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Hydrogeologic Investigation of the Advanced Coal Liquefaction Research and Development Facility Wilsonville, Alabama

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MASTER

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DEPARTMENT OF ENERGY

ORNL-27 (3-96)

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Published:

**Prepared for
U. S. Department of Energy
Pittsburgh Energy Technology Center**

**Prepared by:
Oak Ridge National Laboratory
Environmental Technology Section
P.O. Box 2567
Grand Junction, Colorado 81502**

**Managed by:
Lockheed Martin Energy Systems, Inc
for the
U.S. Department of Energy
under contract No. DE-AC05-84OR21400**

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Acronyms and Abbreviations

ACLR&D	Advanced Coal Liquefaction Research & Development
bgs	below ground surface
CDP	common depth point
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
d	day
DOE	U.S. Department of Energy
ft	feet
GJ	Grand Junction
HSA	hollow stem auger
i.d.	inside diameter
in.	inches
msl	mean sea level
ORNL	Oak Ridge National Laboratory
PETC	Pittsburgh Energy Technology Center
PVC	polyvinyl chloride
RI	remedial investigation
SCF	Southern Clean Fuels
SCS	Southern Company Services
TLU	thermal liquefaction unit

EXECUTIVE SUMMARY

A hydrogeologic site characterization was conducted at the former Advanced Coal Liquefaction Research and Development facility in Wilsonville, Alabama, by the Oak Ridge National Laboratory Grand Junction office for the U. S. Department of Energy Pittsburgh Energy Technology Center. This characterization provided baseline environmental information necessary for closeout of facility operations.

The hydrogeologic assessment was non-routine because of the unusual structural complexity of the subsurface. Bedrock drilling demonstrated that both an overturned fold and a strike-slip fault are present beneath the site. Moreover, the site is also underlain by limestone that contains solution cavities. However, it was determined that potential groundwater contamination in the residuum is not a threat to the environment and that groundwater in the limestone aquifers is not flowing toward potential receptors.

1. INTRODUCTION

This document describes the geology and hydrogeology at the former Advanced Coal Liquefaction Research and Development (ACLR&D) facility in Wilsonville, Alabama. The work was conducted by personnel from the Oak Ridge National Laboratory Grand Junction office (ORNL/GJ) for the U.S. Department of Energy (DOE) Pittsburgh Energy Technology Center (PETC). Characterization information was requested by PETC to provide baseline environmental information for use in evaluating needs and in subsequent decision-making for further actions associated with the closeout of facility operations. The hydrogeologic conceptual model presented in this report provides significant insight regarding the potential for contaminant migration from the ACLR&D facility and may be useful during other characterization work in the region.

The ACLR&D facility is no longer operational and has been dismantled. The site was characterized in three phases: the first two phases were an environmental assessment study and a soil sampling study (APCO 1991) and the third phase the hydraulic assessment. Currently, a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial investigation (RI) to address the presence of contaminants on the site is underway and will be documented in an RI report. This technical memorandum addresses the hydrogeologic model only.

2. FACILITY BACKGROUND

The ACLR&D facility is located in the eastern portion of Shelby County in north-central Alabama. The facility lies immediately west of the E. C. Gaston Steam Plant located on the west bank of the Coosa River near the confluence with Yellow Leaf Creek (Fig. 2.1).

The ACLR&D facility was constructed in 1974 by the Electric Power Research Institute as a pilot plant to develop clean-burning, coal-derived fuels from high-sulfur, high-ash coal. DOE support of facility operations began in 1976 (SCS 1991). Catalytic, Inc., later Catalytic Division of United Engineers and Constructors, operated the facility from inception to August 1988 when Southern Company Services (SCS) assumed responsibility for the site. A subsidiary of SCS, Southern Clean Fuels (SCF) division of Southern Electric International, was the subcontractor providing operations and maintenance support. SCS is currently conducting the CERCLA RI at the facility.

Over the course of the Phase III investigation performed by ORNL/GJ, the facility was decommissioned and demolished by SCS. The only remaining structures and utilities are the main office building and the sewage treatment plant.

Fig. 2.1. Location of the ACLR&D facility.

3. METHODS

3.1 Summary

The Phase III investigation consisted of the following components: 1) a geologic investigation to delineate the complex structure and stratigraphy at the site, 2) extensive soil sampling to delineate the lateral and vertical extent of any potential contamination, and 3) installation of piezometers, monitoring wells, and bedrock wells to determine groundwater flow directions and to obtain groundwater quality data. Because the results of soil and groundwater analysis are being evaluated in the on-going RI, only the methods used to conduct the hydrogeologic investigation are described below.

3.2 Investigation Chronology

Eighty-eight holes were drilled during Phase III field work between May 1992 and June 1993. The borings included 6 piezometers, 15 monitoring wells, 55 boreholes, and 12 coreholes. Presented below is a brief summary of what was accomplished during each of the field efforts:

- May 1992: Twenty-five holes were drilled. Of these, three were completed as piezometers (PZ04, PZ08, and PZ09), and three were completed as monitoring wells (MW05, MW07, and MW15). The rest of the holes were borings drilled to a maximum depth of 16 ft.
- June 1992: Thirteen holes were drilled. Of these, one was a bedrock corehole (CH36), four were completed as monitoring wells (MW26, MW32, MW35, and MW37), and eight holes were soil borings to a maximum depth of 16 ft.
- October 1992: Twenty holes were drilled. Of these, three were completed as piezometers (PZ49, PZ52 and PZ57), and 17 were soil borings drilled to auger refusal at the top of bedrock.
- December 1992: A shallow seismic reflection study was completed that consisted of a common depth point (CDP) survey using an 8-gauge auger gun at a total of 500 stations separated by 4 ft along three connecting lines.
- April 1993: Nineteen holes were drilled. Eight holes were completed as monitoring wells (MW59, MW60, MW61, MW62, MW63, MW64, MW72, and MW73), and 11 were soil borings drilled to auger refusal at the top of bedrock. MW61 was installed to replace MW15, which was destroyed during decommissioning of the ACLR&D facility.
- May 1993: Eleven bedrock coreholes were drilled to characterize the underlying structure and stratigraphy. Depth of these varied significantly due to rock type and structure.

The above referenced drilling locations are illustrated in Fig. 3.1.

Scale
Feet

0 100 200

0 25 50

- ⊕ Monitoring Well
- ⊕ Piezometer
- ⊖ Bedrock Corehole
- Borehole
- Seismic Line

Fig. 3.1. Location of borings and seismic lines.

3.3 Drilling Methods

Two types of drilling methods were used during the course of the investigation. Hollow stem augers (HSAs) were used to drill and sample weathered overburden materials (residuum). Generally, 4¼-in.-i.d. (inside diameter) HSAs were used in conjunction with 2½-in.-i.d. by 24-in.-long split-spoon samplers equipped with four 6-in. brass sleeves. Samples were collected at 5-ft intervals. Bedrock coring was performed using a standard NX-size wireline core barrel that provided continuous rock cores.

Monitoring wells were constructed with 2-in.-i.d. schedule-40 polyvinyl chloride (PVC) pipe and screen. A 0.010-in., machine-slotted screen size was used on all piezometers and monitoring wells. The monitoring wells and annular materials were installed through the augers. Generally, a 5-ft screened interval was used, but on several occasions, 15- to 20-ft screened intervals were installed to intercept perched water above the bedrock-residuum interface. The annular space was filled with 16- to 20-graded silica sand to at least 3 ft above the top of the screen. A 3-ft bentonite seal was then emplaced using bentonite chips. The remainder of the annulus was filled to the surface with a cement-bentonite grout consisting of 6 parts cement to 1 part bentonite. The PVC riser was covered with a protective steel casing (6- or 8-in. diameter) equipped with a hinged locking device and cemented in place. Three steel posts were located radially around the riser and cemented in place. Additionally, a number of wells and piezometers were completed in below-grade, traffic-rated vaults to accommodate the site decommissioning activities. All overburden lithology and rock cores were logged by experienced geologists. Drilling logs and completion records for soil borings, piezometers, monitoring wells, and bedrock coreholes are presented in the appendix.

Monitoring wells and piezometers were developed to various degrees. Due to the low permeability of the overburden and the limited available groundwater, most of the development was performed using a surge block and a bailer. In two cases (MW07 and MW37), sufficient water was available to allow pumping with a submersible electric pump.

Monitoring well installation, lithological logging, and well development were accomplished using the procedures described in the ORNL Environmental Technology Section procedures manual (ORNL 1993).

3.4 Seismic Survey Methods

Data acquisition for a shallow seismic-reflection study was completed in December 1992. The geophysical study consisted of a CDP survey using an 8-gauge auger gun at a total of 500 stations separated by 4 ft along three connecting lines. Figure 3.1 shows the locations of the three seismic lines.

Factors such as cultural noise interference (utilities and facility dismantling operations), a very attenuative near-surface (gravel road base), and low overall signal to noise ratios (poor signal reception over noise from seismic source) contributed to low data quality. Hence, the survey proved inconclusive.

A description of the methods used and results of the seismic-reflection survey are presented by Miller et al. (1993).

4. REGIONAL GEOLOGY AND HYDROGEOLOGY

4.1 Geology

The ACLR&D site is located within the Coosa deformed belt of the Coosa Valley and Ridge district of the Alabama Valley and Ridge physiographic section (Fig. 4.1). The Coosa deformed belt is a structurally complex sequence of Paleozoic-age sedimentary rocks. The geologic sequence ranges in age from Cambrian to Mississippian. The stratigraphic column for rocks that outcrop in Shelby County is shown in Fig. 4.2. The Cambrian and Ordovician rocks consist primarily of carbonates, while the Mississippian rocks are comprised of cherty limestones, sandstones, and shales. A thin unit of Devonian sandstone is also present in the Wilsonville area. The following stratigraphic descriptions of the formations pertinent to this investigation are taken from Thomas and Drahovzal (1974).

The oldest geologic group that outcrops in the region is the Knox Group, which is upper Cambrian to lower Ordovician in age. The Cambrian Copper Ridge Formation of the Knox Group outcrops south of the site where it has been thrust over Mississippian rocks. The unweathered Copper Ridge Formation is a light- to medium-gray, fine-crystalline, massive, siliceous dolomite that weathers to reddish-brown silty clays.

The Knox Group is overlain by a sequence of Ordovician carbonates: in ascending order, the Newala, Lenoir, and Little Oak Limestones, and the Athens Shale. The Newala Limestone consists of dark-gray to pearl-gray to bluish-gray, fine-crystalline, thick-bedded limestone that may contain dolomitic beds lending a mottled appearance. The overlying Lenoir Limestone is a dark-gray, fine-crystalline, medium- to thick-bedded limestone. Overlying the Lenoir is the Little Oak Limestone, the youngest of the Ordovician carbonates in the region. The Little Oak Limestone is a dark-gray, coarse-crystal-line, thick-bedded, cherty limestone. The chert is usually black and forms thin, discontinuous beds in fresh outcrops. The Athens Shale is a facies-equivalent of the Little Oak Limestone in numerous areas of Shelby County. Unweathered Athens Shale consists of a dark-gray to black fissile shale with occasional thin beds of argillaceous limestone.

The Ordovician Formations are unconformably overlain by rocks of Devonian age. The Devonian is represented by the Frog Mountain Sandstone and the Chattanooga Shale. Both units are very thin in Shelby County and are absent in many areas.

The Frog Mountain Sandstone consists of medium-bedded, fine- to coarse-grained quartz sandstone. The Chattanooga Shale consists of black, fissile shale that contains low-grade uranium and pyrite.

Three Mississippian units unconformably overlie the Devonian formations (Fig. 4.2). The three Mississippian units present in the Coosa deformed belt are the Fort Payne chert, the Floyd Formation, and the Parkwood Formation. Due to lithologic similarities, the Floyd and Parkwood Formations are usually mapped as one unit.

The Fort Payne is the oldest Mississippian formation mapped in the Coosa belt. The Fort Payne consists of a light-gray, fine-crystalline, very siliceous limestone. It may be fossiliferous at various localities, containing primarily crinoid stem columns.

Fig. 4.1. Physiographic location of the Coosa deformed belt.

SYSTEM		Pennsylvanian		Mississippian		SYSTEM	
SERIES		Lower		Upper		SERIES	
GROUP, FORMATION, AND MEMBER		Pottsville Formation		Parkwood Formation		Floyd Shale	
LITH- OLOGY							
THICK- NESS (feet)		4920-9000±		470-2000+		800-2000	
THICK- NESS (meters)		1500-2745±		143-610+		244-610	
Devon- ian	Lower	Fort Payne Ch.				0-200	0-61
		Chattanooga Sh.				0-7	0-2
		Frog Mountain S.S.				0-75	0-23
		Little Oak ls.				0-100	0-30
		Athens Sh.				15-350	4-107
Ordo- vician	Middle	Lenoir L.S.				400-700	122-213

SYSTEM		Cambrian		Ordovician		SYSTEM	
SERIES		Upper		Lower		SERIES	
GROUP, FORMATION, AND MEMBER		Knox Group		Knox Group		GROUP, FORMATION, AND MEMBER	
LITH- OLOGY						LITH- OLOGY	
THICK- NESS (feet)						THICK- NESS (feet)	
THICK- NESS (meters)						THICK- NESS (meters)	
1000 exp	Rome Formation	Conasauga Formation	Brierfield Dolomite	Ketona Dolomite	Bibb Dolomite	Copper Ridge Dolomite	Chepultepec Dolomite
305 exp	Rome Formation	Conasauga Formation	Brierfield Dolomite	Ketona Dolomite	Bibb Dolomite	Copper Ridge Dolomite	Chepultepec Dolomite

AL018

Fig. 4.2. Stratigraphic column for the rocks of Shelby County. Source: Thomas, W. A., and J. A. Drahovzal, eds. 1974. *The Coosa Deformed Belt in the Alabama Appalachians*. Alabama Geological Society Guide book for the 12th Annual Field Trip.

The Floyd and Parkwood Formations overlie the Fort Payne. Both are composed of dark-gray to black fissile shale with occasional beds of interbedded quartz sandstone. The lower portion of the Floyd may contain carbonate units locally.

4.2 Regional Hydrogeology

An overview of the regional hydrogeology was taken from Planert and Pritchett (1989). These investigators concluded that the two major regional aquifers are the Knox-Shady of Cambrian-Ordovician age and the Tuscumbia-Fort Payne of Mississippian age. The highest yields from the aquifers are associated with solution openings in carbonate rock. Planert and Pritchett (1989) also determined that fractures in rock materials, due to faulting and the porous, cherty soil resulting from weathering, increase the aquifer's susceptibility to contamination on a local scale.

5. RESULTS

5.1 Hydrogeologic Investigation

The following sections present the results of the hydrogeologic investigation performed at the ACLR&D facility. Discussion of results is divided into stratigraphy, structure, and hydrogeology.

5.1.1 Stratigraphy

Surface geology at the ACLR&D consists of weathered remnants of four Paleozoic formations which, in ascending order are: the Ordovician carbonates (undifferentiated in this report), Devonian Frog Mountain Sandstone, Mississippian Fort Payne Limestone, and Mississippian Floyd Shale. Figures 5.1 and 5.2 illustrate the surface and bedrock geology at the site. Most of the site rests on Fort Payne residuum, while the southwest corner overlies weathered Floyd Shale. The north-central and northwest corners of the ACLR&D site rest on weathered Frog Mountain Sandstone and Ordovician residuum. Descriptions of weathered and unweathered sections of the four Paleozoic formations encountered at the site are presented below.

5.1.1.1 Ordovician Carbonates (Undifferentiated)

The weathered profile of the Ordovician is primarily a yellowish-brown silty clay to clayey silt, depending on depth. Residual silty-clay stringers and manganese oxide nodules are common in the entire weathered interval. Thickness of the weathered zone varies from 20 to 35 ft.

The unweathered Ordovician sequence consists primarily of medium- to dark-gray microcrystalline limestone. In areas where the Ordovician is overlain by the Frog Mountain Sandstone, very dark gray to black dolomitic zones give the limestone a mottled appearance. The mottled appearance decreases with depth, and the limestone becomes increasingly argillaceous. Silt-clay laminae and white calcite-healed fractures are common throughout the entire sequence. Fossil content increases with depth where elongated and very deformed sponges are present. Generally, the Ordovician carbonates appear most susceptible to solutioning near the contact with the weathered overburden or where overlain by fractured

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	Mf	Floyd Shale/Limestone
	Mfp	Fort Payne Limestone
	Dfm	Frog Mountain Sandstone
	Ou	Ordovician Carbonates (Undifferentiated)

	Fault (Dashed Where Inferred)
	Formation Contact
	Direction of Movement

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Fig. 5.1. Surface geology at the ACLR&D site.

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Wilsonville Alabama

Fig. 5.2. Bedrock geology at the ACLR&D site.

AL013A
REV 11/06/96

sandstone that is in turn overlain by the weathered overburden. Areas where major structural features are present also appear to influence the degree of solutioning in the Ordovician carbonates.

5.1.1.2 Devonian Frog Mountain Sandstone

The weathered profile of the Frog Mountain Sandstone varies across the site. In areas where the Frog Mountain is only moderately weathered, it consists of a medium to lavender-gray, very fine grained siliceous sandstone (quartzite). In these locations, it was usually impossible to auger through. Where the Frog Mountain is very weathered, it consists of a buff, very fine grained, sub-round to sub-angular, moderately to well-sorted, friable sandstone. Fractures are common, are usually filled with red silty clay, and become more abundant with depth. Frog Mountain thickness varies from 5 to 15 ft, depending on the amount of weathering and structure in the immediate area.

The unweathered Frog Mountain Sandstone consists of a very dark gray to black, very fine grained quartzite. The Frog Mountain is extremely hard and brittle and is fractured throughout the entire sequence. Fractures in the Frog Mountain exhibit abundant iron oxide staining and secondary mineral growth, which are indicative of significant fluid movement. These fractures provide pathways for solutioning of the underlying Ordovician carbonates. Drilling in the Frog Mountain was extremely difficult due to the amount of fracturing and the tendency of the formation to cave in.

5.1.1.3 Mississippian Fort Payne Limestone

The Fort Payne Limestone weathers to a red to reddish-yellow silty clay with thin beds and/or cobbles of light-gray to light-gray-blue chert. Brachiopod and crinoid stem fossils are common in both the silty clay and the weathered chert. The weathered Fort Payne varies in thickness significantly, from 2 to 35 ft, as a result of structure.

The unweathered Fort Payne consists of a light- to medium-gray, microcryptocrystalline limestone that contains abundant bedded chert and fossils (brachiopods and crinoid stems). No solution features were observed in the Fort Payne, probably due to the relatively high silica content. Drilling in the Fort Payne proved very difficult because of hardness due to the amount of chert encountered.

5.1.1.4 Mississippian Floyd Formation

Shale within the Floyd Formation weathers to a variety of colors, with light- to medium-gray, lavender-gray, reddish-gray, and yellowish-brown predominant near the surface. With depth, the color grades to a very dark grayish brown to very dark gray immediately above the unweathered zone. The weathered shale is firm and somewhat fissile, with very deformed relict bedding planes readily visible. The weathered shale zones range in thickness from 17 to 35 ft.

The limestone within the Floyd Formation weathers to a reddish-brown to reddish-yellow silty clay that is sometimes difficult to distinguish from other weathered limestones. The weathered limestone ranges in thickness from 1 to 10 ft.

Unweathered shale within the Floyd occurs as two units at the ACLR&D site. The lower unit is comprised of a very dark gray to black, microcrystalline, very fossiliferous limestone with abundant interbedded shale. Crinoid stems, brachiopods, echinoderm fragments, and fenestrella bryozoans make

up a majority of the fossil content. White calcite-healed fractures and slickensides are common and indicative of the significant folding and faulting that has occurred in the area. Floyd Formation limestone varies in thickness from 26 to approximately 40 ft.

The upper Floyd consists of a black, moderately hard, fissile shale. It exhibits a sub-waxy to vitreous luster and is very carbonaceous. Thin, very dark gray to black, very fine grained, siliceous, sandstone beds up to 2 in. thick are scattered throughout the shale interval. White calcite-healed fractures and very deformed bedding planes are common throughout, indicating the high degree of folding and faulting in the area.

5.1.2 Structural Geology

Results of the drilling indicate that the ACLR&D site is underlain by two significant structural features. The location of these features is presented in Fig. 5.2. The oldest and most dominant is an overturned fold that trends northwest to southeast across the facility. The second feature is a strike-slip fault that trends north to south along the eastern edge of the site. Lateral displacement along the strike-slip fault is estimated at 500 ft, where the eastern block slipped to the north relative to the western block.

Cross section A - A' from CH78 to CH81 illustrates a conceptualized diagram of the overturned fold as determined from the available data (Fig. 5.3). The inferred axis of the fold strikes approximately N45W and plunges southeast up to 30°. Lithologic information from CH87 and field reconnaissance northwest of the site suggest that the fold continues to the northwest, possibly for several miles. To the southeast, the fold is offset to the north where it is breached by the strike-slip fault. Weathered remnants of overturned bedding are observed in CH36 (Fig. 5.4) and further east on the E.C. Gaston Steam Plant property, suggesting that the fold continues to the east or southeast. However, there is not enough data to plot the inferred location of the fold axis east of the strike-slip fault.

Cross section B - B' from CH81 to CH36 (Fig. 5.4) illustrates formation relationships on opposite sides of the strike-slip fault. In addition to the main fault, a small area of faulting has occurred between CH83 and CH55. It appears that a large piece of Frog Mountain Sandstone was sheared off during movement on the strike-slip fault and wedged in its current position as shown in Fig. 5.4. Evidence of this secondary faulting is found in the extensive fault gouge material observed during the drilling of nearby monitoring wells (MW35 and MW37).

The combined effects of faulting, folding, and weathering of the various rock types have produced a bedrock surface that dips gently to the northeast (Fig. 5.5). The bedrock surface contour map depicts several low spots that represent the areas where carbonate rocks have been dissolved. These low areas are significant in that they represent conduits for potential contaminant migration from the weathered residuum into the bedrock groundwater system.

5.1.3 Hydrogeology

Discussion of the hydrogeology is divided into hydrostratigraphy, groundwater flow directions, and hydraulic characteristics.

Fig. 5.3. Cross section A - A' illustrating the overturned fold.

Fig. 5.4. Cross section B - B' illustrating the strike-slip fault.

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EXPLANATION

- ⊕ Monitoring Well
- ⊕ Piezometer
- Borehole
- ⊙ Bedrock Borehole
- Contour Interval 5 ft.

FIG. 5.5
REV 11/06/95

Fig. 5.5. Bedrock contour map.

5.1.3.1 Hydrostratigraphy

As previously discussed, the ACLR&D site is characterized by an overturned fold and strike-slip fault associated with the Coosa deformed belt. A weathered residuum overlying the bedrock further complicates the site hydrogeology. Delineating the site hydrogeology into continuous aquifers in order to understand groundwater flow directions and rates involves an additional level of analysis. For example, in regions dominated by continuous layered geology, permeable zones can be identified and monitored at discrete levels. This is not possible at the ACLR&D site, where permeable units may be discontinuous due to faults or folds or may be weathered into lower permeability residuum where exposed to the surface. Consequently, the water-bearing capacity of the geologic units and their continuity and locations with regard to observed groundwater flow directions must all be considered in determining a geologic unit's ability to be an important pathway for contaminant migration.

In general terms, the hydrostratigraphy at the ACLR&D site can be divided into two zones: a low-permeability residuum and an intact bedrock unit. The residuum consists of fine-grained material that exhibits relict bedding characteristics and very low permeability. Consequently, the emphasis of this section will be placed on the bedrock hydrology. The lithology and structure of the bedrock and its relationship to groundwater migration will be discussed in detail.

One of the initial assumptions of the hydrogeologic investigation at the site was that it was essential to determine the location of carbonate units that could exhibit karst features and subsequently act as pathways for contaminant migration. Sinkhole activity due to karst limestones has been previously identified in the region. As noted on the cross sections (Figs. 5.3 and 5.4), limestones were identified throughout the bedrock underlying the facility.

5.1.3.2 Groundwater Flow Directions

Residuum

The potentiometric map for the residuum based on April 1993 water-level data is presented in Fig. 5.6. Although the general flow direction is east to northeast and follows the topography in the area (which slopes towards the Coosa River), groundwater flow in the residuum is influenced by several local factors. Primarily, groundwater flow in the less-permeable clays of the residuum is controlled by bedrock topography and consistently seeks the lowest areas. Therefore, the most obvious direction of groundwater movement is toward the lowest point in the bedrock near MW37 in Fig. 5.5. The less-permeable clays overlying the topographic lows in Fig. 5.5 have less-measurable effects on groundwater flow due to their limited capacity to transmit water to the bedrock system. The groundwater mound observed under MW62 (Fig. 5.6) coincides with the thermal liquefaction unit (TLU) area, which was the oldest process facility, and probably results from leaking utilities in the area creating an artificially high water table (Charles Cantrell, SCF, personal communication with Frank Gardner, ORNL/GJ, October 10, 1992). Additional evidence of leaking utilities was noted by field personnel during drilling activities, where saturated sediments were observed from immediately below the ground surface to the bedrock. Other suspected sources of artificial water in the residuum are the waste sump south of the TLU and the caustic waste sump within the TLU. Residuum water levels are further complicated by the heterogeneity of the residuum itself. The combinations of low-permeability clays, chert, and weathered sandstone within the residuum aquifer along with the artificial water sources can yield misleading

Fig. 5.6. April 1993 residuum potentiometric map.

water-level information. Finally, the fault along the eastern property boundary appears to have an influence on groundwater flow by presenting a more-permeable path for residuum water to reach the bedrock aquifer system. Consequently, additional water levels were obtained and more potentiometric maps were updated as part of the RI.

Bedrock

Groundwater flow directions in the bedrock are controlled by the hydraulic gradient and the geologic structure of the permeable units. The hydrogeology of the bedrock is characterized by water movement along fractures that may be enhanced by solution. The complex structure of the bedrock, as discussed in the structural geology section, has yielded an equally complex fracture pattern. Regional tectonics along with local folding, thrusting, and faulting have resulted in a wide distribution of fractures.

The key to groundwater flow in a fractured aquifer is understanding the degree of interconnection of the fractures. One method is to compare the water-level measurements from wells completed in different fracture zones in the bedrock. Figure 5.7 presents the potentiometric map for the bedrock aquifer, which suggests that the bedrock fractures are interconnected and transmitting water toward the Coosa River. Water-level data from CH81 were not used due to the presence of leaking utilities in the area. The interconnection of the fractures is important from a contaminant-transport point of view. If contaminants enter a selected set of fractures, then a downgradient well completed in a separate set of fractures that are hydraulically isolated may not detect the contamination.

5.1.3.3 Hydraulic Characteristics

Residuum

The permeability of the residuum underlying the site can be characterized as less-permeable sediments due to the fine-grain texture. Table 5.1 shows the results of single-well tests conducted on selected wells. Water levels in most of the residuum wells recover at such slow rates that it is impossible to conduct reliable permeability tests. Consequently, the hydraulic conductivity values presented in Table 5.1 represent maximum values for the residuum. These values range from those typical of a silt unit to those of a clay unit and yield an average hydraulic conductivity of less than 10^{-1} ft/d.

Table 5.1. Results of single-well pumping tests

Well Number	Test Number	Hydraulic Conductivity, ft/d
MW15	1	3.37×10^{-2}
	2	3.93×10^{-2}
MW26	1	1.21×10^{-4}
MW07	1	3.89×10^{-1}

Fig. 5.7. May 1993 bedrock potentiometric map.

Bedrock

In order to characterize the permeability of the bedrock, fractures were logged by core drilling, and selected coreholes were packer-tested. It was not possible to packer-test every corehole because several holes were blocked by rock debris from fractured zones. Consequently, fractures located during the drilling either by circulation loss or fractured core are listed in Table 5.2. The Frog Mountain Formation is fractured wherever it is encountered as competent rock. Composed of brittle quartzite, the Frog Mountain has fractured due to the intense folding and faulting in the area. Undifferentiated Ordovician limestones were also found to be fractured, with solution enhancement in several coreholes. With the exception of CH80, all of the water-producing fractures in limestone were located near the bedrock/residuum contact. This is the result of small fractures located near the recharge source that were enhanced by solution. With depth, many of these fractures are filled with calcite and become impermeable. CH80, on the other hand, contains a fracture below the bedrock/residuum contact that is associated with a fold. The Fort Payne Formation appears to be less fractured than the other formations. In CH55, the observed fractures are associated with extensive fractures in the Frog Mountain. In CH85, limited cavities in the Fort Payne are associated with extensive cavities in the overlying limestone of the Floyd Shale.

Table 5.2 Fracture locations in bedrock coreholes

Corehole	Interval, ft bgs	Geologic unit	Comments
CH55	80.0 to 83.0	Mfp	Near Dfm contact
CH55	87.5 to 89.5	Dfm	Major fracture, circulation lost
CH80	95.0 to 96.0	Ou	Other fractures present
CH82	51.4 to 51.8	Ou	Near residuum contact
CH83	51.7 to 55.0	Dfm	Near residuum contact
CH84	46.0 to 53.0	Dfm	Collapsed into hole
CH85	28.0 to 53.0	Mf/Mfp	Several large cavities
CH86	49.0 to 58.0	Ou or Mfp (?)	Several large cavities
CH88	51.0 to 61.0	Ou	Several large cavities

Mfp = Mississippian Fort Payne Limestone
 Dfm = Devonian Frog Mountain Sandstone
 Ou = Ordovician undifferentiated carbonates
 Mf = Mississippian Floyd Limestone
 ft bgs = feet below ground surface

Packer tests were conducted on several coreholes to determine the bedrock permeability (Table 5.3). The bedrock is not fractured throughout the entire section, as indicated by the large number of zones that exhibited no measurable permeability. The packer tests also suggest that water movement in the bedrock is isolated to scattered fractures that are capable of producing substantial quantities of water. On a general scale, the Frog Mountain exhibits significant fracture permeability where present in the bedrock. The undifferentiated Ordovician limestones show scattered permeable fractures, with large sections of impermeable rock. The Fort Payne is generally impermeable or exhibits a low permeability, as found in CH55. Although the Floyd Limestone was not tested, the absence of fractures observed in cores from CH36, CH55, and CH79 suggests that this unit generally exhibits low permeability. The only exception to this condition was observed in the severe solutioning of the Floyd Limestone in CH85, where mud-filled cavities were observed during drilling. Upon removal of the coring equipment, the corehole collapsed, preventing any packer tests at this location.

Table 5.3 Packer test results for bedrock coreholes

Corehole	Interval tested, ft bgs	Geologic unit	Hydraulic K, ft/d
CH36	57.0 to 102.0	Mfp	0
CH55	79.8 to 102.0	Mfp, Dfm, Ou	*
	71.0 to 81.0	Mfp	1.7
	66.0 to 76.0	Mfp	6.5
CH80	87.0 to 96.7	Ou	*
CH81	77.0 to 85.7	Ou	0
	67.0 to 85.7	Ou	0
	57.7 to 85.7	Ou	0
	47.7 to 85.7	Ou	0
	37.0 to 85.7	Ou	0
CH82	81.7 to 91.7	Ou	0
	71.7 to 91.7	Ou	0
	61.7 to 91.7	Ou	0
	51.7 to 91.7	Ou	0
	48.0 to 91.7	Ou	*
CH86	44.0 to 59.5	Ou or Mfp (?)	*

* = Permeability exceeds the maximum value measurable.

Mfp = Mississippian Fort Payne Limestone

Dfm = Devonian Frog Mountain Sandstone

Ou = Ordovician undifferentiated carbonates

ft bgs = feet below ground surface

5.2 Discussion

The hydrogeologic model presented in the previous sections indicates that the residuum (surface soils) exhibits low permeability. Furthermore, low hydraulic conductivities suggest little potential for significant lateral contamination migration. Indeed, once water is removed from these formations, water-level recovery time is slow (hours to days). The total amount of water that can be removed is so small that any attempt for beneficial use of this water is precluded. Hence, on-going characterization work should focus on the more permeable bedrock.

The geologic investigation revealed complex structural features in the bedrock underlying the ACLR&D facility. The bedrock is made up of limestone that contains numerous solution cavities (indicated by the large cavities in coreholes, Table 5.2). The karst nature of the bedrock and the highly faulted structure are particularly conducive to contaminant migration. However, based on the available hydrologic data (regional and site-specific), the two Wilsonville municipal water-supply wells, which are approximately 1.5 miles southwest of the ACLR&D site, are upgradient of the ACLR&D site and are thus safe from potential contamination. Furthermore, access to the ACLR&D site is restricted, and its proximity to the E.C. Gaston Steam Plant precludes anything other than industrial use.

6. CONCLUSION

The hydrogeologic assessment, although complicated by the unusual structural complexity of the subsurface, nevertheless provided valuable information about potential contaminant migration at the site. In summary, the potential receptors and migration characteristics brought to light by the hydrogeologic investigation allow these conclusions: 1) the location and present conditions of the site provide significant safety with regard to the potential exposure to humans and the environment; 2) potential groundwater contamination in the residuum is not a threat to the environment; and 3) groundwater in the limestone aquifers is not flowing toward potential receptors.

7. REFERENCES

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APPENDIX

MONITORING WELL, BEDROCK WELL, PIEZOMETER, AND SOIL BORING LOGS

MONITORING WELL, BEDROCK WELL, PIEZOMETER, AND SOIL BORING LOGS

This appendix is divided into four sections:

Section 1: Monitoring Well Logs

Section 2: Bedrock Well Logs

Section 3: Piezometer Logs

Section 4: Soil Boring logs

Monitoring Well Logs

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: P.M. Kearn Date: 05/14/92 Page: 1 OF 1
 Hole No.: MW05 Casing Elevation: 462.84' Ground Elevation: N/A
 Total Depth: 42.5' No. of Compl.: 1 Rig Type: CME-55 Location: N. of Rose SR
 Auger Size: 3.5" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: limestone gravel and clay, black organic appearance, no odor, saturated due to leak in nearby sump?
2					
4	SP	X			ML CLAYEY SILT: reddish brown (2.5YR 5/4), with yellowish mottle, stiff, moist, abundant sandstone fragments, sandstone is fine grained, moderately sorted, moderately cemented non-calcareous.
6					
8					
10	SP	X			SANDSTONE: buff, fine grained, moderately sorted, subangular to subrounded, moderately cemented to friable, slightly moist, (Frog Mtn.).
12					
14					
16	SP	X			SANDSTONE: as above with minor amounts of mottling with a reddish brown clayey silt, strong solvent odor in auger cuttings, numerous blow counts.
18					
20	SP	X			SANDSTONE: as above with an increase in mottling mottle is a red (2.5YR 4/6) clayey silt, slightly moist, very strong solvent odor, shut rig down at 22", HNU reading greater than 5ppm in breathing zone.
22					
24	SP	X			CL SILTY CLAY: red (2.5YR 4/6) with yellowish mottle, stiff, slightly moist, scattered sandstone fragments, MnO staining.
26					
28					ML CLAYEY SILT: yellowish brown (10YR 5/8), slightly moist, MnO nodules, (Ordovician).
30	SP	X			
32					
34	SP	X			ML CLAYEY SILT: reddish brown (2.5YR 5/4) with yellowish mottle, slightly moist.
36					
38					
40	SP	X			ML CLAYEY SILT: as above with increasing moisture content.
42	SP	X			LIMESTONE: light gray, weathered, refusal at 42.5', (Ordovician Undifferentiated).
44					
46					
48					
50					

Well Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: P. M. Kearn Date: 05/15/92 Page: 1 OF 1
Hole No.: MW07 Casing Elevation: 462.52'-L 462.70'-U Ground Elevation: N/A
Total Depth: 53.50 No. of Compl.: 2 Rig Type: CME-55 Location: East of Waste Water Sump
Auger Size: 3.50" I.D. Sample Type: 3"x2" Splitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F. G. Gardner Date: 08/04/92

DEPTH FEET	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: gravel with a black organic stained matrix.
2					
4	SP				CL SILTY CLAY: yellowish red (5YR 5/6) with yellowish brown mottle, stiff, dry, MnO staining.
6					
8					
10	SP				ML CLAYEY SILT: strong brown (7.5YR 5/8), slight moisture, abundant blueish gray chert, MnO staining. (Ft. Payne).
12					
14	SP				ML CLAYEY SILT: as above.
16					
18					
20	SP				ML CLAYEY SILT: as above, abundant chert, slight moisture content.
22					
24	SP				ML CLAYEY SILT: as above, slight increase in moisture.
26					
28					
30	SP				ML CLAYEY SILT: as above, with moisture sheen in the highly weathered chert rubble, MnO staining.
32					
34	SP				SANDSTONE: buff, very fine grained, subrounded, moderately sorted, friable, slightly moist, (Frog Mtn.).
36					
38					
40	SP				CL SILTY CLAY: red (2.5YR 4/6), wet in areas, sticky, platy dark gray possible quartzite or fissile shale, all oriented at approximately 60 degrees.
42					
44	SP				ML CLAYEY SILT: yellowish red (5YR 5/6), soft, sticky, moist, fairly homogeneous.
46					
48					
50	SP				ML CLAYEY SILT: as above, scattered sandstone fragments, buff colored, very fine grained, possible fault gouge.
52					
54	SP				LIMESTONE: light grayish brown, weathered, wet, (Ordovician?).
56					
58					
60					

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 05/17/92 Page: 1 OF 1
Hole No.: MW15 Casing Elevation: 461.39 Ground Elevation: N/A
Total Depth: 49.25 No. of Compl.: 1 Rig Type: CME-55 Location: N.W. Corner TLU
Auger Size: 3.50" I.D. Sample Type: 3"x2" Splitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					Concrete 9".
2					FILL: dark reddish brown (2.5YR 3/4), stiff, damp, predominantly clay with interbedded gravel and sand, moderate hydrocarbon odor.
4	SP	X			
6					CL SILTY CLAY: red (2.5YR 4/8) with a yellow to yellowish brown mottle, scattered light gray to light gray blue chert, chert content increasing with depth, (Ft. Payne).
8					
10	SP	X			
12					SANDSTONE: buff to slightly yellowish red, very fine grained, moderately sorted, subangular to subrounded, friable, fairly clean matrix, strong hydrocarbon and solvent odor, split spoon refusal at 10.25'. (Frog Mtn).
14	SP	X			
16					CL SILTY CLAY: red (2.5YR 4/8), firm to stiff, slightly damp, abundant sandstone clasts to .5", strong hydrocarbon and solvent odor, odor is strongest right at the sand silty clay contact, split spoon refusal at 15".
18					
20	SP	X			
22					SANDSTONE: yellowish brown to light gray, very fine grained subangular to subrounded, moderately sorted, abundant red silty clay fill in fractured zones, clay content decreases with depth, sand becoming very clean and friable in the light gray zones.
24	SP	X			
26					
28					ML CLAYEY SILT: red (2.5YR 4/8) with increasing brownish yellow (10YR 6/8), soft, wet, abundant MnO staining, moderate hydrocarbon odor. (Ordovician).
30	SP	X			
32					
34	SP	X			
36					ML CLAYEY SILT: yellow (10YR 7/8) with occasional red mottle, soft, damp, trace hydrocarbon odor.
38					
40	SP	X			
42					ML CLAYEY SILT: as above, increasing moisture content, abundant MnO stain.
44	SP	X			
46					ML CLAYEY SILT: yellow (10YR 7/8), increasing red soft, wet, occasional deformed relict bedding planes.
48					
50	SP	X			
					LIMESTONE: light yellowish brown, very weathered, saturated, (Ordovician Undifferentiated).

orn1

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 6/1/92 Page: 1 OF 1
 Hole No.: MW25 Casing Elevation: 454.14' Ground Elevation: N/A
 Total Depth: 47.5' No. of Compl.: 1 Rig Type: CME-55 Location: N.W. Corner of Plant
 Auger Size: 3.5" I.D. Sample Type: 3"X2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					
2					CL SANDY CLAY: strong brown (7.5YR 5/8), soft, damp, occasional interbedded gravels to .5".
4	SP	X			
6					
8					CL SILTY CLAY: predominantly red (2.5YR 4/8) with a brownish yellow mottle (10YR 6/8), scattered light gray mottle, very stiff, slightly damp. (Ordovician).
10	SP	X			
12					
14					CL SILTY CLAY: as above, decreasing light gray mottle.
16	SP	X			
18					
20	SP	X			ML CLAYEY SILT: red (2.5YR 4/8) with a yellowish brown mottle, stiff, slightly damp, visible relict bedding, bedding planes appear vertical in sampler.
22					
24					ML CLAYEY SILT: color as above, starting to see occasional MnO staining.
26	SP	X			
28					
30	SP	X			ML CLAYEY SILT: as above.
32					
34					ML CLAYEY SILT: brownish yellow (10YR 6/8), soft, wet, especially on cleanly broken sample faces, abundant MnO staining, some visible relict bedding.
36	SP	X			
38					
40	SP	X			ML CLAYEY SILT: as above, very weathered and deformed relict bedding, moisture content increasing.
42					
44	SP	X			ML CLAYEY SILT: as above, soft, wet.
46					
48	SP	X			LIMESTONE: light gray, very weathered, saturated, (Ordovician Undifferentiated).
50					

orn1

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/4/92 Page: 1 OF 1
 Hole No.: MW32 Casing Elevation: 453.13' Ground Elevation: N/A
 Total Depth: 26' No. of Compl.: 1 Rig Type: CME-55 Location: East of Plant
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Split spoon "Calif method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH FEET	SAMPLE TYPE	SAMPLE DRY	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					
2					
4	SP	X			FILL: grayish brown (10YR 5/2) with occasional red (2.5YR 5/8), soft, wet, predominantly clay with abundant interbedded gravel and sand, abundant roots, root channels and organic debris.
6					
8					
10	SP	X			FILL: grayish brown (10YR 5/2) grading to a yellowish brown (10YR 5/8) with a red mottle, scattered gravel, decreasing root and organic debris.
12					
14	SP	X			CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle, very stiff, slightly damp, scattered light gray very weathered chert, (reworked Ft. Payne).
16					
18					
20	SP	X			SHALE: light reddish gray with yellowish brown staining, hard, very weathered, fissile, dry to slightly damp, (Floyd Shale).
22					
24					
26	SP	X			SHALE: as above, increasing gray, hard, slightly damp.
28					
30					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>		Date: <u>6/4/92</u>		Page: <u>1 OF 1</u>	
Hole No.: <u>MW35</u>		Casing Elevation: <u>450.28'</u>		Ground Elevation: <u>N/A</u>	
Total Depth: <u>34.5'</u>		No. of Compl.: <u>1</u>		Rig Type: <u>CME-55</u>	
				Location: <u>West of Parking lot</u>	
Auger Size: <u>3.5" I.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves.</u>			
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>		Date: <u>08/04/92</u>	

DEPTH FEET	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					
2					
4	SP				FILL: yellowish brown (10YR 5/8), angular lime-stone road base to approximately 1.5', in-creasing clay content with depth, wet.
6					
8					
10					
12					
14	SP				CL SILTY CLAY: red (2.5YR 4/8) with yellowish to yellowish brown mottle, very stiff, slightly damp, (Reworked Ft. Payne?).
16					
18					
20					
22					
24	SP				SHALE: medium gray, reddish gray, yellowish brown staining, firm fissile, dry to slightly damp. (Floyd Shale).
26					
28					
30	SP				ML CLAYEY SILT: yellowish brown (10YR 5/8), soft, becoming wet, fairly homogeneous, occasionally slightly sandy, possible fault gouge.
32					
34	SP				ML CLAYEY SILT: color as above, very soft, satur-ated, scattered fragments of buff-colored sand-stone to 0.75", possible fault gouge.
36					
38					
40					
42					
44					
46					
48					
50					SHALE: medium to very dark gray, dark gray brown, firm to hard, platy, slightly damp, vertical bedding planes.

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 6/6/92		Page: 1 OF 1	
Hole No.: MW37		Casing Elevation: 461.33'		Ground Elevation: N/A	
Total Depth: 68.25		No. of Compl.: 1		Rig Type: CME-55	
Auger Size: 3.5" I.D.		Sample Type: 3"X2' Splitspoon "Calif. method", brass sleeves.		Location: East of Plant	
Project: Wilsonville, AL		Data Verified By: F.G. Gardner		Date: 08/04/92	
DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: yellowish brown (10YR 5/8), angular lime-
2					stone road base to approximately 1.5', in-
4	SP	X			creasing clay content with depth, wet, lost
6					sample interval 4-6' description based on
8					auger cuttings.
10	SP	X			CL SILTY CLAY: red (2.5YR 4/8) with yellowish
12					to yellowish brown mottle, very stiff, slightly
14					damp, possible fill.
16					
18					
20	SP	X			SHALE: medium gray, reddish gray, yellowish brown
22					staining, firm fissile, dry to slightly damp.
24					(Floyd Shale).
26					
28					
30					
32					
34	SP	X			SHALE: medium to reddish gray becoming reddish
36					to yellowish brown, very weathered, scattered
38					red silty clay, (weathered Floyd Limestone?).
40	SP	X			CL SILTY CLAY: red (2.5YR 4/8) with yellowish
42					brown mottle, stiff, slightly damp, scattered
44					light gray chert to 1"
46	SP	X			ML CLAYEY SILT: yellowish brown (10YR 5/8),
48					becoming wet, fairly homogeneous, occasionally
50					slightly sandy.
52	SP	X			ML CLAYEY SILT: color as above, very soft, wet,
54					noticeable shale-like bedding planes, slightly
56					sandy, (weathered Floyd Limestone?).
58	SP	X			CL SILTY CLAY: red (2.5YR 4/8) with yellowish
60					brown mottle, firm, wet, abundant light gray
62					to light brown chert, abundant MnO staining.
64	SP	X			CL SILTY CLAY: as above, abundant chert, wet,
66					especially along fracture faces on the chert,
68					(Ft. Payne).
70					
72					

Auger T.D. was 64', started to pound split spoon for sample of bedrock. After a few blows sampler fell to 68.25', possible void or cavity.

LIMESTONE: medium gray, weathered, wet, sample description based on a few fragments that were in the sampler shoe. (Ft. Payne).

ornl

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/13/93 Page: 1 OF 1
 Hole No.: MW59 Casing Elevation: 454.44' Ground Elevation: N/A
 Total Depth: 48.5' No. of Compl.: 1 Rig Type: CME-55 Location: W. of Old Oil Shed
 Auger Size: 3.5" I.D. Sample Type: 2" x 1.5' Split Spoon
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 04/15/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: angular gravel road base to 6" grading to intermixed reddish yellow (7.5YR 6/8) silty clay and gravel. stiff, sl damp.
2					
4	SP				
6					FILL: as above, decreasing gravel, increasing red color.
8					
10	SP				
12					CL SILTY CLAY: red (2.5YR 5/8) with a brownish yellow (10YR 6/8) mottle, stiff, slightly damp, common light gray weathered chert, no odors, (Ft. Payne).
14					
16					
18					CL SILTY CLAY: predominantly as above, scattered MnO staining.
20	SP				
22					
24					
26					SANDSTONE: very dark to medium gray, fine grained subangular to subrounded, moderately sorted, siliceous (quartzite). (Frog Mtn.).
28					
30					No sample recovery 29-31' interval.
32					
34					No sample recovery 34-36' interval.
36	SP				
38					CL SILTY CLAY: strong brown (7.5YR 4/6), soft, definite increase in moisture content, description based on auger cuttings faint solvent odor.
40	SP				
42					CL SILTY CLAY: strong brown (7.5YR 5/8), stiff, damp, abundant coarse grained chert and sandstone, zone appears very brecciated, possible fault gouge, (Ordovician?).
44	SP				
46					ML CLAYEY SILT: yellowish brown (10YR 5/8), soft, wet, scattered MnO staining.
48	SP				
50					Auger refusal at 48.5'.

Prepared By: M.E. Mumby Date: 4/13-14/93 Page: 1 OF 1
 Hole No.: MW60 Casing Elevation: _____ Ground Elevation: N/A
 Total Depth: 52.5' No. of Compl.: 1 Rig Type: CME-55 Location: E. of Old Oil Shed
 Auger Size: 3.5" I.D. Sample Type: 2" X 1.5' Spitspoon
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 4/15/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: angular gravel road base with intermixed red silty clay, dry.
2					
4	SP	X			
6					CL SILTY CLAY: red (2.5YR 5/8) with a brownish yellow (10YR 6/5) mottle, stiff, slightly damp, abundant light gray to light blueish gray bedded chert, chert is moderately weathered, (Ft. Payne).
8					
10	SP	X			
12					
14					CL SILTY CLAY: as above, sample quality is not very good due to small sampler size and the abundance of chert which is tending to block the sampler shoe.
16					
18					
20	SP	X			CL SILTY CLAY: red (2.5YR 4/8), firm, damp, visible water sheen on freshly broken samples, abundant chert.
22					
24					CL SILTY CLAY: red (2.5YR 5/8) to yellowish brown (10YR 5/8), soft, damp, no visible chert, scattered very deformed relict bedding planes, scattered MnO staining.
26					
28					
30					CL SILTY CLAY: as above, abundant MnO staining and nodules, visible relict bedding planes, scattered chert, becoming wet at approximately 30'.
32					
34	SP	X			SANDSTONE: dark to very dark gray, fine grained, subrounded, moderately to well sorted, siliceous (quartzite), dry. (Frog Mtn?).
36					
38					
40	SP	X			No sample 39-41'. going back to larger split spoons.
42					
44	SP	X			CL SILTY CLAY: dark reddish brown (5YR 3/4), soft, wet on freshly broken faces, sample quality improved with larger split spoons.
46					
48					
50	SP	X			ML CLAYEY SILT: yellowish brown (10YR 6/8), soft, wet, (Ordovician?).
52					Auger Refusal at 52.5'.
54					

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/14/93 Page: 1 OF 1
Hole No.: MW61 Casing Elevation: 463.42' Ground Elevation: N/A
Total Depth: 54.6' No. of Compl.: 1 Rig Type: CME-55 Location: Replacement for MW15
Auger Size: 3.5" I.D. Sample Type: 3"X 2' Splitspoon "Calif. method", brass sleeves.
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 04/15/93

DEPTH (FEET)	SAMPLE TYPE	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0				
2				
4	SP			FILL: dark reddish brown (2.5YR 3/4), stiff, damp, predominantly silty clay with interbedded, gravel and sand, moderate hydrocarbon odor.
6				
8				
10	SP			CL SILTY CLAY: red (2.5YR 4/8) with a brownish yellow (10YR 6/8) mottle, stiff, damp, scattered light to light gray blue weathered chert increasing with depth, moderate solvent odor (Ft. Payne).
12				
14				
16				
18				SANDSTONE: medium gray, very fine to fine grained moderately sorted, very hard, siliceous, some zones exhibit a buff color which is representative of weathered zones near fractures, abundant interbedded red silty clay, very difficult drilling (Frog Mtn.).
20	SP			
22				
24				CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown (10Yr 6/8) mottle, firm, slightly damp, scattered MnO staining, moderate solvent and hydrocarbon odor.
26				
28				
30				SANDSTONE: buff, very fine to fine grained, sub-rounded, moderately sorted, friable, slightly damp, moderate solvent odor.
32				
34	SP			ML CLAYEY SILT: yellow (10YR 7/8), soft, damp, scattered sandstone clasts, abundant MnO staining, moderate solvent odor.
36				
38				
40	SP			ML CLAYEY SILT: as above, increasing moisture content with depth.
42				
44	SP			ML CLAYEY SILT: yellow (10YR 7/8) with increasing red, occasional relict bedding planes which show extreme deformation. (Ordovician).
46				
48				Tagged top of bedrock at 48.5'. Auger kicked off and drilling continued with no resistance to approximately 49'. Pounded split spoon from 49 to 51, no resistance and no sample recovery. Augered to 54' and stopped, pounded split spoon to 54.6 (refusal). Possible cavity or slot in the unweathered bedrock, (Ordovician?).
50	SP			
52				
54				
56				

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/15/93 Page: 1 OF 1
 Hole No.: MW62 Casing Elevation: 463.31' Ground Elevation: N/A
 Total Depth: 37.5' No. of Compl.: 1 Rig Type: CME-55 Location: TLU Pad
 Auger Size: 3.5" I.D. Sample Type: 3"X 2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 4/18/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE DITY	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					
2	SP	X			FILL: predominantly red (2.5YR 5/8), intermixed silty clay, gravel and chert, damp, very strong solvent odor.
4	SP	X			
6					CL SILTY CLAY: yellowish brown (10YR 5/8), with scattered light gray mottle, very stiff, dry, very strong solvent odor.
8					
10	SP	X			
12					CL SILTY CLAY: yellowish brown (10YR 5/8), grading to a clayey silt, stiff, slightly damp, scattered friable silt laminae to 2mm, occasional black MnO staining, common very coarse grained weathered chert (Ft. Payne).
14					
16	SP	X			
18					
20	SP	X			ML CLAYEY SILT: yellowish red (5YR 5/8), stiff, damp, abundant chert ranging in size from very coarse grained (vcU) to .5", scattered black MnO staining and some nodules.
22					
24	SP	X			
26					SANDSTONE: yellowish red to buff, very fine grained, moderately to well sorted, friable, sandstone is brecciated to some degree with abundant red silty clay fill in the brecciated zones, damp, moderate solvent odor, (Frog Mtn.).
28					
30	SP	X			
32					
34	SP	X			ML CLAYEY SILT: dark reddish brown (2.5YR 3/4), firm, damp, moisture content increasing with depth, abundant interbedded chert, sand and sandstone fragments, possible fault gouge.
36					
38					Auger refusal at 37.5'. Pounded split spoon for bedrock sample, no sample obtained, (Ordovician?).
40					
42					
44					
46					
48					
50					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>	Date: <u>4/16/93</u>	Page: <u>1 OF 1</u>
Hole No.: <u>MW63</u>	Casing Elevation: <u>463.18'</u>	Ground Elevation: <u>N/A</u>
Total Depth: <u>55.5'</u>	No. of Compl.: <u>1</u>	Rig Type: <u>CME-55</u>
Auger Size: <u>3.5" I.D.</u>	Sample Type: <u>3"X 2' Splitspoon "Calif. method", brass sleeves.</u>	Location: <u>SE Corner Gen. Sta.</u>
Project: <u>Wilsonville, AL</u>	Data Verified By: <u>F.G. Gardner</u>	Date: <u>4/18/93</u>

DEPTH (FEET)	SAMPLE TYPE	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0				
2				
4	SP	X		FILL: angular limestone road base to approximately 4", increasing clay content with depth, black to approximately 1' possibly oil-stained, becoming red thereafter.
6				
8				
10	SP	X		CL SILTY CLAY: red (2.5YR 4/8), stiff, slightly damp, abundant interbedded light gray to light gray blue weathered chert, chert exhibits a vugular texture and is fossiliferous, (Ft. Payne).
12				
14				
16	SP	X		CL SILTY CLAY: as above.
18				
20				
22	SP	X		CL SILTY CLAY: red (2.5YR 4/8), stiff, slightly damp, abundant bedded chert, chert is light gray to light gray blue, vugular, fossiliferous no odors.
24				
26				
28	SP	X		CL SILTY CLAY: as above, with a yellowish brown mottle, decreasing chert content.
30				
32				
34	SP	X		ML CLAYEY SILT: yellowish red (5YR 5/8), soft, wet scattered light gray blue moderately weathered chert.
36				
38				
40	SP	X		ML CLAYEY SILT: yellowish brown (10YR 5/8), stiff damp, occasional very weathered chert, scattered black MnO staining, grades to a yellow (10YR 6/8) clayey sand at approximately 33'.
42				
44				
46	SP	X		CS CLAYEY SAND: yellow (10YR 5/8), firm, damp, very fine grained, subrounded, moderately to well sorted (Frog Mtn.).
48				
50				
52	SP	X		ML CLAYEY SILT: red (2.5YR 4/8), firm, damp, abundant MnO staining and nodules, no visible chert, common very deformed relict bedding planes.
54				
56	SP	X		SANDSTONE: very dark to medium gray, some buff, very fine grained, subrounded moderately sorted, abundant red silty clay fracture fill, entire interval is brecciated to some degree.
58				
60				

Auger refusal at 54'. Pounded split spoon to refusal at 55.5'.

LIMESTONE: light gray, very weathered, saturated, (Ord. Undifferentiated).

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/16/93 Page: 1 OF 1
 Hole No.: MW64 Casing Elevation: 463.33' Ground Elevation: N/A
 Total Depth: 49' No. of Compl.: 1 Rig Type: CME-55 Location: NW Corner L. W. Sump
 Auger Size: 3.5" I.D. Sample Type: 3"X 2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 4/18/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: strong brown (7.5YR 4/6), primarily uncon-
2					solidated gravel with some intermixed clay.
4	SP	X			
6					
8					CL SILTY CLAY: red (2.5YR 4/8) with a brownish
10	SP	X			yellow (10YR 6/8) mottle, stiff, damp, scattered
12					very weathered light gray chert to 0.5", weak
14					solvent odor (Ft. Payne).
16	SP	X			
18					CL SILTY CLAY: as above, moderate solvent odor,
20					abundant chert.
22	SP	X			
24					CL SILTY CLAY: red (2.5YR 4/8) decreasing
26					yellowish brown mottle, stiff, slightly damp,
28	SP	X			abundant light gray weathered chert to 1.5",
30					beginning to see occasional black MnO staining,
32					slight solvent odor.
34	SP	X			
36					CL SILTY CLAY: as above, abundant chert and black
38					MnO staining and nodules.
40	SP	X			
42					SANDSTONE: medium to dark gray, very fine grained,
44					moderately to well sorted, very hard, siliceous,
46	SP	X			very fractured with abundant silty clay fracture
48					fill in beds up to 2", clay in fractures is wet,
50					(Frog Mtn.).
52					No sample, sandstone fragments blocking shoe 34'
54					to 36' interval.
					CL SILTY CLAY: dark red (2.5YR 3/6), firm, damp,
					moisture content increasing with depth, abun-
					dant black MnO staining, no visible chert,
					(Ord. Limestone).
					ML CLAYEY SILT: dark reddish brown (2.5YR 3/4),
					soft, damp, becoming wet at 46'.
					Auger refusal at 49'. Pounded split spoon for
					bedrock sample.
					LIMESTONE: light to medium gray, predominantly
					weathered residuum, some fragments are micro-
					crystalline very hard, saturated.

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/17-18/93 Page: 1 OF 1
 Hole No.: MW72 Casing Elevation: 452.99' Ground Elevation: N/A
 Total Depth: 38' No. of Compl.: 1 Rig Type: CME-55 Location: NW Corner V-225 Pad
 Auger Size: 3.5" I.D. Sample Type: 3"X 2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 4/20/93

DEPTH FEET	SAMPLE TYPE	SAMPLE DETH	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					
2					FILL: angular gravel road base with some inter-mixed silty clay.
4	SP				
6					CL SILTY CLAY: red (2.5YR 4/8), firm, slightly damp, abundant weathered chert, moderate solvent odor.
8					
10	SP				
12					CL SILTY CLAY: predominantly red (2.5YR 4/8) with some yellowish brown mottle, stiff, slightly damp, abundant light gray to light gray blue weathered chert, slight solvent odor (Ft. Payne).
14					
16	SP				
18					CL SILTY CLAY: as above grading to a clayey sand at 19.8', firm, damp.
20	SP				
22					SANDSTONE: buff grading to a very dark gray, very fine grained, subrounded, moderately to well sorted, friable in the buff weathered zones, very hard, siliceous in the dark gray unweathered zones, (Frog Mtn.).
24					
26	SP				
28					SANDSTONE: buff, very fine grained, subrounded, moderately to well sorted, friable, visible vertical fractures, with black MnO fracture fill, damp.
30	SP				
32					SANDSTONE: as above grading back to more of an unweathered lavender gray, very difficult drilling.
34					
36	SP				ML CLAYEY SILT: predominantly red (2.5YR 4/8) with a brownish yellow (10YR 6/8) mottle and banding, soft, wet, moderate amount of MnO staining, (Ord. Limestone).
38	SP				Auger refusal at 38'. Pounded split spoon for bedrock sample no returns.
40					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/18/93 Page: 1 OF 1
 Hole No.: MW73 Casing Elevation: 463.0' Ground Elevation: N/A
 Total Depth: 37.7' No. of Compl.: 1 Rig Type: CME-55 Location: North End of Facility
 Auger Size: 3.5" I.D. Sample Type: 3"X 2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, Al Data Verified By: F.G. Gardner Date: 4/20/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: angular limestone gravels with intermixed silty clay.
2					
4	SP				SANDSTONE: buff with some medium gray, very fine grained, subrounded moderately to well sorted, friable, fractured with red silty clay fracture fill, slightly damp. (Frog Mtn.).
6					
8					
10	SP				SANDSTONE: as above, poor sample return.
12					
14	SP				CL SILTY CLAY: red (2.5YR 4/8) becoming dark reddish brown (5YR 3/4), firm, slightly damp, occasional yellowish brown mottle, abundant MnO staining and nodules. (Ordovician).
16					
18					
20	SP				CL SILTY CLAY: as above, decreasing yellowish brown mottle, increasing silt content.
22					
24	SP				ML CLAYEY SILT: dark reddish brown (5YR 3/4), soft, wet at approximately 24', scattered red silty clay stringers throughout sample interval, scattered very coarse grained sandstone fragments.
26					
28					
30	SP				ML CLAYEY SILT: brownish yellow (10YR 6/8), soft, wet, fairly homogeneous.
32					
34	SP				
36					
38	SP				Top of Bedrock 35'. Continued augering in a slot to refusal at 37.7'. Pounded split spoon for lithologic sample. Stuck spoon in slot, had a difficult retrieval. Ruined split spoon, (Ordovician?).
40					

Bedrock Well Logs

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By P.M. KEARL/M.E. MUMBY Date 06/07/92 Page 1 of 1
Hole No. CH-36 CASING ELEVATION: 455.56' GROUND ELEVATION: _____
Total Depth 101.7' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type 2" SPLIT SPOON/CME WIRELINE CORE Location SE OF MAIN BUILDING
Project WILSONVILLE Data Verified By F.G. GARDNER Date 07/31/92

DEPTH (FEET)	BLDG/ 6"	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8					
+4					
0					FILL: dark gray brown, predominantly clay with intermixed grass, roots and other organic debris, scattered limestone gravels, damp.
4					
8					
12					CL SILTY CLAY: yellowish red (5 YR 5/8), with a yellowish brown mottle, stiff to firm, slightly damp, abundant light gray to light grayish blue slightly weathered chert, (Ft. Payne).
16					CL SILTY CLAY: as above with abundant chert (auger cuttings).
20					
24					ML CLAYEY SILT: brownish yellow with light gray mottle, very soft, saturated, (possible very weathered chert ?).
28					ML CLAYEY SILT: strong brown (7.5 YR 5/8), very stiff, slightly damp, scattered with occasional light gray to light gray brown chert.
32					SHALE: reddish gray with yellow brown to red staining, hard to firm, platy, very weathered, dry, (Floyd Shale).
36					
40					
44					SHALE: as above (based on auger cuttings and drill rate).
48					SHALE: as above, wet at ~50.5'.
52					TOP OF LIMESTONE BEDROCK @ 53 FT.
56					WELL COMPLETION INFORMATION: 3" NX steel casing set at 54.5 ft. Cemented to surface with neat cement. Core hole begins at 51.7 ft, 100% recovery to 101.7 ft,
60					LIMESTONE: light to medium gray, microcrystalline, abundant white calcite-filled fractures, scattered shale partings, 1-cm black shale (coal luster) at 60', core is intact with small fractures at 54' as noted by Fe oxide staining, 45 degree dip in bedding, 100% recovery, calcareous single small vug at ~55', scattered crinoids and brachiopods (Floyd limestone).
64					
68					
72					NOTE: possible contact, fracture at 71.5', continuous across the core, calcite crystals below this fracture, limestone changes character with abundant chert (Fort Payne Limestone).
76					
80					LIMESTONE: light gray, noticeable decrease in shale partings, very hard drilling, 10 cm partings that appear to be fractures that have been filled by chert, same 45 degree dip as above, no white calcite-filled fractures as above, some of the chert is bedded, some is scattered nodules.
84					
88					
92					LIMESTONE: as above, several breaks of fractures (?) parallel to the bedding plane are apparent and scattered throughout the section.
96					
100					
104					TD 101.7 Ft.

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By M.E. MUMBY Date 10/14-16/92 12/10/92 Page 1 of 2
Hole No. CH55 CASING ELEVATION: 461.65' GROUND ELEVATION: _____
Total Depth 151.7' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location 5' SOUTH OF MW37
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/92

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By <u>M.E. MUMBY</u>		Date <u>10/14-16/92 12/10/92</u> Page <u>2</u> of <u>2</u>	
Hole No. <u>CH55</u>		CASING ELEVATION: <u>461.65'</u> GROUND ELEVATION: _____	
Total Depth <u>151.7'</u>		Number of Completions <u>1</u> Rig Type <u>CME 55</u>	
Core Size <u>1.5"</u>		Sample Type <u>CME WIRELINE CORE</u> Location <u>5' SOUTH OF MW37</u>	
Project <u>WILSONVILLE</u>		Data Verified By <u>F.G. GARDNER</u> Date <u>11/5/92</u>	

DEPTH (FEET)	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
108	NX CORE HOLE		LIMESTONE: light to medium gray, micro to occasionally crypto-crystalline, scattered dark gray shale laminations decreasing with depth, small calcite-filled fractures (1-2 mm) dipping at approximately 45 degrees.
112			LIMESTONE: predominantly as above, argillaceous from 114 to 117'.
116			LIMESTONE: light to medium gray, micro to cryptocrystalline, small calcite-filled fractures, occasional very dark grayish brown silt/clay laminations.
120			LIMESTONE: as above, one major fracture at 138.1', exhibits a FeO-stained surface along the fracture face, fracture fill is siliceous and shows some small crystal growth along with a very grainy texture, both appear to be solution features.
124			LIMESTONE: light to medium gray, becoming increasingly crypto-crystalline, small calcite-filled fractures.
128			T.D. 151.7' on 10/16/92. Hole was re-entered on 12/10/92 for seismic purposes.
132			LIMESTONE: medium gray, predominantly cryptocrystalline, hard, scattered white calcite healed fractures, occasional silt/clay laminations to 1cm, laminations are non-calcareous, fissile, pyritic.
136			LIMESTONE: as above, common silt/clay laminations to 4 cm, becoming abundant, and very deformed at 165.5', possible soft sediment deformation, becoming uniform again at 172.9', scattered cubic pyrite, brachs and other fossil debris.
140			LIMESTONE: medium to dark grayish brown, microcrystalline, hard, argillaceous, becoming very fossiliferous especially in the argillaceous zones, common white calcite-healed fractures.
144			LIMESTONE: dark brownish gray, microcrystalline, hard, very fossiliferous (stromatolites) from 194.3 to 196', common white calcite-healed fractures becoming absent at approximately 194'.
148			LIMESTONE: as above becoming increasingly cryptocrystalline.
152			T.D. 201.7'.
156			
160			
164			
168			
172			
176			
180			
184			
188			
192			
196			
200			
204			
208			
212			
216			
220			

Well Summary Information

Prepared By M.E. MINNEY, C.A. MUHR Date 5/7/93 Page 1 of 2

Hole No. CH78 CASING ELEVATION: 469.98 GROUND ELEVATION:

Total Depth 163' Number of Completions 1 Rig Type CME 55

Core Size 1.5" Sample Type CME WIRELINE CORE Location SOUTH OF BH50

Project WILSONVILLE Date Verified By F.G. GARDNER Date 11/5/93

DEPTH (FEET)	STRATIGRAPHIC CORRELATION	WELL CONSTRUCTION	UNSATUR	DESCRIPTION
0				
4				
8				
12				
16				
20				
24				
28				
32				
36				
40				
44				
48				
52				
56				
60				
64				
68				
72				
76				
80				
84				
88				
92				
96				
100				
104				

Auger refusal at 84.5'.
 WELL COMPLETION INFORMATION:
 3" PVC casing set at 84.5'.
 Cemented 10' up from bottom of casing with neat cement.

SHALE: black, firm to brittle, vitreous luster, fissile, bedding planes are inclined to 60 degrees, some zones show evidence of movement, common slickensides on fracture faces, scattered pyrite, (Floyd Shale).

SHALE: as above.

OAK RIDGE NATIONAL LABORATORY
Well Summary Information

Prepared By M.E. MUMBY Date 5/7/93 Page 2 of 2
Hole No. CH78 CASING ELEVATION: 469.98' GROUND ELEVATION: _____
Total Depth 163' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location SOUTH OF BH50
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

DEPTH (FEET)	RUN # WIRELINE SECTION	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
108					SHALE: black, firm to brittle, vitreous, fissile, common slickensides along fracture faces, good sharp contact with the underlying Floyd Limestone, highly pyritized right at the contact.
112					Top of Floyd Limestone 112.2'.
116					LIMESTONE: very dark gray, microcrystalline, very hard, occasional beds of black calcareous shale, very fossiliferous with crinoid columns, brachiopods, and Fenestrella bryozoans in the shaley zones, abundant white calcite-healed fractures.
120					LIMESTONE: as above, small vertical fault plane at 121.2', fault continues to approximately 122.7', entire zone is very deformed.
124					LIMESTONE: very dark gray, microcrystalline, very hard, fossiliferous, small fractured zone from 125.4' to 126.3', shows no indication of fluid movement.
128					LIMESTONE: very dark gray, microcrystalline, very hard, definite increase in the amount of black shale below 126.3', very fossiliferous, abundant white calcite-healed fractures inclined 60 degrees to vertical, 2" nodule of chert at 138.2'.
132					LIMESTONE: as above, slight decrease in the amount of white calcite-healed fractures.
136					Top of Ft. Payne Limestone 150.5'.
140					LIMESTONE: medium to light gray, micro to cryptocrystalline in part, no shale beds present, occasional fossils, brachs, crinoid stems, abundant light gray bedded chert and chert nodules.
144					
148					
152					
156					
160					
164					T.D. 163'.
168					
172					
176					
180					
184					
188					
192					
196					
200					
204					
208					
212					
216					
220

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By M.E. MUMBY C.A. MUHR Date 5/8/93 Page 1 of 2
Hole No. CH79 CASING ELEVATION: 467.46' GROUND ELEVATION: _____
Total Depth 166.6' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location NORTHEAST OF CH78
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By M.E. MUMBY C.A. MUHR P.M. KEARL Date 5/8/93 Page 2 of 2
Hole No. CH79 CASING ELEVATION: 457.45' GROUND ELEVATION: _____
Total Depth 166.6' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location NORTHEAST OF CH78
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

DEPTH (FEET)	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
108	NX CORE HOLE		LIMESTONE: very dark gray to black, microcrystalline, hard, very fossiliferous, shaley, increasing white calcite-healed fractures.
112			LIMESTONE: as above.
116			
120			SHALE: black, firm to brittle, sub-waxy to vitreous luster, very carbonaceous, non-calcareous, limestone shale contact shows extreme deformation, shale is pyritic right along the contact, common slickensides are visible on fracture faces, (Floyd Shale).
124			
128			
132			SHALE: as above with occasional black quartzite sandstone beds to 2 inches.
136			
140			SHALE: very dark gray to black, firm to brittle, vitreous, common slickensides, very deformed bedding with calcite stringers throughout.
144			
148			
152			LIMESTONE: dark gray, microcrystalline, hard, abundant white calcite-healed microfractures, fossiliferous (crinoids, brachs), appears very similar to the limestone above 118', fold?, shaley with common slickensides along the shale partings, limestone is noticeably deformed, (Floyd Limestone).
156			
160			
164			
168			T.D. 166.6'.
172			
176			
180			
184			
188			
192			
196			
200			
204			
208			
212			
216			
220			

Prepared By	M.E. MUMBY D.M. FRINGS		Date	5/7/93	Page	1 of 1
Hole No.	CH80	CASING ELEVATION:	461.91'	GROUND ELEVATION:		
Total Depth	96.7'	Number of Completions	1	Rig Type	CME 55	
Core Size	1.5"	Sample Type	2" S. SPOON (OVERBURDEN), CME WIRELINE CORE		Location SE CORNER OF STORAGE PAD	
Project	WILSONVILLE	Data Verified By	F.G. GARDNER	Date	11/5/95	

DEPTH (FEET)	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8			
+4			
0			
4			ML CLAYEY SLIT: red (2.5YR 4/8) to brownish yellow (10YR 6/8), stiff, with scattered chert fragments, (possible fill).
8			ML CLAYEY SILT: reddish yellow (5YR 6/8) to yellowish brown (10YR 5/8), stiff, scattered friable sandstone fragments.
12			CL SILTY CLAY: yellowish red (5YR 5/6), stiff, scattered pale brown (10YR 8/4) friable sandstone fragments, (Frog Mtn.).
16			CL SILTY CLAY: red (2.5YR 5/6), stiff.
20			CL SILTY CLAY: as above
24			CL SILTY CLAY: red (2.5YR 4/6) with a yellow (10YR 7/6) mottle, stiff, no visible chert, (Ordovician).
28			
32			
36			
40			
44			
48			
52			Auger refusal at 52.5'. WELL COMPLETION INFORMATION: 3" PVC well casing set at 52.5'. Cemented 10' up from bottom of casing with neat cement.
56			LIMESTONE: dark gray to dark gray brown, microcrystalline, hard, argillaceous in part, common dark gray brown silt/clay laminations, scattered fossils and fossil debris, good series of open fractures and possible small cavity from 55.5 to 57', some fracture faces show FeO staining and some secondary mineral growth. (Ordovician Undifferentiated).
60			LIMESTONE: dark gray to dark gray brown, microcrystalline, hard, argillaceous, common silt/clay laminations, starting to see soft sediment deformation at approximately 62.4' to 70' becoming uniform again below 70', good open fractures with FeO staining and secondary mineral growth at 61.6' and 68.8', cavity from 71.6' to 73'.
64			LIMESTONE: medium to dark gray brown with medium to light gray mottling, common silt/clay laminations and argillaceous zones, becoming fossiliferous (stromatolites and bryozoans), common white calcite-healed fractures, good open fracture with FeO staining at 75.2'.
68			LIMESTONE: color as above, small fault at 86 to 87.2', zone is very deformed and fractured with small white calcite-healed fractures running parallel to the fault, fault plane is inclined approximately 75 to 80 degrees and exhibits FeO staining.
72			LIMESTONE: medium to dark gray brown with medium to light gray mottle, microcrystalline, hard, becoming very fossiliferous, two open fractures at 95 and 96' with a small vertical fracture between the two, common FeO staining on all the fracture faces.
76			T.D. 96.7'.
80			
84			
88			
92			
96			
100			
104

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By M.E. MUMBY C.A. MUHR D.M. FRINGS Date 5/8/93 Page 1 of 1
Hole No. CH81 CASING ELEVATION: 463.12' GROUND ELEVATION: _____
Total Depth 85.7' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type 2' S. SPOON (OVERBURDEN), CME WIRELINE CORE Location SE CORNER OF STORAGE PAD
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

DEPTH (FEET)	RUN # SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8				
+4				
0				
4				CL SILTY CLAY: red (2.5YR 4/8), stiff, abundant angular cobble-size chert, (Ft. Payne).
8				
12				
16				SANDSTONE: gray, fine grained, moderately hard, unweathered, common red (2.5YR 4/8) and yellow (10YR 6/8) clay lenses, becoming increasingly friable with depth, (Frog Mtn.).
20				SANDSTONE: as above.
24				
28				
32				CL SILTY CLAY: reddish brown (2.5YR 4/4), stiff, slightly plastic.
36				Auger refusal at 37.1'
40				WELL COMPLETION INFORMATION: 3" PVC well casing set at 37.1'. Cemented 10' up from bottom of casing with neat cement.
44				LIMESTONE: medium to dark gray, micro to cryptocrystalline in part, very hard, argillaceous, common silt/clay laminations, scattered soft sediment deformation, scattered fossils, possible elongated sponges?, (Ordovician Undifferentiated).
48				
52				LIMESTONE: predominantly as above, silt clay laminations show no soft sediment deformation and area inclined 30-40 degrees, common fossils (sponges?), scattered white calcite-healed fractures.
56				
60				
64				LIMESTONE: medium to dark gray, microcrystalline, hard, decreasing fossils, becoming absent at approximately 69.7', common very dark gray silt/clay laminations, abundant from 70-74', scattered white calcite-healed fractures.
68				
72				
76				Distinct color change at approximately 74'.
80				LIMESTONE: medium to light gray, microcrystalline, very hard, scattered dark gray silt/clay laminations decreasing with depth, becoming more cryptocrystalline with depth, common white calcite-healed fractures abundant from 82.1-84'.
84				
88				T.D. 85.7'.
92				
96				
100				
104

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By C.A. MUHR Date 5/7/93 Page 1 of 1
Hole No. CH82 CASING ELEVATION: 463.89' GROUND ELEVATION: _____
Total Depth 91.7' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location SW CORNER LIQUID WASTE SUMP
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

Well Summary Information

Prepared By	M.E. MUMBY C.A. MUHR D.M. FRINGS (overburden)	Date	5/7/93	Page	1 of 1
Hole No.	CH83	CASING ELEVATION:	464.08'	GROUND ELEVATION:	
Total Depth	99.3'	Number of Completions	1	Rig Type	CME 55
Core Size	1.5"	Sample Type	CME WIRELINE CORE	Location	ADJACENT TO P209
Project	WILSONVILLE	Date Verified By	F.G. GARDNER	Date	11/5/95

DEPTH (FEET)	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8			
+4			
0			CL SILTY CLAY: red (2.5YR 4/8), fairly stiff.
4			
8			
12			
16			ML CLAYEY SILT: brownish yellow (10YR 6/8), possible weathered shale?
20			
24			CL SILTY CLAY: reddish yellow (7.5YR 6/8), soft, moist, abundant large angular weathered chert fragments, increasing MnO staining. (Ft. Payne).
28			
32			CL SILTY CLAY: reddish brown (5YR 4/4), soft, scattered pale brown rock fragments, possible fault gouge.
36			
40			
44			Auger refusal at 49'.
48			WELL COMPLETION INFORMATION: 3" PVC Well casing set at 49'. Cemented 10' up from bottom of casing with neat cement.
52			SANDSTONE: very dark to occasionally light gray, very fine grained, subrounded, moderately to well sorted, siliceous (quartzite), very hard, extremely fractured with abundant FeO staining along fracture faces, cavity from 53.7 to 56.7', lost circulation, no returns, (Frog Mtn.).
56			
60			LIMESTONE: medium gray with a very dark gray mottle from 57' to approximately 63.1', micro to occasionally cryptocrystalline, very hard, dolomitic in the dark gray mottled zones, scattered very small white calcite-healed fractures, occasional very dark gray silt/clay laminations, (Ordovician Undifferentiated).
64			
68			LIMESTONE: light gray, microcrystalline, very hard, common white calcite-healed fractures, slightly argillaceous.
72			
76			
80			
84			LIMESTONE: medium gray with a dark gray mottle, microcrystalline, hard, argillaceous in the dark gray zones, common white calcite-healed fractures inclined to 60 degrees.
88			
92			LIMESTONE: light to medium gray, microcrystalline, hard, occasional very dark grayish brown silt/clay laminations, scattered small white calcite-healed fractures.
96			
100			T.D. 99.3'.
104

OAK RIDGE NATIONAL LABORATORY Well Summary Information

Prepared By P.M. KEARL D.M. FRINGS (over burden) Date 5/11/93 Page 1 of 1
Hole No. CH84 CASING ELEVATION: N/A GROUND ELEVATION: 459.11'
Total Depth 91.7' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE 2' S SPOON OVERBURDEN Location SE CORNER OF FACILITY
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/05/93

DEPTH (FEET)	RAW # INTERVAL	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8					
+4					
0					
4					CL SILTY CLAY: red (2.5YR 4/8), stiff, abundant chert to cobble size, (Ft. Payne).
8					
12					
16					
20					
24					
28					CL SILTY CLAY: red (2.5YR 4/8), stiff, abundant chert to cobble size.
32					
36					CL SILTY CLAY: red (2.5YR 4/8) to strong brown (7.5YR 5/6), soft, moist, slightly sandy.
40					Auger refusal at 49'.
44					WELL COMPLETION INFORMATION: 3" PVC Well casing set at 49'. Cemented 10' up from bottom of casing with neat cement.
48					SANDSTONE: medium to dark gray, fine grained sub rounded moderately sorted, grading into a very hard quartzite, very fractured with abundant FeO staining along the fracture faces, cavities from 46 to 46.5' and 50 to 53', both are clay filled, (Frog Mtn).
52					
56					LIMESTONE: medium gray, microcrystalline, hard, abundant white calcite healed fractures, no apparent secondary porosity, fractures decreasing with depth, (Ordovician Undifferentiated).
60					
64					
68					LIMESTONE: predominantly as above, scattered white calcite healed fractures.
72					
76					
80					
84					
88					LIMESTONE: medium gray, microcrystalline, hard, vertical fracture at 90' with an argillaceous fracture fill, core separated along fracture.
92					
96					T.D. 91.7'.
100					
104

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By M.E. MUMBY C.A. MUHR D.M. FRINGS (overburden) Date 5/7/93 Page 1 of 1
Hole No. CH85 CASING ELEVATION: 460.52' GROUND ELEVATION: N/A
Total Depth 60.0' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE 2' S SPOON OVERBURDEN Location SE OF CH55
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/95

DEPTH (FEET)	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8			
+4			
0			FILL: strong brown (7.5YR 5/6) stiff, predominantly clay with scattered limestone aggregate.
4			
8			
12			SHALE: strong brown (7.5YR 5/6) to gray (7.5YR n5) to red (2.5YR 5/8), firm, banded, very weathered, (Floyd Shale).
16			
20			
24			Auger refusal at 49'.
28			WELL COMPLETION INFORMATION: 3" PVC Well casing set at 49'. Cemented 10' up from bottom of casing with neat cement.
32			LIMESTONE: very dark gray to black, microcrystalline, hard, shaley, very fossiliferous with abundant brachiopod, crinoid and bryozoan fragments, large cavity from 28.6 to 38.5', lost circulation, cavity is filled with chert rubble and very dark brown limey mud, chert rubble is extensively stained with FeO indicating fluid movement. (Ordovician Undifferentiated).
36			
40			LIMESTONE: as above, large open solution features are present and filled with a tan limey mud, mud is very fossiliferous with Fenestrella bryozoan fragments the most prevalent, cavity from 39.7 to 41.7', large cavity from 42.2 to 51', cavity is filled with FeO-stained chert rubble.
44			
48			
52			Cavity from 51.7 to 53.2'.
56			LIMESTONE: light gray, microcrystalline, very hard, abundant nodules and beds of light to dark gray chert, beds range in thickness from 1 to 3", scattered fossil debris, occasional open fractures with no indication of fluid movement.
60			
64			T.D. 60'.
68			
72			
76			
80			
84			
88			
92			
96			
100			
104

OAK RIDGE NATIONAL LABORATORY Well Summary Information

Prepared By	C.A. MUHR	Date	5/21/93	Page	1	of	1
Hole No.	CH86	CASING ELEVATION:	454.87'	GROUND ELEVATION:	N/A		
Total Depth	59.5'	Number of Completions	1	Rig Type	CME 55		
Core Size	1.5"	Sample Type	CME WIRELINE CORE	Location	SE OF CH55		
Project	WILSONVILLE	Data Verified By	F.G. GARDNER	Date	11/05/93		

DEPTH (FEET)	RUN #	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8					
+4					
0					
4					
8					
12					
16					
20					
24					
28					
32					
36					
40					
44					
48					
52					
56					
60					
64					
68					
72					
76					
80					
84					
88					
92					
96					
100					
104					

No overburden data available.

Auger refusal at 49'.

WELL COMPLETION INFORMATION:
3" PVC Well casing set at 49'.
Cemented 10' up from bottom of casing with neat cement.

LIMESTONE: medium to light gray, microcrystalline, very hard, common white calcite healed fractures inclined at approximately 30-45 degrees, cavities from 49.8 to 53.4' and 53.7 to 57.9'.
(Ordovician Undifferentiated).

Driller reported very difficult drilling at 59.5', possible chert bed?
Decided to cease drilling at this depth.
T.D. 59.5'.

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By C.A. MUHR Date 5/21/93 Page 1 of 2
Hole No. CH87 CASING ELEVATION: 470.96' GROUND ELEVATION: N/A
Total Depth 151.1' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location NORTHWEST OF FACILITY
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/95

DEPTH (FEET)	ROW 2 INFORM CONCZ	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8					
+4					
0					
4					
8					
12					
16					
20					
24					
28					
32					Overburden data not available, lithology is most likely Floyd Shale based on the hole location.
36					
40					
44					
48					
52					
56					
60					
64					
68					
72					
76					
80					
84					
88					
92					
96					Auger refusal at 95'. WELL COMPLETION INFORMATION: 3" PVC well casing set at 95'. Cemented 10' up from bottom of casing with neat cement.
100					SHALE: black, vitreous, brittle, abundant slickensides, bedding planes are dipping approximately 60 to 90 degrees. (Floyd Shale).
104

OAK RIDGE NATIONAL LABORATORY

Well Summary Information

Prepared By C.A. MUHR Date 5/21/93 Page 2 of 2
Hole No. CH87 CASING ELEVATION: 470.95' GROUND ELEVATION: _____
Total Depth 151.1' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type CME WIRELINE CORE Location NORTHWEST OF FACILITY
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/93

DEPTH (FEET)	LOG INTERVAL	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
108					Top of Floyd Limestone 107'.
112	$\frac{F_2}{107.2}$				LIMESTONE: dark to very dark gray, microcrystalline, hard, very fossiliferous with brachiopods, crinoid stems, and bryozoans the most prevalent, common white sparry calcite-healed fractures inclined at approximately 60 degrees, scattered shaley zones 1 to 4" thick.
116					
120	$\frac{F_4}{119.3}$				
124					LIMESTONE: as above, very shaley zone from 123.5 to 126', abundant fossils.
128					
132	$\frac{F_6}{124.2}$				
136					LIMESTONE: dark to very dark gray, microcrystalline, hard, very fossiliferous, very shaley from 137 to 140', slickensides and white calcite-filled fractures are common in the shaley zone indicating movement within this zone,
140	$\frac{F_8}{137.0}$				
144					
148					Top of Fort Payne Limestone is approximately 145'.
152	$\frac{F_{10}}{145.0}$				LIMESTONE: light to medium gray, micro to cryptocrystalline in part, very hard, occasional fossils, scattered silt/clay laminations.
156					T.D. 151.1'.
160					
164					
168					
172					
176					
180					
184					
188					
192					
196					
200					
204					
208					
212					
216					
220

OAK RIDGE NATIONAL LABORATORY Well Summary Information

Prepared By C.A. MUHR Date 5/21/93 Page 1 of 1
Hole No. CH88 CASING ELEVATION: 462.44' GROUND ELEVATION: _____
Total Depth 64.5' Number of Completions 1 Rig Type CME 55
Core Size 1.5" Sample Type 2" S. SPOON (OVERBURDEN), CME WIRELINE CORE Location NORTH OF FACILITY
Project WILSONVILLE Data Verified By F.G. GARDNER Date 11/5/95

DEPTH (FEET)	RUN # INTERVAL	SAMPLE INTERVAL	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
+8					
+4					
0					
4					CL SILTY CLAY: reddish yellow (7.5YR 6/6) to red (2.5YR 5/8), stiff, common chert, (Ft. Payne).
8					
12					SM SILTY SAND: reddish yellow (7.5YR 6/6) to light gray (7.5YR N/7), fine grained, clayey, possible top Frog Mountain Sandstone.
16					SANDSTONE: buff, very fine grained subrounded, moderately sorted, friable to unconsolidated, very weathered.
20					
24					
28					
32					CL SILTY CLAY: red (2.5YR 5/8) with a reddish yellow (7.5YR 7/8) mottle, highly plastic, (Ordovician).
36					
40					
44					
48					Auger refusal at 37.1'
52					WELL COMPLETION INFORMATION: 3" PVC well casing set at 37.1'. Cemented 10' up from bottom of casing with neat cement.
56					LIMESTONE: gray, poorly washed, bioparitic, cavity from 51.9 to 57.4', cavity is clay-filled, abundant FeO staining on what core was recovered, (Ordovician Undifferentiated).
60					Cavity from 58.0 to 61.7', clay-filled.
64					LIMESTONE: as above occasional silt/clay laminations 1 to 10 mm.
68					Lost core barrel in hole. Tried to retrieve core barrel using an overshot tool. Retrieval was unsuccessful and resulted in the loss of both the core barrel and overshot tool. Drilling halted at 64.5'.
72					T.D.64.5'.
76					
80					
84					
88					
92					
96					
100					
104					

Piezometer Logs

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Well Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>P.M. Kearn</u>		Date: <u>05/13/92</u>		Page: <u>1 OF 1</u>	
Hole No.: <u>PZ04</u>		Casing Elevation: <u>461.35'</u>		Ground Elevation: <u>N/A</u>	
Total Depth: <u>51'</u>		No. of Compl.: <u>1</u>		Rig Type: <u>CME-55</u>	
		Location: <u>Adj. to field office</u>			
Auger Size: <u>3.5" I.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves.</u>			
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>		Date: <u>08/04/92</u>	

DEPTH FEET	SAMPLE TYPE	SAMPLE INTV	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: gravel and clayey silt, dark gray to black, organic stain (fuel oil?).
2					
4	SP	X			CL SILTY CLAY: yellowish brown (10YR 5/8), with a light gray to buff mottle, slightly moist, abundant sandstone fragments.
6					
8					
10	SP	X			ML CLAYEY SILT: yellowish red (5YR 5/8), abundant chert and sandstone fragments.
12					SANDSTONE: fine grained, moderately sorted sub-angular, buff, friable, common limonite staining. (Frog Mtn.).
14	SP	X			CL SILTY CLAY: red (2.5YR 4/8), mottled with clean sandstone, sandstone is yellowish brown with (10YR 7/8) with dark gray to black mottling, fine grained, moderately sorted and limonite stained.
16					
18					
20	SP	X			CL SILTY CLAY: red (2.5YR 5/8) with reddish yellow mottle decreasing sand which is dark gray to black, fine grained with abundant organic material, scattered MnO staining.
22					
24	SP	X			CL SILTY CLAY: as above increasing MnO staining, scattered dark gray sand.
26					
28					
30	SP	X			ML CLAYEY SILT: yellow (10YR 7/6), uniform with MnO staining, saturated. (Ordovician).
32					
34	SP	X			ML CLAYEY SILT: yellow as above but mottled with reddish brown clayey silt, very moist, MnO staining.
36					
38					
40	SP	X			ML CLAYEY SILT: as above, wet.
42					
44	SP	X			ML CLAYEY SILT: as above.
46					
48					
50	SP	X			ML CLAYEY SILT: as above, very calcareous, spoon did not need pounding for sampling, typical of Ordovician residuum.
52					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: P.M. Kearn Date: 5/16/92 Page: 1 OF 1
 Hole No.: PZ08 Casing Elevation: 461.45' Ground Elevation: N/A
 Total Depth: 35' No. of Compl.: 1 Rig Type: CME-55 Location: E. of facility
 Auger Size: 3.5" I.D. Sample Type: 3"x2' Splitspoon "Calif method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F. G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: gravel road base.
2					
4	SP	X			CL SILTY CLAY: red (2.5YR 5/8), with a yellowish brown mottle, slightly moist, abundant blueish gray bedded chert (Ft. Payne).
6					
8					
10	SP	X			CL SILTY CLAY: as above.
12					
14					
16	SP	X			CL SILTY CLAY: as above.
18					
20	SP	X			CL SILTY CLAY: as above, with abundant MnO staining.
22					
24	SP	X			
26					SANDSTONE: buff, fine grained, moderately sorted, subangular to subrounded, lenses of dark gray siliceous sandstone (quartzite), slightly moist. (Frog Mtn.).
28					
30	SP	X			SANDSTONE: as above, with scattered MnO staining.
32					
34	SP	X			ML CLAYEY SILT: red (2.5YR 4/6), with a light gray calcareous mottle (Ordovician?), scattered sand, moist.
36					Refusal at 35', top of bedrock?
38					
40					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/16/92 Page: 1 OF 1
 Hole No.: P209 Casing Elevation: 461.57' Ground Elevation: N/A
 Total Depth: 35' No. of Compl.: 1 Rig Type: CME-55 Location: Northeast of TLU
 Auger Size: 3.5" I.D. Sample Type: 3"x2" Solitspoon "Calif method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F. G. Gardner Date: 08/04/92

DEPTH (feet)	SAMPLE TYPE	SAMPLE DITY	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					FILL: angular limestone gravel road base, increasing clay content with depth.
2					
4	SP	X			
6					CL SILTY CLAY: red (2.5YR 5/8) with a yellowish mottle, stiff, slightly damp, occasional small grains of very weathered chert. (Ft. Payne).
8					
10	SP	X			CL SILTY CLAY: as above, distinct weathered relict bedding, very deformed.
12					
14	SP	X			
16					ML CLAYEY SILT: strong brown (7.5YR 5/8), firm damp, scattered yellowish mottle.
18					
20	SP	X			ML CLAYEY SILT: as above, with a gray to very light gray mottle, (weathered chert?), soft, damp.
22					
24	SP	X			
26					ML CLAYEY SILT: color as above, with abundant light gray to light gray blue bedded chert.
28					
30	SP	X			ML CLAYEY SILT: yellowish red, (5YR 5/8), firm, wet, abundant light gray to light gray blue vugular chert.
32					
34	SP	X			CL SILTY CLAY: red (2.5YR 4/8), soft, damp, scattered MnO staining, abundant chert as above, clay is becoming sticky.
36					
38					
40	SP	X			CL SILTY CLAY: as above, occasional relict bedding planes, moist.
42					
44	SP	X			SANDSTONE: very dark gray, very fine grained sub-angular to subrounded, moderately sorted, siliceous (quartzite), (Frog Mtn.).
46					
48					
50					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/12/92 Page: 1 OF 1
 Hole No.: PZ49 Casing Elevation: 459.13' Ground Elevation:
 Total Depth: 61.75' No. of Compl.: 1 Rig Type: CME-55 Location: West of Tank Farm
 Auger Size: 3.5" I.D. Sample Type: 3"x2" Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					Auger to 4'.
2					FILL: angular limestone gravel roadbase to approx-
4	SP				imately 2' grading to a red (2.5YR 4/8) predom-
6					inantly silty shale with decreasing gravel, dry.
8					CL CLAYEY SILT: red (2.5YR 4/8) mottled yellowish
10	SP				brown, very stiff, dry, scattered buff very fine
12					grained sand.
14					CL CLAYEY SILT: as above, occasional very de-
16	SP				formed relict bedding.
18					SANDSTONE: buff, very fine grained, subrounded,
20	SP				moderately to well sorted, friable. Some zones
22					exhibit a very clean matrix, fractured with
24					red silty clay fracture fill, slightly damp,
26	SP				(Frog Mtn).
28					SANDSTONE: as above, becoming very fractured.
30					CL CLAYEY SILT: yellowish brown (10YR 6/8), stiff
32	SP				damp, scattered MnO staining.
34					SANDSTONE: buff, very fine grained, subrounded,
36					moderate to well sorted, increasing clay
38	SP				content.
40					CL CLAYEY SILT: yellowish brown (10YR 6/8) with
42					red banding and mottle, stiff, damp, some
44	SP				visible very deformed relict bedding, abundant
46					MnO, (Ordovician).
48					CL CLAYEY SILT: yellowish brown (10YR 6/8) with
50					red banding, firm to stiff, damp, abundant MnO,
52	SP				occasional very fine sandstone beds to 0.25",
54					scattered sandstone clasts to 0.5", visible
56					relict bedding.
58					GP SAND: dark yellowish brown (10YR 4/6), very
60					fine grained, subrounded, moderately to well
62	SP				sorted, silty in part, predominantly quartz with
64					scattered very dark brown to black accessory
					minerals.
					CL CLAYEY SILT: yellowish brown (10YR 6/8), soft,
					wet, scattered MnO staining.
					Auger refusal at 61'. Pounded splitspoon to 61.75'
					for lithologic sample.
					LIMESTONE: light gray to tan, very weathered,
					saturated, (Ordovician Undifferentiated).

orn1

Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/13/92 Page: 1 OF 1
 Hole No.: P752 Casing Elevation: _____ Ground Elevation: N/A
 Total Depth: 40.5' No. of Compl.: 1 Rig Type: CME-55 Location: S.E. Corn. of facility
 Auger Size: 3.5" I.D. Sample Type: 3"x2" Splitspoon "Calif method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F. G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					Auger to 4'.
2					
4	SP	X			SHALE: light to medium gray to yellowish brown and lavender gray, very hard, somewhat fissile, occasional interbedded siltstone, dry, difficult to pound spoon, (weathered Floyd Shale).
6					
8					
10	SP	X			SHALE: as above with decreasing siltstone beds, dry, very weathered.
12					
14	SP	X			SHALE: very dark gray brown to black, hard, fissile, dry, becoming increasingly dark gray to black with depth, carbonaceous.
16					
18					
20					SHALE: as above.
22					
24					
26					
28					
30					SHALE: very dark gray to black, hard, wet zone at approximately 30' based on auger cuttings, (unweathered Floyd Shale).
32					
34					
36					
38					
40	SP	X			SHALE: very dark gray to black, very hard to brittle, dry, vitreous luster, occasional fractures with white siliceous fracture fill.
42					Auger and splitspoon refusal at 40.5'.
44					
46					
48					
50					

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Well Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 11/15/92 Page: 1 OF 1
 Hole No.: PZ57 Casing Elevation: 440.16' Ground Elevation: _____
 Total Depth: 43.7' No. of Compl.: 1 Rig Type: CME-55 Location: North of Plant Entrance
 Auger Size: 3.5" I.D. Sample Type: 3"X2' Splitspoon "Calif. method", brass sleeves.
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE DRY	WELL CONSTRUCTION	LITHOLOGY	DESCRIPTION
0					Auger to 4'.
2					
4	SP	X			FILL: dark gray (10YR 6/8), loose, dry, pre-
6					dominantly clayey silt with intermixed fine
8					grained sand, abundant organic debris, roots,
10	SP	X			and wood fragments.
12					FILL: brownish yellow (10YR 6/8), soft to firm,
14					damp, occasional wood debris, starting to see
16					some reworked overburden.
18					
20	SP	X			CL SILTY CLAY: predominantly red (2.5YR 4/8) with
22					abundant yellowish brown mottle, firm, slightly
24					damp, abundant light gray very weathered chert,
26					(Ft. Payne).
28					Auger cuttings becoming wet at approximately 24',
30	SP	X			color is grading to more of a yellowish brown.
32					
34					CL CLAYEY SILT: brownish yellow (10YR 6/8), soft,
36					wet, abundant red silty clay laminae, slightly
38					sandy, scattered MnO and MnO staining.
40	SP	X			
42					CL CLAYEY SILT: as above.
44					CL CLAYEY SILT: brownish yellow (10YR 6/8), soft,
46					wet, becoming calcareous at approximately 43'.
48					Auger refusal at 43.6'. Pounded splitspoon to 43.7'
50					for lithologic sample.
					LIMESTONE: very dark gray, microcrystalline,
					weathered wet. (Ft. Payne Limestone).

Soil Boring Logs

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>P.M. Kearl</u> Date: <u>05/12/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH01</u> Ground Elevation: <u>457.89</u>			
Total Depth: <u>6'</u> Rig Type: <u>CME-55</u> Location: <u>N. of Agglomeration Fac.</u>			
Auger Size: <u>3.50" I.D.</u> Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. Gardner</u> Date: <u>08/04/92</u>			
DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	DESCRIPTION
0	SP		SC CLAYEY SAND: very dark gray (10YR 3/1), organic top soil layer, well graded, angular.
2			ML CLAYEY SILT: yellowish brown (10YR 6/6), uniform, structureless, low moisture content.
4	SP		CL SILTY CLAY: color as above with light gray mottling, abundant roots, low moisture.
6			CL SILTY CLAY: as above.
8			SHALE: weathered, noticeable bedding, decomposed roots, moist, (Floyd Shale?).
10			
12			
14			
16			
18			
20			

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: P.M. Kearn Date: 05/12/92 Page: 1 OF 1
 Hole No.: BH02 Ground Elevation: 456.58
 Total Depth: 6' Rig Type: CME-55 Location: N. of Agglomeration Fac.
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0	SP			GM GRAVELLY SILT: dark grayish brown (10YR 4/2), large angular gravel to 5 cm, significant amounts of sand, very moist, alluvial material in swale.
2				
4	SP			ML CLAYEY SILT: brownish yellow (10YR 6/8), moist, large nodules and partings of MnO(?).
6				
8				
10				
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: P.M. Kearl Date: 05/12/92 Page: 1 OF 1
 Hole No.: BH03 Ground Elevation: 458.25
 Total Depth: 6' Rig Type: CME-55 Location: N. of Agglomeration Fac.
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
	SP			SC CLAYEY SAND: gray (10YR 5/1). very sandy. dry overburden soil.
2				ML CLAYEY SILT: brownish yellow (10YR 6/6). scattered chert nodules and quartz.
4				
	SP			ML CLAYEY SILT: red (2.5YR 4/8). with light gray mottling, scattered chert nodules to 5cm. slightly moist. (Ft. Payne).
6				
8				
10				
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>P.M. Kearl</u> Date: <u>5/14/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH05</u> Ground Elevation: _____			
Total Depth: <u>43'</u> Rig Type: <u>CME-55</u> Location: <u>SE of TLU Pad</u>			
Auger Size: <u>3.5" I.D.</u> Sample Type: <u>3"x2' Splitspoon "Calif method", brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Date Verified By: <u>F.G. Gardner</u> Date: <u>08/04/92</u>			
DEPTH (FEET)	SAMPLE TYPE	SAMPLE DATA	LITHOLOGY
0			
2			
4	SP	X	
6			
8			
10	SP	X	
12			
14	SP	X	
16			
18			
20	SP	X	
22			
24	SP	X	
26			
28			
30	SP	X	
32			
34	SP	X	
36			
38			
40	SP	X	
42	SP	X	
44			
46			
48			
50			
DESCRIPTION			
FILL: gravel, black organic matter.			
ML CLAYEY SILT: reddish yellow (7.5YR 6/8), mottled with stringers of silt, slightly moist.			
ML CLAYEY SILT: as above.			
ML CLAYEY SILT: as above with siltstone occurring as friable fragments.			
ML CLAYEY SILT: as above.			
CL SILTY CLAY: reddish brown (5YR 5/4), moist, abundant chert, bedded chert in shoe up to 3 cm MnO nodules, (Ft. Payne).			
CL SILTY CLAY: red (2.5YR 4/6), moist, abundant blueish gray chert, some portions are friable.			
ML CLAYEY SILT: red (2.5YR 4/6), as above, scattered vugs are present in the chert.			
ML CLAYEY SILT: brownish yellow (10YR 6/6), mottled with reddish brown clayey silt, moist, chert is absent, abundant MnO staining.			
SANDSTONE: buff, fine grained, moderately sorted, subangular to subrounded, moist. (Frog Mtn.)			
Auger refusal at 43'.			

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 05/17/92 Page: 1 OF 1
Hole No.: BH10 Ground Elevation: 461.56
Total Depth: 11' Rig Type: CME-55 Location: SW corner Rose SR
Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE IDTV	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4"
2				FILL: very dark gray (2.5YR3/0), predominantly clay with interbedded gravel, some sand, abundant organic debris, damp, soft.
4	SP			
6				CL SILTY CLAY: red (2.5YR 4/8), with yellowish brown mottling, firm, slightly damp, abundant very weathered light gray to light grayish blue chert, occasional very weathered relict bedding planes, very deformed, (Ft. Payne).
8				
10	SP			
12				
14				
16				
18				
20				

ornl

Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 05/17/92 Page: 1 OF 1
 Hole No.: BH11 Ground Elevation: 461.32
 Total Depth: 11' Rig Type: CME-55 Location: SW corner Rose SR
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4"
2				FILL: very dark gray (2.5YRN 3/0), predominantly clay with interbedded gravel, some sand, abundant organic debris, damp, soft.
4	SP			
6				
8				SANDSTONE: buff to yellowish red, very fine grained, subangular to subrounded, moderately sorted, friable, clean, occasional interbedded red clay, predominantly quartz with scattered dark accessory minerals. (Frog Mtn.).
10	SP			
12				
14				
16				
18				
20				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 05/17/92 Page: 1 OF 1
Hole No.: BH12 Ground Elevation: 451.34
Total Depth: 11' Rig Type: CME-55 Location: N of NW corner Rose SR
Auger Size: 3.50" I.D. Sample Type: 3"x2" Splitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4"
2				FILL: very dark gray (2.5YR 3/0), predominantly clay with interbedded gravel, some sand, abundant organic debris, damp, soft.
4				
6	SP			
8				
10	SP			SANDSTONE: buff to yellowish red, very fine grained, subangular to subrounded, moderately sorted, friable, clean, occasional interbedded red clay, predominantly quartz with scattered dark accessory minerals, occasional fragments of very weathered chert at fill/sandstone contact. (Frog Mtn.).
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 05/17/92 Page: 1 OF 1
 Hole No.: BH13 Ground Elevation: 459.93
 Total Depth: 11' Rig Type: CME-55 Location: NW of BH12
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Solitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4"
2				FILL: very dark gray (2.5YRN 3/0) grading to a red to reddish yellow with depth, firm, predominantly clay with some interbedded gravel and sand, scattered organic debris, very damp to wet, visible water sheen on freshly broken sample faces.
4	SP			
6				
8				
10	SP			SANDSTONE: buff to yellowish brown, very fine grained, subangular to subrounded, moderately sorted, friable, clean, occasional interbedded red clay, predominantly quartz with scattered dark accessory minerals, slightly damp, (Frog Mtn.).
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 05/17/92 Page: 1 OF 1
 Hole No.: BH14 Ground Elevation: 450.19
 Total Depth: 11' Rig Type: CME-55 Location: NE of BH13
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4"
2				FILL: very dark gray (2.5YR 3/0) grading to a red to reddish yellow with depth, firm, predominantly clay with some interbedded gravel and sand, scattered organic debris, very damp to wet, visible water sheen on freshly broken sample faces.
4	SP			
6				
8				
10	SP			SANDSTONE: buff to yellowish brown, very fine grained, subangular to subrounded, moderately sorted, friable, clean, occasional interbedded red clay, predominantly quartz with scattered dark accessory minerals, slightly damp, (Frog Mtn.).
12				CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle, stiff, slightly damp, possible interbedded clay zone within the sandstone.
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumbv</u>		Date: <u>5/18/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH16</u>		Ground Elevation: <u>N/A</u>		
Total Depth: <u>11'</u>		Rig Type: <u>CME-55</u>	Location: <u>NE Corner Rose SR Unit</u>	
Auger Size: <u>3.50" I.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>	Date: <u>08/04/92</u>	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 9 "
2				FILL: dark gray to black (7.5YR N4/0 to 7.5YR N2/0), angular limestone gravels and scattered sand with some interbedded clay.
4	SP			
6				CL SILTY CLAY: red (2.5YR 4/8), very stiff, dry abundant light gray to light gray blue chert, slightly weathered, (Ft. Payne).
8				
10	SP			CL SILTY CLAY: brownish yellow (10YR 6/8) with some interbedded red, stiff, damp, abundant chert, occasional very weathered and deformed relict bedding.
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/18/92 Page: 1 OF 1
 Hole No.: BH17 Ground Elevation: N/A
 Total Depth: 11' Rig Type: CME-55 Location: SE Corner TLU Unit
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4".
2				FILL: red (2.5YR 4/8), very stiff, damp, predominantly clay with some interbedded sand and small gravel.
4	SP			
6				
8				CL SILTY CLAY: red (2.5YR 5/8) with a yellowish brown mottle, stiff, damp, abundant light gray very weathered chert, silt content increasing with depth. (Ft. Payne).
10	SP			
12				
14				
16				
18				
20				

Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/18/92 Page: 1 OF 1
 Hole No.: BH18 Ground Elevation: N/A
 Total Depth: 10' Rig Type: CME-55 Location: SW Corner V-225 Pad
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4				
5	SP			
6				
8				
10	SP			
12				
14				
16				
18				
20				

FILL: gray (5YR 5/1), angular limestone gravels grading to a predominantly sand with some interbedded gravel and clay, dry.

CL SILTY CLAY: red (2.5YR 5/8) with a yellowish brown mottle, stiff, damp, abundant light gray very weathered chert, silt content increasing with depth, (Ft. Payne).

SANDSTONE: buff with occasional dark gray, very fine grained, subangular to subrounded, moderately sorted, friable, fairly clean matrix slightly damp, slight solvent odor, sampler refusal at 10 ft., (Frog Mtn.).

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/19/92 Page: 1 OF 1
Hole No.: BH19 Ground Elevation: N/A
Total Depth: 15' Rig Type: CME-55 Location: SW Corner V-225 Pad
Auger Size: 3.50" I.D. Sample Type: 3"x2' Spitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: dark gray (2.5YR N4/0) to red (2.5YR 4/8), predominantly angular gravel road base, increas- ing clay content with depth, wet.
4				
5	SP			
6				FILL: sand, gray, coarse grained, saturated, very strong solvent odor, oily sheen on both the split spoon and sample, gray color possibly is the result of solvent contamination.
8				
10	SP			FILL: as above becoming fine to coarse grained, occasional scattered gravels, saturated, very strong solvent odor.
12				
14	SP			CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown to yellowish red mottle, stiff, slightly damp, scattered very weathered light gray chert moderate solvent odor, (Ft. Payne).
16				
18				
20				SANDSTONE: very dark gray, very fine grained, sub angular to subrounded, moderately sorted, siliceous (quartzite), dry, (Frog Mtn.).

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>		Date: <u>5/19/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH20</u>		Ground Elevation: <u>N/A</u>		
Total Depth: <u>16'</u>		Rig Type: <u>CME-55</u>	Location: <u>North End V-225 Pad</u>	
Auger Size: <u>3.50" I.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>		Date: <u>08/04/92</u>

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4				
6	SP			
8				
10	SP			
12				
14				
16	SP			
18				
20				

FILL: dark gray (2.5YR N4/0) to red (2.5YR 4/8), predominantly angular gravel road base, increasing clay content with depth, wet, occasional black heavy oil stain on some of the gravel, strong solvent odor.

CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle, firm, soft, slightly damp, abundant weathered light gray chert, moderate solvent odor. (Ft. Payne).

CL SILTY CLAY: as above with occasional MnO staining.

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>		Date: <u>5/19/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH21</u>		Ground Elevation: <u>N/A</u>		
Total Depth: <u>11'</u>		Rig Type: <u>CME-55</u>	Location: <u>NE Corner Rose SR Unit</u>	
Auger Size: <u>3.50" I.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. method", brass sleeves</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>		Date: <u>08/04/92</u>

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4".
2				FILL: very dark gray (2.5YR N3/0), predominantly angular limestone gravel with some interbedded clay and silt, wet.
4	SP			ML CLAYEY SILT: red (2.5YR 4/8) with a yellowish brown to yellowish red mottle, firm, slightly damp, scattered MnO staining, no odors, (Ft. Payne).
6				
8				
10	SP			ML CLAYEY SILT: as above, decreasing mottle.
12				SANDSTONE: buff to reddish yellow, very fine grained, subangular to subrounded, moderately sorted, friable, slightly damp. (Frog Mtn.).
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 5/19/92 Page: 1 OF 1
 Hole No.: BH22 Ground Elevation: N/A
 Total Depth: 14' Rig Type: CME-55 Location: Old Hill Area
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				
2				FILL: very dark gray to black (2.5YR N3/0 to 2.5YR N2.5/0), damp, predominantly clay with some intermixed gravel, abundant wood fragments and yellow fiber, possible asbestos.
4	SP			
6				
8				
10	SP			FILL: as above with abundant metal, wire and plastic, refusal at 10', possible wood, augered to approximately 11'.
12	SP			Started to pound spoon for the 11-13' sample interval, spoon fell approximately 3', pulled sampler from hole, saturated with oil and solvent possible 55 gallon drum, buff colored sandstone present in shoe of the sampler.
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/19/92 Page: 1 OF 1
 Hole No.: BH23 Ground Elevation: N/A
 Total Depth: 11' Rig Type: CME-55 Location: Old Hill Area
 Auger Size: 3.50" I.D. Sample Type: 3"x2" Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH FEET	SAMPLE TYPE	SAMPLE IDTY	LITHOLOGY	DESCRIPTION
0				
2				
4				
6	SP			
8				
10	SP			
12				
14				
16				
18				
20				

FILL: yellowish red (5YR 5/6), very stiff, dry predominantly clay and clayey silt with abundant interbedded gravel and sand.

SHALE: reddish brown, very weathered fissile. occasional MnO staining, no odors. (Floyd Shale).

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 5/19/92 Page: 1 OF 1
Hole No.: BH24 Ground Elevation: N/A
Total Depth: 13.8' Rig Type: CME-55 Location: Old Hill Area
Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH FEET	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				
2				
4				
5	SP			FILL: very dark gray to black (SYR 3/1 to SYR 2.5/1), silty clay with intermixed sand and gravel, abundant organic debris, wood, metal, and insulation material possible asbestos.
6				
8				
10	SP			FILL: as above, abundant wood, partial recovery
12				
13.8	SP			FILL: as above, abundant insulation material, auger refusal at 13.8'.
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 5/20/92 Page: 1 OF 1
 Hole No.: BH25 Ground Elevation: N/A
 Total Depth: 10' Rig Type: CME-55 Location: Old Hill Area
 Auger Size: 3.50" I.D. Sample Type: 3"x2' Splitspoon "Calif. method", brass sleeves
 Project: Wilsonville, AL Date Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4				
SP				
6				
8				
SP				
10				
12				
14				
16				
18				
20				

FILL: very dark gray to black (SYR 3/1 to SYR 2.5/1), silty clay with intermixed sand and gravel.

SHALE: yellowish brown, fissile, very weathered, dry, (Floyd Shale).

SHALE: light gray to light yellowish brown, weathered, firm, silty.

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>6/2/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH27</u> Ground Elevation: <u>N/A</u>			
Total Depth: <u>7'</u> Rig Type: <u>Little Beaver</u> Location: <u>TLU UNIT</u>			
Auger Size: <u>3" O.D.</u> Sample Type: <u>1.5"x2' Solitspoon</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. Gardner</u> Date: <u>08/04/92</u>			

DEPTH FEET	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4 inches.
2	SP			FILL: red (2.5YR 4/8), predominantly clay with intermixed sand and occasional gravel, very stiff, slightly damp.
4				
6	SP			CL SILTY CLAY: red (2.5YR 4/8), with a yellowish brown mottle, stiff, damp, possible scattered very weathered light gray chert, slight hydrocarbon odor, (Ft. Payne?).
8				
10				
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 5/2/92 Page: 1 OF 1
 Hole No.: BH28 Ground Elevation: N/A
 Total Depth: 6' Rig Type: Little Beaver Location: Rose SR Unit
 Auger Size: 3" O.D. Sample Type: 1.5"x2' Splitspoon
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4 inches. Auger to 2'.
2	SP			FILL: angular limestone gravel to 1", de- creasing by 2', saturated, abundant free oil on water surface below the concrete, strong hydrocarbon and solvent odor, sample description based on auger cuttings.
4	SP			FILL: red (2.5YR 4/8), predominantly clay with intermixed sand and occasional gravel, soft, wet, moderate hydrocarbon and solvent odor.
6				CL SILTY CLAY: red (2.5YR 4/8), with a yellowish brown mottle, stiff to firm, damp, slight hy- drocarbon odor.
8				
10				
12				
14				
16				
18				
20				

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>6/3/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH29</u> Ground Elevation: <u>N/A</u>			
Total Depth: <u>5.5'</u> Rig Type: <u>Little Beaver</u> Location: <u>Rose SR Unit</u>			
Auger Size: <u>3" O.D.</u> Sample Type: <u>1.5"x2' Splitspoon</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. Gardner</u> Date: <u>08/04/92</u>			
DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	DESCRIPTION
0			CONCRETE: 4 inches. Auger to 1.5'.
2	SP		FILL: angular limestone gravel to 1", de- creasing by 2', saturated, abundant free oil on water surface below the concrete, strong hydrocarbon and solvent odor, sample description based on auger cuttings.
4	SP		No Sample 3.5 to 5.5', gravel blocking shoe, based on the color of clay on the outside of the splitspoon it appears to be silty clay as in the previous borehole (BH28).
6			
8			
10			
12			
14			
16			
18			
20			

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>		Date: <u>6/3/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH30</u>		Ground Elevation: <u>N/A</u>		
Total Depth: <u>7.5'</u>		Rig Type: <u>Little Beaver</u>	Location: <u>Rose SR Unit</u>	
Auger Size: <u>3" O.D.</u>		Sample Type: <u>1.5"x2" Splitspoon</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>	Date: <u>08/04/92</u>	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4 inches. Auger to 3.5'.
2				FILL: angular limestone gravel to 1", de- creasing by 2', saturated, decreasing free oil on water surface below the concrete, trace hydrocarbon and solvent odor, sample description based on auger cuttings.
4	SP			
6	SP			FILL: very dark gray (2.5YR N3/0) grading to a strong brown (7.5YR 5/8), increasing clay content with depth, saturated, no odor.
8				
10				
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 6/3/92 Page: 1 OF 1
 Hole No.: BH31 Ground Elevation: N/A
 Total Depth: 6.5' Rig Type: Little Beaver Location: Rose SR Unit
 Auger Size: 3" O.D. Sample Type: 1.5"x2' Spitspoon
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				CONCRETE: 4 inches. Auger to 3.5'.
2				FILL: angular limestone gravel to 1", de- creasing by 2', saturated, no visible free oil on water surface below the concrete, no odors, sample description based on auger cuttings.
4	SP			FILL: very dark gray (2.5YR N3/0) grading to a strong brown (7.5YR 5/8), increasing clay content with depth, saturated, no odor.
6	SP			CL SILTY CLAY: red (2.5YR 4/8) with yellow to yellowish brown mottle, firm to stiff, slightly damp, scattered very weathered light gray to light gray blue chert?, (Ft. Payne?).
8				
10				
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 6/4/92 Page: 1 OF 1
 Hole No.: BH33 Ground Elevation: N/A
 Total Depth: 16' Rig Type: CME-55 Location: East of Plant
 Auger Size: 3.50" I.D. Sample Type: 3"x2" Split spoon "Calif method", brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. Gardner Date: 08/04/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4	SP			FILL: grayish brown (10YR 5/2) with occasional red (2.5YR 5/8), soft, wet, predominantly clay with abundant interbedded gravel and sand, abundant roots, root channels and organic material.
6				
8				
10	SP			FILL: grayish brown (10YR 5/2) grading to a yellowish brown (10YR 5/8), soft, wet, predominantly clay, decreasing root and organic debris, scattered gravel.
12				
14	SP			SHALE: light reddish gray with yellowish brown staining, hard, dry to slightly damp, fissile very weathered, (Floyd Shale).
16				
18				
20				
22				
24				
26				
28				
30				

Prepared By: <u>M.E. Mumby</u>		Date: <u>6/4/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH34</u>		Ground Elevation: <u>N/A</u>		
Total Depth: <u>11'</u>		Rig Type: <u>CME-55</u>	Location: <u>East of Plant</u>	
Auger Size: <u>3.50" I.D.</u>		Sample Type: <u>3"x2' Split spoon "Calif method", brass sleeves</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. Gardner</u>	Date: <u>08/04/92</u>	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: grayish brown (10YR 5/2) with occasional red (2.5YR 5/8), soft, wet, predominantly clay with abundant interbedded gravel and sand, abundant roots, root channels and organic material.
4	SP			
6				CL SILTY CLAY: red (2.5YR 4/8) with yellowish brown mottle, very stiff, slightly damp.
8				
10	SP			
12				SHALE: light reddish gray with yellowish brown staining, hard, dry to slightly damp, fissile, very weathered, (Floyd Shale).
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>P.M. Kearl</u> Date: <u>05/13/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH38</u> Ground Elevation: <u>470.89'</u>			
Total Depth: <u>29.25</u> Rig Type: <u>CME-55</u> Location: <u>60' West of Prod. Well</u>			
Auger Size: <u>3.50" I.D.</u> Sample Type: <u>3"x2' Spolitspoon "Calif. method", brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. Gardner</u> Date: <u>08/04/92</u>			
DEPTH (FEET)	SAMPLE TYPE	SAMPLE DVT	LITHOLOGY
0			
2			
4	SP	X	
6			
8			
10	SP	X	
12			
14	SP	X	
16			
18			
20	SP	X	
22			
24	SP	X	
26			
28	SP	X	
30			
32			
34			
36			
38			
40			
42			
44			
46			
48			
50			

FILL: limestone gravel with silty clay.

CL SILTY CLAY: reddish yellow (5YR 6/8), damp, abundant blueish gray angular chert up to 2 cm. (Ft Payne).

CL SILTY CLAY: as above.

ML CLAYEY SILT: reddish yellow (5YR 6/8), damp, abundant bedded chert.

ML CLAYEY SILT: color as above, decreasing chert, abundant MnO staining.

ML CLAYEY SILT: as above.

SANDSTONE: buff to yellow, very fine grained, sub-angular to subrounded moderately sorted, scattered large grain quartz.

Twisted off Kelly Spindle.

SANDSTONE: dark gray very fine grained, quartzite, grading back into a buff-colored very fine grained friable sand, (Frog Mtn.).

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/9/92		Page: 1 OF 1
Hole No.: BH39		Ground Elevation:		
Total Depth: 30.25		Rig Type: CME-55	Location: E. of W. Treatment Plant	
Auger Size: 6.5" O.D.		Sample Type: 3"x2" Splitspoon "Calif. Method. Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER		Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				
4	SP	X		
6				FILL: strong brown (7.5YR 5/8), grading to a red (2.5YR 5/8), very stiff, dry, predominantly silty clay with abundant interbedded sand and gravel to 0.25", no visible organic debris.
8				
10	SP	X		
12				CL SILTY CLAY: red (2.5YR 4/8) with occasional yellowish brown mottle, dry to very slightly damp, abundant bedded chert, chert is light gray to light gray blue, vugular, moderately weathered, (Ft. Payne).
14	SP	X		
16				
18				
20	SP	X		CL SILTY CLAY: yellowish red (5YR 5/8), firm, damp with a visible water sheen on freshly broken faces, decreasing chert at approximately 18', scattered black MnO staining.
22				
24	SP	X		CL SILTY CLAY: color as above, soft, damp, increasing silt content, scattered chert to 0.25", scattered MnO stain and nodules.
26				
28				
30	SP	X		CL SILTY CLAY: yellowish red (5YR 5/8), soft, damp, 3" buff colored sandstone stringer at approximately 29.8', sandstone is very fine grained, subrounded, and moderately sorted with a red silt matrix.
32				Auger refusal at 30'.
34				Hammered split spoon at 30' for lithologic sample.
36				SANDSTONE: very dark gray, very fine grained sub-rounded siliceous (quartzite), fractured with white siliceous fracture fill, (Frog Mtn.).
38				
40				
42				
44				
46				
48				
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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/9/92 Page: 1 OF 1
 Hole No.: BH40 Ground Elevation: _____
 Total Depth: 35.25 Rig Type: CME-55 Location: North of BH39 (Barrel Loc)
 Auger Size: 6.5" O.D. Sample Type: 3"x2' Splitspoon "Calif. Method, Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				FILL: reddish brown (2.5YR 4/4), predominantly silty clay with abundant interbedded gravel road base and some sand, dry, based on auger cuttings.
4	SP	X		
6				CL SILTY CLAY: red to reddish brown (2.5YR 4/8 - 5YR 4/4), stiff, dry, abundant light gray to light gray blue weathered chert. (Ft. Payne).
8				
10	SP	X		
12				
14	SP	X		CL SILTY CLAY: predominantly as above with increasing red, occasional yellowish brown mottle, stiff, damp, abundant bedded light gray to light gray blue weathered chert.
16				
18				
20	SP	X		CL SILTY CLAY: red (2.5YR 4/8), stiff, damp, scattered MnO staining and nodules.
22				
24	SP	X		CL SILTY CLAY: as above, abundant chert and MnO stain and nodules.
26				
28				
30	SP	X		
32				CL CLAYEY SILT: yellowish brown (10YR 5/6), soft, wet, interbedded shale, sandstone and red silty clay, very deformed, FAULT GOUGE?
34	SP	X		
36				SANDSTONE: light yellowish gray to gray very fine grained, subrounded, moderately sorted, fractured with MnO fracture fill.
38				Sampler refusal at 35.25'. quartzite?
40				
42				
44				
46				
48				
50				

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/9/92		Page: 1 OF 1
Hole No.: BH41		Ground Elevation:		
Total Depth: 46'		Rig Type: CME-55	Location: North Northwest of MW32	
Auger Size: 6.5" O.D.		Sample Type: 3"x2" Splitspoon "Calif. Method, Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER	Date: 11/16/92	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				
4	SP	X		FILL: very dark gray (10YR 4/1), soft to firm predominantly silty clay with abundant inter-bedded gravel, sand and organic debris, scattered burned wood fragments.
6				
8				
10	SP	X		FILL: as above, abundant wood fragments, slight organic odor.
12				
14	SP	X		ML CLAYEY SILT: brownish yellow (10YR 6/8), firm, to stiff, slightly damp, scattered light gray to gray weathered chert, chert is vugular, scattered thin laminae of red silty clay, (Ft. Payne).
16				
18				
20	SP	X		ML CLAYEY SILT: as above, scattered chert clasts to 1", color grading to a reddish yellow.
22				
24	SP	X		ML CLAYEY SILT: brownish to reddish yellow (10YR 6/8-7.5YR 6/8) scattered red mottle, firm damp, occasional light gray very weathered chert.
26				
28				
30	SP	X		ML CLAYEY SILT: color as above, fossiliferous, Bryozoa (Fenestellate?) and possible brachiopods, starting to see black MnO staining, occasional very weathered chert.
32				
34	SP	X		ML CLAYEY SILT: brownish yellow (10YR 6/8), soft, wet, fossiliferous, abundant MnO stain and nodules.
36				
38				ML CLAYEY SILT: as above.
40	SP	X		
42				CL SILTY CLAY: red (2.5YR 4/8), soft, wet, abundant bedded light to dark gray moderately weathered chert, chert exhibits a vugular texture, slight decrease in MnO staining.
44	SP	X		SC CLAYEY SAND: yellowish red (5YR 4/6), fairly well graded, very fine to medium grained, sub-rounded, moderately to poorly sorted, wet, massive bedded chert at 46'.
46				Auger refusal at 46'.
48				
50				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/10/92 Page: 1 OF 1
 Hole No.: BH42 Ground Elevation: _____
 Total Depth: 21' Rig Type: CME-55 Location: Southwest Corner TLU Unit
 Auger Size: 6.5" O.D. Sample Type: 3"x2' Splitspoon "Calif. Method, Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 11/16/92

DEPTH FEET	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				
4	SP	X		FILL: strong brown (7.5YR 4/6), soft, damp, predominantly limestone gravel road base with some intermixed silty clay to approximately 3.5'.
6				FILL: very dark gray to black (2.5YR N3/0 to 2.5YR N2.5/0), loose, saturated, predominantly angular limestone gravel to 0.75" with intermixed clay and sand, very strong hydrocarbon odor, visible free product and sheen on sample and sampler, (diesel?).
8				
10	SP	X		FILL: as above.
12				CL SILTY CLAY: red (2.5YR 4/6), with a yellowish brown mottle, stiff, damp, moderate amount of light gray weathered chert, moderate to strong hydrocarbon odor, abundant fluid running into the borehole from saturated fill zone above. (Ft. Payne).
14	SP	X		
16				
18				
20	SP	X		CL SILTY CLAY: as above, moderate hydrocarbon and solvent odor, still have abundant fluid filling the borehole. Decision was made to stop drilling at 21' to avoid any further downhole contamination.
22				
24				
26				
28				
30				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/10/92		Page: 1 OF 1
Hole No.: BH43		Ground Elevation:		
Total Depth: 46'		Rig Type: CME-55	Location: East of MW05	
Auger Size: 6.5" O.D.		Sample Type: 3"x2" Splitspoon "Calif. Method, Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER	Date: 11/16/92	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				FILL: very dark gray (2.5YR N3/0) becoming red (2.5YR 4/8), predominantly angular limestone gravel road base, based on auger cuttings.
4	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle, very stiff, dry visible relict bedding planes, no visible chert, slight solvent odor.
6				
8				
10	SP	X		CL SILTY CLAY: as above.
12				
14	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle and banding, stiff, damp, moderate solvent odor.
16				
18				
20	SP	X		SANDSTONE: lavender gray grading to buff by 20' very fine grained, subrounded, moderately sorted friable, occasionally fractured with a red silty clay fracture fill, (Frog Mtn.).
22				
24	SP	X		SANDSTONE: predominantly as above, color is grading between buff and lavender, buff-colored sandstone is friable, lavender-colored sandstone exhibits a more siliceous matrix and a higher degree of consolidation, trace solvent odor.
26				
28	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with yellowish brown banding and mottling, firm to stiff, damp abundant MnO stain and nodules, visible relict bedding, thin laminae of buff-colored sandstone decreasing with depth.
30				
32				
34				
36				CL SILTY CLAY: as above increasing brownish yellow color, based on auger cuttings.
38				
40	SP	X		ML CLAYEY SILT: brownish yellow (10YR 6/8), firm, wet on freshly broken sample faces, occasional red mottle, scattered MnO staining, fairly homogeneous, (Ordovician).
42				
44				
46	SP	X		Auger Refusal at 46', pound splitspoon for lithologic sample.
48				LIMESTONE: dark to very dark gray, very fine crystalline, no visible intercrystalline porosity, dry. (Ordovician Undifferentiated).
50				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>10/10/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH44</u> Ground Elevation: _____			
Total Depth: <u>39'</u> Rig Type: <u>CME-55</u> Location: <u>East side of TLU pad.</u>			
Auger Size: <u>6.5" O.D.</u> Sample Type: <u>3"x2' Splitspoon "Calif. Method, Brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. GARDNER</u> Date: <u>11/16/92</u>			
DEPTH FEET	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY
0			Concrete 4"
2			Auger to 4'.
4	SP	X	FILL: very dark gray (2.5YR N3/0) becoming red (2.5YR 4/8), predominantly angular limestone gravel road base, based on auger cuttings.
6			CL SILTY CLAY: yellowish brown (10YR 5/8), with a light gray mottle, very stiff, dry, very strong solvent odor.
8			
10	SP	X	CL SILTY CLAY: predominantly as above with increasing red, occasional friable silt laminae to 2 mm, occasional scattered weathered chert to 0.5", dry, very strong solvent odor. (Ft. Payne).
12			
14	SP	X	ML CLAYEY SILT: yellowish brown (10YR 5/8), stiff, slightly damp, abundant light gray and occasional red mottle, strong solvent odor.
16			
18			ML CLAYEY SILT: yellowish red (5YR 5/8), stiff, damp, abundant chert ranging in size from very coarse grained (vcU) to 1/2", scattered black MnO staining, occasional nodules, occasional very deformed relict bedding, possibly in close proximity to a fault plane due to the range in size of the chert.
20	SP	X	
22			
24	SP	X	SANDSTONE: yellowish red to buff, very fine grained, subrounded, moderately to well sorted, friable, sandstone is brecciated to some degree with red silty clay and MnO fill in the brecciated zones, damp.
26			
28			
30	SP	X	SANDSTONE: as above, very brecciated.
32			CL CLAYEY SILT: dark reddish brown (2.5YR 3/4), firm, damp with moisture content increasing with depth, abundant coarse grained chert, appears brecciated, possible fault gouge.
34	SP	X	
36			CL CLAYEY SILT: red (2.5YR 4/8), firm, damp, abundant interbedded sand, chert and sandstone, scattered MnO, FAULT GOUGE.
38	SP	X	Auger refusal at 37', splitspoon refusal at 39'.
40			LIMESTONE: predominantly residuum, tan to light brown very weathered, very calcareous, becomes very dark gray at bedrock interface, saturated, (Ordovician?).
42			
44			
46			
48			
50			

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>10/11/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH45</u> Ground Elevation: _____			
Total Depth: <u>26'</u> Rig Type: <u>CME-55</u> Location: <u>Rose SR Unit</u>			
Auger Size: <u>6.5" O.D.</u> Sample Type: <u>3"x2' Splitspoon "Calif. Method, Brass sleeves"</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. GARDNER</u> Date: <u>11/16/92</u>			

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Concrete 8".
2				Auger to 4'.
4	SP	X		
6				FILL: very dark gray (2.5YR N3/0) loose, saturated predominantly angular limestone gravel road base with intermixed sand and clay, no odors.
8				FILL: as above decreasing gravel content, clay content increasing with depth.
10	SP	X		
12				
14	SP	X		
16				CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown mottle, very stiff to stiff, damp, scattered light gray to light gray blue very weathered chert, (Ft. Payne).
18				
20	SP	X		
22				CL SILTY CLAY: as above.
24	SP	X		
26				SANDSTONE: buff to occasionally dark gray, very fine grained, subrounded, moderately sorted, damp, entire interval is brecciated and has abundant interbedded silty clay and MnO. FAULT GOUGE?
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
50				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u>		Date: <u>10/11/92</u>		Page: <u>1 OF 1</u>	
Hole No.: <u>BH46</u>		Ground Elevation: _____			
Total Depth: <u>50.5'</u>		Rig Type: <u>CME-55</u>		Location: <u>S. End of Rose SR Unit</u>	
Auger Size: <u>6.5" O.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. Method, Brass sleeves</u>			
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. GARDNER</u>		Date: <u>11/16/92</u>	
DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION	
0				Auger to 4'.	
2					
4	SP	X		FILL: very dark gray (2.5YR N3/0) loose, saturated	
6				predominantly angular limestone gravel road base	
8				with intermixed sand and clay, moderate to	
10	SP	X		strong solvent odor.	
12				FILL: as above decreasing gravel content, clay	
14	SP	X		content increasing with depth, decreasing sol-	
16				vent odor.	
18				CL SILTY CLAY: banded red (2.5YR 4/8) and yellow-	
20	SP	X		ish brown (10YR 6/8), stiff, slightly damp, very	
22				deformed relict bedding planes, increasing red	
24	SP	X		color with depth, scattered light gray very	
26				weathered chert, slight solvent odor, (Ft.	
28				Payne?)	
30	SP	X		Partial recovery on sample interval 19-21'.	
32				Approximatley 8" recovered.	
34	SP	X		SANDSTONE: buff to yellowish red, very fine	
36				grained, subrounded, moderately to well sorted,	
38	SP	X		friable, fractured with red silty clay frac-	
40				ture fill, damp, slight solvent odor, (Frog	
42	SP	X		Mtn).	
44				CL CLAYEY SILT: yellowish brown (10YR 5/8), stiff,	
46	SP	X		slightly damp, scattered MnO stain and nodules.	
48					
50	SP	X		SANDSTONE: as above with a noticeable decrease in	
52				the amount of fracturing, slight solvent odor,	
				difficult drilling.	
	SP	X		CL CLAYEY SILT: yellowish brown (10YR 5/8) banded	
				with red (2.5YR 4/8) silty clay, stiff, damp,	
				abundant MnO and MnO staining, visible very de-	
				formed relict bedding.	
				CL CLAYEY SILT: color as above, abundant MnO and	
				MnO staining, scattered thin lenses of dark	
				yellowish brown sand, wet.	
				at 50.5' for lithologic sample.	
				LIMESTONE: very dark gray to grayish brown, micro-	
				crystalline, scattered white sparry calcite,	
				(Ordovician).	

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/11/92		Page: 1 OF 1
Hole No.: BH47		Ground Elevation:		
Total Depth: 48.5'		Rig Type: CME-55	Location: Northwest of MW15	
Auger Size: 6.5" O.D.		Sample Type: 3"x2' Splitspoon "Calif. Method. Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER		Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				FILL: gray grading to a dark reddish brown (2.5YR N5/0-2.5YR 4/8), angular limestone gravel road base grading to a predominantly silty clay, based on auger cuttings.
4	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with a yellow to yellowish brown mottle, stiff, dry, scattered light gray to light gray blue very weathered chert, slight hydrocarbon or solvent odor.
6				CL SILTY CLAY: as above.
8				SANDSTONE: buff to yellowish red, very fine grained, subrounded, moderately to well sorted, friable, fractured to some extent with red silty clay fracture fill, trace solvent odor, (Frog Mtn.).
10	SP	X		SC SANDY CLAY: red (2.5YR 4/8), firm, damp, scattered sandstone clasts to 0.5".
12				
14	SP	X		
16				
18				
20	SP	X		SANDSTONE: predominantly as above, abundant fractures, red silty clay fracture fill, becoming brecciated towards the bottom of the interval. (fault plane?).
22				
24	SP	X		SANDSTONE: reddish yellow with zones of buff, very fine grained, subrounded, moderately to well sorted, damp, abundant fractures with red silty clay fracture fill, increasing clay content in the matrix.
26				
28				
30	SP	X		FAULT GOUGE: intermixed red silty clay, buff-colored sandstone, MnO and light gray coarse grained chert, damp.
32				
34	SP	X		FAULT GOUGE: as above.
36				
38				CL CLAYEY SILT: yellowish brown (10YR 6/8) with occasional interbedded red silty clay decreasing with depth, soft, damp, moisture content increasing with depth.
40	SP	X		CL CLAYEY SILT: as above, becoming wet at approximately 40.5'.
42				
44				
46				
48	SP	X		Auger refusal at 48'. Pounded split spoon for lithologic sample to 48.5'.
50				LIMESTONE: light brownish gray, very weathered. (Ordovician).

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/12/92		Page: 1 OF 1
Hole No.: BH48		Ground Elevation:		
Total Depth: 43.5'		Rig Type: CME-55	Location: North of Tank Farm	
Auger Size: 6.5" O.D.		Sample Type: 3"x2" Splitspoon "Calif. Method, Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER	Date: 11/16/92	

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				FILL: light to dark gray, predominantly angular limestone gravel road base with intermixed clay and sand, dry, based on auger cuttings.
4	SP	X		
6				CL SILTY CLAY: red (2.5YR 4/8), very stiff, dry, abundant buff very fine grained sandstone clasts to 1", occasional chert clasts to 0.5".
8				
10	SP	X		
12				
14	SP	X		CL SILTY CLAY: as above, sandstone clasts decreasing becoming absent by 15'.
16				
18				
20	SP	X		CL SILTY CLAY: red (2.5YR 4/8), with increasing yellowish brown, stiff, damp, scattered MnO stain and nodules, increasing silt content, (Ordovician).
22				
24	SP	X		ML CLAYEY SILT: yellowish brown (10YR 6/8), minor amounts of interbedded red silty clay, stiff, damp, moderate amount of MnO stain and nodules.
26				
28				
30	SP	X		ML CLAYEY SILT: yellowish brown (10YR 6/8), firm, damp, visible very deformed relict bedding planes.
32				
34				
36				
38				
40	SP	X		ML CLAYEY SILT: as above, increasing moisture content with depth.
42				
44	SP			Auger and splitspoon refusal at 43.5'.
46				LIMESTONE: light gray to tan, very weathered, saturated, (Ordovician).
48				
50				

Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.F. Mumby</u>		Date: <u>10/13/92</u>		Page: <u>1 OF 1</u>
Hole No.: <u>BH50</u>		Ground Elevation: _____		
Total Depth: <u>71'</u>		Rig Type: <u>CME-55</u>	Location: <u>West of Fire Tank</u>	
Auger Size: <u>6.5" O.D.</u>		Sample Type: <u>3"x2' Splitspoon "Calif. Method", Brass sleeves</u>		
Project: <u>Wilsonville, AL</u>		Data Verified By: <u>F.G. GARDNER</u>		Date: <u>11/16/92</u>

DEPTH (FEET)	SAMPLE TYPE	SAMPLE INTV	LITHOLOGY	DESCRIPTION
0				
2				Auger to 4'.
4	SP	X		SHALE: light to medium gray, grayish purple, with some yellow, hard, fissile, dry, very weathered, (Floyd Shale).
6				
8				
10	SP	X		SHALE: as above, dry.
12				
14				
16	SP	X		SHALE: medium gray to dark lavender gray, hard, fissile, dry, still exhibits weathered texture.
18				
20	SP	X		SHALE: as above.
22				
24				
26				
28				
30				
32				
34	SP	X		SHALE: dark lavender gray, becoming very dark gray to black at 35.5', formation fissile, dry, becoming less weathered with depth.
36				
38				
40				
42				
44				
46				
48				
50	SP	X		SHALE: very dark gray with minor amounts of yellow and lavender gray, firm, fissile, dry, appears slightly brecciated. Scattered very dark gray to black chert nodules.
52				
54				
56				SHALE: very dark gray to black, dry to slightly damp. Based on auger cuttings.
58				
60				
62				
64				SHALE: as above.
66				
68				
70	SP	X		SHALE: very dark gray to black, brittle, exhibits a vitreous luster, fractured with a white siliceous fracture fill, scattered very dark gray to black chert, very carbonaceous.
72				Auger refusal at 70.5'. Pounded splitspoon to refusal at 71.0'. Went back to auger and could not get past 70.5'. Hole T.D. at 71.0'.
74				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/13/92 Page: 1 OF 1
 Hole No.: BH51 Ground Elevation: _____
 Total Depth: 69.5' Rig Type: CME-55 Location: N. of Drum Storage Area
 Auger Size: 6.5" O.D. Sample Type: 3"x2' Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				Auger to 4'.
2				FILL: dark gray, predominantly angular limestone road base with some intermixed clay and sand.
4	SP	X		SHALE: light to medium gray and yellowish brown, lavender gray, hard to firm, earthy, fissile to dry, (Floyd Shale).
6				
8				
10	SP	X		SHALE: as above.
12				
14	SP	X		SHALE: as above, increasing dark grays.
16				
18				
20	SP	X		
22				
24				
26				SHALE: very dark brown to black, dry, based on auger cuttings.
28				
30				
32				
34	SP	X		SHALE: very dark gray to black, brittle, dry, has vitreous to waxy texture, very carbonaceous.
36				
38				
40				
42				
44				
46				
48				
50				
52				
54				SHALE: as above.
56				
58				
60				
62				
64				
66				
68				Augered to 69.5'. Ran out of auger. Pounded splitspoon to 70.25', no sample recovery.
70	SP	X		
72				
74				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby		Date: 10/14/92		Page: 1 OF 1
Hole No.: BH53		Ground Elevation:		
Total Depth: 21.8'		Rig Type: CME-55	Location:	
Auger Size: 6.5" O.D.		Sample Type: 3"x2" Splitspoon "Calif. Method", Brass sleeves		
Project: Wilsonville, AL		Data Verified By: F.G. GARDNER	Date: 11/16/92	

DEPTH FEET	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				Auger to 9'.
4				
6				CL SILTY CLAY: red (2.5YR4/8), firm to stiff, slightly damp, abundant light gray to light grayish blue chert fragments, moderate solvent odor, (Ft. Payne).
8				
10	SP			CL SILTY CLAY: banded red and yellow (10YR6/8), firm to stiff, damp, abundant Mn oxides, moderate solvent odor, increasing silt content.
12				
14	SP			
16				SANDSTONE: buff, very fine grained, subrounded, moderately to well sorted, friable, fairly clean matrix, slightly damp, (Frog Mtn.).
18				
20	SP			CL CLAYEY SILT: dark reddish brown (5YR3/2), firm, damp, abundant interbedded chert and sand, some visible bedding.
22	SP			LIMESTONE: light to medium gray, no visible porosity, slightly weathered, wet, (Ordovician).
24				Auger refusal at 21.5', 21.8' sample refusal.

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/14/92 Page: 1 OF 1
 Hole No.: BH54 Ground Elevation: _____
 Total Depth: 28' Rig Type: CME-55 Location: _____
 Auger Size: 6.5" O.D. Sample Type: 3"x2' Splitspoon "Calif. Method" Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				Auger to 11'.
4				
6				CL CLAYEY SILT: red (2.5YR4/8), firm, slightly damp moderate solvent odor, abundant weathered chert, (Ft. Payne).
8				
10	SP	X		CL SILTY CLAY: predominantly red, (2.5YR4/8), with some yellowish brown mottle, stiff, slight- ly damp, abundant light gray to light grayish blue weathered chert, slight solvent odor.
12				
14	SP	X		CL SILTY CLAY: as above, chert becoming angular, no odor.
16				
18				
20	SP	X		
22				SANDSTONE: medium gray, very fine grained, sub- rounded, moderately sorted, (Frog Mtn.).
24				
26				SANDSTONE: dark lavender gray, very fine grained, subrounded, moderately sorted, very hard, sil- iceous quartzite.
28	SP	X		Auger and sample refusal at 28.0'.
30				
32				
34				
36				
38				
40				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>10/15/92</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH56</u> Ground Elevation: _____			
Total Depth: <u>17'</u> Rig Type: <u>CME-55</u> Location: _____			
Auger Size: <u>6.5" O.D.</u> Sample Type: <u>3"x2' Splitspoon "Calif. Method", Brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. GARDNER</u> Date: <u>11/16/92</u>			

DEPTH (FEET)	SAMPLE TYPE	SAMPLE DIAG	LITHOLOGY	DESCRIPTION
0				
2				Auger to 4'. FILL: angular limestone road base grading to a predominantly red clay with intermixed gravel and some dry sand.
4	SP	X		CL CLAYEY SILT: red (2.5YR4/8), very stiff, slight- ly damp, abundant interbedded weathered light gray chert, no odors, appears reworked, possible fill.
6				
8				
10	SP	X		CL SILTY CLAY: possible fill as above.
12				
14				CL SILTY CLAY: red, (2.5YR4/8), very stiff, slight- ly damp, abundant interbedded chert, looks nat- ive due to chert size, clasts about 1". blue weathered chert, slight solvent odor, (Ft. Payne).
16	SP	X		SANDSTONE: medium to dark gray, very fine grained, subrounded, moderately sorted, siliceous (quartzite), extremely difficult drilling, (Frog Mtn.).
18				Auger refusal at 17'.
20				
22				
24				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 10/15/92 Page: 1 OF 1
 Hole No.: BH58 Ground Elevation: _____
 Total Depth: 6' Rig Type: CME-55 Location: _____
 Auger Size: 6.5" O.D. Sample Type: 3"x2' Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 11/16/92

DEPTH (FEET)	SAMPLE TYPE	SAMPLE DITY	LITHOLOGY	DESCRIPTION
0				CONCRETE
2	SP			FILL: yellowish brown (10yr5/4), predominantly clayey silt with some gravel. gravel absent by 2.5', abundant small wood debris. damp.
4	SP			FILL: as above.
6				
8				
10				
12				
14				
16				
18				
20				
22				
24				

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Borehole Summary Information.

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/17/93 Page: 1 OF 1
 Hole No.: BH55 Ground Elevation: 468.67'
 Total Depth: 16' Rig Type: CME-55 Location: SW Corner W.T. Plant
 Auger Size: 6.5" O.D. Sample Type: 3"x 2' Splitspoon "Calif. Method". Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/20/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE IDTV	LITHOLOGY	DESCRIPTION
0				
2				
4				
6	SP			
8				
10	SP			
12				
14				
16	SP			
18				
20				

FILL: angular limestone road base with some intermixed weathered shale.

SHALE: reddish yellow, reddish gray, hard, dry, very weathered, very deformed bedding planes. (Floyd Shale).

SHALE: as above, increasing gray hues.

SHALE: as above.

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>4/17/93</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH66</u> Ground Elevation: <u>469.87'</u>			
Total Depth: <u>9.2'</u> Rig Type: <u>CME-55</u> Location: <u>E of W.I. Plant</u>			
Auger Size: <u>6.5" O.D.</u> Sample Type: <u>3"x 2' Splitspoon "Calif. Method", Brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. GARDNER</u> Date: <u>4/20/93</u>			

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				FILL: angular limestone road base with some intermixed weathered shale.
2				
4	SP			SHALE: reddish yellow, reddish gray, hard, dry, very weathered, very deformed bedding planes. (Floyd Shale).
5	SP			SANDSTONE: very dark gray, very fine grained, subrounded, moderately to well sorted, very hard siliceous. (quartzite).
6				
8				SHALE: as above.
9	SP			SANDSTONE: as above.
10				Sampler refusal at 9.2'.
12				
14				
16				
18				
20				

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Borehole Summary Information
OAK RIDGE NATIONAL LABORATORY

Prepared By: <u>M.E. Mumby</u> Date: <u>4/17/93</u> Page: <u>1 OF 1</u>			
Hole No.: <u>BH57</u> Ground Elevation: <u>469.87'</u>			
Total Depth: <u>11.0'</u> Rig Type: <u>CME-55</u> Location: <u>E of W.T. Plant</u>			
Auger Size: <u>6.5" O.D.</u> Sample Type: <u>3"x 2' Splitspoon "Calif. Method" Brass sleeves</u>			
Project: <u>Wilsonville, AL</u> Data Verified By: <u>F.G. GARDNER</u> Date: <u>4/20/93</u>			

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				FILL: angular limestone road base with some intermixed weathered shale.
2				
4	SP			SHALE: predominantly light to medium gray, common yellowish brown and reddish gray, weathered, hard, dry. (Floyd Shale).
6				
8				
10	SP			SHALE: as above.
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.F. Mumby Date: 4/17/93 Page: 1 OF 1
 Hole No.: BH68 Ground Elevation: 466.38'
 Total Depth: 11.0' Rig Type: CME-55 Location: S. of Fire Water Tank
 Auger Size: 6.5" O.D. Sample Type: 3"x 2' Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/20/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4				
6	SP			FILL: angular limestone road base with inter- mixed silty clay. dry.
8				
10	SP			CL SILTY CLAY: red (2.5YR 4/8). stiff, slightly damp, abundant light gray to light gray blue weathered chert. (Ft. Payne).
12				
14				
16				
18				
20				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/17/93 Page: 1 OF 1
 Hole No.: BH69 Ground Elevation: 467.92'
 Total Depth: 11.0' Rig Type: CME-55 Location: S. of Fire Water Tank
 Auger Size: 6.5" O.D. Sample Type: 3"x 2' Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/20/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				
4				
6	SP			
8				
10	SP			
12				
14				
16				
18				
20				

FILL: angular limestone road base with inter-mixed silty clay. dry.

CL SILTY CLAY: red (2.5YR 4/8), stiff, slightly damp, abundant light gray to light gray blue weathered chert, scattered MnO staining and nodules. (Ft. Payne).

CL SILTY CLAY: as above.

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumbv Date: 4/17/93 Page: 1 OF 1
 Hole No.: BH70 Ground Elevation: 459.05'
 Total Depth: 31.0' Rig Type: CME-55 Location: _____
 Auger Size: 6.5" O.D. Sample Type: 3"x 2" Spitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/20/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with inter- mixed silty clay. dry.
4	SP	X		
6				SHALE: reddish yellow, reddish gray, firm to hard, dry, very deformed bedding planes (Floyd Shale).
8				
10	SP	X		
12				SHALE: as above.
14				
16	SP	X		
18				SHALE: medium gray, platy, firm to hard, slightly damp, becoming less weathered.
20	SP	X		
22				SHALE: predominantly as above increasing dark gray color with depth, dry.
24				
26	SP	X		
28				SHALE: medium gray, earthy, firm, dry, scattered very dark gray very fine grained sandstone clasts, sandstone is very hard siliceous (Quartzite).
30	SP	X		
32				SHALE: medium gray, earthy, firm to hard, fissile, moderately weathered.
34				
36				
38				
40				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/17/93 Page: 1 OF 1
 Hole No.: BH71 Ground Elevation: 461.82'
 Total Depth: 6.5' Rig Type: CME-55 Location: E. Side V-225 Pad
 Auger Size: 6.5" O.D. Sample Type: 3"x 2" Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/20/93

DEPTH FEET	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with some intermixed silty clay, grading to predominantly silty clay by 4' with only scattered gravel.
4				
5	SP			CL SILTY CLAY: red (2.5YR 4/8), firm, slightly damp, abundant MnO staining.
6				SANDSTONE: dark gray, very fine grained, sub-rounded, moderate to well sorted, very hard, siliceous (quartzite), dry (Frog Mtn?). Auger refusal at 6.5'.
8				
10				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/19/93 Page: 1 OF 1
 Hole No.: BH74 Ground Elevation: 460.92'
 Total Depth: 38' Rig Type: CME-55 Location: N. end of Facility
 Auger Size: 6.5" O.D. Sample Type: 3"x 2' Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/21/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with some intermixed silty clay, dry.
4	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with a yellowish brown (10YR 6/8) mottle, firm, damp, no visible chert (Ordovician).
6				
8				
10	SP	X		CL SILTY CLAY: color as above, stiff, slightly damp, scattered buff colored sandstone clasts to 1", scattered MnO staining.
12				
14	SP	X		SILTY CLAY: predominantly red (2.5YR 4/8) with some brownish yellow (10YR 6/8) mottle, fairly stiff, damp, moisture content increasing with depth, common MnO staining, no odors.
16				
18				
20				
22				
24	SP	X		ML CLAYEY SILT: brownish yellow (10YR 6/8), soft, damp, abundant black MnO staining and scattered nodules, fairly homogeneous.
26				
28				
30				
32				
34	SP	X		ML CLAYEY SILT: as above, wet.
36				
38				Auger refusal at 38'.
40				
42				
44				
46				
48				
50				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/19/93 Page: 1 OF 1
 Hole No.: BH75 Ground Elevation: 461.25'
 Total Depth: 21' Rig Type: CME-55 Location: E. of Former Tank Farm
 Auger Size: 6.5" O.D. Sample Type: 3"x 2" Splitspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/21/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with some intermixed silty clay, dry.
4	SP	X		SANDSTONE: buff to light gray, very fine grained subrounded, moderate to well sorted, friable, vertical fractures present with red silty clay fracture fill, slightly damp. (Frog Mtn.).
6				
8				
10	SP	X		
12				
14	SP	X		ML CLAYEY SILT: brownish yellow (10YR 6/8) with some red (2.5YR 4/8), firm to stiff, damp, common MnO staining, slight solvent odor, (Ordovician).
16				
18				
20	SP	X		ML CLAYEY SILT: as above, slight increase in red color, damp.
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/19/93 Page: 1 OF 1
 Hole No.: BH76 Ground Elevation: 460.87'
 Total Depth: 47.5' Rig Type: CME-55 Location: S. of Former Tank Farm
 Auger Size: 6.5" O.D. Sample Type: 3"x 2" Spillspoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/21/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with some intermixed silty clay, dry.
4	SP	X		CL SILTY CLAY: red (2.5YR 4/8) with a brownish yellow (10YR 6/8) mottle, stiff, dry, abundant light gray to light gray blue weathered chert, moderate to strong solvent odor from 9-11', (Ft. Payne).
6				
8				
10	SP	X		CL SILTY CLAY: as above, slight solvent odor.
12				
14	SP	X		SANDSTONE: buff, very fine grained, subrounded, moderately to well sorted, friable, entire interval is fractured and has abundant red silty clay fracture fill, slightly damp. (Frog Mtn).
16				
18				
20	SP	X		SANDSTONE: as above, entire interval is fractured and has red silty clay fracture fill, moderate solvent odor.
22				
24	SP	X		CL SILTY CLAY: predominantly red (2.5YR 4/8) with a brownish yellow (10YR 6/8) mottle, firm to stiff, slightly damp, no visible chert, common black MnO staining, moderate solvent odor, (Ordovician).
26				
28				
30	SP	X		CL SILTY CLAY: as above, color grading to predominantly brownish yellow, moisture and silt content increasing with depth.
32				
34				
36				
38				
40	SP	X		ML CLAYEY SILT: predominantly brownish yellow (10YR 6/8) with some red (2.5YR 4/8), firm, damp, common MnO staining, slight solvent odor.
42				
44				
46				
48				Auger refusal at 47.5'.
50				

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Borehole Summary Information

OAK RIDGE NATIONAL LABORATORY

Prepared By: M.E. Mumby Date: 4/20/93 Page: 1 OF 1
 Hole No.: BH77 Ground Elevation: 451.47'
 Total Depth: 12.5' Rig Type: CME-55 Location: S. Side V-225 Pad
 Auger Size: 6.5" O.D. Sample Type: 3"x 2" Split spoon "Calif. Method", Brass sleeves
 Project: Wilsonville, AL Data Verified By: F.G. GARDNER Date: 4/21/93

DEPTH (FEET)	SAMPLE TYPE	SAMPLE ID#	LITHOLOGY	DESCRIPTION
0				
2				FILL: angular limestone road base with some intermixed silty clay, slightly damp.
4	SP			FILL: coarse grained sand, saturated with oil and solvent, abundant free product floating in sampler, extremely strong solvent odor.
6				
8				
10	SP			CL SILTY CLAY: red (2.5YR 4/8) with common brownish yellow (10YR 6/8) mottle, stiff, slightly damp, abundant light gray to light gray blue weathered chert, scattered MnO staining, strong solvent odor, (Ft Payne).
12	SP			Auger refusal at 12.4'. Pounded split spoon to 12.5' for sample.
14				SANDSTONE: very dark gray, very fine grained, sub-rounded, moderate to well sorted, very hard, siliceous (quartzite), dry (Frog Mtn.).
16				
18				
20				

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