of errors in decisions supported by survey results is unavoidable. For this reason, positive actions must be taken to manage the uncertainty in the survey results so that sound, defensible decisions may be made. These actions include proper survey planning to control known causes of uncertainty, proper application of quality control (QC) procedures during implementation of the survey plan to detect and control significant sources of error , and careful analysis of uncertainty before the data are used to support decision making. These actions describe the flow of data throughout each type of survey, and are combined in the Data Life Cycle as shown in Figure 2.1.

There are four phases of the Data Life Cycle:

- *Planning Phase.* The survey design is developed and documented using the Data Quality Objectives (DQO) Process. Quality assurance and quality control (QA/QC) procedures are developed and documented in the Quality Assurance Project Plan (QAPP). The QAPP is the principal product of the planning process which incorporates the DQOs as it integrates all technical and quality aspects for the life cycle of the project, including planning, implementation, and assessment. The QAPP documents planning results for survey operations and provides a specific format for obtaining the type and quality of data needed for decision making. The QAPP elements are presented in an order corresponding to the Data Life Cycle by grouping them into two types of elements: 1) project management; and 2) collection and evaluation of environmental data (ASQC 1995). The DQO process is described in Appendix D, and applied in Chapters 3, 4, and 5 of this manual. Development of the QAPP is described in Section 9.2 and applied throughout decommissioning.

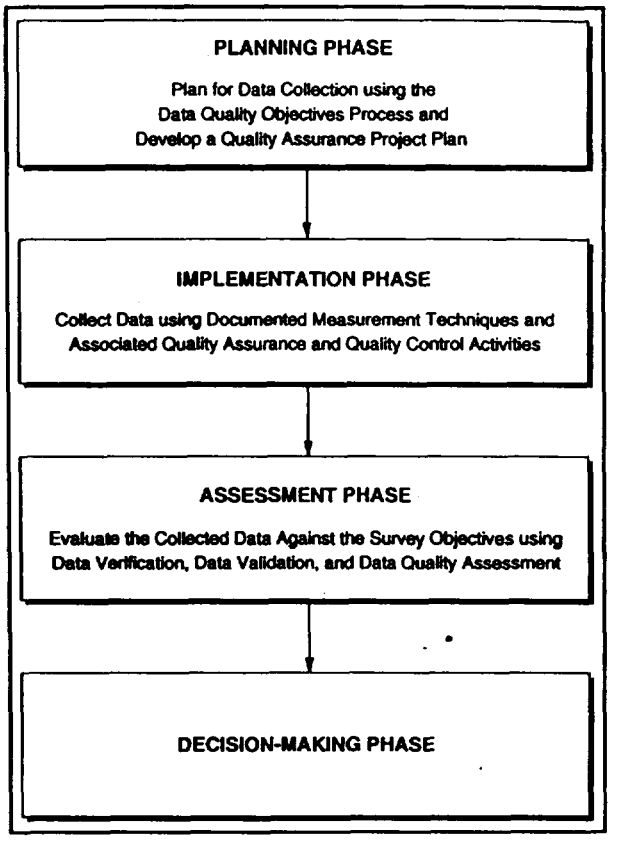


Figure 2.1 The Data Life Cycle

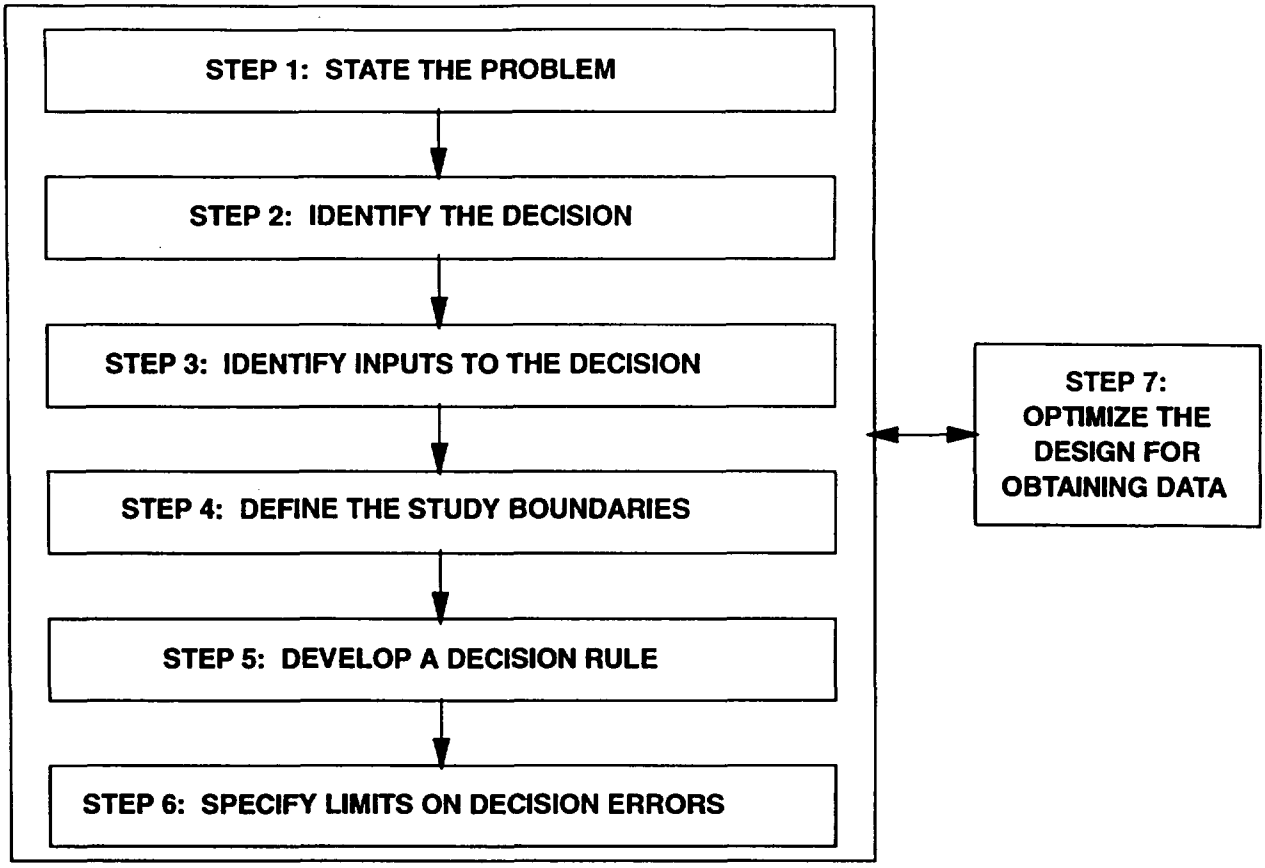


Figure 2.2 The Data Quality Objectives Process

- specify the detection limit for all measurement techniques (scanning, direct measurement, and sample analysis) specified in the QAPP: the minimum detectable concentration (MDC) is unique for each measurement system (Section 6.7)
- calculate the estimated number of measurements (N) and specify the measurement locations required to demonstrate compliance: the number of measurements depends on the relative shift (Δ/σ), Type I and Type II decision error rates (α and β), the potential for small areas of elevated activity, and the selection and classification of survey units (Section 5.5.2.2, Section 5.5.2.3)
- specify the documentation requirements for the survey, including survey planning documentation: documentation supporting the decision on whether or not the site complies with the release criterion is determined on a site-specific basis (Appendix N, Section N.2)

There are five steps in the DQA Process:

- Review the DQOs and Survey Design
- Conduct a Preliminary Data Review
- Select the Statistical Test
- Verify the Assumptions of the Statistical Test
- Draw Conclusions from the Data

The strength of DQA is its design that progresses in a logical and efficient manner to promote an understanding of how well the data meet the intended use. The Assessment Phase is described in more detail in Appendix E. Section 2.6 discusses the flexibility of the Data Life Cycle and describes the use of survey designs other than those described later in MARSSIM.

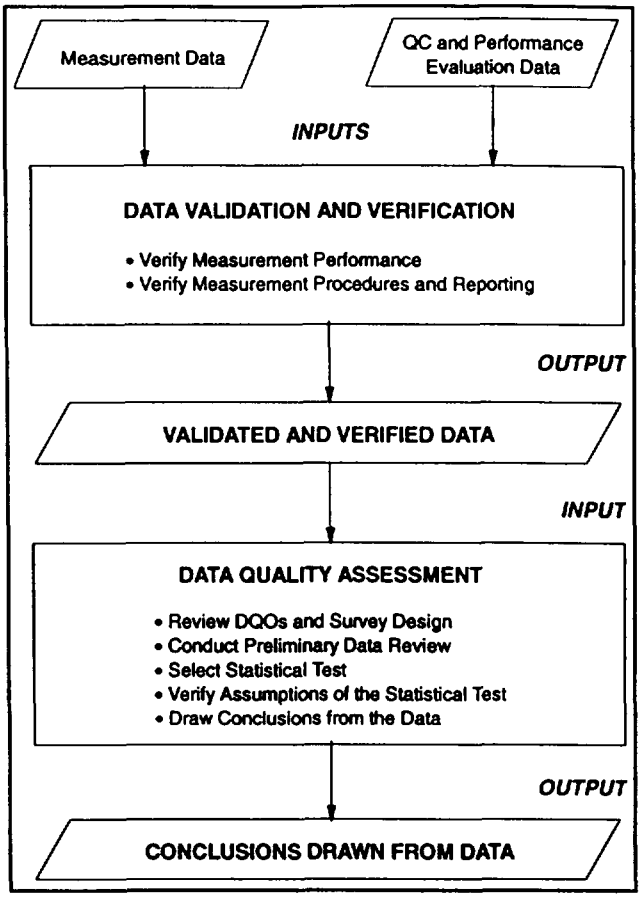


Figure 2.3 The Assessment Phase of the Data Life Cycle

2.3.4 Uncertainty in Survey Results

Uncertainty in survey results arises primarily from two sources: survey design errors and measurement errors. Survey design errors occur when the survey design is unable to capture the complete extent of variability that exists for the radionuclide distribution in a survey unit. Since it is impossible in every situation to measure the residual radioactivity at every point in space and time, the survey results will be incomplete to some degree. It is also impossible to know with complete certainty the residual radioactivity at locations that were not measured, so the incomplete survey results give rise to uncertainty. The greater the natural or inherent variation in residual radioactivity, the greater the uncertainty associated with a decision based on the survey results. The unanswered question is: "How well do the survey results represent the true level of residual radioactivity in the survey unit?"

Measurement errors create uncertainty by masking the true level of residual radioactivity and may be classified as random or systematic errors. Random errors affect the precision of the measurement system, and show up as variations among repeated measurements. Systematic errors show up as measurements that are biased to give results that are consistently higher or lower than the true value. Measurement uncertainty is discussed in Section 6.8.

Table 2.1 The Data Life Cycle used to Support the Radiation Survey and Site Investigation Process

RSSI Process	Data Life Cycle		MARSSIM Guidance
Site Identification			Provides information on identifying potential radiation sites (Section 3.3)
Historical Site Assessment	Historical Site Assessment Data Life Cycle	Plan Implement Assess Decide	Provides information on collecting and assessing existing site data (Sections 3.4 through 3.9) and potential sources of information (Appendix G)
Scoping Survey	Scoping Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing scoping surveys, especially as sources of information when planning final status surveys (Section 5.2)
Characterization Survey	Characterization Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing characterization surveys, especially as sources of information when planning final status surveys (Section 5.3)
Remedial Action Support Survey	Remedial Action Data Life Cycle	Plan Implement Assess Decide	Discusses the purpose and general approach for performing remedial action support surveys, especially as sources of information when planning final status surveys (Section 5.4)
Final Status Survey	Final Status Data Life Cycle	Plan Implement Assess Decide	Provides detailed guidance for planning final status surveys (Chapter 4 and Section 5.5), selecting measurement techniques (Chapter 6, Chapter 7, and Appendix H), and assessing the data collected during final status surveys (Chapter 8 and Chapter 9)

2.4.1 Site Identification

The identification of known, likely, or potential sites is generally easily accomplished, and is typically performed before beginning decommissioning. Any facility preparing to terminate an NRC or agreement state license would be identified as a site. Formerly terminated NRC licenses may also become sites for the EPA Superfund Program. Portions of military bases or DOE facilities may be identified as sites based on records of authorization to possess or handle radioactive materials. In addition, information obtained during the performance of survey activities may identify additional potential radiation sites related to the site being investigated. Information on site identification is provided in Section 3.3.

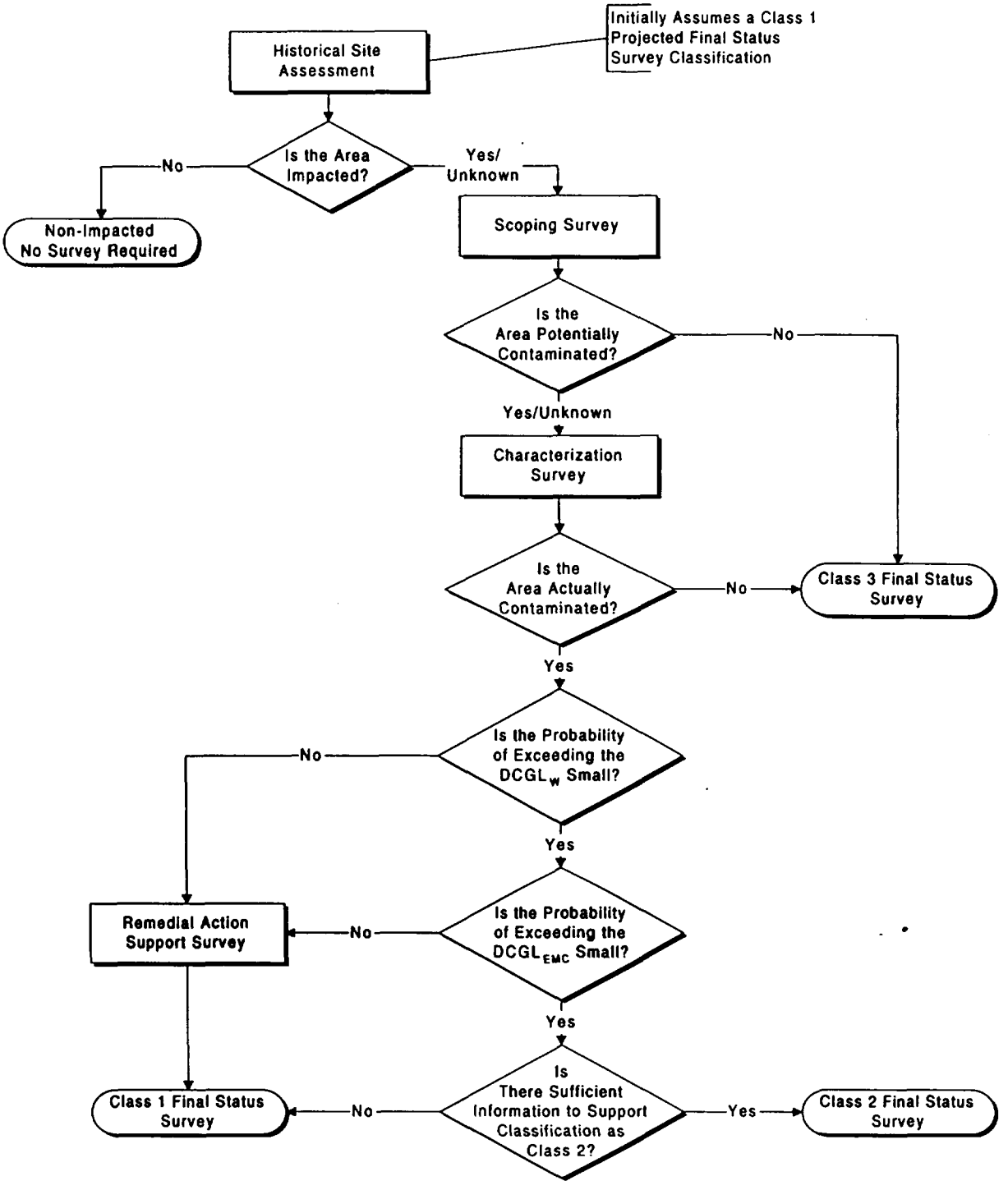


Figure 2.4 The Radiation Survey and Site Investigation Process in Terms of Area Classification

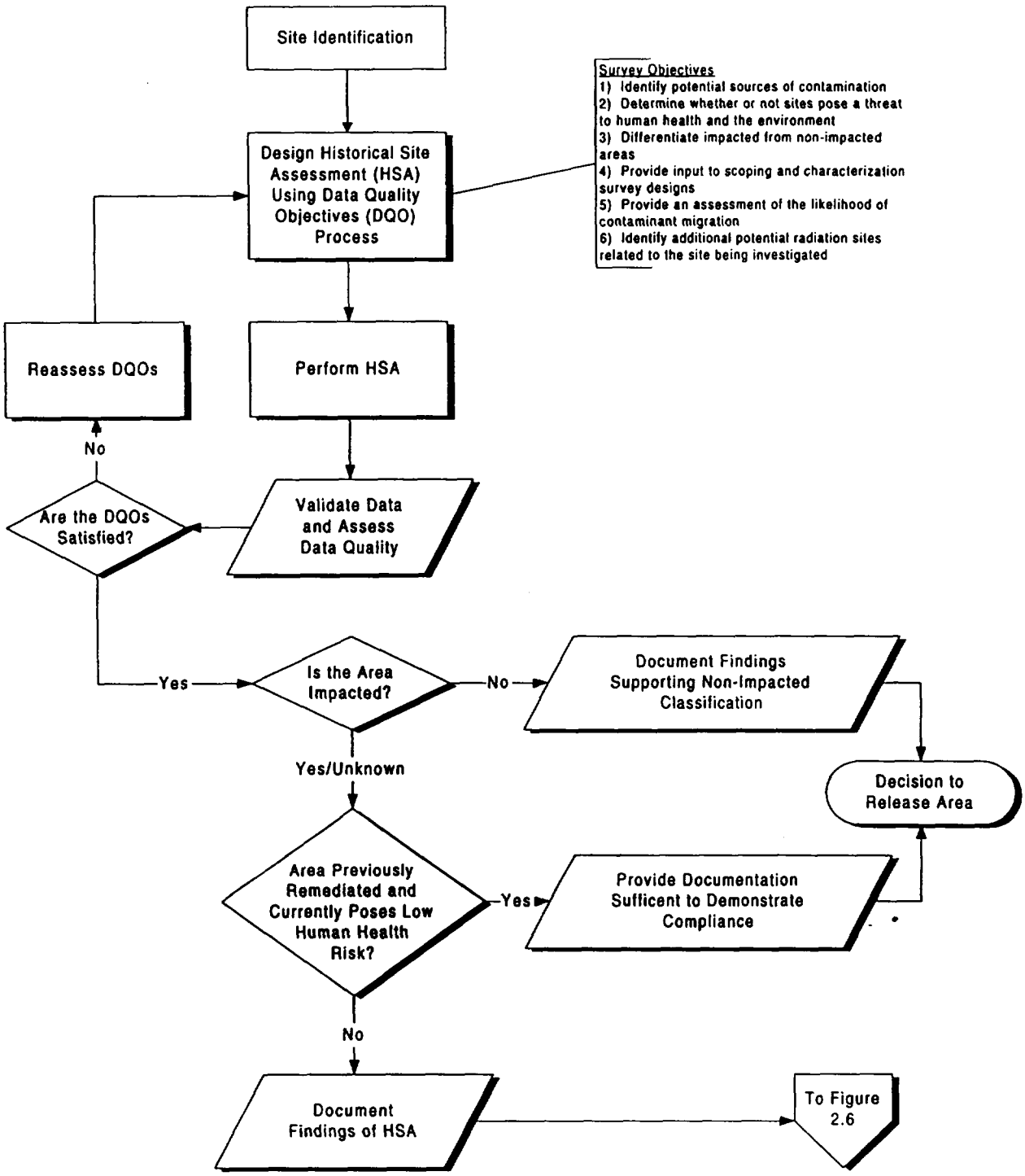


Figure 2.5 The Historical Site Assessment Portion of the Radiation Survey and Site Investigation Process

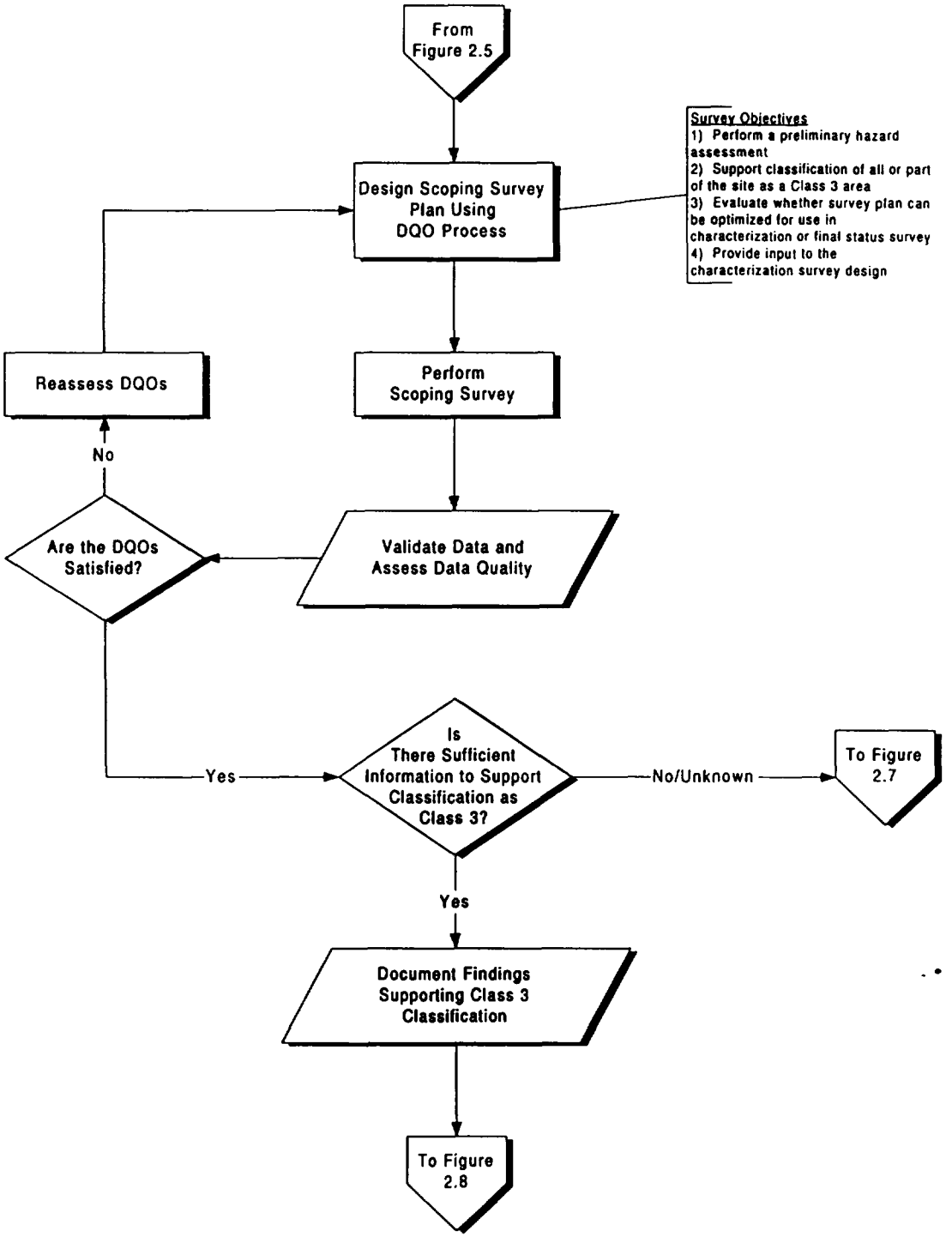
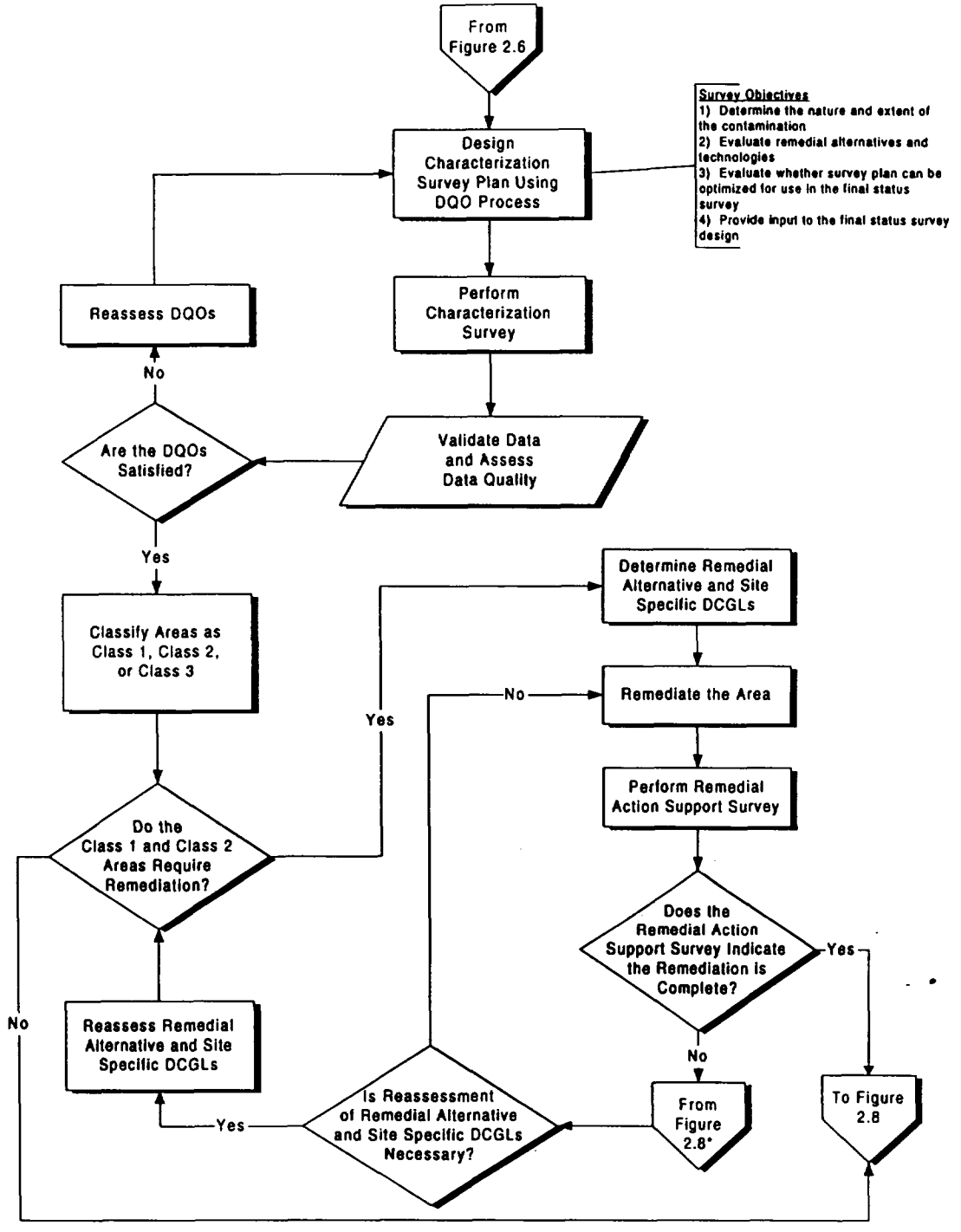
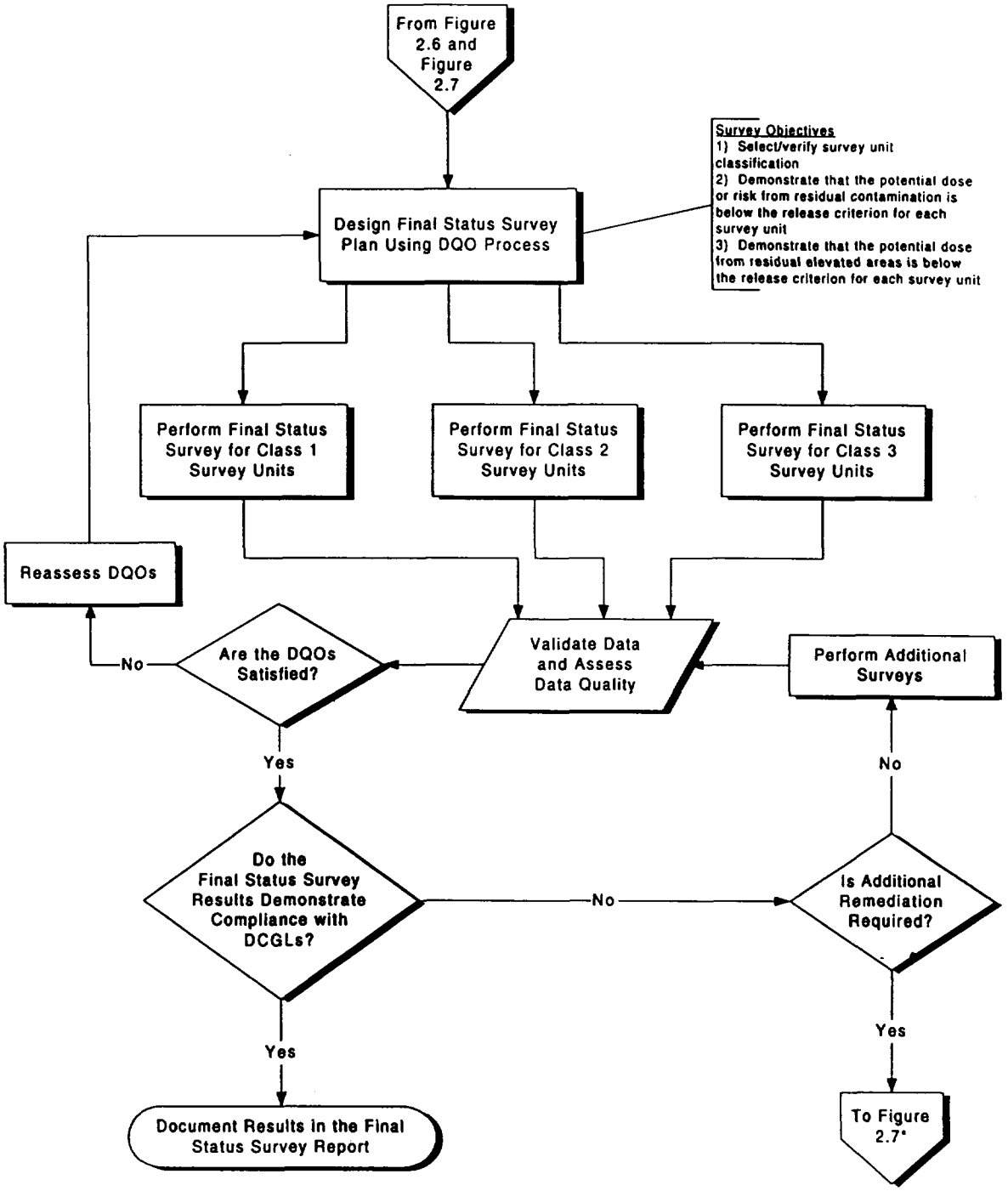


Figure 2.6 The Scoping Survey Portion of the Radiation Survey and Site Investigation Process



* The point where survey units that fail to demonstrate compliance in the final status survey in Figure 2.8 re-enter the process

Figure 2.7 The Characterization and Remedial Action Support Survey Portion of the Radiation Survey and Site Investigation Process



* Connects with the Remedial Action Support Survey portion of the process in Figure 2.7

Figure 2.8 The Final Status Survey Portion of the Radiation Survey and Site Investigation Process

Coal Combustion: Nuclear Resource or Danger

By Alex Gabbard

Alex Gabbard at the coal pile for ORNL's steam plant.

Over the past few decades, the American public has become increasingly wary of nuclear power because of concern about radiation releases from normal plant operations, plant accidents, and nuclear waste. Except for Chernobyl and other nuclear accidents, releases have been found to be almost undetectable in comparison with natural background radiation. Another concern has been the cost of producing electricity at nuclear plants. It has increased largely for two reasons: compliance with stringent government regulations that restrict releases of radioactive substances from nuclear facilities into the environment and construction delays as a result of public opposition.

Americans living near coal-fired power plants are exposed to higher radiation doses than those living near nuclear power plants that meet government regulations

Partly because of these concerns about radioactivity and the cost of containing it, the American public and electric utilities have preferred coal combustion as a power source. Today 52% of the capacity for generating electricity in the United States is fueled by coal, compared with 14.8% for nuclear energy. Although there are economic justifications for this preference, it is surprising for two reasons. First, coal combustion produces carbon dioxide and other greenhouse gases that are suspected to cause climatic warming, and it is a source of sulfur oxides and nitrogen oxides, which are harmful to human health and may be largely responsible for acid rain. Second, although not as well known, releases from coal combustion contain naturally occurring radioactive materials--mainly, uranium and thorium.

Former ORNL researchers J. P. McBride, R. E. Moore, J. P. Witherspoon, and R. E. Blanco made this point in their article "Radiological Impact of Airborne Effluents of Coal and Nuclear Plants" in the December 8, 1978, issue of Science magazine. They concluded that Americans living near coal-fired power plants are exposed to higher radiation doses than those living near nuclear power plants that meet government regulations. This ironic situation remains true today and is addressed in this article.

The fact that coal-fired power plants throughout the world are the major sources of radioactive materials released to the environment has several implications. It suggests that coal combustion is more hazardous to health than nuclear power and that it adds to the background radiation burden even more than does nuclear power. It also suggests that if radiation emissions from coal plants were regulated, their capital and operating costs would increase, making coal-fired power less economically competitive.

Finally, radioactive elements released in coal ash and exhaust produced by coal combustion contain fissionable fuels and much larger quantities of fertile materials that can be bred into fuels by absorption of neutrons, including those generated in the air by bombardment of oxygen, nitrogen, and other nuclei with cosmic rays; such fissionable and fertile materials can be recovered from coal ash using known technologies. These nuclear materials have growing value to private concerns and governments that may want to market them for fueling nuclear power plants. However, they are also available to those interested in accumulating material for nuclear weapons. A solution to this potential problem may be to encourage electric utilities to process coal ash and use new trapping technologies on coal combustion exhaust to isolate and collect valuable metals, such as iron and aluminum, and available nuclear fuels.

Exhibit 39

Makeup of Coal and Ash

Coal is one of the most impure of fuels. Its impurities range from trace quantities of many metals, including uranium and thorium, to much larger quantities of aluminum and iron to still larger quantities of impurities such as sulfur. Products of coal combustion include the oxides of carbon, nitrogen, and sulfur; carcinogenic and mutagenic substances; and recoverable minerals of commercial value, including nuclear fuels naturally occurring in coal.

The amount of thorium contained in coal is about 2.5 times greater than the amount of uranium

Coal ash is composed primarily of oxides of silicon, aluminum, iron, calcium, magnesium, titanium, sodium, potassium, arsenic, mercury, and sulfur plus small quantities of uranium and thorium. Fly ash is primarily composed of non-combustible silicon compounds (glass) melted during combustion. Tiny glass spheres form the bulk of the fly ash.

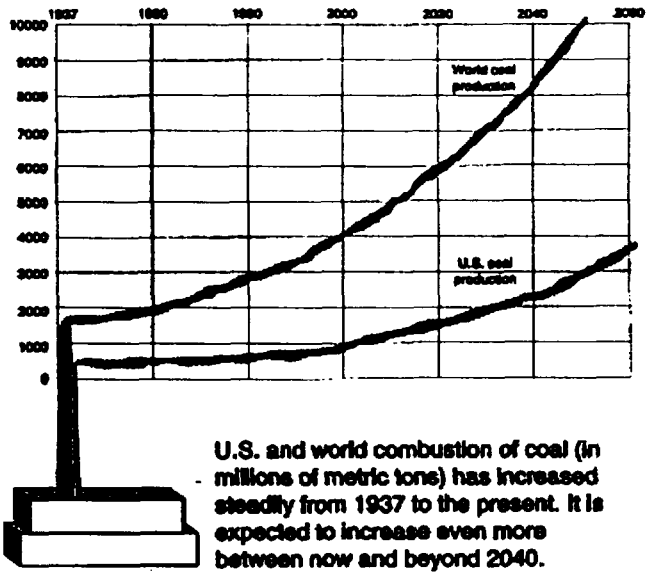
Since the 1960s particulate precipitators have been used by U.S. coal-fired power plants to retain significant amounts of fly ash rather than letting it escape to the atmosphere. When functioning properly, these precipitators are approximately 99.5% efficient. Utilities also collect furnace ash, cinders, and slag, which are kept in cinder piles or deposited in ash ponds on coal-plant sites along with the captured fly ash.

Trace quantities of uranium in coal range from less than 1 part per million (ppm) in some samples to around 10 ppm in others. Generally, the amount of thorium contained in coal is about 2.5 times greater than the amount of uranium. For a large number of coal samples, according to Environmental Protection Agency figures released in 1984, average values of uranium and thorium content have been determined to be 1.3 ppm and 3.2 ppm, respectively. Using these values along with reported consumption and projected consumption of coal by utilities provides a means of calculating the amounts of potentially recoverable breedable and fissionable elements (see sidebar). The concentration of fissionable uranium-235 (the current fuel for nuclear power plants) has been established to be 0.71% of uranium content.

Uranium and Thorium in Coal and Coal Ash

As population increases worldwide, coal combustion continues to be the dominant fuel source for electricity. Fossil fuels' share has decreased from 76.5% in 1970 to 66.3% in 1990, while nuclear energy's share in the worldwide electricity pie has climbed from 1.6% in 1970 to 17.4% in 1990. Although U.S. population growth is slower than worldwide growth, per capita consumption of energy in this country is among the world's highest. To meet the growing demand for electricity, the U.S. utility industry has continually expanded generating capacity. Thirty years ago, nuclear power appeared to be a viable replacement for fossil power, but today it represents less than 15% of U.S. generating capacity. However, as a result of low public support during recent decades and a reduction in the rate of expected power demand, no increase in nuclear power generation is expected in the foreseeable future. As current nuclear power plants age, many plants may be retired during the first quarter of the 21st century, although some may have their operation extended through license renewal. As a result, many nuclear plants are likely to be replaced with coal-fired plants unless it is considered feasible to replace them with fuel sources such as natural gas and solar energy.

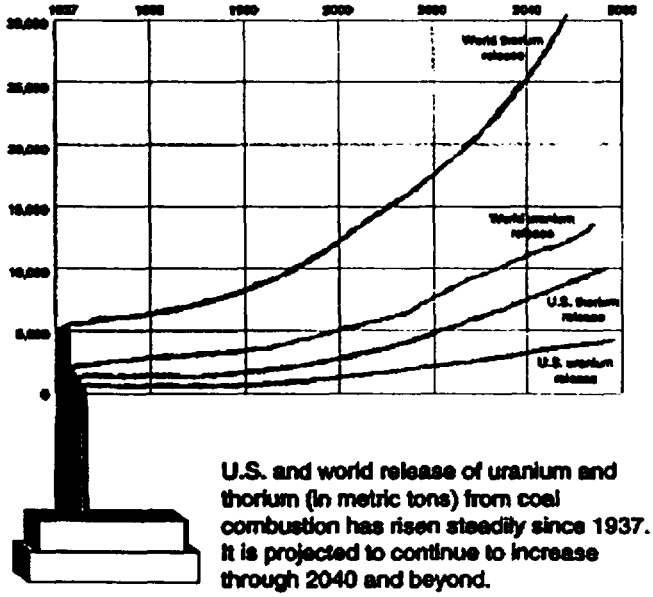
U.S. AND WORLD COAL COMBUSTION (millions of tons)



U.S. and world combustion of coal (in millions of metric tons) has increased steadily from 1937 to the present. It is expected to increase even more between now and beyond 2040.

As the world's population increases, the demands for all resources, particularly fuel for electricity, is expected to increase. To meet the demand for electric power, the world population is expected to rely increasingly on combustion of fossil fuels, primarily coal. The world has about 1500 years of known coal resources at the current use rate. The graph above shows the growth in U.S. and world coal combustion for the 50 years preceding 1988, along with projections beyond the year 2040. Using the concentration of uranium and thorium indicated above, the graph below illustrates the historical release quantities of these elements and the releases that can be expected during the first half of the next century, given the predicted growth trends. Using these data, both U.S. and worldwide fissionable uranium-235 and fertile nuclear material releases from coal combustion can be calculated.

U.S. AND WORLD RELEASE OF URANIUM AND THORIUM



U.S. and world release of uranium and thorium (in metric tons) from coal combustion has risen steadily since 1937. It is projected to continue to increase through 2040 and beyond.

Because existing coal-fired power plants vary in size and electrical output, to calculate the annual coal consumption of these facilities, assume that the typical plant has an electrical output of 1000 megawatts. Existing coal-fired plants of this capacity annually burn about 4 million tons of coal each year. Further, considering that in 1982 about 616 million short tons (2000 pounds per ton) of coal was burned in the United States (from 833 million short tons mined, or 74%), the number of typical

coal-fired plants necessary to consume this quantity of coal is 154.

Using these data, the releases of radioactive materials per typical plant can be calculated for any year. For the year 1982, assuming coal contains uranium and thorium concentrations of 1.3 ppm and 3.2 ppm, respectively, each typical plant released 5.2 tons of uranium (containing 74 pounds of uranium-235) and 12.8 tons of thorium that year. Total U.S. releases in 1982 (from 154 typical plants) amounted to 801 tons of uranium (containing 11,371 pounds of uranium-235) and 1971 tons of thorium. These figures account for only 74% of releases from combustion of coal from all sources. Releases in 1982 from worldwide combustion of 2800 million tons of coal totaled 3640 tons of uranium (containing 51,700 pounds of uranium-235) and 8960 tons of thorium.

Based on the predicted combustion of 2516 million tons of coal in the United States and 12,580 million tons worldwide during the year 2040, cumulative releases for the 100 years of coal combustion following 1937 are predicted to be:

U.S. release (from combustion of 111,716 million tons):

Uranium: 145,230 tons (containing 1031 tons of uranium-235)

Thorium: 357,491 tons

Worldwide release (from combustion of 637,409 million tons):

Uranium: 828,632 tons (containing 5883 tons of uranium-235)

Thorium: 2,039,709 tons

Radioactivity from Coal Combustion

The main sources of radiation released from coal combustion include not only uranium and thorium but also daughter products produced by the decay of these isotopes, such as radium, radon, polonium, bismuth, and lead. Although not a decay product, naturally occurring radioactive potassium-40 is also a significant contributor.

The population effective dose equivalent from coal plants is 100 times that from nuclear plants

According to the National Council on Radiation Protection and Measurements (NCRP), the average radioactivity per short ton of coal is 17,100 millicuries/4,000,000 tons, or 0.00427 millicuries/ton. This figure can be used to calculate the average expected radioactivity release from coal combustion. For 1982 the total release of radioactivity from 154 typical coal plants in the United States was, therefore, 2,630,230 millicuries.

Thus, by combining U.S. coal combustion from 1937 (440 million tons) through 1987 (661 million tons) with an estimated total in the year 2040 (2516 million tons), the total expected U.S. radioactivity release to the environment by 2040 can be determined. That total comes from the expected combustion of 111,716 million tons of coal with the release of 477,027,320 millicuries in the United States. Global releases of radioactivity from the predicted combustion of 637,409 million tons of coal would be 2,721,736,430 millicuries.

For comparison, according to NCRP Reports No. 92 and No. 95, population exposure from operation of 1000-MWe nuclear and coal-fired power plants amounts to 490 person-rem/year for coal plants and 4.8 person-rem/year for nuclear plants. Thus, the population effective dose equivalent from coal plants is 100 times that from nuclear plants. For the complete nuclear fuel cycle, from mining to reactor operation to waste disposal, the radiation dose is cited as 136 person-rem/year; the equivalent dose for coal use, from mining to power plant operation to waste disposal, is not listed in this report and is probably unknown.

During combustion, the volume of coal is reduced by over 85%, which increases the concentration of the metals originally in the coal. Although significant quantities of ash are retained by precipitators, heavy metals such as uranium tend to concentrate on the tiny glass spheres that make up the bulk of fly ash. This uranium is released to the atmosphere with the escaping fly ash, at about 1.0% of the original amount, according to NCRP data. The retained ash is enriched in uranium several times over the original uranium concentration in the coal because the uranium, and thorium, content is not decreased as the volume of coal is reduced.

All studies of potential health hazards associated with the release of radioactive elements from coal combustion conclude that the perturbation of natural background dose levels is almost negligible. However, because the half-lives of radioactive

potassium-40, uranium, and thorium are practically infinite in terms of human lifetimes, the accumulation of these species in the biosphere is directly proportional to the length of time that a quantity of coal is burned.

Although trace quantities of radioactive heavy metals are not nearly as likely to produce adverse health effects as the vast array of chemical by-products from coal combustion, the accumulated quantities of these isotopes over 150 or 250 years could pose a significant future ecological burden and potentially produce adverse health effects, especially if they are locally accumulated. Because coal is predicted to be the primary energy source for electric power production in the foreseeable future, the potential impact of long-term accumulation of by-products in the biosphere should be considered.

The energy content of nuclear fuel released in coal combustion is greater than that of the coal consumed

Energy Content: Coal vs Nuclear

An average value for the thermal energy of coal is approximately 6150 kilowatt-hours(kWh)/ton. Thus, the expected cumulative thermal energy release from U.S. coal combustion over this period totals about 6.87 x 10E14 kilowatt-hours. The thermal energy released in nuclear fission produces about 2 109 kWh/ton. Consequently, the thermal energy from fission of uranium-235 released in coal combustion amounts to 2.1 x 10E12 kWh. If uranium-238 is bred to plutonium-239, using these data, the thermal energy from fission of this isotope alone constitutes about 2.9 x 10E14 kWh, or about half the anticipated energy of all the utility coal burned in this country through the year 2040. If the thorium-232 is bred to uranium-233 and fissioned, the thermal energy capacity of this isotope is approximately 7.2 x 10E14 kWh, or 105% of the thermal energy released from U.S. coal combustion for a century. The total of the thermal energy capacities from each of these three fissionable isotopes is about 10.1 x 10E14 kWh, 1.5 times more than the total from coal. World combustion of coal has the same ratio, similarly indicating that coal combustion wastes more energy than it produces.

Views of the Tennessee Valley Authority's Bull Run and Kingston Steam Plants. These coal-fired facilities generate electricity for Oak Ridge and the surrounding area.

Consequently, the energy content of nuclear fuel released in coal combustion is more than that of the coal consumed! Clearly, coal-fired power plants are not only generating electricity but are also releasing nuclear fuels whose commercial value for electricity production by nuclear power plants is over $7 trillion, more than the U.S. national debt. This figure is based on current nuclear utility fuel costs of 7 mils per kWh, which is about half the cost for coal. Consequently, significant quantities of nuclear materials are being treated as coal waste, which might become the cleanup nightmare of the future, and their value is hardly recognized at all.

How does the amount of nuclear material released by coal combustion compare to the amount consumed as fuel by the U.S. nuclear power industry? According to 1982 figures, 111 American nuclear plants consumed about 540 tons of nuclear fuel, generating almost 1.1 x 10E12 kWh of electricity. During the same year, about 801 tons of uranium alone were released from American coal-fired plants. Add 1971 tons of thorium, and the release of nuclear components from coal combustion far exceeds the entire U.S. consumption of nuclear fuels. The same conclusion applies for worldwide nuclear fuel and coal combustion.

Another unrecognized problem is the gradual production of plutonium-239 through the exposure of uranium-238 in coal waste to neutrons from the air. These neutrons are produced primarily by bombardment of oxygen and nitrogen nuclei in the atmosphere by cosmic rays and from spontaneous fission of natural isotopes in soil. Because plutonium-239 is reportedly toxic in minute quantities, this process, however slow, is potentially worrisome. The radiotoxicity of plutonium-239 is 3.4 x 10E11 times that of uranium-238. Consequently, for 801 tons of uranium released in 1982, only 2.2 milligrams of plutonium-239 bred by natural processes, if those processes exist, is necessary to double the radiotoxicity estimated to be released into the biosphere that year. Only 0.075 times that amount in plutonium-240 doubles the radiotoxicity. Natural processes to produce both plutonium-239 and plutonium-240 appear to exist.

Conclusions

For the 100 years following 1937, U.S. and world use of coal as a heat source for electric power generation will result in the distribution of a variety of radioactive elements into the environment. This prospect raises several questions about the risks and benefits of coal combustion, the leading source of electricity production.

First, the potential health effects of released naturally occurring radioactive elements are a long-term issue that has not been fully addressed. Even with improved efficiency in retaining stack emissions, the removal of coal from its shielding overburden in the earth and subsequent combustion releases large quantities of radioactive materials to the surface of the earth. The emissions by coal-fired power plants of greenhouse gases, a vast array of chemical by-products, and naturally occurring radioactive elements make coal much less desirable as an energy source than is generally accepted.

Second, coal ash is rich in minerals, including large quantities of aluminum and iron. These and other products of commercial value have not been exploited.

Third, large quantities of uranium and thorium and other radioactive species in coal ash are not being treated as radioactive waste. These products emit low-level radiation, but because of regulatory differences, coal-fired power plants are allowed to release quantities of radioactive material that would provoke enormous public outcry if such amounts were released from nuclear facilities. Nuclear waste products from coal combustion are allowed to be dispersed throughout the biosphere in an unregulated manner. Collected nuclear wastes that accumulate on electric utility sites are not protected from weathering, thus exposing people to increasing quantities of radioactive isotopes through air and water movement and the food chain.

Fourth, by collecting the uranium residue from coal combustion, significant quantities of fissionable material can be accumulated. In a few year's time, the recovery of the uranium-235 released by coal combustion from a typical utility anywhere in the world could provide the equivalent of several World War II-type uranium-fueled weapons. Consequently, fissionable nuclear fuel is available to any country that either buys coal from outside sources or has its own reserves. The material is potentially employable as weapon fuel by any organization so inclined. Although technically complex, purification and enrichment technologies can provide high-purity, weapons-grade uranium-235. Fortunately, even though the technology is well known, the enrichment of uranium is an expensive and time-consuming process.

Because electric utilities are not high-profile facilities, collection and processing of coal ash for recovery of minerals, including uranium for weapons or reactor fuel, can proceed without attracting outside attention, concern, or intervention. Any country with coal-fired plants could collect combustion by-products and amass sufficient nuclear weapons material to build up a very powerful arsenal, if it has or develops the technology to do so. Of far greater potential are the much larger quantities of thorium-232 and uranium-238 from coal combustion that can be used to breed fissionable isotopes. Chemical separation and purification of uranium-233 from thorium and plutonium-239 from uranium require far less effort than enrichment of isotopes. Only small fractions of these fertile elements in coal combustion residue are needed for clandestine breeding of fissionable fuels and weapons material by those nations that have nuclear reactor technology and the inclination to carry out this difficult task.

Fifth, the fact that large quantities of uranium and thorium are released from coal-fired plants without restriction raises a paradoxical question. Considering that the U.S. nuclear power industry has been required to invest in expensive measures to greatly reduce releases of radioactivity from nuclear fuel and fission products to the environment, should coal-fired power plants be allowed to do so without constraints?

If increased regulation of nuclear power plants is demanded, then we can expect a significant redirection of national policy in regulation of radioactive emissions from coal combustion

This question has significant economic repercussions. Today nuclear power plants are not as economical to construct as coal-fired plants, largely because of the high cost of complying with regulations to restrict emissions of radioactivity. If coal-fired power plants were regulated in a similar manner, the added cost of handling nuclear waste from coal combustion would be significant and would, perhaps, make it difficult for coal-burning plants to compete economically with nuclear power.

Because of increasing public concern about nuclear power and radioactivity in the environment, reduction of releases of nuclear materials from all sources has become a national priority known as "as low as reasonably achievable" (ALARA). If increased regulation of nuclear power plants is demanded, can we expect a significant redirection of national policy so that radioactive emissions from coal combustion are also regulated?

Although adverse health effects from increased natural background radioactivity may seem unlikely for the near term, long-term accumulation of radioactive materials from continued worldwide combustion of coal could pose serious health hazards. Because coal combustion is projected to increase throughout the world during the next century, the increasing accumulation of coal

combustion by-products, including radioactive components, should be discussed in the formulation of energy policy and plans for future energy use.

One potential solution is improved technology for trapping the exhaust (gaseous emissions up the stack) from coal combustion. If and when such technology is developed, electric utilities may then be able both to recover useful elements, such as nuclear fuels, iron, and aluminum, and to trap greenhouse gas emissions. Encouraging utilities to enter mineral markets that have been previously unavailable may or may not be desirable, but doing so appears to have the potential of expanding their economic base, thus offsetting some portion of their operating costs, which ultimately could reduce consumer costs for electricity.

Both the benefits and hazards of coal combustion are more far-reaching than are generally recognized. Technologies exist to remove, store, and generate energy from the radioactive isotopes released to the environment by coal combustion. When considering the nuclear consequences of coal combustion, policymakers should look at the data and recognize that the amount of uranium-235 alone dispersed by coal combustion is the equivalent of dozens of nuclear reactor fuel loadings. They should also recognize that the nuclear fuel potential of the fertile isotopes of thorium-232 and uranium-238, which can be converted in reactors to fissionable elements by breeding, yields a virtually unlimited source of nuclear energy that is frequently overlooked as a natural resource.

The amount of uranium-235 alone dispersed by coal combustion is the equivalent of dozens of nuclear reactor fuel loadings

In short, naturally occurring radioactive species released by coal combustion are accumulating in the environment along with minerals such as mercury, arsenic, silicon, calcium, chlorine, and lead, sodium, as well as metals such as aluminum, iron, lead, magnesium, titanium, boron, chromium, and others that are continually dispersed in millions of tons of coal combustion by-products. The potential benefits and threats of these released materials will someday be of such significance that they should not now be ignored.--*Alex Gabbard of the Metals and Ceramics Division*

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Where to?

TABLE 2

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANT LEVELS IN ON-SITE MONITORING WELLS INDUSTRIAL EXCESS LANDFILL SITE[a]

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993	
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration
Organic									
Benzene	5	13-S	180	13-S	310	13-S	460	13-S	540 D[c]
		14-I	11	14-I	6 J[c]	14-S	1,000	14-I	7 J[c]
		14-S	1,100	14-S	1,100 D[c]	15-S	210	14-S	510
		15-S	170	15-S	310	17-S	7 J[c]	15-S	62 D[c]
				17-S	6 J[c]			17-S	8 J[c]
1,2-Dichloroethane	5	15-S	36 J[c]	15-S	55 J[c]	15-S	43 J[c]	15-S	52 D[c]
Ethylbenzene	700			15-S	1,200	15-S	840		
Methylene chloride	5	15-S	14 J[c]						
Vinyl chloride	2							15-S	19
Unfiltered Metals[d]									
Antimony	6			17-S	198 J[c]	17-S	147		
Background[e]		Not detected in background				12-D	25.4 B[c]	20-I	22.9 BJ[c]
				12-I	14.8 B[c]	12-I	ND	20-S	23.8 BJ[c]
Arsenic	50	13-S	61.7	4-S	109	4-S	63.5	4-S	56.1
		14-S	103	13-S	53.5	13-S	64.1	13-S	71.8
				14-S	139			17-S	50.5
Background[e]		20-I	4.4B[c]	12-D	7.5 B[c]	12-D	3.2 BJ[c]	20-D	2.4 BJ[c]
		20-S	7.1B[c]	12-I	13.3	12-I	1.7 BJ[c]	20-I	15.4
		12-D	4.6B[c]					20-S	13.7
		12-I	12.4					12-D	3.8 BJ[c]
								12-I	3.5 BJ[c]
Barium	2,000			14-S	2,530	17-S	3,460		
				17-S	2,510				
Background[e]		12-I	390	12-D	165	12-D	149 B[c]	12-I	311
		12-D	106	12-I	389	12-I	261	12-D	173
		20-D	134					20-C	169
		20-I	136					20-I	278
		20-S	153					20-S	226

Exhibit 40

TABLE 2 (Continued)

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANTS LEVELS IN ON-SITE MONITORING WELLS INDUSTRIAL EXCESS LANDFILL SITE

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993	
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration
Beryllium	4			14-S	6.2	2-D 4-S 17-S	11.7 7.9 9.7		
Background[c]		Not detected in background		Not detected in background		Not detected in background		20-I	1 BJ[c]
Cadmium	5			4-S 17-S	6.7 11.2				
Background[c]		12-I	34	12-I	38.8	Not detected in background		20-D	4 B[c]
Chromium	100	14-S	104	14-S	160	9-I 17-S	217 173		
Background[c]		12-D	13.4	12-D 12-I	3.5 a 25.4	Not detected in background		20-D 20-I 20-S	12.4 33.6 14.5
Lead	15 (action level)	2-D 9-S 14-S	53.2 24.1 169	4-S 14-S 15-S 17-S	129 164 19.2 308 J[c]	2-D 3-D 4-S 7-S 17-S	47 J[c] 24.8 48.4 16.1 388	2-D 3-D 3-I 4-S	48.3 15.7 J[c] 66.3 J[c] 62
Background[c]		20-D 12-D 12-I	8.7 3.1 44.4	12-D 12-I	32 19	12-D 12-I	2.7 BJ[c] 1.4 BJ[c]	12-I 20-D 20-I 20-S 12-D	11.8J[c] 7 23.3 22 3.3
Mercury	2								
Background[c]		Not detected in background		Not detected in background		Not detected in background		Not detected in background	

TABLE 2 (Continued)

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANTS LEVELS IN ON-SITE MONITORING WELLS INDUSTRIAL EXCESS LANDFILL SITE

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993		
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration	
Nickel	100	2-D 14-S	106 160	14-S 17-S	254 195	2-D 17-S	187 434			
Background[c]		12-D 12-I	35.1 63.4	12-D 12-I	ND 43.1	Not detected in background		20-D 20-I 20-S	18.1 41.1 23.6	B[c]

Notes:

[a] All analytical results presented in this table utilize rigorous Quality Assurance/Quality Control (QA/QC) protocols and documentation.

[b] Micrograms per liter (µg/L).

[c] The letter "J" is a commonly used data qualifier that means the concentration given is estimated and the actual concentration could be a small percentage higher or lower than the listed concentration. The letter "D" is also a data qualifier that is used when the concentration of a certain compound or compounds is too high. In that case, the sample is diluted to a lower concentration and the resulting concentration is multiplied by a dilution factor to calculate the actual concentration. The letter "B" indicates that the contaminant was also detected in an associated blank.

[d] Results for unfiltered metals samples are used because research performed at the EPA Robert S. Kerr Environmental Research Laboratory suggests that a large fraction of mobile inorganic contamination in groundwater is of colloidal dimensions that is removed using 0.45 micron filters.

[e] Results for background include all detections of a contaminant in background wells MW-12I, MW-12D, MW-20S, MW-20I, or MW-20D. If a background well is not listed, the contaminant was not detected in that background well.

TABLE 3

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANT LEVELS IN OFF-SITE MONITORING AND OBSERVATION WELLS INDUSTRIAL EXCESS LANDFILL SITE[a]

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993	
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration
Organic									
Benzene	5	21-S	7 J[c]	21-S	11	21-S OW-11	17 23		
1,2-Dichloroethane	5	21-S	5 J[c]	21-S	7 J[c]	21-S	8 J[c]		
Ethylbenzene	700								
Methylene chloride	5					27-I	22		
Vinyl chloride	2	21-S	7 J[c]	11-I 21-S OW-5	2 J[c] 9 J[c] 13			OW-5	5 J[c]
Unfiltered Metals[d]									
Antimony	6			8-S 18-S 23-S 25-S 27-S	61 J[c] 106 J[c] 315 J[c] 175 J[c] 98.9 J[c]	18-S 24-S 27-S	99 161 133		
Background[e]		Not detected in background		12-I	14.8 B[c]	12-D 12-I	25.4 B[c] ND	20-I 20-S	22.9 BJ[c] 23.8 BJ[c]
Arsenic	50	18-S 24-S	76.9 132	23-S	54.8 J[c]				
Background[e]		20-I 20-S 12-D 12-I	4.4B[c] 7.1B[c] 4.6B[c] 12.4	12-D 12-I	7.5 B[c] 13.3	12-D 12-I	3.2 BJ[c] 1.7 BJ[c]	20-D 20-I 20-S 12-D 12-I	2.4 BJ[c] 15.4 13.7 3.8 BJ[c] 3.5 BJ[c]
Barium	2,000			OW-9	2,090	24-S 27-S	2,320 2,120		
Background[e]		12-D 20-D 20-I 20-S	106 134 136 153	12-D 12-I	165 389	12-D 12-I	149 B 261	12-D 20-D 20-I 20-S	173 169 278 226

TABLE 3 (Continued)

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANT LEVELS IN OFF-SITE MONITORING AND OBSERVATION WELLS INDUSTRIAL EXCESS LANDFILL SITE[a]

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992			March 1993		
		Well	Concentration	Well	Concentration	Well	Concentration		Well	Concentration	
Beryllium	4	18-S 21-I 27-S	5.9 5 5.8	23-S 27-S	5.2 7.4	8-S 18-S 19-S 23-S 24-S 25-S 27-S	46.9 51.3 6.6 9.1 95.7 24 121		24-S	5.4	
Background[c]		Not detected in background		Not detected in background		Not detected in background			20-I	1	BJ[c]
Cadmium	5	1-D 8-D 24-S	79.4 11.5 8	1-D 8-D 12-I 18-S 23-S 25-S 27-S	56 7.9 38.8 5.3 11.8 8.7 14	1-D 8-D 27-S	15.1 6.3 7.4	J[c]	1-D 8-D 28-D	11.4 5.4 265	
Background[c]		12-I	34	12-I	38.8	Not detected in background			20-D	4	8
Chromium	100	18-S 21-I 27-S	278 137 124	18-S 25-I 25-S 27-S	228 341 160 131	8-S 18-S 24-I 24-S 25-S 27-S	137 375 739 214 127 297	 J[c] J[c] J[c] J[c]	18-S 24-S	262 168	
Background[c]		12-D	13.4	12-D 12-I	3.5 25.4	Not detected in background			20-D 20-I 20-S	12.4 33.6 14.5	

TABLE 3 (Continued)

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANT LEVELS IN OFF-SITE MONITORING AND OBSERVATION WELLS INDUSTRIAL EXCESS LANDFILL SITE[a]

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993	
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration
Lead	15 (action level)	1-D	27.4	1-D	17.3	8-D	24.1 J[c]	1-D	20
		8-S	106	6-S	32	8-S	83.1	6-S	53.4
		10-S	90.8	8-D	80.3	10-S	17.5	8-D	17.3
		11-S	16.1	8-S	85.2 J[c]	18-S	174 J[c]	8-S	34.7 J[c]
		18-I	20.6	10-D	52.2 J[c]	19-S	15.1 J[c]	10-S	32.1 J[c]
		18-S	279	10-S	18.8 J[c]	23-S	34.5 J[c]	18-S	54.9
		19-S	18.4	11-D	29.9 J[c]	24-I	26.4 J[c]	21-S	20.7
		21-I	155	18-S	155	24-S	659	23-S	83.4
		23-I	19.8	19-S	16.5	25-I	15.4	24-S	264 J[c]
		23-S	63.4	23-I	60.1	25-S	136 J[c]	25-I	24.5
		24-S	278	23-S	205 J[c]	26-S	15.2 J[c]	27-I	25.6 J[c]
		25-S	104	24-S	74.8 J[c]	27-S	700 J[c]	27-S	16.1 J[c]
		27-S	453	25-I	50.2 J[c]	OW-8	26.5 J[c]	28-D	20.5 J[c]
				25-S	214 J[c]			OW-9	15.5 J[c]
				27-D	60.9				
				27-I	102 J[c]				
				27-S	613				
					J[c]				
Background[c]		20-D	8.7	12-D	32	12-D	2.7 BJ[c]	12-I	11.8J[c]
		12-D	3.1	12-I	19	12-I	1.4 BJ[c]	20-D	7
		12-I	44.4					20-I	23.3
								20-S	22
								12-D	3.3
Mercury	2			27-S	2.5	27-S	2.6	OW-11	2.4
						OW-11	5.5		
Background[c]		Not detected in background		Not detected in background		Not detected in background		Not detected in background	

TABLE 3 (Continued)

ORGANIC COMPOUNDS AND METALS DETECTED AT LEVELS EXCEEDING MAXIMUM CONTAMINANT LEVELS IN OFF-SITE MONITORING AND OBSERVATION WELLS INDUSTRIAL EXCESS LANDFILL SITE[a]

Compound	Maximum Contaminant Level (µg/L)[b]	May 1992		August 1992		December 1992		March 1993		
		Well	Concentration	Well	Concentration	Well	Concentration	Well	Concentration	
Nickel	100	8-S	113	8-S	147	8-S	241	18-S	177	
		10-S	144	18-S	189	11-I	130	23-S	105	
		18-S	276	23-S	175	18-S	319	24-S	401	
		21-I	195	25-I	352	21-S	134			
		24-S	211	25-S	200	24-I	1,240			
		27-S	219	26-S	123	24-S	649			
				27-S	341	25-S	206			
						27-S	735			
Background[c]		12-D	35.1	12-D	ND	Not detected in background		20-D	18.1	B[c]
		12-I	63.4	12-I	43.1			20-I	41.1	
								20-S	23.6	

Notes:

[a] All analytical results presented in this table utilize rigorous Quality Assurance/Quality Control (QA/QC) protocols and documentation.

[b] Micrograms per liter (µg/L).

[c] The letter "J" is a commonly used data qualifier that means the concentration given is estimated and the actual concentration could be a small percentage higher or lower than the listed concentration. The letter "B" indicates that the contaminant was also detected in an associated blank.

[d] Results for unfiltered metals samples are used because research performed at the EPA Robert S. Kerr Environmental Research Laboratory suggests that a large fraction of mobile inorganic contamination in groundwater is of colloidal dimensions that is removed using 0.45 micron filters.

[e] Results for background include all detections of a contaminant in background wells MW-12I, MW-12D, MW-20S, MW-20I, or MW-20D. If a background well is not listed, the contaminant was not detected in that background well.

TABLE 8.7
Natural Attenuation Pathways for Metals (and Other Inorganics)

Chemical	Natural attenuation pathways	Caveats, special data needs
Pb^{2+}	Sorption to iron hydroxides, organic matter, carbonate minerals, formation of insoluble sulfides.	Low pH destabilizes carbonates, iron hydroxides. Comingled organic acids and chelates (e.g., EDTA) may decrease sorption. Low E_H dissolves iron hydroxides, but favors sulfide formation.
CrO_4^{2-}	Reduction by organic matter, sorption to iron hydroxides, formation of $BaCrO_4$	Low pH destabilizes carbonates, iron hydroxides. Low E_H dissolves iron hydroxides. Are reductants available?
As(III or V)	Sorption to iron hydroxides, formation of sulfides	Low pH destabilizes carbonates, iron hydroxides. Low E_H dissolves iron hydroxides.
Zn^{2+}	Sorption to iron hydroxides, carbonate minerals, formation of sulfides	Low pH destabilizes carbonates, iron hydroxides. Comingled organic acids and chelates may decrease sorption. Low E_H dissolves iron hydroxides.
Cd^{2+}	Sorption to iron hydroxides, carbonate minerals, formation of insoluble sulfides.	Low pH destabilizes carbonates, iron hydroxides. Comingled organic acids and chelates may decrease sorption. Low E_H dissolves iron hydroxides, but favors formation of sulfides.
Ba^{2+}	Sorption to iron hydroxides, formation of insoluble sulfate minerals	Low pH destabilizes carbonates, iron hydroxides. Low E_H dissolves iron hydroxides. What are sulfate levels?
Ni^{2+}	Sorption to iron hydroxides, carbonate minerals	Low pH destabilizes carbonates, iron hydroxides. Comingled organic acids and chelates may decrease sorption. Low E_H dissolves iron hydroxides, but favors sulfide formation.
Hg^{2+}	Formation of insoluble sulfides	Methylated by organisms
NO_3^-	Reduction by biologic processes	
RADIOACTIVES		
UO_2^{2+}	Sorption to iron hydroxides, precipitation of insoluble minerals, reduction to insoluble valence states	Low pH destabilizes carbonates, iron hydroxides. Comingled organic acids and chelates may decrease sorption. High pH and/or carbonate levels decrease sorption. Low E_H dissolves iron hydroxides.
Pu(V and VI)	Sorption to iron hydroxides, formation of insoluble hydroxides	May move as a colloid. Low E_H dissolves iron hydroxides.
Sr^{2+}	Sorption to carbonate minerals, formation of insoluble sulfates	Low pH destabilizes carbonates.
Am^{3+}	Sorption to carbonate minerals	Low pH destabilizes carbonates. High pH increases solubility of Am-carbonate minerals.

TABLE 8.7 (continued)
Natural Attenuation Pathways for Metals (and Other Inorganics)

Chemical	Natural attenuation pathways	Caveats, special data needs
Cs^+	Sorption to clay innerlayers	High NH_4^+ levels may lessen sorption. How abundant are clays?
I^-	Sorption to sulfides, organic matter	Sorbs to very little else.
TcO_4^-	Possible reductive sorption to reduced minerals (e.g., magnetite), forms insoluble reduced oxides and sulfides.	Sorbs to very little else.
Th^{4+}	Sorption to most minerals, formation of insoluble hydroxide	May move as a colloid
Co^{2+}	Sorption to iron hydroxides, carbonate minerals	Low pH destabilizes carbonates.

TABLE 8.8
Data Needs for Natural Attenuation of Metals

Chemical	Data needs
Pb^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable. E_H, and if E_H is low, sulfide levels. Organic carbon content.
CrO_4^{2-}	E_H, electron donor levels, pH (reduction rates are faster at low pH). See chromate example in Chapter 7.
As(III or V)	E_H and if E_H is low, sulfide levels.
Zn^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable. E_H, and if E_H is low, sulfide levels.
Cd^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable. E_H, and if E_H is low, sulfide levels.
Ba^{2+}	Sulfate levels.
Ni^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable. E_H, and if E_H is low, sulfide levels.
Hg^{2+}	E_H, and if E_H is low, sulfide levels.
UO_2^{2+}	Iron hydroxide availability, pH, availability of reducing compound
Pu(V and VI)	Iron hydroxide availability, pH, availability of reducing compound
Sr^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable.
Am^{3+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable.
Cs^+	Clay content, cation exchange capacity.
I^-	Metal sulfide mineral content
TcO_4^-	E_H, and if E_H is low, sulfide levels.
Co^{2+}	Iron hydroxide availability; pH, alkalinity, and Ca^{2+} levels to answer if calcium carbonate is stable.

TABLE 8

OHIO EPA AQUATIC LIFE WATER QUALITY CRITERIA
(all concentrations in ug/l)

Compound	AAC*	CAC**
Acenaphthene	67	67
Acetone	550,000	78,000
Acrylonitrile	460	430
Aniline	10	0.44
Antimony	650	190
Arsenic	360	190
Benzene	1,100	560
Bis(2-ethylhexyl)phthalate	1,100	8.4
Bromoform	1,500	1,000
2-Butanone	160,000	7,100
Butyl benzyl phthalate	230	49
Carbon tetrachloride	1,800	280
Chlorobenzene	590	26
Chloroform	1,800	79
2-Chlorophenol	200	8.8
1,2-Dichlorobenzene	160	11
1,3-Dichlorobenzene	250	87
1,4-Dichlorobenzene	110	43
1,2-Dichloroethane	12,000	3,500
1,1-Dichloroethylene	1,500	78
1,2-trans-Dichloroethylene	7,000	310

a Pentachlorophenol AAC = $e^{[1.005(pH) - 4.8725]}$

b Pentachlorophenol CAC = $e^{[1.005(pH) - 5.3799]}$

* Acute Aquatic Criterion (AAC), ug/l; maximum concentration.

** Chronic Aquatic Criterion (CAC), ug/l; 30 day average.

TABLE 8 (Continued)

OHIO EPA AQUATIC LIFE WATER QUALITY CRITERIA
(all concentrations in ug/l)

Compound	AAC*	CAC**
2,4-Dichlorophenol	200	18
Diethylamine	5,600	250
Diethyl phthalate	2,600	120
Dimethyl phthalate	1,700	73
Di-n-butyl phthalate	350	190
2,6-Dinitrotoluene	950	42
Ethylbenzene	1,400	62
Ethylene glycol	4,100,000	180,000
Fluoranthene	400	8.9
Isophorone	6,000	900
Methylene chloride	9,700	430
2-Methylphenol	500	22
4-Methylphenol	140	6.2
Napthalene	160	44
Nitrobenzene	1,350	740
4-Nitrophenol	790	35
N-Nitrosodiphenylamine	290	13
Pentachlorophenol	a	b
Phenol (Warmwater Habitat)	5,300	370
(Coldwater Habitat)	5,000	200

a Pentachlorophenol AAC = $e^{[1.005(pH) - 4.8725]}$

b Pentachlorophenol CAC = $e^{[1.005(pH) - 5.3799]}$

* Acute Aquatic Criterion (AAC), ug/l; maximum concentration.

** Chronic Aquatic Criterion (CAC), ug/l; 30 day average.

TABLE 8 (Continued)

OHIO EPA AQUATIC LIFE WATER QUALITY CRITERIA
(all concentrations in ug/l)

Compound	AAC*	CAC**
Styrene	1,250	56
1,1,2,2-Tetrachloroethane	1,000	360
Tetrachloroethylene	540	73
Thallium	71	16
Toluene	2,400	1,700
1,2,4-Trichlorobenzene	150	77
1,1,1-Trichloroethane	2,000	88
1,1,2-Trichloroethane	2,000	650
Trichloroethylene	1,700	75
2,4,6-Trichlorophenol	16	2.5

a Pentachlorophenol AAC = $e^{[1.005(pH) - 4.8725]}$

b Pentachlorophenol CAC = $e^{[1.005(pH) - 5.3799]}$

* Acute Aquatic Criterion (AAC), ug/l; maximum concentration.

** Chronic-Aquatic Criterion (CAC), ug/l; 30 day average.

waste must be managed in accordance with RCRA. [Relevant and Appropriate]

e) U.S. EPA Groundwater Protection Strategy, August 1984. Identifies groundwater quality to be achieved during remedial actions based on aquifer characteristics and use. [To Be Considered]

f) CERCLA Section 121(d)(3). Sets forth requirements that an off-site facility accepting CERCLA hazardous substances must meet. [Applicable]

g) Ohio Administrative Code 3745-52, 53. Regulates the manifesting and transporting of hazardous waste. [Applicable]

h) Ohio Water Quality Standards, OAC 3745-1. Establishes minimum requirements for surface water quality. [Applicable]

i) Ohio Water Pollution Control, OAC 3745-33. Regulates point source discharges to surface waters of the State. [Applicable]

j) Ohio Water Pollution Control, OAC 3745-31. Establishes requirement for Best Available Technology for any new source of pollution and an anti-degradation policy for waters of the State. [Applicable]

k) Ohio Regulations for Naturally occurring Radioactive Materials OAC 3701-70, 71, and 38 if lead-210 concentrations on spent carbon exceed limits. [Applicable]

l) Federal Stream Dredging Requirements, Section 404 CWA, if Metzger Ditch needs to be dredged. [Applicable]

m) State Stream Dredging Requirements, 401 Certification of dredging projects, if Metzger Ditch needs to be dredged. [Applicable]

3. Location Specific ARARs

The Agency has identified no location specific ARARs. The site does not contain a wetland. Nor is it a National Historic Site.

C. Cost Effectiveness: The selected remedy is cost effective. It is protective of human health and the environment, attains ARARs, and through a variety of measures, ensures long-term

effectiveness with proper operation and maintenance. The selected remedy is less costly than Alternative 2B while providing equal protectiveness. Although the no action alternative is the least expensive, it does not provide overall protection of human health or the environment and does not attain ARARs. The selected remedy provides a degree of protectiveness proportionate to its cost.

D. Utilization of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable: Although permanent treatment technologies are used to address the existing groundwater contamination and landfill gas generated in the landfill, the primary source will be addressed by containment. The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this action. Because of the disposal area size; the fact that there are no on-site hot spots representing major sources of contamination; and the difficulties, risk, and cost involved with implementing a source treatment remedy, it is not practicable to treat the source area. Compared to the no action alternative and Alternative 2B, the selected remedy represents the best balance among the nine criteria and is the most appropriate solution for the site.

E. Preference for Treatment as a Principal Element: Only a portion of the selected remedy, ground water extraction and treatment and landfill gas collection and flaring, satisfies the statutory preference for treatment. A principal threat, the landfill/source area will be contained rather than treated. Because of the disposal area size; the fact that there are no on-site "hot spots" representing major sources of contamination; and the difficulties, risk, and cost involved with implementing a source treatment remedy, it is not practicable to treat the disposal area.

1. Chemical Specific ARARs and TBCs Groundwater

a) MCLs for the following compounds [Relevant and Appropriate]

Maximum Contaminant Levels (MCLs) are established under the Safe Drinking Water Act. These are the maximum contaminant concentrations allowed in regulated public water supplies. Levels are based on a chemical's toxicity, treatability, (including cost consideration), and analytical limits of detection.

MCLs are "relevant" to the remedial action at the IEL site because groundwater at the site is or may be used for drinking water. MCLs are "appropriate" because they set enforceable drinking water standards for public water supplies. As MCLs apply to water at its point of distribution ("at the tap"), these levels are appropriate for groundwater at this site because residential wells that might use the aquifers underlying the site generally have minimal or no treatment. Thus, these standards will have to be applied in the groundwater itself to ensure safe levels at the tap.

Compound	Concentration ug/l	
*Vinyl chloride	2	
*1,2-Dichloroethane	5	
*Benzene	5	
1,4-Dichlorobenzene	75	
Barium	1000	
Chromium	50	
Lead	50	
Arsenic	50	
Cadmium	10	
Selenium	10	
Silver	50	
Copper	1000	(secondary MCL)
Iron	300	(secondary MCL)
Manganese	50	(secondary MCL)
Zinc	5000	(secondary MCL)

b) Proposed MCLs for the following compounds [To Be Considered]

Proposed MCLs for into the "To Be Considered" category because, until adopted, they do not constitute promulgated standards. Nevertheless, the Agency intends to meet and/or consider the proposed standards for the following compounds.

Compound	Concentration ug/l
Toluene	2000
*Tetrachloroethene	5

Exhibit 44

Chlorobenzene	100
Ethylbenzene	700
Xylenes	10000
Barium	5000
Chromium	100
Lead	5
Arsenic	30
Cadmium	5
Selenium	50

c) Ambient Quality Criteria Adjusted for Drinking Water [To Be Considered]

Ambient Water Quality Criteria for Human Health (WQC) are established under the Clean Water Act. The original WQC assumed that people drank contaminated surface water and ate contaminated fish that lived in that water. The Superfund program adapted these criteria to groundwater by calculating the corresponding contaminant concentration for exposure to contaminated drinking water alone. (Superfund Public Health Evaluation Manual, October 1986).

Compound	Concentration ug/l
Nickel	15.4
Cyanide	200

d) 1×10^{-6} cumulative cancer risk based on the summation of the cancer risk from all carcinogenic compounds of concern. [To Be Considered]

In accordance with the Superfund Public Health Evaluation Manual, carcinogenic risks are additive. When a mixture of carcinogenic compounds is found at a site, reduction in the concentrations of those compounds to a level whereby the sum of the carcinogenic risk is 1×10^{-6} is necessary to protect public health. The compounds above marked with an asterisk are known or suspected carcinogens (arsenic is a known carcinogen but shall not be included in the calculation because the levels at the site are considered to be naturally occurring) and, in accordance with the SPHEM methodology for risk calculations, the risk from the sum of the concentrations of these compounds should not exceed 1×10^{-6}.

2. Action Specific ARARs and TBCs

Landfill Cap

a) RCRA Section 3004, 40 CFR 264 and 265, Subpart N. Establishes technical requirements for landfill closure,

including cap specifications, sloping, surface drainage etc. [Relevant and Appropriate]

b) Ohio Air Pollution Control Standards, OAC 3745-15 through, 3745-25. Requires control of fugitive dust emissions. [Applicable]

Methane Venting System Expansion

a) Ohio Air Pollution Control Standards, OAC 3745-15 through 3745-25. Requires the use of Best Available Technology to control new sources of air pollution. [Applicable]

b) National Ambient Air Quality Standards, 40 CFR 50 - 3 hour average for hydro-carbons is 0.160 mg/m^3. [Relevant and Appropriate]

c) RCRA Section 4004 Criteria. Requires methane concentrations at compliance wells (at boundary of landfill) to be 5 percent by volume or less. [To Be Considered]

Ground Water Extraction and Treatment

a) NPDES discharge limitations Clean Water Act Section 402 40 CFR 122, 123, 125 and Subchapter N. Regulates discharge of water into public water. Includes contaminated groundwater pumped, treated, and discharged to surface water. Permit limits shall be established in accordance with the Ohio EPA Aquatic Life Water Quality Criteria applicable to Metzgers Ditch. Table 8 presents the criteria to be used for establishing NPDES discharge limitations. [Applicable]

b) RCRA Subtitle C, 40 CFR 260. Regulates the generation, transport, storage, treatment, and disposal of hazardous waste in the course of remedial action. Any spent carbon and/or sludge from the on-site treatment plant considered to be a hazardous waste must be managed in accordance with RCRA. [Relevant and Appropriate]

c) RCRA Section 3003, 40 CFR 262 and 263, 40 CFR 170 to 179. Regulating the transport of hazardous waste. Any spent carbon and/or sludge from the on-site treatment plant considered to be a hazardous waste must be transported in accordance with RCRA transportation regulations. [Applicable]

d) RCRA Section 3004(d) and (e). RCRA Land disposal restrictions. Any spent carbon or sludge from the treatment plant considered to be a land ban regulated

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY	CITE		SUBPARAGRAPH							
APC	3704.05		A-I	PROHIBITS VIOLATION OF AIR POLLUTION CONTROL RULES	PROHIBITS EMISSION OF AN AIR CONTAMINANT IN VIOLATION SEC. 3704 OR ANY RULES, PERMIT, ORDER OR VARIANCE ISSUED PURSUANT TO THAT SECTION OF THE ORC.	MAY PERTAIN TO ANY SITE WHERE EMISSIONS OF AN AIR CONTAMINANT OCCURS EITHER AS A PRE-EXISTING CONDITION OF THE SITE OR AS A RESULT OF REMEDIAL ACTIVITIES. SHOULD BE CONSIDERED FOR VIRTUALLY ALL SITES.	3745-15 TO 3745-26	CHEMICAL	ACTION		3/16/93
DD	3714.13			DEMOLITION DEBRIS FACILITIES - VIOLATIONS PROHIBITED	PROHIBITS VIOLATIONS OF ANY SECTION OF CHAPTER 3714 CONCERNING CONSTRUCTION AND DEMOLITION DEBRIS DISPOSAL FACILITIES OR ANY RULE OR ORDER ISSUED PURSUANT TO IT. DISPOSAL OF ASBESTOS IS SPECIFICALLY PROHIBITED WITHOUT AUTHORIZATION.	PERTAINS TO CONSTRUCTION AND DEMOLITION DEBRIS FACILITIES WHERE HAZARDOUS WASTE OR HAZARDOUS CONSTITUENTS HAVE COME TO BE LOCATED. CONSIDER FOR SITES WHERE REMEDIAL ACTION WILL INCLUDE DEMOLITION OF STRUCTURES OR ASBESTOS HAS COME TO BE LOCATED.		ACTION			3/16/93
HW	3734.02		(G)	EXEMPTIONS TO SOLID & HAZ. WASTE T/S/D REQUIREMENTS	PROVIDES AUTHORITY AND CONDITIONS BY WHICH THE DIRECTOR MAY EXEMPT ANY PERSON FROM PERMITTING OR OTHER REQUIREMENTS GOVERNING THE GENERATION, STORAGE, TREATMENT, TRANSPORT OR DISPOSAL OF SOLID OR HAZARDOUS WASTE.	PERTAINS TO ANY SITE AT WHICH SOLID OR HAZARDOUS WASTE HAS COME TO BE LOCATED. CERTAIN ALTERNATIVES INCLUDE EXCAVATION ACTIVITIES WHICH MAY UNCOVER SOLID AND/OR HAZARDOUS WASTE. SHOULD THOSE ACTIVITIES REQUIRE THE MANAGEMENT OF SOLID/HAZARDOUS WASTES ON-SITE, AN EXEMPTION TO PERMITTING AND OTHER REQUIREMENTS MAY BE WARRANTED.		ACTION			
HW	3734.02		(H)	"DIGGING" WHERE HAZ OR SOLID WASTE FACILITY WAS LOCATED	FILLING, GRADING, EXCAVATING, BUILDING, DRILLING OR MINING ON LAND WHERE HAZARDOUS WASTE OR SOLID WASTE FACILITY WAS OPERATED IS PROHIBITED WITHOUT PRIOR AUTHORIZATION FROM THE DIRECTOR OF THE OHIO EPA.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS OR SOLID WASTE HAS COME TO BE LOCATED. CERTAIN ALTERNATIVES INCLUDE EXCAVATION ACTIVITIES WHICH MAY UNCOVER SOLID AND/OR HAZARDOUS WASTE. SHOULD THOSE ACTIVITIES REQUIRE THE MANAGEMENT OF SOLID/HAZARDOUS WASTES ON-SITE, AN EXEMPTION TO PERMITTING AND OTHER REQUIREMENTS MAY BE WARRANTED.		LOCATION	ACTION		
HW APC	3734.02		(I)	AIR EMISSIONS FROM HAZARDOUS WASTE FACILITIES	NO HAZARDOUS WASTE FACILITY SHALL EMIT ANY PARTICULATE MATTER, DUST, FUMES, GAS, MIST, SMOKE, VAPOR OR ODOROUS SUBSTANCE THAT INTERFERS WITH THE COMFORTABLE ENJOYMENT OF LIFE OR PROPERTY OR IS INJURIOUS TO PUBLIC HEALTH.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE MANAGED SUCH THAT AIR EMISSIONS MAY OCCUR. CONSIDER FOR SITES THAT WILL UNDERGO MOVEMENT OF EARTH OR INCINERATION.					
IW	3734.02.1			STANDARDS FOR INFECTIOUS WASTE HANDLING AND TREATMENT	ESTABLISHES STANDARDS FOR GENERATORS, TRANSPORTERS, AND OWNER OPERATORS OF TREATMENT FACILITIES FOR INFECTIOUS WASTE.	PERTAINS TO ALL SITE AT WHICH INFECTIOUS WASTE HAS COME TO BE LOCATED AND/OR INFECTIOUS WASTE MIGHT BE COMMINGLED WITH ANY OTHER TYPE OF WASTE.		CHEMICAL	ACTION		3/15/93
HW	3734.02.7		A,B	HANDLING LOW-LEVEL RADIOACTIVE WASTE PROHIBITED	A) PROHIBITS COMMINGLING LOW LEVEL RADIOACTIVE WASTE WITH ANY TYPE OF SOLID WASTE, HAZARDOUS WASTE, OR INFECTIOUS WASTE. B) NO OWNER OR OPERATOR OF A SOLID, INFECTIOUS OR HAZARDOUS WASTE FACILITY SHALL ACCEPT FOR TRANSFER, STORAGE, TREATMENT OR DISPOSAL OF ANY RADIOACTIVE WASTE.	PERTAINS TO ALL SITES AT WHICH LOW LEVEL RADIOACTIVE WASTE HAS COME TO BE LOCATED.		CHEMICAL	ACTION		3/15/93
SW	3734.03			PROHIBITS OPEN DUMPING OR BURNING	PROHIBITS OPEN BURNING OR OPEN DUMPING OF SOLID WASTE OR TREATED OR UNTREATED INFECTIOUS WASTE.	PERTAINS TO ANY SITE AT WHICH SOLID WASTE HAS COME TO BE LOCATED OR WILL BE GENERATED DURING A REMEDIAL ACTION.	3745-19, 3745-27-05	ACTION	LOCATION		3/15/93

Exhibit 45

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

SECTION											LAST REVISION
SW	3734.04.1		A,C,D,G	EXPLOSIVE GAS MONITORING	REQUIRES EXPLOSIVE GAS MONITORING PLANS FOR SANITARY LANDFILLS AND PROVIDES AUTHORITY TO THE DIRECTOR OF OHIO EPA TO ORDER AN OWNER OR OPERATOR OF A FACILITY TO IMPLEMENT AN EXPLOSIVE GAS MONITORING AND	PERTAINS TO ALL SANITARY LANDFILLS EXCEPT FOR THOSE THAT DISPOSED OF NONPUTRESCIBLE WASTES.	3745-27-12	LOCATION	ACTION		3/15/93
					REPORTING PLAN.						
HW	3734.05		(D)(6)(c)	HAZARDOUS WASTE FACILITY ENVIRONMENTAL IMPACT	A HAZARDOUS WASTE FACILITY INSTALLATION AND OPERATION PERMIT SHALL NOT BE APPROVED UNLESS IT PROVES THAT THE FACILITY REPRESENTS THE MINIMUM ADVERSE ENVIRONMENTAL IMPACT, CONSIDERING THE STATE OF AVAILABLE TECHNOLOGY, THE NATURE AND ECONOMICS OF VARIOUS ALTERNATIVES AND OTHER PERTINENT CONSIDERATIONS.	PERTAINS TO ALL SITES AT WHICH HAZARDOUS WASTE HAS COME TO BE LOCATED AND/OR AT WHICH HAZARDOUS WASTE WILL BE TREATED, STORED OR DISPOSED OF. MAY FUNCTION AS SITING CRITERIA.					
HW	3734.05		(D)6.d,g,h	HAZARDOUS WASTE SITING CRITERIA	(D),6,d. A HAZARDOUS WASTE FACILITY INSTALLATION AND OPERATION PERMIT SHALL NOT BE APPROVED UNLESS IT PROVES THAT THE FACILITY REPRESENTS THE MINIMUM RISK OF ALL OF THE FOLLOWING: (I)CONTAMINATION OF GROUND AND SURFACE WATERS (ii)FIRES OR EXPLOSIONS FROM TREATMENT, STORAGE OR DISPOSAL METHODS; (iii)ACCIDENT DURING TRANSPORTATION; (iv)IMPACT ON PUBLIC HEALTH AND SAFTEY; (v)AIR POLLUTION; (vi)SOIL CONTAMINATION; (D),6,g,h. PROHIBITS THE FOLLOWING LOCATIONS FOR TREATMENT, *STORAGE AND DISPOSAL OF ACUTE* HAZARDOUS WASTE: (I) WITHIN 2000 FEET OF ANY RESIDENCE, SCHOOL, HOSPITAL, JAIL OR PRISON; (II) ANY NATURALLY OCCURRING WETLAND; (Iii) ANY FLOOD HAZARD AREA; (Iv) WITHIN ANY STATE PARK OR NATIONAL PARK OR RECREATION AREA	PERTAINS TO ALL SITES AT WHICH HAZARDOUS WASTE HAS COME TO BE LOCATED AND/OR AT WHICH HAZARDOUS WILL BE TREATED, STORED OR DISPOSED OF. MAY FUNCTION AS SITING CRITERIA.		ACTION	LOCATION		
HW	3734.14.1			CONDITIONS FOR DISPOSAL OF ACUTE HAZARDOUS WASTE	PROHIBITS DISPOSAL OF ACUTE HAZARDOUS WASTE UNLESS IT: (1) CANNOT BE TREATED, RECYCLED OR DESTROYED; (2) HAS BEEN REDUCED TO ITS LOWEST LEVEL OF TOXICITY; AND (3) HAS BEEN COMPLETELY ENCAPSULATED OR PROTECTED TO PREVENT LEACHING.	PERTAINS TO ANY SITE WHERE ACUTE HAZARDOUS WASTE HAS COME TO BE LOCATED.		CHEMICAL	ACTION		3/17/93
APC WS	3767.13			PROHIBITION OF NUISANCES	PROHIBITS NOXIOUS EXHALATIONS OR SMELLS AND THE OBSTRUCTION OF WATERWAYS.	PERTAINS TO ANY SITE THAT MAY HAVE NOXIOUS SMELLS OR MAY OBSTRUCT WATERWAYS.		ACTION	CHEMICAL		
WS	3767.14			PROHIBITION OF NUISANCES	PROHIBITION AGAINST THROWING REFUSE, OIL, OR FILTH INTO LAKES, STREAMS, OR DRAINS.	PERTAINS TO ALL SITES LOCATED ADJACENT TO LAKES, STREAMS, OR DRAINS.		ACTION	CHEMICAL		3/15/93
WS	6111.04			ACTS OF POLLUTION PROHIBITED	POLLUTION OF WATERS OF THE STATE IS PROHIBITED.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED ON-SITE GROUND OR SURFACE WATER OR WILL HAVE A DISCHARGE TO ON-SITE SURFACE OR GROUND WATER.		ACTION			
WS	6111.04.2			RULES REQUIRING COMPLIANCE WITH NATIONAL EFFLUENT STDS	ESTABLISHES REGULATIONS REQUIRING COMPLIANCE WITH NATIONAL EFFLUENT STANDARDS.	PERTAINS TO ANY SITE WHICH WILL HAVE A POINT SOURCE DISCHARGE.		ACTION			

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CATEGORY											LAST REVISION
WS	6111.07		A,C	WATER POLLUTION CONTROL REQUIREMENTS - DUTY TO COMPLY	PROHIBITS FAILURE TO COMPLY WITH REQUIREMENTS OF SECTIONS 6111.01 TO 6111.08 OR ANY RULES, PERMIT OR ORDER ISSUED UNDER THOSE SECTIONS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND WATER OR SURFACE WATER OR WILL HAVE A DISCHARGE TO ON-SITE SURFACE OR GROUND WATER.		ACTION			3/16/93
REC		1501:14-3	11-Feb	SOIL AND DRAINAGE	REQUIREMENTS FOR RECLAMATION OF SURFACE MINED AREAS. ISOLATION OF ACID DRAINAGE, RESTRICTION ON SURFACE WATER IMPOUNDMENTS, RULES FOR USE OF EXPLOSIVES, PROTECTION OF UNDERGROUND WATER SUPPLIES, SAFETY OF HIGHWALLS, RESOILING, REVEGETATION, DAMS AND DIVERSIONS.	CONSIDER FOR SITES WITH SOIL BORROW AREAS OR EXTENSIVE EXCAVATION.					7/12/96
REC		1501:14-4	3-Jan	GEOLOGICAL SURVEYS	REQUIRES SURVEY AND OTHER INFORMATION FOR SURFACE MINING.	CONSIDER FOR SITE WITH BORROW SOURCE AREA OR EXTENSIVE EXCAVATION.					7/12/96
WS		3745-1-03		ANALYTICAL AND COLLECTION PROCEDURES	SPECIFIES ANALYTICAL METHODS AND COLLECTION PROCEDURES FOR SURFACE WATER DISCHARGES.	PERTAINS TO BOTH DISCHARGES TO SURFACE WATERS AS A RESULT OF REMEDIATION AND ANY ON-SITE SURFACE WATERS AFFECTED BY SITE CONDITIONS.		ACTION			
WS		3745-1-04	A,,B,C,D,E	THE "FIVE FREEDOMS" FOR SURFACE WATER	ALL SURFACE WATERS OF THE STATE SHALL BE FREE FROM: ı A) OBJECTIONAL SUSPENDED SOLIDS. ı B)FLOATING DEBRIS, OIL AND SCUM. ı C) MATERIALS THAT CREATE A NUISANCE. ı D) TOXIC, HARMFUL OR LETHAL SUBSTANCES. ı E) NUTRIENTS THAT CREATE NUISANCE GROWTH	PERTAINS TO BOTH DISCHARGES TO SURFACE WATERS AS A RESULT OF REMEDIATION AND ANY ON-SITE SURFACE WATERS AFFECTED BY SITE CONDITIONS.		CHEMICAL			
WS		3745-1-05	A-F	ANTIDEGRADATION POLICY FOR SURFACE WATER	PREVENTS DEGRADATION OF SURFACE WATER QUALITY BELOW DESIGNATED USE OR EXISTING WATER QUALITY. EXISTING INSTREAM USES SHALL BE MAINTAINED AND PROTECTED. THE MOST STRINGENT CONTROLS FOR TREATMENT SHALL BE REQUIRED BY THE DIRECTOR TO BE EMPLOYED FOR ALL NEW AND EXISTING POINT SOURCE DISCHARGES. PREVENTS ANY DEGRADATION OF "STATE RESOURCE WATERS".	REQUIRES THAT BEST AVAILABLE TECHNOLOGY (BAT) BE USED TO TREAT SURFACE WATER DISHARGES. DWQPA USES THIS RULE TO SET STANDARDS WHEN EXISTING WATER QUALITY IS BETTER THAN THE DESIGNATED USE.		CHEMICAL			5/1/98
WS		3745-1-06	A,B	MIXING ZONES FOR SURFACE WATER	(A) PRESENTS THE CRITERIA FOR ESTABLISHING NON-THERMAL MIXING ZONES FOR POINT SOURCE DISCHARGES (B) PRESENTS THE CRITERIA FOR ESTABLISHING THERMAL MIXING ZONES ı FOR POINT SOURCE DISCHARGES	APPLIED AS A TERM OF DISCHARGE PERMIT TO INSTALL (PTI). WOULD PERTAIN TO AN ALTERNATIVE WHICH RESULTED IN A POINT SOURCE DISCHARGE.		CHEMICAL			
WS		3745-1-07	C	WATER QUALITY CRITERIA	ESTABLISHES WATER QUALITY CRITERIA FOR POLLUTANTS WHICH DO NOT HAVE SPECIFIC NUMERICAL OR NARRATIVE CRITERIA IDENTIFIED IN TABLES 7-1 THROUGH 7-15 OF THIS RULE.	PERTAINS TO BOTH DISCHARGES TO SURFACE WATERS AS A RESULT OF REMEDIAL ACTION AND ANY SURFACE WATERS AFFECTED BY SITE CONDITIONS.		CHEMICAL	ACTION		3/18/93
WS		3745-1-24		WATER USE DES FOR MUSKINGUM RIVER	ESTABLISHES WATER USE DESIGNATIONS FOR STREAM SEGMENTS WITHIN THE MUSKINGUM RIVER BASIN.	PERTINENT IF STREAM OR STREAM SEGMENT IS ON-SITE AND IS EITHER AFFECTED BY SITE CONDITIONS OF IF REMEDY INCLUDES DIRECT DISCHARGE. USED BY DWQPA TO ESTABLISH WASTE LOAD ALLOCATIONS.		ACTION	LOCATION		
DSW		3745-1-34	A-D	WATER QALITY CRITERIA FOR THE OHIO RIVER DRAINAGE BASIN	APPLIES TO DISCHARGES TO STREAMS WITHIN THE OHIO RIVER BASIN, USED BY DSW TO DETERMINE DISCHARGE LIMITS	CONSIDER FOR SITES WITH DISCHARGES TO OHIO RIVER BASIN					10/31/97

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DSW		3745-1-35	A-G	SITE-SPECIFIC MODIFICATIONS TO CRITERIA AND VALUES	DESCRIBES STANDARDS BY WHICH AGENCY MAY MAKE SITE SPECIFIC ADJUSTMENTS TO DETERMINE WATER QUALITY STANDARDS AND DISCHARGE LIMITS. CONSIDERS LOCAL CONDITIONS SUCH AS WATER CHEMISTRY OR SENSITIVE SPECIES THAT MAY	CONSIDER FOR ANY SITE THAT WILL DISCHARGE TO SURFACE WATERS OF OHIO					10/31/97
					NECESSITATE MODIFICATIONS TO DISCHARGE STANDARDS.						
DSW		3745-1-37	A-G	METHODOLOGIES FOR DERIVING BIOACCUMULATION FACTORS	USED BY DSW IN PREDICTING HUMAN AND AQUATIC HEALTH EFFECTS OF POLLUTANTS. IMPACTS DISCHARGE LIMITS/	CONSIDER FOR SITES WITH SURFACE WATER DISCHARGES.					10/31/97
DSW		3745-1-50	A-NN	WETLAND DEFINITIONS	DEFINES TERMS USED IN WETLANDS RELATED REGULATIONS.	CONSIDER FOR SITES THAT HAVE IMPACTED WETLANDS OR WHERE REMEDIAL ACTIVITIES WOULD IMPACT WETLANDS.					5/1/98
DSW		3745-1-51	A-C	WETLAND NARRATIVE CRITERIA	LISTS CRITERIA TO BE PROTECTED IN WETLAND ENVIRONMENTS	CONSIDER FOR SITES THAT HAVE IMPACTED WETLANDS OR WHERE REMEDIAL ACTIVITIES WOULD IMPACT WETLANDS.					5/1/98
DSW		3745-1-52		NUMERIC CHEMICAL CRITERIA FOR WASTE WATER DISCHARGE	REQUIRES THAT DISCHARGE CRITERIA APPLY AT "END OF PIPE"	CONSIDER FOR SITES THAT HAVE IMPACTED WETLANDS OR WHERE REMEDIAL ACTIVITIES WOULD IMPACT WETLANDS.					5/1/98
DSW		3745-1-53		WETLAND USE DESIGNATION	ALL SURFACE WATERS OF THE STATE WHICH MEET THE DEFINITION OF A WETLAND IN RULE 3745-1-02 ARE ASSIGNED THE WETLAND DESIGNATED USE.	CONSIDER FOR SITES THAT HAVE IMPACTED WETLANDS OR WHERE REMEDIAL ACTIVITIES WOULD IMPACT WETLANDS.					5/1/98
DSW		3745-1-54	A-D	WETLAND ANTIDEGRADATION	REQUIRES THAT ALL WETLANDS BE ASSIGNED A CATEGORY CLASSIFICATION AND GIVES CRITERIA FOR CLASSIFICATION. DISCUSSES REQUIREMENTS FOR AVOIDANCE AND MINIMIZATION OF WETLANDS DAMAGE AS WELL AS COMPENSATORY MITIGATION.	CONSIDER FOR SITES THAT HAVE IMPACTED WETLANDS OR WHERE REMEDIAL ACTIVITIES WOULD IMPACT WETLANDS.					5/1/98
APC		3745-15-06	A1,A2	MALFUNCTION & MAINTENANCE OF AIR POLL CONTROL EQUIPMENT	ESTABLISHES SCHEDULED MAINTENANCE AND SPECIFIES WHEN POLLUTION SOURCE MUST BE SHUT DOWN DURING MAINTENANCE	PERTAINS TO ANY SITE WHICH UTILIZES OR WILL UTILIZE AIR POLLUTION CONTROL EQUIPMENT ON-SITE.	3745-15-01,3745-15-02	ACTION			
APC		3745-15-07	A	AIR POLLUTION NUISANCES PROHIBITED	DEFINES AIR POLLUTION NUISANCE AS AS THE EMISSION OR ESCAPE INTO THE AIR FROM ANY SOURCE(S) OF SMOKE, ASHES, DUST, DIRT, GRIME, ACIDS, FUMES, GASES, VAPORS, ODORS AND COMBINATIONS OF THE ABOVE THAT ENDANGER HEALTH, SAFETY OR WELFARE OF THE PUBLIC OR CAUSE PERSONAL INJURY OR PROPERTY DAMAGE. SUCH NUISANCES ARE PROHIBITED.	PERTAINS TO ANY SITE WHICH CAUSES, OR MAY REASONABLY CAUSE, AIR POLLUTION NUISANCES. CONSIDER FOR SITES THAT WILL UNDERGO EXCAVATION, DEMOLISION, CAP INSTALLATION, METHANE PRODUCTION, CLEARING AND GRUBBING, WATER TREATMENT, INCINERATION AND WASTE FUEL RECOVERY.	3745-15-01,3745-15-02	ACTION			
APC		3745-16-02	B,C	STACK HEIGHT REQUIREMENTS	ESTABLISHES ALLOWABLE STACK HEIGHT FOR AIR CONTAMINANT SOURCES BASED ON GOOD ENGINEERING PRACTICE.	PERTAINS TO ANY SITE THAT HAS OR WILL HAVE AN AIR CONTAMINANT SOURCE ON-SITE (PARTICULATE, DUST, FUMES, GAS, MIST, SMOKE, VAPOR, ODORS) EMITTED FROM A STACK. CONSIDER FOR REMEDIES INCORPORATING INCINERATION, WASTE FUEL RECOVERY AND WASTEWATER TREATMENT.	3745-16-01	ACTION			
APC		3745-17-02	A,B,C	PARTICULATE AMBIENT AIR QUALITY STANDARDS	ESTABLISHES SPECIFIC STANDARDS FOR TOTAL SUSPENDED PARTICULATES.	PERTAINS TO ANY SITE THAT MAY EMIT MEASURABLE QUANTITIES OF PARTICULATE MATTER (BOTH STACK AND FUGITIVE). CONSIDER FOR SITES THAT WILL UNDERGO EXCAVATION, DEMOLITION, CAP INSTALLATION, CLEARING AND GRUBBING, INCINERATION AND WASTE FUEL RECOVERY.	3745-17-01,3745-17-03	CHEMICAL			

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APC		3745-17-05		PARTICULATE NON-DEGRADATION POLICY	DEGRADATION OF AIR QUALITY IN ANY AREA WHERE AIR QUALITY IS BETTER THAN REQUIRED BY 3745-17-02 IS PROHIBITED	PERTAINS TO SITES IN CERTAIN LOCATIONS THAT MAY EMIT OR ALLOW THE ESCAPE OF PARTICULATES (BOTH STACK AND FUGITIVE). CONSIDER FOR SITES THAT WILL UNDERGO EXCAVATION, DEMOLITION, CAP INSTALLATION, CLEARING AND GRUBBING, INCINERATION.	3745-17-01,3745-17-03	CHEMICAL	LOCATION		
APC		3745-17-07	A-D	VISIBLE PARTICULATE EMISSION CONTROL	SPECIFIES THE ALLOWABLE OPACITY FOR PARTICULATE EMISSIONS; PROVIDES EXCEPTIONS FOR UNCOMBINED WATER, START-UP/SHUTDOWN OF FUEL BURNING EQUIPMENT, MALFUNCTIONS.	PERTAINS TO ANY EMISSION OF PARTICULATE FROM A STACK. CONSIDER FOR INCINERATION AND FUEL BURNING.	3745-17-01,3745-17-03	CHEMICAL			1/31/98
APC		3745-17-08	A1,A2,B,D	EMISSION RESTRICTIONS FOR FUGITIVE DUST	ALL EMISSIONS OF FUGITIVE DUST SHALL BE CONTROLLED.	PERTAINS TO SITES WHICH MAY HAVE FUGITIVE EMISSIONS (NON-STACK) OF DUST. CONSIDER FOR SITES THAT WILL UNDERGO GRADING, LOADING OPERATIONS, DEMOLITION, CLEARING AND GRUBBING AND CONSTRUCTION.	3745-17-01,3745-17-03	ACTION			1/31/98
APC		3745-17-09	A,B,C	INCINERATOR PARTIC EMISSION & ODOR RESTRICTIONS	ESTABLISHES PARTICULATE EMISSION LIMITATIONS AND DESIGN-OPERATION REQUIREMENTS TO PREVENT THE EMISSION OF OBJECTIONABLE ODORS.	PERTAINS TO ANY REMEDY INCORPORATING INCINERATION	3745-17-01,3745-17-03	ACTION			
APC		3745-17-10	A,B,C	FUEL BURNING PARTIC EMISSION RESTRICTIONS	ESTABLISHES PARTICULATE EMISSION LIMITATIONS FOR FUEL BURNING EQUIPMENT.	PERTAINS TO ANY REMEDY INCORPORATING FUEL BURNING (WASTE FUEL RECOVERY).	3745-17-01,3745-17-03	ACTION			
APC		3745-18-02	A,B,C,D	SULFUR DIOXIDE AMBIENT AIR QUALITY STANDARDS	ESTABLISHES PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS FOR SULFUR DIOXIDE.	PERTAINS TO ANY SITE THAT EMITS OR WILL EMIT SULFUR DIOXIDE. CONSIDER FOR INCINERATION, FUEL BURNING (WASTE FUEL RECOVERY).	3745-18-01,3745-18-04	ACTION	CHEMICAL		
APC		3745-18-04	A,B,C,E,F	SULFUR DIOXIDE MEASUREMENT METHODS AND PROCEDURES	SPECIFIES TESTING METHODS AND PROCEDURES FOR SULFUR DIOXIDE EMISSIONS COMPLIANCE TESTING	PERTAINS TO ANY SITE THAT WILL EMIT SULFUR DIOXIDE. CONSIDER FOR SITES THAT WILL UTILIZE INCINERATION OR FULE RECOVERY (WASTE FUEL RECOVERY).	3745-18-01	ACTION	CHEMICAL		
APC		3745-18-05	A	SULFUR DIOXIDE AMBIENT MONITORING REQUIREMENTS	THE DIRECTOR OF THE OHIO EPA MAY REQUIRE ANY SOURCE OF SULFUR DIOXIDE EMISSIONS TO INSTALL, OPERATE AND MAINTAIN MONITORING DEVICES, MAINTAIN RECORDS AND FILE REPORTS.	PERTAINS TO ANY SITE THAT EMITS OR WILL EMIT SULFUR DIOXIDE. CONSIDER FOR INCINERATOIN, FUEL BURNING (WASTE FUEL RECOVERY).	3745-18-01,3745-18-04	ACTION	CHEMICAL		
APC		3745-18-06	A-G	SULFUR DIOXIDE EMISSION LIMIT PROVISIONS	ESTABLISHES GENERAL LIMIT PROVISIONS FOR SULFUR DIOXIDE.	PERTAINS TO ANY SITE THAT WILL EMIT SULFUR DIOXIDE. CONSIDER FOR SITES THAT WILL UNDERGO INCINERATION OR FUEL BURNING (WASTE FUEL RECOVERY).	3745-18-01,3745-18-04	ACTION	CHEMICAL		
APC		3745-19-03	A,B,C,D	OPEN BURNING STANDARDS IN RESTRICTED AREAS	OPEN BURNING WITHOUT PRIOR AUTHORIZATION FROM OHIO EPA IS PROHIBITED.	PERTAINS TO SITES WITHIN A RESTRICTED AREA (WITHIN THE BOUNDARY OF A MUNICIPALITY AND A ZONE EXTENDING BEYOND SUCH MUNICIPALITY).	3745-19-01,3745-19-02	LOCATION	ACTION		
DSW		3745-2-04	A-G	DEVELOPMENT OF WATER QUALITY BASED EFFLUENT LIMITATIONS	USED BY DSW TO DETERMINE WASTE LOAD ALLOCATIONS FOR DISCHARGES TO SURFACE WATER. IMPACTS DISCHARGE LIMITS.	CONSIDER FOR ANY SITE WITH DISCHARGE TO SURFACE WATERS					10/31/97
DSW		3745-2-05	A,B	CALCULATING WASTELOAD ALLOCATIONS	PROCESS FOR CALCULATING WASTELOAD ALLOCATIONS FOR DISCHARGES.	CONSIDER FOR SITES WITH SURFACE WATER DISCHARGES					10/31/97
DSW		3745-2-06	A-D	APPLICATION OF PRELIMINARY EFFLUENT LIMITATIONS	METHODOLOGY FOR CALCULATING DISCHARGE LIMITATIONS BASED ON CHEMICAL AND BIOLOGICAL FACTORS.						10/31/97
DSW		3745-2-07	A,B	ADDITIVE EFFECTS OF POLLUTANTS	DESCRIBES PROCESS FOR CALCULATING COMBINED EFFECTS OF MULTIPLE WATER CONTAMINANTS. USED TO CALCULATE DISCHARGE LIMITS.	CONSIDER FOR SITES WITH DISCHARGES TO SURFACE WATERS.					10/31/97
DSW		3745-2-08	A-L	MIXING ZONE DEMONSTRATION AND SIZING REQUIREMENTS	METHODS FOR DETERMINING EFFECTS OF MIXING ZONES. USED IN CALCULATING DISCHARGE LIMITS.	CONSIDER FOR SITES WITH SURFACE WATER DISCHARGES.					10/31/97
DSW		3745-2-09	A-F	WHOLE EFFLUENT TOXICITY AND WATER QUALITY BASED LIMITS	METHODS FOR CALCULATING TOXICITY BASED CONSIDERATIONS FOR DISCHARGE LIMITS.	CONSDIER FOR SITES WITH SURFACE WATER DISCHARGES.					10/31/97

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DSW		3745-2-10	A-G	WASTELOAD ALLOCATION FOR AMMONIA NITROGEN TOXICITY	METHOD FOR CALCULATING DISCHARGES OF AMMONIA-NITROGEN.	CONSIDER FOR SITES WITH SURFACE WATER DISCHARGES.					10/31/97
DSW		3745-2-11	A-F	DISSOLVED OXYGEN MODELING	METHODS FOR CALCULATING EFFECTS OF DISCHARGE ON DISSOLVED OXYGEN.	CONSIDER FOR SITES WITH SURFACE WATER DISCHARGES					10/31/97
DSW		3745-2-12	A-Q	TOTAL MAXIMUM DAILY	FURTHER METHODOLOGY FOR	CONSIDER FOR SITES WITH SURFACE WATE				40CFR130.7	10/31/97
				LOADS	CALCULATING DISCHARGES. INCLUDES EFFECTS OF NONPOINT SOURCES.	DISCHARGES.					
APC		3745-20-06	A,B	STANDARD FOR ACTIVE ASBESTOS WASTE DISPOSAL SITES	ESTABLISHES OPERATING STANDARDS FOR AN ACTIVE ASBESTOS WASTE DISPOSAL SITES.	PERTAINS TO SITES WHERE ASBESTOS HAS COME TO BE LOCATED AND MUST BE CONSOLIDATED ON-SITE. CONSIDER FOR LANDFILLS WHERE WASTES WILL BE EXCAVATED AND RE-DEPOSITED ON-SITE.	3745-20-01	CHEMICAL	ACTION		3/18/93
APC		3745-20-07	A,B,C	STANDARD FOR INACTIVE ASBESTOS WASTE DISPOSAL SITES	ESTABLISHES EMISSIONS AND MAINTENANCE STANDARDS FOR INACTIVE ASBESTOS WASTE DISPOSAL SITES.	PERTAINS TO SITES WHERE ASBESTOS HAS COME TO BE LOCATED. CONSIDER FOR LANDFILLS WITH INADEQUATE COVER OR WHERE WASTES WILL CONSOLIDATED.	3745-2-01	CHEMICAL	LOCATION		3/18/93
APC		3745-21-02	A,B,C	AMBIENT AIR QUALITY STANDARDS AND GUIDELINES	ESTABLISHES SPECIFIC AIR QUALITY STANDARDS FOR CARBON MONOXIDE, OZONE AND AND NON-METHANE HYDROCARBONS	PERTAINS TO ANY SITE WHICH WILL EMIT CARBON OXIDES, OZONE OR NON-METHANE HYDROCARBONS. CONSIDER FOR SITES THAT WILL UNDERGO WATER TREATMENT, INCINERATION AND FUEL BURNING (WASTE FUEL RECOVERY)	3745-21-01,3745-21-03,3745-21-10	CHEMICAL	ACTION		3/18/93
APC		3745-21-03	B,C,D	METHODS OF AMBIENT AIR QUALITY MEASUREMENT	SPECIFIES MEASUREMENT METHODS TO DETERMINE AMBIENT AIR QUALITY FOR THE FOLLOWING CONSTITUENTS: CARBON MONOXIDE, OZONE AND NON-METHANE HYDROCARBONS.	PERTAINS TO ANY SITE WHICH WILL EMIT CARBON MONOXIDE, OZONE OR NON-METHANE HYDROCARBONS. CONSIDER FOR FOR SITES WHERE TREATMENT SYSTEMS WILL RESULT IN AIR EMISSIONS.	3745-21-01, 3745-21-02	CHEMICAL	ACTION		3/20/93
APC		3745-21-07	A,B,G,I,J	ORGANIC MATERIALS EMISSION CONTROL: STATIONARY SOURCES	REQUIRES CONTROL OF EMISSIONS OF ORGANIC MATERIALS FROM STATIONARY SOURCES. REQUIRES BEST AVAILABLE TECHNOLOGY.	PERTAINS TO ANY SITE WHICH IS EMITTING OR WILL EMIT ORGANIC MATERIAL. CONSIDER FOR SITES THAT WILL UNDERGO WATER TREATMENT (AIR STRIPPING), INCINERATION AND FUEL BURNING (WASTE FUEL RECOVERY).	3745-21-01,3745-21-03,3745-21-10	ACTION	CHEMICAL		3/20/93
APC		3745-21-08	A-E	CARBON MONOXIDE EMISSION CONTROL: STATIONARY SOURCES	REQUIRES ANY STATIONARY SOURCE OF CARBON MONOXIDE TO MINIMIZE EMISIONS BY THE USE OF BEST AVAILABLE CONTROL TECHNOLOGIES AND OPERATING PRACTICES IN ACCORDANCE WITH BEST CURRENT TECHNOLOGY.	PERTAINS TO ANY SITE WHICH IS EMITTING OR WILL EMIT CARBON MONOXIDE. CONSIDER FOR SITES THAT WILL UNDERGO WATER TREATMENT, INCINERATION AND FUEL BURNING (WASTE FUEL RECOVERY).	3745-21-01,3745-21-03,3745-21-10	ACTION	CHEMICAL		
APC		3745-21-09		VOC EMISSIONS CONTROL: STATIONARY SOURCES	ESTABLISHES LIMITATIONS FOR EMISSIONS OF VOLATILE ORGANIC COMPOUNDS FROM STATIONARY SOURCES.		3745-21-01,3745-21-03,3745-21-10	ACTION			
APC		3745-23-01		NITROGEN DIOXIDE AMBIENT AIR QUALITY STANDARDS	ESTABLISHES A MAXIMUM AMBIENT AIR QUALITY STANDARD FOR NITROGEN DIOXIDE.	PERTAINS TO ANY SITE WHICH IS EMITTING OR WILL EMIT NITROGEN DIOXIDE. CONSIDER FOR SITES THAT WILL UNDERGO WATER TREATMENT, INCINERATION AND FUEL BURNING (WASTE FUEL RECOVERY).	3745-23-02, 3745-23-05	CHEMICAL	ACTION		
APC		3745-23-02	A,B	MEASUREMENT METHODS FOR NITROGEN DIOXIDE	SPECIFIES METHODS OF MEASUREMENT FOR NITROGEN DIOXIDE TO DETERMINE AMBIENT AIR QUALITY.	PERTAINS TO ANY SITE WHICH WILL EMIT NITRIGEN DIOXIDE. CONSIDER FOR SITES WHERE TREATMENT SYSTEMS MAY RESULT IN NITROGEN DIOXIDE EMISSIONS, ESP. THERMAL TREATMENT SYSTEMS.	3745-23-01, 3745-23-04	ACTION	CHEMICAL		3/20/93
APC		3745-23-06		NITROGEN OXIDES EMISSION CONTROLS: STATIONARY SOURCE	REQUIRES THAT ALL STATIONARY SOURCES OF NITROGEN OXIDE MINIMIZE EMISSIONS BY THE USE OF THE LATEST AVAILABLE CONTROL TECHNIQUES AND OPERATING PRACTICES IN ACCORDANCE WITH BEST CURRENT TECHNOLOGY. ESTABLISHES LIMIT FOR NITROGEN OXIDE EMISSIONS FROM COMBUSTION.	PERTAINS TO ANY SITE WHICH WILL EMIT NITROGEN OXIDES. CONSIDER FOR SITES WHERE TREATMENT SYSTEMS WILL RESULT IN NITROGEN OXIDE EMISSIONS, ESP. THERMAL TREATMENT.	3745-23-02,3745-23-05	ACTION	CHEMICAL		3/20/93
APC		3745-25-03		EMISSION CONTROL ACTION PROGRAMS	REQUIRES PREPARATION FOR AIR POLLUTION ALERTS, WARNINGS AND EMERGENCIES.	PERTAINS TO ANY SITE WHICH IS EMITTING OR MAY EMIT AIR CONTAMINANTS.		ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

SW		3745-27-03	B	EXEMPTIONS TO SOLID WASTE REGULATIONS	DEFINES EXEMPTIONS TO SOLID WASTE REGULATIONS AND ESTABLISHES LIMITATIONS ON TEMPORARY STORAGE OF PUTRESCIBLE WASTE OR ANY SOLID WASTE WHICH CAUSES A NUISANCE OR HEALTH HAZARD. STORAGE OF PUTRESCIBLE WASTE	PERTAINS TO ANY SITE AT WHICH SOLID WASTE WILL BE MANAGED. CONSIDER ESPECIALLY FOR OLD LANDFILLS WHERE SOLID WASTE MAY BE EXCAVATED AND/OR CONSOLIDATED.	3745-27-01, 3745-27-05	ACTION			3/20/93
					BEYOND SEVEN DAYS IS CONSIDERED OPEN DUMPING.						
SW		3745-27-05	A,B,C	AUTHORIZED, LIMITED & PROHIBITED SOLID WASTE DISPOSAL	ESTABLISHES ALLOWABLE METHODS OF SOLID WASTE DISPOSAL; SANITARY LANDFILL, INCINERATION, COMPOSTING. PROHIBITS MANAGEMENT BY OPEN BURNING AND OPEN DUMPING.	PERTAINS TO ANY SITE AT WHICH SOLID WASTES WILL BE MANAGED. PROHIBITS MANAGEMENT BY OPEN BURNING AND OPEN DUMPING.	3745-27-01	ACTION			
SW		3745-27-06	B,C	REQUIRED TECHNICAL INFORMATION FOR SANITARY LANDFILLS	SPECIFIES THE MINIMUM TECHNICAL INFORMATION REQUIRED OF A SOLID WASTE PERMIT TO INSTALL. INCLUDED ARE A HYDROGEOLOGIC INVESTIGATION REPORT, LEACHATE PRODUCTION AND MIGRATION INFORMATION, SURFACE WATER DISCHARGE INFORMATION, DESIGN CALCULATIONS, PLAN DRAWINGS.	THIS PARAGRAPH PRESENTS SUBSTANTIVE REQUIREMENTS OF A SOLID WASTE PERMIT TO INSTALL. PERTAINS TO ANY NEW SOLID WASTE DISPOSAL FACILITY CREATED ON-SITE AND EXPANSIONS OF EXISTING SOLID WASTE LANDFILLS . ALSO PERTAINS TO EXISTING AREAS OF CONTAMINATION THAT ARE CAPPED PER SOLID WASTE RULES . THIS RULE ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			
SW		3745-27-07	A,B	LOCATION CRITERIA FOR SOLID WASTE DISPOSAL PERMIT	SPECIFIES LOCATIONS IN WHICH SOLID WASTE LANDFILLS ARE NOT TO BE SITED. INCLUDES FLOODPLAINS, SAND OR GRAVEL PITS, LIMESTONE OR SANDSTONE QUARRIES, AREAS ABOVE SOLE SOURCE AQUIFERS, WETLANDS, ETC.	THIS RULE PREVENTS THE ESTABLISHMENT OF NEW SOLID WASTE LANDFILLS AND EXPANSIONS OF EXISTING SOLID WASTE LANDFILLS IN CERTAIN UNFAVORABLE LOCATIONS. ALSO MAY PROHIBIT THE LEAVING OF WASTE IN-PLACE IN CERTAIN UNFAVORABLE LOCATIONS.		LOCATION			
SW		3745-27-07	D,F,G,H	ADDITIONAL CRITERIA FOR SANITARY LANDFILL APPROVAL	ADDITIONAL SITING REQUIREMTNS WITH RESPECT TO GEOLOGY, WATER SUPPLIES, OCCUPIED PROPERTIES, PARKLANDS AND MINE SUBSIDENCE AREAS. GOVERNS EXPANSION OF EXISTING SITES	PERTAINS TO NEW SANITARY LANDFILLS FOR SOLID WASTE DISPOSAL AND EXPANSIONS OF EXISTING FACILITIES		LOCATION	ACTION		6/1/94
SW		3745-27-08	C,D-H	CONSTRUCTION SPECIFICATIONS FOR SANITARY LANDFILLS	SPECIFIES THE MINIMUM REQUIREMENTS FOR THE SOIL/CLAY LAYERS, GRANULAR DRAINAGE LAYER, GEOSYNTHETICS, LEACHATE MANAGEMENT SYSTEM, GAS MONITORING SYSTEM, ETC. ALSO ESTABLISHES CONSTRUCTION REQUIREMENTS FOR FACILITIES TO BE LOCATED IN GEOLOGICALLY UNFAVORABLE AREAS.	PERTAINS TO ANY NEW SOLID WASTE DISPOSAL FACILITY CREATED ON-SITE AND ANY EXPANSIONS TO EXISTING SOLID WASTE LANDFILLS. PORTIONS ALSO PERTAIN TO AREAS OF CONTAMINATION THAT ARE CAPPED PER SOLID WASTE RULES. MAY SERVE AS SITING CRITERIA.		ACTION			
SW		3745-27-10	B,C,D,E,F	SANITARY LANDFILL - GW MONITORING AND CORRECTION	GROUND WATER MONITORING PROGRAM MUST BE ESTABLISHED FOR ALL SANITARY LANDFILL FACILITIES. THE SYSTEM MUST CONSIST OF A SUFFICIENT NUMBER OF WELLS THAT ARE LOCATED SO THAT SAMPLES INDICATE BOTH UPGRADIENT (BACKGROUND) AND DOWNGRADIENT WATER SAMPLES. THE SYSTEM MUST BE DESIGNED PER THE MINIMUM REQUIREMENTS SPECIFIED IN THIS RULE. THE SAMPLING AND ANALYSIS PROCEDURES USED MUST COMPLY WITH THIS RULE. SPECIFIES PROCEDURES FOR ASSESSMENT AND CORRECTION OF CONTAMINATION.	PERTAINS TO ANY NEW SOLID WASTE FACILITY AND ANY EXPANSIONS OF EXISTING SOLID WASTE LANDFILLS ON-SITE. ALSO MAY PERTAIN TO EXISTING AREAS OF CONTAMINATION THAT ARE CAPPED IN-PLACE PER THE SOLID WASTE RULES.		ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY		CITE	PARAGRAPH							LAST REVISION
SW		3745-27-11	B,G	FINAL CLOSURE OF SANITARY LANDFILL FACILITIES	REQUIRES CLOSURE OF A LANDFILL IN A MANNER WHICH MINIMIZES THE NEED FOR POST-CLOSURE MAINTENANCE AND MINIMIZES POST-CLOSURE FORMATION AND RELEASE OF LEACHATE AND EXPLOSIVE GASES TO AIR, SOIL GROUND WATER OR	SUBSTANTIVE REQUIREMENTS PERTAIN TO ANY NEW SOLID WASTE LANDFILLS CREATED ON-SITE, ANY EXPANSIONS OF EXISTING SOLID WASTE LANDFILLS ON-SITE AND ANY EXISTING AREAS OF CONTAMINATION THAT ARE CAPPED IN-		ACTION			8/27/93
					SURFACE WATER. SPECIFIES ACCEPTABLE CAP DESIGN; SOIL BARRIER LAYER, GRANULAR DRAINAGE LAYER, SOIL AND VEGETATIVE LAYER. PROVIDES FOR USE OF COMPARABLE MATERIALS TO THOSE SPECIFIED WITH APPROVAL OF DIRECTOR.	PLACE PER THE SOLID WASTE RULES.					
SW		3745-27-12	A,B,D,E,MN	SANITARY LANDFILL - EXPLOSIVE GAS MONITORING	ESTABLISHES WHEN AN EXPLOSIVE GAS MONITORING PLAN IS REQUIRED FOR SOLID WASTE LANDFILLS. SPECIFIES THE MINIMUM INFORMATION REQUIRED IN SUCH A PLAN, INCLUDING DETAILED ENGINEERING PLANS, SPECIFICATIONS, INFORMATION ON GAS GENERATION POTENTIAL, SAMPLING AND MONITORING PROCEDURES, ETC. MANDATES WHEN REPAIRS MUST BE MADE TO AN EXPLOSIVE GAS MONITORING SYSTEM. THIS RULE ONLY APPLIES TO LADFILLS WHICH RECEIVED "PUTRESCIBLE" SOLID WASTES.	PERTAINS TO ANY SITE WHICH HAS HAD OR WILL HAVE PUTRESCIBLE SOLID WASTES PLACED ON-SITE AND WHICH HAS A RESIDENCE OR OTHER OCCUPIED STRUCTURE LOCATED WITHIN 1000 FEET OF THE EMPLACED SOLID WASTE.		ACTION	LOCATION		
SW		3745-27-12	I, J	EXPLOSIVE GAS MONITORING FOR SANITARY LANDFILLS	IDENTIFIES PARAMETERS AND SCHEDULE FOR EXPLOSIVE GAS MONITORING	PERTAINS TO ANY DISPOSAL SITE WHERE EXPLOSIVE GAS GENERATION AND MIGRATION MAY BE A THREAT.		ACTION	CHEMICAL		
SW		3745-27-13	C	DISTURBANCES WHERE HAZ OR SOLID WASTE FAC WAS OPERATED	REQUIRES THAT A DETAILED PLAN BE PROVIDED TO DESCRIBE HOW ANY PROPOSED FILLING, GRADING, EXCAVATING, BUILDING, DRILLING OR MINING ON LAND WHERE A HAZARDOUS WASTE FACILITY OR SOLID WASTE FACILITY WAS OPERATED WILL BE ACCOMPLISHED. THIS INFORMATION MUST DEMONSTRATE THAT THE PROPOSED ACTIVITIES WILL NOT CREATE A NUISANCE OR ADVERSELY AFFECT THE PUBLIC HEALTH OR THE ENVIRONMENT. SPECIAL TERMS TO CONDUCT SUCH ACTIVITIES MAY BE IMPOSED BY THE DIRECTOR TO PROTECT THE PUBLIC AND THE ENVIRONMENT.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS OR SOLID WASTE HAS BEEN MANAGED, EITHER INTENTIONALLY OR OTHERWISE. DOES NOT PERTAIN TO AREAS THAT HAVE HAD ONE-TIME LEAKS OR SPILLS.		ACTION	LOCATION		
SW		3745-27-14	A	POST-CLOSURE CARE OF SANITARY LANDFILL FACILITIES	SPECIFIES THE REQUIRED POST-CLOSURE CARE FOR SOLID WASTE FACILITIES. INCLUDES CONTINUING OPERATION OF LEACHATE AND SURFACE WATER MANAGEMENT SYSTEMS, MAINTENANCE OF THE CAP SYSTEM AND GROUND WATER MONITORING.	SUBSTANTIVE REQUIREMENTS PERTAIN TO ANY NEWLY CREATED SOLID WASTE LANDFILLS ON-SITE, ANY EXPANSIONS OF EXISTING SOLID WASTE LANDFILLS ON-SITE AND ANY EXISTING AREAS OF CONTAMINATION THAT ARE CAPPED PER THE SOLID WASTE RULES.		ACTION			
SW		3745-27-18	A-D	SOLID WASTE INCINERATOR & COMPOSTING OPERATIONS	ESTABLISHES OPERATIONAL REQUIREMENTS FOR SOLID WASTE INCINERATORS AND COMPOSTING FACILITIES.	PERTAINS TO ANY SITE AT WHICH SOLID WASTE WILL BE EITHER INCINERATED OR COMPOSTED ON-SITE.		ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY	CHEM	CITE	RELATIONSHIP PARAGRAPH	SUBJECT	REQUIREMENT	APPLICATION	SYN	ARAR TYPE	FEDERAL EQUIVALENT REGULATION	LAST REVISION
SW		3745-27-19	E	SANITARY LANDFILL GENERAL OPERATIONAL REQUIREMENTS	SPECIFIES GENERAL OPERATIONAL REQUIREMENTS FOR SOLID WASTE LANDFILLS. INCLUDES REQUIREMENTS FOR: PREPARATIONS FOR OPERATING DURING INCLEMENT WEATHER; MANAGEMENT TO MINIMIZE NOISE , DUST AND ODORS;	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. PORTIONS ALSO MAY PERTAIN TO EXISTING AREAS OF CONTAMINATION THAT WILL BE		ACTION			
					VECTOR CONTROL; ADEQUATE FIRE CONTROL EQUIPMENT; NOT CAUSING A NUISANCE OR HEALTH HAZARD OR WATER POLLUTION; MINIMIZATION OF DISTURBED AREA; CHEMICAL COMPATABILITY TESTING, IF NECESSARY. SPECIFIES THAT BULK LIQUIDS, HAZARDOUS WASTE , PCBs AND INFECTIOUS WASTE MAY NOT BE ACCEPTED FOR DISPOSAL.	CAPPED IN-PLACE PER SOLID WASTE RULES.					
SW		3745-27-19	D(2)	SANITARY LANDFILL OPERATIONS - CONSTRUCTION COMPLIANCE	REQUIRES THE OWNER/OPERATOR TO IMPLEMENT MEASURES TO ATTAIN COMPLIANCE WITH REQUIREMENTS OF THESE RULES IN THE EVENT THAT TESTING INDICATES THAT A COMPONENT OR PORTION OF THE LANDFILL HAVE NOT BEEN CONSTRUCTED IN ACCORDANCE WITH THOSE RULES.	PERTAINS TO "NEW" SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. ALSO PERTAINS TO CONSTRUCTION OF FINAL COVER SYSTEMS.		ACTION			
SW		3745-27-19	F, G	SANITARY LANDFILL OPER. - DAILY AND INTERMEDIATE COVER	INCLUDES REQUIREMENTS FOR DAILY COVER AND INTERMEDIATE COVER FOR TEMPORARILY INACTIVE AREAS.	PERTAINS TO "NEW" SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING FACILITIES TO BE EXPANDED DURING REMEDIATION		ACTION			
SW		3745-27-19	H	SANITARY LANDFILL OPERATIONS - FINAL COVER	INCLUDES REQUIREMENTS FOR THE FINAL CAP SYSTEM FOR AREAS AT FINAL ELEVATIONS.	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. PORTIONS ALSO MAY PERTAIN TO EXISTING AREAS OF CONTAMINATION THAT WILL BE CAPPED IN-PLACE PER SOLID WASTE RULES.		ACTION			
SW		3745-27-19	L	SANITARY LANDFILL OPERATIONS - PCBs AND HAZARDOUS WASTE	REQUIRES OWNERS/OPERATORS TO CONDUCT A PROGRAM TO DETECT PCB WASTE AND HAZARDOUS WASTE PRIOR TO DISPOSAL. UPON DETECTION OR SUSPECTED DETECTION OF SUCH WASTES, REQUIRES THOSE WASTES TO NOT BE PLACED AT THE WORKING FACE OF THE LANDFILL AND TO MANAGE THOSE WASTES IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS.	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION.		ACTION			
SW		3745-27-19	J	SANITARY LANDFILL OPERATIONS - SURFACE WATER MGMNT.	SURFACE WATER MUST BE DIVERTED FROM AREAS WHERE SOLID WASTE IS BEING, OR HAS BEEN, DEPOSITED. ALSO REQUIRES RUN-ON AND RUN-OFF TO BE CONTROLLED TO MINIMIZE INFILTRATION THROUGH THE COVER MATERIALS AND TO MINIMIZE EROSION OF THE CAP SYSTEM.	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. PORTIONS ALSO MAY PERTAIN TO EXISTING AREAS OF CONTAMINATION THAT WILL BE CAPPED IN-PLACE PER SOLID WASTE RULES.		ACTION			
SW		3745-27-19	K	SANITARY LANDFILL OPERATIONS - LEACHATE MANAGEMENT	REQUIRES REPAIR OF LEACHATE OUTBREAKS; COLLECTION AND TREATMENT OF LEACHATE ON THE SURFACE OF THE LANDFILL; AND ACTIONS TO MINIMIZE, CONTROL OR ELIMINATE CONDITIONS CAUSING LEACHATE OUTBREAKS.	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. PORTIONS ALSO MAY PERTAIN TO EXISTING AREAS OF CONTAMINATION THAT WILL BE CAPPED IN-PLACE PER SOLID WASTE RULES.		ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

[illegible]	[illegible]	[illegible]	PARAGRAPH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FEDERAL REGULATION	LAST REVISION
SW		3745-27-20		SANITARY LANDFILLS - PROHIBITIONS AND CLOSURE	SPECIFIES CERTAIN OPERATIONAL AND LOCATION STANDARDS FOR LANDFILLS ACCEPTING WASTE AFTER JUNE 1, 1994. ALSO REQUIRES CLOSURE OF EXISTING UNITS WHICH DO NOT MEET THOSE STANDARDS BY OCTOBER 6, 1996.	PERTAINS TO NEW SOLID WASTE DISPOSAL FACILITIES TO BE CREATED ON-SITE AND EXISTING LANDFILLS THAT WILL BE EXPANDED DURING REMEDIATION. PORTIONS		ACTION			
ISW		3745-29-06		PERMIT TO INSTALL ISW LANDFILL	REQUIRES TECHNICAL INFORMATION ON SITE AND SURROUNDING FOR PROPOSED LANDFILL AS WELL AS TECHNICAL DETAILS OF DESIGN AND OPERATION OF SITE.	INDUSTRIAL SOLID WASTE LANDFILL					6/1/94
ISW		3745-29-07	C,D,H	ADDITIONAL CRITERIA FOR ISW LANDFILLS	SITING CRITERIA SPECIFY MINIMUM SETBACK DISTANCES FROM PARKLANDS, GROUNDWATER SOURCES, MINES RIVERS, PROPERTY LINES, DOMICILES AND SURFACE WATER	INDUSTRIAL SOLID WASTE LANDFILLS					6/1/94
ISW		3745-29-08	C,D,E,F	CONSTRUCTION REQUIREMENTS FOR ISW LANDFILLS	SPECIFIES REQUIREMENTS FOR LINERS, TESTPADS, LEACHATE COLLECTION SYSTEMS, SURVEY MARKERS, SURFACE WATER CONTROL, GAS CONTROL, EARTHQUAKE RESISTANCE, CAPPING.	INDUSTRIAL SOLID WASTE LANDFILLS					6/1/94
ISW		3745-29-10	A-F	GROUNDWATER MONITORING PLAN FOR ISW LANDFILLS	REQUIRES GROUNDWATER MONITORING SYSTEM, LISTS CHEMICALS TO BE TESTED FOR, DISCUSSES STATISTICAL METHODS TO BE USED, REQUIRES CORRECTIVE ACTION PLANS IF CONTAMINATION IS FOUND.	APPLICABLE TO UPPERMOST AQUIFER UNDER LANDFILL AND ZONES OF SATURATION ABOVE THAT AQUIFER.					6/1/94
ISW		3745-29-11	B,G,H	FINAL CLOSURE OF ISW LANDFILLS	REQUIRES CAPPING,REGRADING, GROUNDWATER MONITORING, SURFACE WATER MANAGEMENT, LEACHATE CONTROL AND FENCING FOR CLOSED SITES.	INDUSTRIAL SOLID LANDFILL SITES					6/1/94
ISW		3745-29-14	A,B	POST CLOSURE CARE OF ISW LANDFILL	REQUIRES CONTINUING MAINTENANCE OF CAP, GROUNDWATER MONITORING SYSTEM, GAS CONTROL SYSTEM, LEACHATE CONTROL SYSTEM,SURFACE WATER CONTROL. MANDATES QUARTERLY INSPECTION. GENERALLY REQUIRES CARE FOR 30 YEARS AFTER CLOSURE.	PERTAINS TO SITES CLOSED AFTER 03/01/87					6/1/94
ISW		3745-29-19	E,F,J,K	OPERATIONAL CRITERIA FOR ISW LANDFILLS	SPECIFIES REQUIREMENTS FOR FENCING, LITTER CONTROL, RODENT CONTROL, FORBIDDEN WASTES (LIQUIDS, INFECTIOUS, ASBESTOS, PCB'S ETC.) COVER REQUIREMENTS, SURFACE WATER CONTROL, PERSONNEL QUALIFICATIONS, LEACHATE MANAGEMENT, CAPPING , RECORD KEEPING.	INDUSTRIAL SOLID WASTE LANDFILLS EXCEPT IF PLAN WAS APPROVED PRIOR TO 07/29/76 OR IF PERMIT TO INSTALL WAS ISSUED PRIOR TO 01/01/80					6/1/94
RSW		3745-30-04	A-C	RESIDUAL WASTE LANDFILL CLASSIFICATION	GIVES STANDARDS FOR CLASSIFICATION OF RESIDUAL WASTES. GIVES EXCEPTIONS FROM MONITORING, SOIL LINER, CAPPING, GEOMEMBRANE, LEACHATE COLLECTION REQUIREMENTS FOR CLASS IV WASTES.	PERTAINS TO REMEDIATION SITES WITH WASTES THAT QUALIFY AS RESDIUAL SOLID WASTE. GIVES RULES FOR DISPOSAL OF THOSE WASTES.	3745-30-01,3745-30-03				1/13/92
RSW		3745-30-06	B	CRITERIA FOR PTI FOR RESIDUAL SOLID WASTE LANDFILL	LOCATION CRITERIA WITH RESPECT TO PARKLANDS, WATER SUPPLIES, QUAKE FAULTS, MINES, FLOODPLAINS. SEPARATION REQUIREMENTS BETWEEN LANDFILL LINERS AND AQUIFERS FOR EACH CLASS OF RESIDUAL SOLID WASTE.	PERTAINS TO REMEDIATION SITES WITH RESIDUAL SOLID WASTE. GIVES RULES FOR DISPOSAL OF THOSE WASTES.					1/13/92
RSW		3745-30-07	C,D,E	RESIDUAL SOLID WASTE LANDFILL FACILITY • CONSTRUCTION	LINER REQUIREMENTS FOR EACH CLASS OF RESIDUAL SOLID WASTE. REQUIREMENTS FOR GEOMEMBRANES, LEACHATE COLLECTION SYSTEM, WATER RUNOFF CONTROL, GAS CONTROL, TEST PADS, ETC.	PERTAINS TO REMEDIATION SITES WITH RESIDUAL SOLID WASTE. GIVES RULES FOR RESIDUAL SOLID WASTE DISPOSAL.					1/13/92

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	LAST REVISION
RSW		3745-30-08	B-F	GROUNDWATER MONITORING, RESIDUAL SOLID WASTE LANDFILLS	REQUIRES MONITORING WELLS FOR UPPERMOST AQUIFER AND ZONE OF SATURATION BELOW LANDFILL. REQUIRES COLLECTION PLAN, QA PROCEDURES AND CORRECTIVE ACTION IF CONTAMINATION OCCURS.	PERTAINS TO SITES WHERE RESIDUAL SOLID WASTE IS BURIED					1/13/92
RSW		3745-30-09	F	FINAL CLOSURE, RESIDUAL SOLID WASTE LANDFILL	REQUIRES CAPPING, GROUNDWATER MONITORING, SITE SECURITY AT RSW SITE.	PERTAINS TO RSW LANDFILL SITES.					1/13/92
RSW		3745-30-10	A-C	POST-CLOSURE CARE OF RESIDUAL WASTE LANDFILL FACILITIES	ESTABLISHES TIME FRAME FOR POST-CLOSURE CARE. REQUIRES MAINTENANCE OF CAP, LEACHATE CONTROL SYSTEM AND GAS CONTROL SYSTEM AND GROUND WATER MONITORING. MANDATES QUARTERLY INSPECTIONS.	PERTAINS TO SITES WHERE RSW IS LANDFILLED.					1/13/92
RSW		3745-30-14	D-DD	OPERATION OF FACILITIES	REQUIRES CONTROL OF ODERS, NOISE, ACCESS, DUST, AIR EMISSIONS. INCLUDES REQUIREMENTS FOR CAPPING, COVERING, SURFACE WATER CONTROL, LEACHATE CONTROL, FIRE PREVENTION, NUISANCE AVOIDANCE.	PERTAINS TO SITES WHERE RSW IS LANDFILLED.					1/13/92
APC		3745-31-03	A (2)	PERMIT TO INSTALL, EXEMPTIONS	EXEMPTS SUPERFUND (CERCLA) SITES FROM AIR PERMITTING REQUIREMENTS. SUCH SITES MUST STILL MET SUBSTANTIVE REQUIREMENTS OF PERMIT AND AIR EMISSION LIMITS.	APPLIES TO SUPERFUND SITES WHERE ALL ACTIVITIES ARE CARRIED OUT ON-SITE.					8/13/96
WS APC		3745-31-05		WATER/AIR PERMIT CRITERIA FOR DECISION BY THE DIRECTOR	A PERMIT TO INSTALL (PTI) OR PLANS MUST DEMONSTRATE BEST AVAILABLE TECHNOLOGY (BAT) AND SHALL NOT INTERFER WITH OR PREVENT THE ATTAINMENT OR MAINTENANCE OF APPLICABLE AMBIENT AIR QUALITY STANDARDS.	PERTAINS TO ANY SITE THAT WILL DISHARGE TO ON-SITE SURFACE WATER OR WILL EMIT CONTAMINANTS INTO THE AIR.		ACTION			
WS		3745-32-05		WATER QUALITY CRITERIA FOR DECISION BY THE DIRECTOR	SPECIFIES SUBSTANTIVE CRITERIA FOR SECTION 401 WATER QUALITY CRITERIA FOR DREDGING, FILLING, OBSTRUCTIONG OR ALTERING WATERS OF THE STATE.	PERTAINS TO ANY SITE THAT HAS OR WILL AFFECT WATERS OF THE STATE.		ACTION			
UIC		3745-34-06		PROHIBITION OF UNAUTHORIZED INJECTION	UNDERGROUND INJECTION IS PROHIBITED WITHOUT AUTHORIZATION FROM THE DIRECTOR.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.		ACTION			
UIC		3745-34-07		NO MOVEMENT OF FLUID INTO UNDERGROUND DRINKING WATER	THE UNDERGROUND INJECTION OF FLUID CONTAINING ANY CONTAMINANT INTO AN UNDERGROUND SOURCE OF DRINKING WATER IS PROHIBITED IF THE PRESENCE OF THAT CONTAMINANT MAY CAUSE A VIOLATION OF THE PRIMARY DRINKING WATER STANDARDS OR OTHER WISE ADVERSELY AFFECT THE HEALTH OF PERSONS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-08		ELIMINATION OF CLASS IV WELLS	THE INJECTION OF HAZARDOUS OR RADIOACTIVE WASTE DIRECTLY INTO AN UNDERGROUND SOURCE OF DRINKING WATER IS PROHIBITED.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-09		REQUIREMENTS FOR WELLS INJECTING HAZARDOUS WASTE	SPECIFIES REQUIREMENTS FOR THE INJECTION OF HAZARDOUS WASTES UNDERGROUND. SEE 3745-34-08 FOR LIMITATIONS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-10		WAIVER OF REQUIREMENT BY DIRECTOR	THE DIRECTOR MAY AUTHORIZE LESS STRINGENT REQUIREMENTS FOR AN INJECTION THAT DOES NOT OCCUR INTO, THROUGH OR ABOVE AN UNDERGROUND SOURCE OF DRINKING WATER.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING					
UIC		3745-34-13		CLASS V WELLS	SPECIFIES REQUIREMENTS FOR CLASS V WELLS. SEE 3745-34-04 FOR DEFINITIONS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING					

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UIC		3745-34-26		CONDITIONS APPLICABLE TO ALL PERMITS	SPECIFIES MINIMUM CONDITIONS TO BE APPLIED TO ALL UNDERGROUND INJECTIONS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-34		MECHANICAL INTEGRITY	SPECIFIES REQUIREMENTS TO BE MET TO ENSURE MECHANICAL INTEGRITY OF WELLS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND.					
						CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-36		PLUGGING AND ABANDONING CLASS I WELLS	SPECIFIES REQUIREMENTS TO BE MET WHEN PLUGGING OR ABANDONING A CLASS I WELL. SEE 3745-34-04 FOR DEFINITIONS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
UIC		3745-34-37		CONSTRUCTION REQUIREMENTS FOR CLASS I WELLS	SPECIFIES CONSTRUCTION AND SITING REQUIREMENTS FOR CLASS I WELLS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.		ACTION	LOCATION		
UIC		3745-34-38		OPERATING, MONITORING & REPORTING REQ FOR CLASS I WELLS	SPECIFIES OPERATING, MONITORING AND REPORTING REQUIREMENTS NECESSARY FOR CLASS I WELLS.	PERTAINS TO SITES AT WHICH MATERIALS ARE TO BE INJECTED UNDERGROUND. CONSIDER FOR TECHNOLOGIES SUCH AS BIOREMEDIATION AND SOIL FLUSHING.					
HW		3745-50-315	A	ADD'L REG OF CERTAIN HAZ WASTE RECYCLING ACTIVITIES	DIRECTOR MAY REGULATE HAZARDOUS WASTES OTHERWISE EXEMPTED BECAUSE OF RECYCLING ACTIVITIES AS HAZARDOUS WASTES ON A CASE-BY-CASE BASIS. THE CRITERIA TO MAKE THIS DECISION ARE PROVIDED BY THIS RULE.	PERTAINS TO ANY SITE THAT HAS HAZARDOUS WASTES THAT WILL BE EXEMPTED FROM THE HAZARDOUS WASTE RULES PER OAC 3745-51-06 (RECYCLING EXEMPTIONS).	3745-50-10,3745-50-11	ACTION	CHEMICAL		
HW		3745-50-44	A	PERMIT INFO REQUIRED FOR ALL HAZ WASTE FACILITIES	ESTABLISHES THE SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE FACILITY COMPLIANCE. INCLUDES INFORMATION SUCH AS FACILITY DESCRIPTION, WASTE CHARACTERISTICS, EQUIPMENT DESCRIPTIONS, CONTINGENCY PLAN, FACILITY LOCATION, TOPOGRAPHIC MAP, ETC.	PERTAINS TO ANY SITE WHICH WILL HAVE TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTE OCCURRING ON-SITE OR HAS EXISTING AREAS OF HAZARDOUS WASTE CONTAMINATION ON-SITE THAT WILL BE CAPPED IN-PLACE. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.	3745-50-10,3745-50-11	ACTION			
HW		3745-50-44	B	PERMIT INFO REQ FOR ALL HAZ WASTE LAND DISP FAC ILITIES	ESTABLISHES THE SUBSTANTIVE HAZARDOUS WASTE LAND DISPOSAL PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUATE PROTECTION OF THE GROUND WATER. INCLUDES INFORMATION SUCH AS GROUND WATER MONITORING DATA, INFORMATION ON INTERCONNECTED AQUIFERS, PLUME(S) OF CONTAMINATION, PLANS AND REPORTS ON GROUND WATER MONITORING PROGRAM, ETC.	PERTAINS TO ANY FACILITY/SITE WHICH WILL HAVE HAZARDOUS WASTE DISPOSED OF ON-SITE OR HAS EXISTING AREAS OF HAZARDOUS WASTE CONTAMINATION ON-SITE THAT WILL BE CAPPED IN-PLACE. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			
HW		3745-50-44	C1	ADD'L PERMIT INFO: HAZ WASTE STORAGE IN CONTAINERS	ESTABLISHES THE SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF CONTAINER STORAGE. INCLUDES INFORMATION SUCH AS DESCRIPTION OF CONTAINMENT SYSTEM, DETAILED DRAWINGS, ETC. SEE OAC 3745-55-70 THROUGH 3745-55-78 FOR ADDITIONAL CONTAINER REQUIREMENTS.	PERTAINS TO ANY SITE AT WHICH STORAGE OF HAZARDOUS WASTE ON-SITE WILL OCCUR IN CONTAINERS. CONSIDER FOR WASTES AND CONTAMINATED SOILS THAT ARE STORED PRIOR TO TREATMENT OR DISPOSAL. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-55-70 THROUGH 3745-55-78, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			

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HW		3745-50-44	C2	ADD'L PERMIT INFO: HAZ WASTE STORAGE/ TREAT IN TANKS	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF TANK TREATMENT AND STORAGE UNITS. INCLUDES INFORMATION SUCH AS ASSESSMENT OF STRUCTURAL	PERTAINS TO ANY SITE AT WHICH STORAGE OR TREATMENT OF HAZARDOUS WASTE IN TANKS WILL OCCUR ON-SITE. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-55-90 THROUGH 3745-55-99, ESTABLISHES THE MINIMUM INFORMATION		ACTION			
					INTEGRITY, DETAILED PLANS OF TANK SYSTEM(S), DESCRIPTION OF SECONDARY CONTAINMENT SYSTEM, ETC. SEE OAC 3745-55-90 THROUGH 3745-55-99 FOR ADDITIONAL REQUIREMENTS.ı	REQUIRED DURING THE REMEDIAL DESIGN STAGE. ı					
HW		3745-50-44	C3	ADD'L PERMIT INFO: HAZ WASTE STOR/TREAT IN SURF IMPOUND	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF BOTH NEW SURFACE IMPOUNDMENTS AND EXTENSIONS OF EXISTING SURFACE IMPOUNDMENTS USED TO STORE OR TREAT HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED PLANS AND REPORTS, INFORMATION ON STRUCTURAL INTEGRITY, CLOSURE INFORMATION, ETC. SEE OAC 3745-56-20 THROUGH 3745-56-33 FOR ADDITIONAL SURFACE IMPOUNDMENT REQUIREMENTS. ı	PERTAINS TO ANY SITE AT WHICH EITHER A NEW SURFACE IMPOUNDMENT WILL BE INSTALLED OR AN EXISTING SURFACE IMPOUNDMENT WILL BE EXPANDED. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-20-50 THROUGH 3745-33-60, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE. ı		ACTION			
HW		3745-50-44	C4	ADD'L PERMIT INFO: HAZ WASTE STOR/TREAT IN WASTE PILES	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF SURFACE IMPOUNDMENTS USED TO TREAT OR STORE HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED DESIGN PLANS AND REPORTS, CONTROL OF RUN-ON AND RUN-OFF, CLOSURE INFORMATION, ETC. SEE OAC 3745-56-20 THROUGH 3745-56-33 FOR ADDITIONAL SURFACE IMPOUNDMENT REQUIREMENTS. ı	PERTAINS TO SITE AT WHICH HAZARDOUS WASTE WILL BE STORED OR TREATED IN SURFACE IMPOUNDMENTS. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-56-20 THROUGH 3745-56-33, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE. ı		ACTION			5/28/93
HW		3745-50-44	C5	ADD'L PERMIT INFO: HAZ WASTE TREAT/DISP BY LAND TREAT	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF LAND TREATMENT TO TREAT OR DISPOSE OF HAZARDOUS WASTES. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DESIGN MEASURES TO MAXIMIZE TREATMENT, DIMENSIONS OF TREATMENT ZONE, DESIGN OF UNIT, INFORMATION ON POTENTIAL CROPS, ETC. SEE OAC 3745-56-70 THROUGH 3745-56-83 FOR ADDITIONAL LAND TREATMENT REQUIREMENTS. ı	PERTAINS TO ANY SITE AT WHICH LAND TREATMENT WILL BE USED TO TREAT OR DISPOSE OF HAZARDOUS WASTES. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-20-50 THROUGH 3745-33-60, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE. ı		ACTION			

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CATEGORY		CITATION	PERTINENT PARAGRAPH							LAST REVISION
HW		3745-50-44	C6	ADD'L PERMIT INFO: ENVIRONMENTAL PERFORMANCE STANDARDS	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS, AND UNDERGROUND INJECTION WELLS USED TO TREAT, STORE OR DISPOSE OF HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED DESIGN PLANS AND REPORTS, CONTROL OF RUN-ON AND RUN-OFF, CLOSURE INFORMATION, ETC. SEE OAC 3745-57-01 ADDITIONAL REQUIREMENTS.	PERTAINS TO SITE AT WHICH HAZARDOUS WASTE WILL BE OR HAS BEEN STORED, TREATED OR DISPOSED OF IN SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS OR UNDERGROUND INJECTION WELLS . THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-57-01 ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			5/29/93
HW		3745-50-44	C7	ADD'L PERMIT INFO: HAZ WASTE DISPOSAL IN LANDFILLS	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF LANDFILLS USED FOR DISPOSAL OF HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED DESIGN PLANS AND REPORTS, CONTROL OF RUN-ON AND RUN-OFF, CLOSURE INFORMATION, ETC.. SEE OAC 3745-57-02 THROUGH 3745-57-18 FOR ADDITIONAL LANDFILL REQUIREMENTS.	PERTAINS TO SITE AT WHICH HAZARDOUS WASTE WILL BE OR HAS BEEN DISPOSED OF IN LANDFILLS. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-57-02 THROUGH 3745-57-18, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			
HW		3745-50-44	C8	ADD'L PERMIT INFO: HAZ WASTE TREATMENT BY INCINERATION	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF INCINERATORS USED TO TREAT HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED DESIGN PLANS AND REPORTS, TRIAL BURN DATA, CLOSURE INFORMATION, ETC... SEE OAC 3745-57-40 THROUGH 3745-57-51 FOR ADDITIONAL INCINERATOR REQUIREMENTS.	PERTAINS TO SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED BY INCINERATION. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-57-40 THROUGH 3745-57-51, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION	?		5/28/93
HW		3745-50-44	C9	ADD'L PERMIT INFO: HAZ WASTE T/S/D IN MISC UNITS	ESTABLISHES SUBSTANTIVE HAZARDOUS WASTE PERMIT REQUIREMENTS NECESSARY FOR OHIO EPA TO DETERMINE ADEQUACY OF MISCELLANEOUS UNITS USED TO TREAT OR STORE HAZARDOUS WASTE. INCLUDES INFORMATION SUCH AS WASTE CHARACTERISTICS, DETAILED DESIGN PLANS AND REPORTS, CONTROL OF RUN-ON AND RUN-OFF, CLOSURE INFORMATION, ETC.. SEE OAC 3745-57-90 THROUGH 3745-57-93 FOR ADDITIONAL REQUIREMENTS FOR MISCELLANEOUS UNITS.	PERTAINS TO FACILITY/SITE AT WHICH HAZARDOUS WASTE WILL BE STORED, TREATED OR DISPOSED OF IN MISCELLANEOUS UNITS. THIS, ALONG WITH OTHER PARAGRAPHS OF THIS RULE AND OAC 3745-57-90 THROUGH 3745-57-93, ESTABLISHES THE MINIMUM INFORMATION REQUIRED DURING THE REMEDIAL DESIGN STAGE.		ACTION			5/28/93
HW		3745-50-58	E,I,J	HAZARDOUS WASTE FACILITY PERMIT CONDITIONS	ESTABLISHES GENERAL PERMIT CONDITIONS APPLIED TO ALL HAZARDOUS WASTE FACILITIES IN OHIO. INCLUDES CONDITIONS SUCH AS OPERATION AND MAINTENANCE, SITE ACCESS, MONITORING, ETC.	PERTAINS TO ALL ALTERNATIVES THAT WILL INCORPORATE TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTE.		ACTION			8/27/93
HW		3745-50-62	A,B,C,D	TRIAL BURN FOR INCINERATORS	SPECIFIES REQUIREMENTS OF A TRIAL BURN.	PERTAINS TO ANY ALTERNATIVE INCORPORATING ON-SITE INCINERATION.		ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY	[illegible]	[illegible]	PARAGRAPH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FEDERAL REGULATIONS	LAST REVISION
HW		3745-51-05	A-J	REQ. FOR CONDITIONALLY EXEMPT SMALL QUANTITY GENERATORS	SPECIFIES REQUIREMENTS FOR CONDITIONALLY EXEMPT SMALL QUANTITY GENERATORS OF HAZARDOUS WASTE. PROVIDES RELIEF FROM MANY OF THE HAZARDOUS WASTE REGULATIONS.	CONSIDER FOR SITES WHERE THE QUANTITY OF HAZARDOUS WASTE GENERATED BY AN ON-SITE ACTION WILL BE LESS THAN 100 KG PER MONTH. MONTHLY LIMIT FOR ACUTE HAZARDOUS WASTE IS ONE (1) KG.		ACTION	CHEMICAL		3/29/93
HW		3745-51-06	A,B,C(1)	REQUIREMENTS FOR RECYCLED MATERIALS	DEFINES RECYCLED HAZARDOUS WASTES AND ESTABLISHES SPECIFIC EXEMPTIONS FOR THESE WASTES FROM THE HAZARDOUS WASTE REGULATIONS.	PERTAINS TO ANY SITE AT WHICH RECYCLING OF HAZARDOUS WASTES MAY TAKE PLACE. CONSIDER FOR SITES AT WHICH THE FOLLOWING MATERIALS ARE PRESENT: ,INDUSTRIAL ETHYL ALCOHOL ,USED BATTERIES ,USED OIL ,SCRAP METAL ,PETROLEUM PRODUCTS ,K087 COAL AND COKE TAR SLUDGE		ACTION	CHEMICAL		3/29/93
HW		3745-51-07	A,B	RESIDUES OF HAZ WASTES IN EMPTY CONTAINERS	EXEMPTS THE RESIDUES OF HAZARDOUS WASTES FROM EMPTY CONTAINERS FROM THE HAZARDOUS WASTE REGULATIONS. PROVIDES SPECIFIC DEFINITIONS FOR THESE RESIDUES.	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES STORAGE OF HAZARDOUS WASTE ON-SITE IN CONTAINERS.		ACTION			
HW		3745-52-11	A-D	EVALUATION OF WASTES	ANY PERSON GENERATING A WASTE MUST DETERMINE IF THAT WASTE IS A HAZARDOUS WASTE (EITHER THROUGH LISTING OR BY CHARACTERISTIC).	PERTAINS TO SITES AT WHICH WASTES OF ANY TYPE (BOTH SOLID AND HAZARDOUS) ARE LOCATED.	3745-51-01 THROUGH 3745-51-33	CHEMICAL	ACTION		3/29/93
HW		3745-52-20		HAZARDOUS WASTE MANIFEST - GENERAL REQUIREMENTS	REQUIRES A GENERATOR WHO TRANSPORTS OR OFFERS FOR TRANSPORTATION HAZARDOUS WASTE FOR OFF-SITE TREATMENT, STORAGE OR DISPOSAL TO PREPARE A UNIFORM HAZARDOUS WASTE MANIFEST	PERTAINS TO SITES WHERE HAZARDOUS WASTE WILL BE TRANSPORTED OFF-SITE FOR TREATMENT, STORAGE OR DISPOSAL	3745-52-10	CHEMICAL	ACTION		5/28/93
HW		3745-52-22		HAZARDOUS WASTE MANIFEST - NUMBER OF COPIES	SPECIFIES THE NUMBER OF MANIFEST COPIES TO BE PREPARED	PERTAINS TO SITES WHERE HAZARDOUS WASTE WILL BE TRANSPORTED OFF-SITE FOR TREATMENT, STORAGE OR DISPOSAL	3745-52-10	CHEMICAL	ACTION		5/28/93
HW		3745-52-23		HAZARDOUS WASTE MANIFEST - USE	SPECIFIES PROCEDURES FOR THE USE OF HAZARDOUS WASTE MANIFESTS INCLUDING A REQUIREMENT THAT THEY BE HAND SIGNED BY THE GENERATOR	ERTAINS TO SITES WHERE HAZARDOUS WASTE WILL BE TRANSPORTED OFF-SITE FOR TREATMENT, STORAGE OR DISPOSAL	3745-52-10	CHEMICAL	ACTION		5/28/93
HW		3745-52-30		HAZARDOUS WASTE PACKAGING	REQUIRES A GENERATOR TO PACKAGE HAZARDOUS WASTE IN ACCORDANCE WITH U.S. DOT REGULATIONS FOR TRANSPORTATION OFF-SITE.	PERTAINS TO ANY SITE WHERE HAZARDOUS WASTE WILL BE GENERATED BY ON-SITE ACTIVITIES AND SHIPPED OFF-SITE FOR TREAMENT AND/OR DISPOSAL.	3745-52-10, 49CFR 173,178,179	CHEMICAL	ACTION		3/30/93
HW		3745-52-31		HAZARDOUS WASTE LABELING	REQUIRES PACKAGES OF HAZARDOUS WASTE TO BE LABELLED IN ACCORDANCE WITH U.S.DOT REGULATIONS FOR OFF-SITE TRANSPORTATION.	PERTAINS TO ANY SITE WHERE HAZARDOUS WASTE WILL BE GENERATED BY ON-SITE ACTIVITIES AND SHIPPED OFF-SITE FOR TREATMENT AND/OR DISPOSAL.	3745-52-10, 49CFR 172	CHEMICAL	ACTION		3/30/93
HW		3745-52-32		HAZARDOUS WASTE MARKING	SPECIFIES LANGUAGE FOR MARKING PACKAGES OF HAZARDOUS WASTE PRIOR TO OFF-SITE TRANSPORTATION	PERTAINS TO ANY SITE WHERE HAZARDOUS WASTE WILL BE GENERATED BY ON-SITE ACTIVITIES AND SHIPPED OFF-SITE FOR TREATMENT AND/OR DISPOSAL.	3745-52-10, 49CFR 172	CHEMICAL	ACTION		3/3/93
HW		3745-52-33		HAZARDOUS WASTE PLACARDING	GENERATOR SHALL PLACARD HAZARDOUS WASTE PRIOR TO OFF-SITE TRANSPORTATION.	PERTAINS TO ANY SITE WHERE HAZARDOUS WASTE WILL BE GENERATED BY ON-SITE ACTIVITIES AND SHIPPED OFF-SITE FOR TREATMENT AND/OR DISPOSAL.	3745-52-10, 49CFR 172(F)	CHEMICAL	ACTION		3/30/93
HW		3745-52-34		ACCUMULATION TIME OF HAZARDOUS WASTE	IDENTIFIES MAXIMUM TIME PERIODS THAT A GENERATOR MAY ACCUMULATE A HAZARDOUS WASTE WITHOUT BEING CONSIDERED AN OPERATOR OF A STORAGE FACILITY. ALSO ESTABLISHES STANDARDS FOR MANAGEMENT OF HAZARDOUS WASTES BY GENERATORS.	PERTAINS TO A SITE WHERE HAZARDOUS WASTE WILL BE GENERATED AS A RESULT OF THE REMEDIAL ACTIVITIES.	3745-52-10	CHEMICAL	ACTION		3/30/93

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CATEGORY		CITATION		TITLE	REQUIREMENT	ANALYSIS	REFERENCE	TYPE	LOCATION	FEDERAL REGULATION	LAST REVISION
HW		3745-54-13	A	GENERAL ANALYSIS OF HAZARDOUS WASTE	PRIOR TO ANY TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTES, A REPRESENTATIVE SAMPLE OF THE WASTE MUST BE CHEMICALLY AND PHYSICALLY ANAYZED.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	CHEMICAL			
HW		3745-54-14	A,B,C	SECURITY FOR HAZARDOUS WASTE FACILITIES	HAZARDOUS WASTE FACILITIES MUST BE SECURED SO THAT UNAUTHORIZED AND UNKNOWING ENTRY ARE MINIMIZED OR PROHIBITED.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	ACTION			
HW		3745-54-15	A,C	INSPECTION REQUIREMENTS FOR HAZARDOUS WASTE FACILITIES	HAZARDOUS WASTE FACILITIES MUST BE INSPECTED REGULARLY TO DETECT MALFUNCTIONS, DETERIORATIONS, OPERATIONAL ERRORS AND DISCHARGES. ANY MALFUNCTIONS OR DETERIORATIONS DETECTED SHALL BE REMEDIED EXPEDITIOUSLY.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	ACTION			
HW		3745-54-17	A,B,C	REQ FOR IGNITABLE,REACTIVE OR INCOMPATABLE HAZ WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN TO PREVENT ACCIDENTAL IGNITION OR REACTION OF IGNITABLE, REACTIVE OR INCOMPATIBLE WASTES.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY REACTIVE, IGNITABLE OR I INCOMPATIBLE WASTES ARE PRESENT.		ACTION	LOCATION		
HW		3745-54-18	A,B,C	LOCATION STANDARDS FOR HAZARDOUS WASTE T/S/D FACILITIES	RESTRICTS THE SITING OF HAZARDOUS WASTE FACILITIES IN AREAS OF SEISMIC ACTIVITY OR FLOODPLAINS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).		LOCATION			
HW		3745-54-31		DESIGN & OPERATION OF HAZARDOUS WASTE FACILITIES	HAZARDOUS WASTE FACILITIES MUST BE DESIGNED, CONSTRUCTED, MAINTAINED AND OPERATED TO MINIMIZE THE POSSIBILITY OF FIRE, EXPLOSION OR UNPLANNED RELEASE OF HAZARDOUS WASTE OR HAZARDOUS CONSTITUENTS TO THE AIR, SOIL OR SURFACE WATER WHICH COULD THREATEN HUMAN HEALTH OR THE ENVIRONMENT.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	ACTION			
HW		3745-54-32	A,B,C,D	REQUIRED EQUIPMENT FOR HAZARDOUS WASTE FACILITIES	ALL HAZARDOUS WASTE FACILITIES MUST BE EQUIPPED WITH EMERGENCY EQUIPMENT, SUCH AS AN ALARM SYSTEM, FIRE CONTROL EQUIPMENT AND A TELEPHONE OR RADIO.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	ACTION			
HW		3745-54-33		TESTING & MAINTENANCE OF EQUIPMENT; HAZ WASTE FACILTIES	ALL HAZARDOUS WASTE FACILITIES MUST TEST AND MAINTAIN EMERGENCY EQUIPMENT TO ASSURE PROPER OPERATION.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).		ACTION			
HW		3745-54-34		ACCESS TO COMMUNICATIONS OR ALARM SYSTEM; HAZ WASTE FAC	WHENEVER HAZARDOUS WASTE IS BEING HANDLED, ALL PERSONNEL INVOLVED SHALL HAVE IMMEDIATE ACCESS TO AN INTERNAL ALARM OR EMERGENCY COMMUNICATION DEVICE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01	ACTION			
HW		3745-54-35		REQUIRED AISLE SPACE AT HAZ WASTE FACILITIES	ADEQUATE AISLE SPACE SHALL BE MAINTAINED TO ALLOW UNOBSTRUCTED MOVEMENT OF PERSONNEL, FIRE EQUIPMENT, SPILL CONTROL EQUIPMENT AND DECONTAMINATION EQUIPMENT INTO ANY AREA OF THE FACILITY OPERATION IN THE EVENT OF AN EMERGENCY.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF). CONSIDER FOR SITES WHERE WASTES WILL BE STORED IN CONTAINERS.	3745-54-01	ACTION			
HW		3745-54-37	A,B	ARRANGEMENTS/ AGREEMENTS WITH LOCAL AUTHORITIES	ARRANGEMENTS OR AGREEMENTS WITH LOCAL AUTHORITIES, SUCH AS POLICE, FIRE DEPARTMENT AND EMERGENCY RESPONSE TEAMS MUST BE MADE. IF LOCAL AUTHORITIES WILL NOT COOPERATE, DOCUMENTATION OF THAT NON-COOPERATION SHOULD BE PROVIDED.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).		ACTION			

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HW		3745-54-52	A-F	CONTENT OF CONTINGENCY PLAN; HAZ WASTE FACILITIES	HAZARDOUS WASTE FACILITIES MUST HAVE A CONTINGENCY PLAN THAT ADDRESSES ANY UNPLANNED RELEASE OF HAZARDOUS WASTES OR HAZARDOUS CONSTIUENTS *INTO THE AIR, SOIL OR SURFACE WATER.* THIS RULE ESTABLISHES THE MINIMUM	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-50, 3745-54-37	ACTION		40CFR112 / 1510	3/30/93
					REQUIRED INFORMATION OF SUCH A PLAN.						
HW		3745-54-53	A,B	COPIES OF CONTINGENCY PLAN; HAZARDOUS WASTE FACILITIES	COPIES OF THE CONTINGENCY PLAN REQUIRED BY 3745-54-50 MUST BE MAINTAINED AT THE FACILITY AND SUBMITTED TO ALL LOCAL POLICE DEPARTMENTS, FIRE DEPARTMENTS, HOSPITALS LOCAL EMERGENCY RESPONSE TEAMS AND THE OHIO EPA.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF)	3745-54-01, 3745-54-52	ACTION			3/30/93
HW		3745-54-54	A	AMENDMENT OF CONTINGENCY PLAN; HAZ WASTE FACILITIES	THE CONTINGENCY PLAN MUST BE AMENDED IF IT FAILS IN AN EMERGENCY, THE FACILITY CHANGES (IN ITS DESIGN, CONSTRUCTION, MAINTENANCE OR OPERATION), THE LIST OF EMERGENCY COORDINATORS CHANGE OR THE LIST OF EMERGENCY EQUIPMENT.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-52, 3745-54-53	ACTION			
HW		3745-54-55		EMERGENCY COORDINATOR; HAZARDOUS WASTE FACILITIES	AT ALL TIMES THERE SHOULD BE AT LEAST ONE EMPLOYEE EITHER ON THE PREMISES OR ON CALL TO COORDINATE ALL EMERGENCY REPSONSE MEASURES.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).		ACTION			
HW		3745-54-56	A-I	EMERGENCY PROCEDURES; HAZARDOUS WASTE FACILITIES	SPECIFIES THE PROCEDURES TO BE FOLLOWED IN THE EVENT OF AN EMERGENCY.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN DISPOSED OF).	3745-54-01, 3745-54-55	ACTION			
HW		3745-54-90		GROUND WATER PROTECTION; APPLICABILITY	ESTABLISHES CIRCUMSTANCES UNDER WHICH AN OPERATOR OF A HAZARDOUS WASTE FACILITY MUST IMPLEMENT A GROUND WATER PROTECTION PROGRAM OR A CORRECTIVE ACTION PROGRAM.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		LOCATION	ACTION		
HW		3745-54-91	A	REQ GROUND WATER PROGRAMS FOR HAZ WASTE FACILITIES	PRESENTS THE GROUND WATER MONITORING AND RESPONSE PROGRAMS REQUIRED FOR HAZARDOUS WASTE LAND-BASED UNITS.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-54-90	ACTION			
HW		3745-54-92		GROUND WATER PROTECTION STANDARD; HAZ WASTE FACILITIES	COMPLIANCE MUST BE ATTAINED WITH THE CONDITIONS SPECIFIED IN THE PERMIT TO ENSURE THAT HAZARDOUS CONSTIUENTS (SEE 3745-54-93) DO NOT EXCEED THE PROMULGATED LIMITS (SEE 3745-54-94).	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-54-90	ACTION	CHEMICAL		
HW		3745-54-93	A,B	HAZARDOUS CONSTITUENTS IN GROUND WATER; HAZ WASTE FAC	REQUIRES THAT PERMIT SPECIFY HAZARDOUS CONSITIUENTS TO WHICH THE GROUND WATER PROTECTION STANDARD OF 3745-54-92 APPLIES. HAZARDOUS CONSTITUENTS ARE CONSTITUENTS IDENTIFIED IN THE APPENDIX OF THIS RULE THAT HAVE BEEN DETECTED IN GROUND WATER IN THE UPPERMOST AQUIFER UNDERLYING THE UNIT(S) AND ARE REASONABLY EXPECTED TO BE IN OR DERIVED FROM WASTE CONTAINED IN THE UNIT(S).	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		CHEMICAL			
HW		3745-54-94	A,B	CONCENTRATION LIMITS FOR GROUND WATER; HAZ WASTE FAC	PRESENTS THE METHODOLOGY FOR DETERMINING CONCENTRATION LIMITS AND ALTERNATIVE CONCENTRATION LIMITS.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		CHEMICAL			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FEDERAL REGULATION	LAST REVISION
HW		3745-54-95	A,B	POINT OF COMPLIANCE FOR GROUND WATER; HAZ WASTE FACIL	ESTABLISHES POINT OF COMPILANCE AT VERTICAL SURFACE LOCATED AT THE HYDRAULICALLY DOWNGRADIENT LIMIT OF THE WASTE MANAGEMENT AREA THAT EXTENDS DOWN INTO THE UPPERMOST AQUIFER UNDERLYING THE UNIT(S).	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION	CHEMICAL		
HW		3745-54-96	A,B,C	COMPLIANCE PERIOD FOR GROUND WATER; HAZ WASTE FACIL	A COMPLIANCE PERIOD DURING WHICH THE GROUND WATER PROTECTION STANDARDS APPLY WILL BE SPECIFIED IN THE PERMIT. RULE REQUIRES THAT THE COMPLIANCE PERIOD FOR A FACILITY UNDERGOING A CORRECTIVE ACTION PROGRAM WILL EXTEND UNTIL IT CAN BE DEMONSTRATED THAT THE GROUND WATER PROTECTION STANDARD OF OAC 3745-54-92 HAS NOT BEEN EXCEEDED FOR A PERIOD OF THREE CONSECUTIVE YEARS.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION	CHEMICAL		3/30/93
HW		3745-54-97	A-H	GEN GROUND WATER MONITORING REQUIREMENTS; HAZ WASTE FAC	PRESENTS GENERAL GROUND WATER MONITORING PROGRAM REQUIREMENTS. INCLUDES NUMBER, LOCATION AND DEPTH OF WELLS, CASING REQUIREMENTS, SAMPLING AND ANALYSIS PROCEDURES, ETC.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION	CHEMICAL		
HW		3745-54-98	A-I	GROUND WATER DETECTION MONITORING PROG; HAZ WASTE FAC	PRESENTS REQUIREMENTS OF GROUND WATER DETECTION PROGRAM.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS) AT WHICH HAZARDOUS CONSTITUENTS HAVE NOT BEEN DETECTED IN THE GROUND WATER. THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-54-90, 3745-54-95	ACTION	CHEMICAL		
HW		3745-54-99	A-J	GROUND WATER COMPLIANCE MONITORING PROG; HAZ WASTE FAC	PRESENTS REQUIREMENTS OF GROUND WATER COMPLIANCE MONITORING PROGRAM.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS) AT WHICH HAZARDOUS CONSTITUENTS HAVE BEEN DETECTED. THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION	CHEMICAL		
HW		3745-55-01	A-F	GROUND WATER CORRECTIVE ACTION PROGRAM; HAZ WASTE FAC	PRESENTS THE REQUIREMENTS OF A GROUND WATER CORRECTIVE ACTION PROGRAM THAT PREVENTS HAZARDOUS CONSTITUENTS FROM EXCEEDING THEIR RESPECTIVE CONCENTRATION LIMITS AT THE COMPLIANCE POINT BY EITHER REMOVAL OR TREATMENT OF THESE HAZARDOUS CONSTITUENTS.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS) AT WHICH HAZARDOUS CONSTITUENTS HAVE BEEN DETECTED. THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-54-90 THROUGH 3745-54-99	ACTION	CHEMICAL		
HW		3745-55-011	A,C	CORRECTIVE ACTION FOR WASTE MANAGEMENT UNITS	REQUIRES AN APPLICANT FOR A HAZARDOUS WASTE PERMIT TO INSTITUTE CORRECTIVE ACTION FOR ALL RELEASES OF HAZARDOUS WASTE OR CONSTITUENTS FROM ANY WASTE MANAGEMENT UNIT, REGARDLESS OF THE TIME AT WHICH WASTE WAS PLACED IN SUCH UNIT.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS, LANDFILLS) AT WHICH HAZARDOUS CONSTITUENTS HAVE BEEN DETECTED. THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-55-01	ACTION			3/30/93
HW		3745-55-11	A,B,C	GENERAL CLOSURE PERFORMANCE STANDARD; HAZ WASTE FACIL	REQUIRES THAT ALL HAZARDOUS WASTE FACILITIES BE CLOSED IN A MANNER THAT MINIMIZES THE NEED FOR FURTHER MAINTENANCE, CONTROLS, MINIMIZES, ELIMINATES OR PREVENTS POST-CLOSURE ESCAPE OF HAZARDOUS WASTE, HAZARDOUS CONSTITUENTS, LEACHATE, CONTAMINATED RUN-OFF OR HAZARDOUS WASTE DECOMPOSITION PRODUCTS TO THE GROUND OR SURFACE WATER OR THE ATMOSPHERE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN TREATED, STORED OR DISPOSED OF).		ACTION			

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CATEGORY											
HW		3745-55-12	B	CONTENT OF CLOSURE PLAN; HAZ WASTE FACILITIES	SPECIFIES THE MINIMUM INFORMATION REQUIRED IN A CLOSURE PLAN FOR OHIO EPA TO DETERMINE THE ADEQUACY OF THE PLAN.	SUBSTANTIVE REQUIREMENTS PERTAIN TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN TREATED, STORED OR DISPOSED OF).	3745-55-10, 3745-55-11	ACTION			
HW		3745-55-14		DISPOSAL/ DECON OF EQUIPMENT, STRUCTURES & SOILS	REQUIRES THAT ALL CONTAMINATED EQUIPMENT, STRUCTURES AND SOILS BE PROPERLY DISPOSED OF OR DECONTAMINATED. REMOVAL OF HAZARDOUS WASTES OR CONSTITUENTS FROM A UNIT MAY CONSTITUTE GENERATION OF HAZARDOUS WASTES.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE IS TO BE TREATED, STORED OR DISPOSED OF (OR HAS BEEN TREATED, STORED OR DISPOSED OF).	3745-55-10	ACTION			
HW		3745-55-17	B	POST-CLOSURE CARE AND USE OF PROPERTY	SPECIFIES THE POST-CLOSURE CARE REQUIREMENTS, INCLUDING MAINTENANCE, MONITORING AND POST-CLOSURE USE OF PROPERTY.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (LANDFILLS AND SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS AND TANKS THAT MEET REQUIREMENTS OF LANDFILLS AFTER CLOSURE). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION			
HW		3745-55-18	B	POST-CLOSURE PLAN	PRESENTS THE INFORMATION NECESSARY FOR OHIO EPA TO DETERMINE THE ADEQUACY OF A POST-CLOSURE PLAN.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (LANDFILLS AND SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS AND TANKS THAT MEET REQUIREMENTS OF LANDFILLS AFTER CLOSURE). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION			
HW		3745-55-19	B	NOTICE TO LOCAL LAND AUTHORITY	REQUIRES THAT A RECORD OF THE TYPE, LOCATION AND QUANTITY OF HAZARDOUS WASTES DISPOSED OF IN EACH UNIT BE SUBMITTED TO THE LOCAL LAND AUTHORITY AND THE DIRECTOR OF THE OHIO EPA. ALSO REQUIRES THAT A NOTATION TO THE DEED TO THE FACILITY PROPERTY BE MADE INDICATING THAT THE LAND WAS USED TO MANAGE HAZARDOUS WASTES AND THAT CERTAIN USE RESTRICTIONS MAY APPLY TO THE PROPERTY.	PERTAINS TO ALL SITES WITH LAND-BASED HAZARDOUS WASTE UNITS (LANDFILLS AND SURFACE IMPOUNDMENTS, WASTE PILES, LAND TREATMENT UNITS AND TANKS THAT MEET REQUIREMENTS OF LANDFILLS AFTER CLOSURE). THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION			
HW		3745-55-71		CONDITION OF CONTAINERS	CONTAINERS HOLDING HAZARDOUS WASTE MUST BE MAINTAINED IN GOOD CONDITION (NO RUST OR STRUCTURAL DEFECTS).	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-72		COMPATIBILITY OF WASTE WITH CONTAINERS	HAZARDOUS WASTES PLACED IN CONTAINER MUST NOT REACT WITH THE CONTAINER MATERIAL OR LINER MATERIAL.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-73		MANAGEMENT OF CONTAINERS	CONTAINERS HOLDING HAZARDOUS WASTE MUST BE CLOSED (EXCEPT TO ADD OR REMOVE WASTE) AND MUST NOT BE HANDLED IN A MANNER THAT MAY RUPTURE THE CONTAINER OR CAUSE IT TO LEAK.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-74		CONTAINER INSPECTIONS	REQUIRES AT LEAST WEEKLY INSPECTIONS OF CONTAINER STORAGE AREAS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-75	A,B,C,D	CONTAINER STORAGE AREA CONTAINMENT SYSTEM	REQUIRES THAT CONTAINER STORAGE AREAS HAVE A CONTAINMENT SYSTEM AND SPECIFIES THE MINIMUM REQUIREMENTS OF SUCH A SYSTEM.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-76		CONTAINER REQUIREMENTS FOR IGNITABLE/REACTIVE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN TO PREVENT ACCIDENTAL IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTES THAT WILL BE STORED IN CONTAINERS.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY REACTIVE OR IGNITABLE WASTES THAT ARE STORED, OR ARE TO BE STORED, IN CONTAINERS.	3745-55-70	ACTION	CHEMICAL		

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CATEGORY											
HW		3745-55-77	A,B,C	CONTAINER REQUIREMENTS FOR INCOMPATIBLE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH INCOMPATIBLE WASTES.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY INCOMPATIBLE WASTES ARE PRESENT.	3745-55-70	ACTION	CHEMICAL		
HW		3745-55-78		CONTAINER CLOSURE REQUIREMENTS	SPECIFIES CLOSURE REQUIREMENTS FOR CONTAINERS AND CONTAINMENT SYSTEM.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE STORED IN CONTAINERS.	3745-55-70	ACTION			
HW		3745-55-91	A,B,D	ASSESSMENT OF EXISTING TANK SYSTEMS INTEGRITY	REQUIRES THAT EACH EXISTING TANK USED TO STORE OR TREAT HAZARDOUS WASTE THAT DOES NOT HAVE SECONDARY CONTAINMENT BE TESTED TO ASSURE TANK INTEGRITY.	PERTAINS TO ANY SITE WHICH HAS EXISTING HAZARDOUS WASTE TREATMENT OR STORAGE TANKS THAT LACK SECONDARY CONTAINMENT.	3745-55-90	ACTION			
HW		3745-55-92	A-G	DESIGN & INSTALLATION OF NEW TANK SYSTEMS OR COMPONENTS	REQUIRES A SECONDARY CONTAINMENT SYSTEM FOR TANKS AND ASSESSMENT TO DETERMINE TANK INTEGRITY.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-93	A-G,I	CONTAINMENT AND DETECTION OF RELEASES FOR TANK SYSTEMS	REQUIRES SECONDARY CONTAINMENT AND LEAK DETECTION SYSTEMS FOR TANKS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-94	A,B,C	GENERAL OPERATING REQUIREMENTS FOR TANK SYSTEMS	SPECIFIES GENERAL OPERATING REQUIREMENTS FOR TANK SYSTEMS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-95	A-D	INSPECTIONS OF TANK SYSTEMS	REQUIRES INSPECTIONS AT LEAST ONCE EACH OPERATING DAY.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-96	A,B,C,E	RESPONSE TO LEAKS OR SPILLS OF TANK SYSTEMS	REQUIRES THAT UNFIT TANKS BE REMOVED FROM USE AND FURTHER RELEASES BE PREVENTED.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-97	A,B	CLOSURE AND POST-CLOSURE CARE FOR TANK SYSTEMS	SPECIFIES CLOSURE AND POST-CLOSURE REQUIREMENTS FOR TANK SYSTEMS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN TANKS.	3745-55-90	ACTION			
HW		3745-55-98		TANK REQUIREMENTS FOR IGNITABLE/REACTIVE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN TO PREVENT ACCIDENTAL IGNITION OR REACTION OF IGNITABLE OR REACTIVE WASTES THAT ARE TREATED OR STORED IN TANKS.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY REACTIVE OR IGNITABLE WASTES ARE STORED OR TREATED (OR TO BE STORED OR TREATED) IN EXISTING TANKS.	3745-55-90	ACTION			
HW		3745-55-99	A,B	TANK REQUIREMENTS FOR INCOMPATIBLE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH POTENTAILLY INCOMPATIBLE WASTES THAT ARE STORED OR TREATED IN TANKS.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY INCOMPATIBLE WASTES ARE STORED OR TREATED (OR TO BE STORED OR TREATED) IN TANKS.	3745-55-90	ACTION			
HW		3745-56-21	A-G	DESIGN & OPERATING REQUIREMENTS ; SURFACE IMPOUNDMENTS	PRESENTS DESIGN AND OPERATING CRITERIA FOR SURFACE IMPOUNDMENTS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION			
HW		3745-56-26	A,B,C	MONITORING & INSPECTION OF SURFACE IMPOUNDMENTS	REQUIRES INSPECTION OF LINERS DURING CONSTRUCTION. ALSO REQUIRES WEEKLY AND AFTER STORM INSPECTIONS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION			
HW		3745-56-27	A-E	EMERGENCY REPAIRS & CONTINGENCY PLANS ; SURFACE IMPOUND	SPECIFIES WHEN AND HOW SURFACE IMPOUNDMENTS SHOULD BE REMOVED FROM SERVICE FOR REPAIRS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION			
HW		3745-56-28	A,B,C	CLOSURE & POST-CLOSURE OF SURFACE IMPOUNDMENTS	PROVIDES CLOSURE AND POST-CLOSURE REQUIREMENTS FOR SURFACE IMPOUNDMENTS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION			

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CATEGORY	SUB	CITATION	PARAGRAPH	TITLE							
HW		3745-56-29	A,B	SURFACE IMP. REQUIREMENTS FOR IGNITABLE/REACTIVE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH POTENTAILLY IGNITABLE OR REACTIVEE WASTES THAT ARE STORED OR TREATED IN SURFACE IMPOUNDMENTS.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY IGNITABLE OR REACTIVE HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL	3745-56-20	ACTION	CHEMICAL		
						NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.					
HW		3745-56-30		SURFACE IMPOUND. REQUIREMENTS FOR INCOMPATIBLE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH POTENTAILLY INCOMPATIBLE WASTES THAT ARE STORED OR TREATED IN SURFACE IMPOUNDMENTS.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY INCOMPATIBLE HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION	CHEMICAL		
HW		3745-56-31	A	CONSTRUCTION INSPECTIONS OF SURFACE IMPOUNDMENTS	ALLOWS OHIO EPA OPPORTUNITY TO INSPECT SURFACE IMPOUNDMENTS DURING CONSTRUCTION AND INSTALLATION.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.		ACTION			
HW		3745-56-33	A,B	SPECIAL REQUIREMENTS FOR "F" WASTES IN SURFACE IMPOUND.	PROHIBITS THE PLACEMENT OF HAZARDOUS WASTES F020, F021, F022, F023, F026 AND F027 IN SURFACE IMPOUNDMENTS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS F-WASTE ARE TREATED OR STORED IN SURFACE IMPOUNDMENTS (LAGOONS). PERTAINS TO SITES WHICH HAVE SURACE IMPOUNDMENTS THAT WILL NOT BE (OR HAVE NOT BEEN) CLEAN CLOSED.	3745-56-20	ACTION	CHEMICAL		
HW		3745-56-51	A-F	DESIGN & OPERATING REQUIREMENTS FOR WASTE PILES	SPECIFIES THE DESIGN AND OPERATION REQUIREMENTS FOR WASTE PILES. INCLUDES LINER SYSTEM, LEACHATE COLLECTION AND REMOVAL SYSTEM, WIND DISPERSAL PREVENTION AND RUN-ON/RUN-OFF CONTROL.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION			
HW		3745-56-54	A,B	MONITORING & INSPECTION OF WASTE PILES	WASTE PILES MUST BE MONITORED DURING CONSTRUCTION OR INSTALLATION AND OPERATION.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION			
HW		3745-56-56	A,B	WASTE PILE REQUIREMENTS FOR IGNITABLE/ REACTIVE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH POTENTAILLY IGNITABLE OR REACTIVE HAZARDOUS WASTES THAT ARE STORED OR TREATED IN WASTE PILES.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY IGNITABLE OR REACTIVE HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION	CHEMICAL		
HW		3745-56-57	A,B,C	WASTE PILE REQUIREMENTS FOR INCOMPATIBLE WASTES	PRESENTS GENERAL PRECAUTIONS TO BE TAKEN WHEN DEALING WITH POTENTAILLY INCOMPATIBLE WASTES THAT ARE STORED OR TREATED IN WASTE PILES.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY INCOMPATIBLE HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION	CHEMICAL		
HW		3745-56-58	A,B,C	CLOSURE & POST-CLOSURE CARE FOR WASTE PILES	SPECIFIES CLOSURE AND POST-CLOSURE CARE REQUIREMENTS FOR WASTE PILES.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION			
HW		3745-56-59	A	CONSTRUCTION INSPECTIONS FOR WASTE PILES	ALLOWS OHIO EPA THE OPPORTUNITY TO INSPECT WASTE PILES DURING CONSTRUCTION.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTE WILL BE EITHER STORED OR TREATED IN WASTE PILES.		ACTION			
HW		3745-56-60	A,B	SPECIAL REQUIREMENTS FOR "F" WASTES IN WASTE PILES	PROHIBITS THE PLACEMENT OF HAZARDOUS WASTES F020, F021, F022, F023, F026 AND F027 IN WASTE PILES.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS F-WASTES WILL BE EITHER STORED OR TREATED IN WASTE PILES.	3745-56-50	ACTION	CHEMICAL		
HW		3745-56-71	A,C	LAND TREATMENT PROGRAM	A LAND TREATMENT PROGRAM MUST BE DESIGNED TO ENSURE THAT HAZARDOUS CONSTITUENTS PLACED IN OR ON THE TREATMENT ZONE ARE DEGRADED, TRANSFORMED OR IMMOBILIZED WITHIN THE TREATMENT ZONE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION			
HW		3745-56-72	A,C	LAND TREATMENT DEMONSTRATION	PRIOR TO THE ACTUAL LAND TREATMENT PROGRAM, A DEMONSTRATION (FIELD OR LABORATORY TESTS) MUST BE CONDUCTED.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION			

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CATEGORY												
HW		3745-56-73	A-G	LAND TREATMENT DESIGN AND OPERATING REQUIREMENTS	A LAND TREATMENT UNIT MUST BE DESIGNED, CONSTRUCTED, OPERATED AND MAINTAINED TO MAXIMIZE DEGRADATION, TRANSFORMATION AND IMMOBILIZATION OF HAZARDOUS CONSTITUENTS IN THE TREATMENT ZONE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION			
HW		3745-56-76	A-C,E	LAND TREATMENT FOOD-CHAIN CROPS	FOOD CHAIN CROPS MAY ONLY BE GROWN IN OR ON THE TREATMENT ZONE IF ALLOWED BY THE DIRECTOR. THE CRITERIA FOR THE DIRECTOR TO MAKE THIS DECISION ARE PROVIDED IN THIS RULE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.I	3745-56-70	ACTION			
HW		3745-56-78	A-F	LAND TREATMENT UNSATURATED ZONE MONITORING	AN UNSATURATED ZONE MONITORING PROGRAM MUST BE ESTABLISHED FOR ALL LAND TREATMENT UNITS. THE REQUIREMENTS OF THIS PROGRAM ARE PRESENTED BY THIS RULE.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION	CHEMICAL		
HW		3745-56-80	A-E	LAND TREATMENT CLOSURE & POST-CLOSURE CARE	ESTABLISHES CLOSURE AND POST-CLOSURE REQUIREMENTS FOR LAND TREATMENT UNITS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION			
HW		3745-56-81	A,B	LAND TREATMENT REQUIREMENTS; IGNITABLE/REACTIVE WASTES	PROHIBITS THE APPLICATION OF IGNITABLE OR REACTIVE WASTE TO THE TREATMENT ZONE, EXCEPT UNDER CERTAIN CIRCUMSTANCES.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY IGNITABLE OR REACTIVE HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION	CHEMICAL		
HW		3745-56-82		LAND TREATMENT REQUIREMENTS FOR INCOMPATIBLE WASTES	PROHIBITS THE PLACEMENT OF INCOMPATIBLE WASTE IN OR ON THE TREATMENT ZONE.	PERTAINS TO ANY SITE AT WHICH POTENTIALLY INCOMPATIBLE HAZARDOUS WASTES WILL BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION	CHEMICAL		
HW		3745-56-83	A,B	SPECIAL REQUIREMENTS FOR "F" WASTES IN LAND TREATMENT	PROHIBITS THE PLACEMENT OF HAZARDOUS WASTES F020, F021, F022, F023, F026 AND F027 IN LAND TREATMENT UNITS.	PERTAINS TO ANY SITE AT WHICH HAZARDOUS F-WASTES ARE TO BE TREATED OR DISPOSED OF IN LAND TREATMENT UNITS.	3745-56-70	ACTION	CHEMICAL		
HW		3745-57-01	A-D	ENVIRONMENTAL PERFORMANCE STANDARDS; LAND-BASED UNITS	SPECIFIES LOCATION, DESIGN, CONSTRUCTION, OPERATION, MAINTENANCE AND CLOSURE REQUIREMENTS FOR LANDFILLS, WASTE PILES, SURFACE IMPOUNDMENTS AND UNDERGROUND INJECTION WELLS.	PERTAINS TO ALL SITES THAT EITHER HAVE OR WILL HAVE AT LEAST ONE OF THE FOLLOWING UNITS ON-SITE: LANDFILLS, WASTE PILES, SURFACE IMPOUNDMENTS, LAND TREATMENT FACILITIES AND UNDERGROUND INJECTION WELLS (THIS INCLUDES EXISTING LAND-BASED AREAS OF CONTAMINATION).		ACTION			
HW		3745-57-03	A-I	LANDFILL DESIGN AND OPERATING REQUIREMENTS	PRESENTS DESIGN AND OPERATING REQUIREMENTS FOR LANDFILLS. INCLUDES LINER, LEACHATE COLLECTION AND REMOVAL, RUN-ON/RUN-OFF CONTROL, ETC.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED. THIS RULE ALSO PERTAINS TO EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-57-02	ACTION			
HW		3745-57-05	A,B	MONITORING AND INSPECTIONS OF LANDFILLS	REQUIRES INSPECTION OF LANDFILLS DURING CONSTRUCTION OR INSTALLATION AND OPERATION.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED. THIS RULE PERTAINS TO EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-57-02	ACTION			
HW		3745-57-10	A,B	LANDFILL CLOSURE AND POST-CLOSURE CARE	SPECIFIES CLOSURE AND POST-CLOSURE REQUIREMENTS FOR HAZARDOUS WASTE LANDFILLS. INCLUDES FINAL COVER AND MAINTENANCE.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED. THIS RULE PERTAINS TO EXISTING LAND-BASED AREAS OF CONTAMINATION.	3745-57-02	ACTION			
HW		3745-57-12	A,B	LANDFILL REQUIREMENTS FOR IGNITABLE/REACTIVE WASTES	PROHIBITS THE DISPOSAL OF IGNITABLE OR REACTIVE WASTE IN A LANDFILL, UNLESS THE WASTE IS TREATED, RENDERED OR MIXED SO THAT THE RESULTANT MATERIAL NO LONGER MEETS THE DEFINITION OF IGNITABLE OR REACTIVE WASTE.	PERTAINS TO ALL SITES AT WHICH POTENTIALLY IGNITABLE OR REACTIVE HAZARDOUS WASTE MAY BE LANDFILLED.	3745-57-02	ACTION	CHEMICAL		

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HW		3745-57-13		LANDFILL REQUIREMENTS FOR INCOMPATIBLE WASTES	PROHIBITS THE DISPOSAL OF INCOMPATIBLE WASTE IN THE SAME CELL OF A LANDFILL.	PERTAINS TO ALL SITES AT WHICH POTENTIALLY INCOMPATIBLE HAZARDOUS WASTE MAY BE LANDFILLED.	3745-57-02	ACTION	CHEMICAL		
HW		3745-57-14	A-D	LANDFILL REQUIREMENTS FOR BULK & CONTAINERIZED LIQUIDS	THE PLACEMENT OF BULK OR NON-CONTAINERIZED LIQUID HAZARDOUS WASTE OR HAZARDOUS WASTES CONTAINING FREE	PERTAINS TO ALL SITES AT WHICH A LIQUID HAZARDOUS WASTE OR HAZARDOUS WASTE CONTAINING FREE LIQUIDS ARE	3745-57-02	ACTION			
					LIQUIDS (WHETHER OR NOT ABSORBANTS HAVE BEEN ADDED) IN ANY LANDFILL IS PROHIBITED.	CONSIDERED FOR LANDFILLING.					
HW		3745-57-15	A,B	LANDFILL REQUIREMENTS FOR CONTAINERS	UNLESS THEY ARE VERY SMALL, CONTAINERS MUST EITHER BE AT LEAST 90% FULL WHEN PLACED IN THE LANDFILL OR CRUSHED/SHREDDED PRIOR TO PLACEMENT IN THE LANDFILL.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED AND CONTAINERS ARE TO BE DISPOSED OF IN THE LANDFILL.	3745-57-02	ACTION			
HW		3745-57-16	A-E	DISPOSAL OF SMALL CONTAINERS OF HAZ WASTES IN OVERPACKS	LAB PACKS CONTAINING HAZARDOUS WASTE MAY BE PLACED IN A LANDFILL IF CERTAIN REQUIREMENTS ARE MET.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED AND LAB PACKS ARE TO BE PLACED IN THE LANDFILL.	3745-57-02	ACTION			
HW		3745-57-17	A	LANDFILL CONSTRUCTION INSPECTIONS	ALLOWS OHIO EPA OPPORTUNITY TO INSPECT LANDFILL DURING CONSTRUCTION.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED. THIS RULE PERTAINS TO EXISTING LAND-BASED AREAS OF CONTAMINATION.		ACTION			
HW		3745-57-18	A,B	SPECIAL REQUIREMENTS FOR "F" WASTES IN LANDFILLS	PROHIBITS THE PLACEMENT OF HAZARDOUS WASTES F020, F021, F022, F023, F026 AND F027 IN LANDFILLS.	PERTAINS TO ALL SITES AT WHICH A HAZARDOUS WASTE LANDFILL WILL EITHER BE LOCATED OR AN EXISTING LANDFILL WILL BE EXPANDED AND F-WASTES ARE BEING CONSIDERED FOR LANDFILLING.	3745-57-02	ACTION	CHEMICAL		
HW		3745-57-91	A,B,C	ENVIRONMENTAL PERFORMANCE STANDARDS FOR MISC UNITS	ESTABLISHES LOCATION, DESIGN, CONSTRUCTION, OPERATION, MAINTENANCE AND CLOSURE REQUIREMENTS FOR MISCELLANEOUS UNITS USED TO TREAT, STORE OR DISPOSE OF HAZARDOUS WASTES.	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTES IN MISCELLANEOUS UNITS.	3745-57-90	ACTION	CHEMCIAL		
HW		3745-57-92		MONITORING, INSPECTING, ANALYZING, ... FOR MISC UNITS	REQUIRES THAT MONITORING, ANALYSIS, INSPECTION, RESPONSE, REPORTING AND CORRECTIVE ACTION BE CONDUCTED AS NECESSARY AT MISCELLANEOUS UNITS TO ASSURE THAT HUMAN HEALTH AND THE ENVIRONMENT ARE PROTECTED.	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTES IN MISCELLANEOUS UNITS.	3745-57-90	ACTION			
HW		3745-57-93		POST-CLOSURE CARE FOR MISC DISPOSAL UNITS	REQUIRES POST-CLOSURE CARE OF MISCELLANEOUS UNITS THAT ARE DISPOSAL UNITS AND OF TREATMENT OR STROAGE MISCELLANEOUS UNITS THAT THAT LEAVE CONTAMINATED SOILS OR GROUND WATER AFTER CLOSURE.	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES TREATMENT, STORAGE OR DISPOSAL OF HAZARDOUS WASTES IN MISCELLANEOUS UNITS.	3745-57-90	ACTION			
HW		3745-58-60	B(2)	RECYCLABLE MATERIALS USED FOR PRECIOUS METALS RECOVERY	SECIFIES REQUIREMENTS FOR GENERATORS AND STORERS OF RECYCLABLE MATERIALS THAT ARE RECLAIMED TO RECOVER PRECIOUS METALS (e.g. GOLD, SILVER, PLATINUM, ETC.)	PERTAINS TO ANY SITE AT WHICH THERE ARE MATERIALS ON-SITE WHICH MAY BE RECLAIMED FOR RECOVERY OF PRECIOUS METALS.		ACTION	CHEMICAL		4/2/93
HW		3745-58-70	A,B	REQUIREMENTS FOR RECLAIMING SPENT LEAD ACID BATTERIES	SPECIFIES REQUIREMENTS FOR PERSONS WHO RECLAIM SPENT LEAD ACID BATTERIES AND FOR PERSONS WHO GENERATE, STORE, TRANSPORT OR COLLECT THEM BUT DO NOT RECLAIM THEM.	PERTAINS TO ANY SITE AT WHICH THERE ARE SPENT LEAD ACID BATTERIES WHICH MAY BE RECLAIMED ON-SITE OR OFF-SITE.		ACTION			4/2/93
HW		3745-59-01	C,E	HAZARD WASTES RESTRICTED FROM LAND DISPOSAL-EXCEPTIONS	LISTS TYPE OF RESTRICTED WASTES THAT MAY BE LAND DISPOSED. LISTS TYPE OF HAZARDOUS WASTES NOT SUBJECT TO LDRs.	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES DISPOSAL OF HAZARDOUS WASTES ON-SITE	3745-59-05 TO 06 3745-59-30 TO 35	ACTION		49.CFR.144.6(A)	4/6/93

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HW		3745-59-03	A,B	DILUTION PROHIBITED AS A SUBSTITUTE FOR TREATMENT	PROHIBITS DILUTION OF A RESTRICTED WASTE OR THE RESIDUAL FROM TREATMENT OF A RESTRICTED WASTE AS A SUBSTITUTE FOR ADEQUATE TREATMENT IN ORDER TO LAND DISPOSE HAZARDOUS WASTE. DILUTION OF WATER WASTES IS	PERTAINS TO ANY ALTERNATIVE THAT INCORPORATES DISPOSAL OF HAZARDOUS WASTE ON-SITE.	3745-59-44 TO 44, 3745-59-30 TO 35	ACTION			4/6/93
					NOT IMPERMISSIBLE DILUTION UNLESS A METHOD HAS BEEN SPECIFIED AS A TREATMENT STANDARD.						
HW		3745-59-04	A	TREATMENT SURFACE IMPOUNDMENT EXCEMPTION	WASTES PROHIBITED FROM LAND DISPOSAL MAY BE TREATED IN A SURFACE IMPOUNDMENT PROVIDED THAT THE CONDIDTIONS STATED IN PARAGRAPH A ARE MET.	PERTAINS TO ANY SITE AT WHICH ON-SITE HAZARDOUS WASTES WILL BE TREATED IN A SURFACE IMPOUNDMENT.	3745-59-30 TO 35 3745-54 TO 56	ACTION			4/6/93
HW		3745-59-07	A,B,C	WASTE ANALYSIS OF HAZARDOUS WASTE	GENERATOR SHALL TEST THE WASTE OR TEST AN EXTRACT OF THE WASTE ACCORDING TO THE FREQUENCY AND TEST METHODS DESCRIBED IN THE RULES, TO DETERMINE IF THE WASTE IS RESTRICTED FROM LANAD DISPOSAL.	PERTAINS TO AN ALTERNATIVE THAT INCORPORATES DISPOSAL OF HAZARDOUS WASTE ON-SITE.	3745-51,3745-54-13,3745-59-32	ACTION			4/7/93
HW		3745-59-09	B,C	SPECIAL RULES REGARDING WASTE THAT EXHIB A CHARACTERIST	PROHIBITS LAND DISPOSAL OF CHARACTERISTIC WASTE UNLESS THE WASTE COMPLIES WITH THE TREATMENT STANDARDS OF LISTED WASTES. IF THE WASTE IS BOTH LISTED AND EXHIBITS A CHARACTERISTIC, THE TREATMENT STANDARD FOR THE LISTED WASTE WILL OPERATE IN LIEU OF THE STANDARD FOR THE CHARACTERISTIC WASTE.	PERTAINS TO ANY SITE IN WHICH ON-SITE DISPOSAL OF HAZARDOUS WASTE IS AN ALTERNATIVE.	3745-51-20 TO 24 3745-51-30 TO 33	ACTION	CHEMICAL		4/12/93
HW		3745-59-30	A,B,C	WASTE SPECIFIC PROHIBITIONS	PROHIBITS SPENT SOLVENT WASTES OR CONTAMINATED SOIL AND DEBRIS RESULTING FROM A RESPONSE ACTION UNDER CERCLA OR RCRA TO BE LAND DISPOSED UNLESS GENERATOR MEETS TREATMENT STANDARDS (3745-59-40 TO 44) OR HAS BEEN GRANTED AN EXTENSION OR EXCEMPTION	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF HAZARDOUS WASTE IS AN ALTERNATIVE	3745-59-05 TO 06 3745-59-40 TO 44	ACTION	CHEMICAL		4/12/93
HW		3745-59-31	A,B,C,D	DIOXIN WASTE PROHIBITIONS	PROHIBITS ON-SITE DISPOSAL OF DIOXIN WASTE UNLESS IT MEETS TREATEMENT STANDARDS OF RULES 3745-59-40 TO 44 OR THE GENERATOR HAS BEEN GRANTED AN EXTENSION OR EXEMPTION.	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF DIOXIN WASTE IS AN ALTERNATIVE	3745-59-05 TO 06 3745-59-40 TO 44	CHEMICAL	ACTION		4/12/93
HW		3745-59-32	A,D,E,F	CALIFORNIA LIST WASTES PROHIBITIONS	PROHIBITS LAND DISPOSAL OF FOLLOWING WASTES: 1. LIQUID WASTES WITH pH<2 OR pH=2; 2. LIQUID WASTES CONTAINING PCBs WITH CONC=50 OR CONC>50 PPM; 3. LIQUID WASTES WITH HALOGENATED ORGANIC LOADING OF > OR = 1000mg/l AND LESS THAN 10,000 mg/l	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF PCB OR HOC CONTAMINATED WASTE IS AN ALTERNATIVE	3745-59-05 TO 06 3745-59-40 TO 44	CHEMICAL	ACTION	40CFR268.5(h)2	4/12/93
HW		3745-59-33	A,B,C,D,E,F,G	FIRST THIRD WASTES PROHIBITIONS	PROHIBITS ON-SITE LAND DISPOSAL OF FIRST THIRD WASTES UNLESS REQUIREMENTS OF PARAGRAPHS D,E,F,G ARE MET	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF FIRST THIRD HAZARDOUS WASTES IS AN ALTERNATIVE	3745-59-40 TO 44	CHEMICAL	ACTION	40CFR268.5(h)2	4/12/93
HW		3745-59-34	A-H	SECOND THIRD WASTES PROHIBITIONS	PROHIBITS ON-SITE LAND DISPOSAL OF SECOND THIRD WASTES UNLESS REQUIREMENTS OF PARAGRAPHS D,E,F,G ARE MET	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF SECOND THIRD HAZARDOUS WASTES IS AN ALTERNATIVE	3745-59-40 TO 44	CHEMICAL	ACTION	40CFR268.5(h)2	4/12/93
HW		3745-59-35	A-I	THIRD THIRD WASTES PROHIBITIONS	PROHIBITS ON-SITE LAND DISPOSAL OF THIRD THIRD WASTES UNLESS REQUIREMENTS OF PARAGRAPHS D,E,F,G ARE MET	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF THIRD THIRD HAZARDOUS WASTES IS AN ALTERNATIVE	3745-59-40 TO 44	CHEMICAL	ACTION	40CFR268.5(h)2	4/12/93

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CATEGORY		CITE									LAST REVISION
HW		3745-59-40	A,B,C	APPLICABILITY OF TREATMENT STANDARDS	PROHIBITS ON-SITE LAND DISPOSAL OF RESTRICTED WASTE UNLESS THE WASTE IS TESTED USING TEST METHOD IN THE APPENDIX TO RULE OAC 3745-21-24 OR THIS RULE AND THE CONCENTRATION OF ANY HAZARDOUS CONSITUENT DOES NOT	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF RESTRICTED WASTE MAY BE AN ALTERNATIVE.	3745-59-42, 3745-51-24,3745-59-43	CHEMICAL	ACTION		4/12/93
					EXCEED THE CONCENTRATION SHOWN IN TABLE CCWE OF RULE 3745-59-41 OR TABLE CCW OF RULE 3745-59-43. A WASTE TREATED USING A TECHNOLOGY SPECIFIED UNDER RULE 3745-59-42 OR EQUIVALENT MAY BE LAND DISPOSED.						
HW		3745-59-41	A	TREATMENT STANDARDS AS CONCENTRATIONS IN WASTE EXTRACTS	RESTRICTED WASTE SHOULD BE TREATED TO CONCENTRATION LEVELS SPECIFIED IN THIS RULE USING TEST METHOD IN THE APPENDIX TO RULE 3745-51-24 OR THE APPENDIX TO RULE 3745-59-40	PERTAINS TO ANY SITE IN WHICH ON-SITE LAND DISPOSAL OF RESTRICTED WASTE IS AN ALTERNATIVE	3745-51-24, 3745-59-40	CHEMICAL			4/12/93
HW		3745-59-42	A,C,D	TREATMENT STANDARDS EXPRESSED AS SPECIFIED TECHNOLOGIES	ESTABLISHES TREATMENT STANDARDS FOR LIQUID HAZARDOUS WASTE CONTAINING PCBs, NON-LIQUID HAZARDOUS WASTE CONTAINING HALOGENATED ORGANIC COMPOUNDS (HOCs) AND LAB PACKS. RADIOACTIVE HAZARDOUS MIXED WASTES ARE NOT SUBJECT TO TREATMENT STANDARDS	PERTAINS TO ANY SITE IN WHICH ON-SITE TREATMENT AND DISPOSAL OF HAZARDOUS WASTE CONTAINING EITHER PCB LIQUID WASTE OR HOC NON-LIQUID WASTE MIGHT TAKE PLACE	3745-59-40 TO 44	ACTION	CHEMICAL		4/12/93
HW		3745-59-43	A,B,C	TREATMENT STANDARDS EXPRESSED AS WASTE CONCENTRATIONS	IDENTIFIES THE RESTRICTED WASTES AND THE CONCENTRATIONS OF THEIR ASSOCIATED HAZARDOUS CONSITUENTS WHICH MAY NOT BE EXCEEDED BY THE WASTE OR TREATMENT RESIDUAL FOR THE ALLOWABLE LAND DISPOSAL OF SUCH WASTE OR RESIDUAL	PERTAINS TO ANY SITE IN WHICH ON-SITE TREATMENT AND DISPOSAL OF RESTRICTED WASTE IS AN ALTERNATIVE	3745-59-41,3745-59-07,3745-57-40 TO 51	CHEMICAL			4/12/93
HW		3745-59-50	A,B,C,D,E	PROHIBITION ON STORAGE OF RESTRICTED WASTE	PROHIBITS ON-SITE STORAGE OF HAZARDOUS WASTES RESTRICTED FROM LAND DISPOSAL BEYOND A SPECIFIED TIME FRAME STATED IN THE RULE.	PERTAINS TO ANY SITE IN WHICH STORAGE OF HAZARDOUS WASTE WILL OCCUR ON SITE TO FACILITATE PROPER RECOVERY, TREATMENT OR DISPOSAL. IN SOME CASES STORAGE OF RESTRICTED WASTES BEYOND ONE YEAR IS ALLOWED.					4/12/93
HW		3745-66-11	A,B	CLOSURE PERFORMANCE STANDARD	OWNER SHALL CLOSE FACILITY IN MANNER THAT MINIMIZES NEED FOR FURTHER MAINTENANCE AND REDUCES OR ELIMINATES POLLUTION OF GROUND WATER, SURFACE WATER OR ATMOSHPERE.i	CONSIDER FOR REMEDIAL PLANS THAT MAY REQUIRE EXTENDED OPERATION AND MAINTENANCE OF EQUIPMENT. CONSIDER ALTERNATIVES WITH LESS LONG-TERM O&M. APPLICABLE FOR RCRA FACILITIES, APPROPRIATE AND RELEVANT FOR OTHER SITES.					9/16/96
APC		3745-71-02		AMBIENT AIR QUALITY STANDARS - LEAD	THE AMBIENT QUALITY STANDARD FOR LEAD SHALL BE A MAXIMUM ARITHMETIC MEAN OF 1.5 MICROGRAMS PER CUBIC METER DURING ANY CALENDAR QUARTER.	CONSIDER FOR SITES WHERE INCINERATION OR WASTE FUEL RECOVERY MAY TAKE PLACE.		ACTION			
APC		3745-76-01	A,B	DEFINITIONS, NMOC LANDFILL GAS EMISSIONS	DEFINES TECHNICAL TERMS RELEVANT TO NONMETHANE GAS EMISSIONS FROM LANDFILLS	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-03	A-C	CONTROL REQUIREMENTS FOR MUNICIPAL SOLID WASTE LANDFILL	ESTABLISHES SIZE AND EMISSION RATE REQUIREMENT FOR NMOC GAS CONTROL. ESTABLISHES PERFORMANCE REQUIREMENTS OF 98 PERCENT GAS DESTRUCTION OR 20 PPM IN EXHAUST GAS.	CONSDIER FOR OLD LANDFILL SITES.					1/31/98
APC		3745-76-04		TEST METHODS AND PROCEDURES	REQUIRES CALCULATION OF GAS EMISSION RATEi	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-05		REPORTING AND RECORDKEEPING GUIDELINES	REQUIRES RECORD KEEPING IN ACCORDANCE WITH 3745-76-12 AND 13i	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-06	A,B	COMLIANCE TIMES	REQUIRES COMPLIANCE WITH TIME SCHEDULES ESTABLISHED IN 3745-76-06	CONSIDER FOR OLD LANDFILL SITES					1/31/98

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CATEGORY		OAC									LAST REVISION
APC		3745-76-07	A,B	STDS FOR AIR EMISSIONS FROM MUNICIPAL WASTE LANDFILLS	REQUIRES CALCULATION OF NMOC EMISSION VOLUMES, INSTALLATION OF GAS CONTROL SYSTEM IF THRESHOLD VOLUME OF 50 MEGAGRAMS/YEAR OF GAS IS EXCEEDED, AND START COLLECTION FROM EACH AREA THAT CEASES ACCEPTING	CONSIDER FOR OLD LANDFILL SITES.					1/31/98
					WASTES. SPECIFIES STANDARDS FOR TERMINATION OF GAS COLLECTION.						
APC		3745-76-08	A-G	OPERATIONAL STANDARDS FOR COLLECTION AND CONTROL	SPECIFIES OPERATIONAL PARAMETERS FOR GAS CONTROL SYSTEMS, INCLUDING TEMPERATURES AND GAS COMPOSITIONS IN SOURCE WELLS, GROUND LEVEL GAS COMPOSITIONS, AND MONITORING REQUIREMENTS.	CONSIDER FOR OLD LANDFILL SITES.					1/31/98
APC		3745-76-09	A-D	TESTS METHODS AND PROCEDURES	REQUIRES CALCULATION OF GAS EMISSION RATES, MEASUREMENT OF GAS COMPOSITION, MONITORING OF GAS VOLUMES AND COMPOSITONS COLLECTED, AND DETERMINATION OF CONTROL SYSTEM EFFICIENCY.	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-10	A-E	COMPLIANCE PROVISIONS	REQUIRES CALCULATION OF EXPECTED GAS EMISSION RATES, DEMONSTRATION OF ADEQUACY OF GAS CONTROL SYSTEM, OPERATION OF GAS CONTROL SYSTEM IN CLOSED AREAS, MEASUREMENT OF SURFACE GAS CONCENTRATIONS AND CORRECTIVE ACTIONS SHOULD EMISSION STANDARDS BE EXCEEDED.	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-11	A-F	MONITORING OF OPERATIONS	REQUIRES SAMPLING PORTS, MONITORING OF GAS TEMPERATURE, PRESSURE AND COMPOSITON, GAS FLOW RATES, AND FLAME TEMPERATURE. DEMONSTRATE ADEQUATE PERFORMANCE OF ALTERNATIVE COLLECTION SYSTEMS. MONITOR SURFACE GAS CONCENTRATIONS.	CONSIDER FOR OLD LANDFILL SITES					1/31/98
APC		3745-76-12	A-G	REPORTING REQUIREMENTS	ESTABLISHES REPORTING REQURIEMENTS FOR LANDFILL SUBJECT TO NMOC EMISSION CONTROL RULES. INCLUDES DESIGN AND TECHNICAL DETAILS OF EQUIPMENT AS WELL AS RESULTS OF EMISSION MONITORING.	CONSIDER FOR OLD LANDFILL SITES.					1/31/98
APC		3745-76-13	A-E	RECORDKEEPING REQUIREMENTS	ESTABLISHES REQUIREMENTS FOR RECORDS TO BE KEPT AT SITES SUBJECT TO NMOC EMISSION RULES.	CONSIDER FOR OLD LANDFILL SITES.					1/31/98
APC		3745-76-14	A-C	SPECIFICATIONS FOR ACTIVE COLLECTION SYSTEMS	REQUIRES ADEQUATE DURABILITY AND PERFORMANCE OF GAS COLLECTION EQUIPMENT. GIVES TECHNICAL REQUIREMENTS TO BE MET.	CONSIDER FOR OLD LANDFILL SITES.					1/31/98
APC		3745-76-15	A-D	FLARE REQUIREMENTS	SPECIFIES PERFORMANCE REQUIREMENTS FOR FLARES INCLUDING GAS FLOW RATES AND MINIMUM BTU CONTENT OF GAS TO BE FLARED.	CONSIDER FOR OLD LANDFILL SITES					1/31/98
DW		3745-81-11	A,B,C	MAXIMUM CONTAMINANT LEVELS FOR INORGANIC CHEMICALS	PRESENTS MAXIMUM CONTAMINANT LEVELS FOR INORGANICS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-12	A,B,C	MAXIMUM CONTAMINANT LEVELS FOR ORGANIC CHEMICALS	PRESENTS MCLS FOR ORGANICS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY											LAST REVISION
DW		3745-81-13	A,B	MAXIMUM CONTAMINANT LEVELS FOR TURBIDITY	PRESENTS MCLS FOR TURBIDITY.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-14	A-E	MAXIMUM MICROBIOLOGICAL CONTAMINANT LEVELS	PRESENTS MCLS FOR MICROBIOLOGICAL CONTAMINANTS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-15	A,B	MAX CONTAMINANT LEVELS FOR RADIUM 226,228,GROSS ALPHAS	PRESENTS MCLS FOR RADIUM-226, RADIUM-228 AND GROSS ALPHA PARTICLE ACTIVITY.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-16	A,B	MAX CONTAM LEVELS FOR BETA PARTICLE & PHOTON RADIOACTIV	PRESENTS MCLS FOR BETA PARTICLE AND PHOTON RADIOACTIVITY FROM MAN-MADE RADIONUCLIDES.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-21	A,B	MICROBIOLOGICAL CONTAMINANT SAMPLING & ANALYTICAL REQ	PRESENTS SAMPLING AND ANALYTICAL REQUIREMENTS FOR MICROBIOLOGICAL CONTAMINANTS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-22	A,B	TUBIDITY CONTAMINANT SAMPLING & ANALYTICAL REQUIREMENTS	PRESENTS SAMPLING AND ANALYTICAL REQUIREMENTS FOR TURBIDITY.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-23	A,E	INORGANIC CONTAMINANT MONITORING REQUIREMNENTS	PRESENTS MONITORING REQUIREMENTS FOR INORGANIC CONTAMINANTS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-24	A-E	ORGANIC CONTAMINANT MONITORING REQUIREMENTS	PRESENTS MONITORING REQUIREMENTS FOR ORGANIC CONTAMINANTS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-25	A-D	ANALYTICAL METHODS FOR RADIOACTIVITY	PRESENTS ANALYTICAL METHODS FOR RADIOACTIVITY.)	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-26	A,B,C	MONITORING FREQUENCY FOR RADIOACTIVITY	PRESENTS MONITORING REQIREMENTS FOR RADIOACTIVITY.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			4/22/93
DW		3745-81-27	A-E	ANALYTICAL TECHNIQUES	PRESENTS GENERAL ANALYTICAL TECHNIQUES FOR MCLS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			4/22/93
DW		3745-81-40	A,B,C	REQUIREMENTS FOR A VARIANCE FROM MCLS	PROVIDES CRITERIA BY WHICH DIRECTOR MAY GRANT VARIANCE FROM MCLS	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			
DW		3745-81-46		ALTERNATIVE TREATMENT TECHNIQUE VARIANCE	ALLOWS FOR THE USE OF ALTERNATIVE TREATMENT TECHNIQUES TO ATTAIN MCLS.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE.		CHEMICAL			

ABRIDGED LISTING OF OHIO UNIVERSAL A[illegible]ts

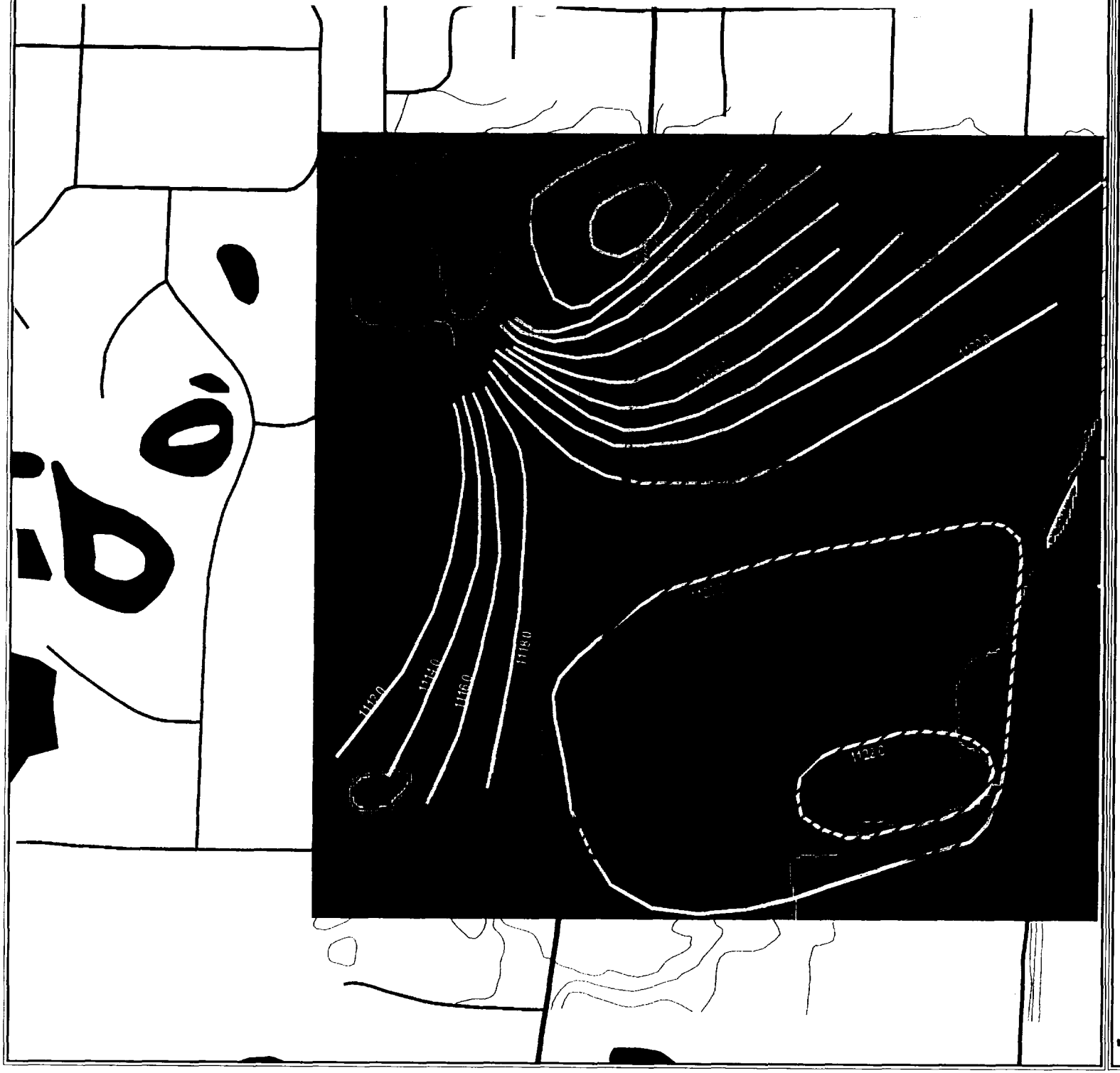
CATEGORY		SAC	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	LAST REVISION
DW		3745-81-60	A,B,C	SANITARY SURVEYS	SANITARY SURVEY REQUIREMENTS FOR SITES WHICH DO NOT COLLECT FIVE OR MORE ROUTINE TOTAL COLIFORM SAMPLES PER MONTH.	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED GROUND OR SURFACE WATER THAT IS EITHER BEING USED OR HAS THE POTENTIAL FOR USE AS DRINKING WATER SOURCE		CHEMICAL	ACTION		4/22/93
DW		3745-81-71	A,B	GEN REQ FOR FILTRATION & DISINFECTION FOR SURFACE WATER	TREATMENT STANDARDS FOR GIARDIA LAMBLIA, VIRUSES, HETEROTROPHIC PLATE COUNT BACTERIA, LEGIONELLA, TURBIDITY	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE	3745-81-72,3745-81-73	ACTION	CHEMICAL		4/22/93
DW		3745-81-72	A,B	DISINFECTION OF WATER FROM SURFACE WATER SOURCES	DISINFECTION REQUIREMENTS AND TREATMENT OF SURFACE WATER	PERTINS TO ANY SITE WHICH HAS CONTAMINATED SURFACE WATER THAT IS EITHER BEING USED , OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE	3745-81-32,3745-81-27,3745-81-74	ACTION	CHEMICAL		4/22/93
DW		3745-81-73	A,B,C	FILTRATION OF WATER FROM SURFACE WATER SOURCES	CONVENTIONAL FILTRATION, SLOW SAND FILTRATION, OR OTHER FILTRATION TREATMENT TECHNOLOGIES FOR TREATMENT OF SURFACE WATER	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED SURFACE WATER THAT IS EITHER BEING USED, OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE	3745-81-27,3745-81-72,3745-81-74	ACTION			4/22/93
DW		3745-81-74	A-D	TURBIDITY AND DISINFECTION MONIT REQ. FOR SURFACE WATER	TURBIDITY AND DISINFECTION MONITORING REQUIREMENTS FOR SURFACE WATER SYSTEMS	PERTAINS TO ANY SITE WHICH HAS CONTAMINATED SURFACE WATER THAT IS EITHER BEING USED OR HAS THE POTENTIAL FOR USE, AS A DRINKING WATER SOURCE	3745-81-72,3745-81-73	ACTION			4/22/93
GW		3745-9-04	A,B	LOCATION/SITING OF NEW GW WELLS	MANDATES THAT GROUND WATER WELLS BE: A) LOCATED AND MAINTAINED SO AS TO PREVENT CONTAMINANTS FROM ENTERING WELL. B) LOCATED SO AS TO BE ACCESSIBLE FOR CLEANING AND MAINTENANCE.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	LOCATION	ACTION		3/18/93
GW		3745-9-05	A1,B-H	CONSTRUCTION OF NEW GW WELLS	SPECIFIES MINIMUM CONSTRUCTION REQUIREMENTS FOR NEW GROUND WATER WELLS IN REGARDS TO CASING MATERIAL, CASING DEPTH, POTABLE WATER, ANNULAR SPACES, USE OF DRIVE SHOE, OPENINGS TO ALLOW WATER ENTRY, CONTAMINANT ENTRY.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	ACTION			
GW		3745-9-06	A,B,D,E	CASING REQUIREMENTS FOR NEW GW WELLS	ESTABLISHES SPECIFIC REQUIREMENTS FOR WELL CASINGS, SUCH AS SUITABLE MATERIAL, DIAMETERS AND CONDITION.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	ACTION			
GW		3745-9-07	A-F	SURFACE DESIGN OF NEW GW WELLS	ESTABLISHES SPECIFIC SURFACE DESIGN REQUIREMENTS, SUCH AS HEIGHT ABOVE GROUND, WELL VENTS, WELL PUMPS, ETC.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	ACTION			
GW		3745-9-08	A,C	START-UP & OPERATION OF GW WELLS	REQUIRE DISINFECION OF NEW WELLS AND USE OF POTABLE WATER FOR PRIMING PUMPS.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	ACTION			
DW		3745-9-09	A-C,D1,E-G	MAINTENANCE & OPERATION OF GW WELLS	ESTABLISHES SPECIFIC MAINTENANCE AND MODIFICATION REQUIREMENTS FOR CASING, PUMP AND WELLS IN GENERAL.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975. WOULD PERTAIN DURING THE FS IF NEW WELLS ARE CONSTRUCTED FOR TREATABILITY STUDIES.	3745-9-01	ACTION			

ABRIDGED LISTING OF OHIO UNIVERSAL ARARs

CATEGORY		CITE										LAST REVISION
GW		3745-9-10	A,B,C	ABANDONMENT OF TEST HOLES & GW WELLS	FOLLOWING COMPLETION OF USE, WELLS AND TEST HOLES SHALL BE COMPLETELY FILLED WITH GROUT OR SIMILAR MATERIAL OR SHALL BE MAINTAINED IN COMPLIANCE OF ALL REGULATIONS.	PERTAINS TO ALL GROUND WATER WELLS ON THE SITE THAT EITHER WILL BE INSTALLED OR HAVE BEEN INSTALLED SINCE FEB. 15, 1975.	3745-9-01	ACTION			
GW		3745-9-11		USE OF WELLS FOR DISPOSAL	NO PERSON SHALL USE ANY WELL TO INJECT OR REINJECT ANY SUBSTANCE INTO THE GROUND WITHOUT NECESSARY PERMITS.	MAY PERTAIN TO SYSTEMS THAT ENTAIL INJECTION OR REINJECTION OF FLUID INTO THE GROUND. CONSIDER FOR IN-SITU BIOREMEDIATION, SOIL FLUSHING AND GROUND WATER PLUME CONTAINMENT	3745-34-06	ACTION			3/19/93

Exhibit 46:

First Priority Areas: Shallow Depth to Ground Water



Ground-Water Contour
Streams
Water Bodies
Wetland & Swamp
River
Lake
Contour
Depth to Water Table
< 5 ft
5 - 10 ft
10 - 15 ft
> 15 ft
No Data

N

1:5400

200 0 200 400 Feet

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