January 7, 1994

AFFIDAVIT OF BERT J. SMITH

I, Bert Smith being duly sworn hereby state as follows:

1. I am Director of Hydrogeology for Roberts/Schornick & Associates, Inc. (RSA), 3700 W. Robinson Street, Norman, Oklahoma 73072. A statement of my professional background is contained in Attachment A-1.

2. I have managed the groundwater characterization studies conducted as part of the Facility Environmental Investigation (FEI) at the Sequoyah Fuels Facility (SFC Facility). The groundwater investigation results are summarized in the "Facility Environmental Investigation Finding Report", July 1991; and in the Addendum Facility Environmental Investigation Findings Report, 1992. I am currently managing RSA's efforts assisting in the preparation of a RCRA Facility Investigation (RFI) Work Plan and a Site Characterization Plan to be submitted by January 31, 1994 to the EPA and NRC, respectively. In the course of managing these efforts, I have reviewed and become familiar with numerous groundwater monitoring records maintained by SFC; and with the history of operations conducted at the SFC Facility since its inception.

3. I have also reviewed the Affidavit of John S. Dietrich, dated December 3, 1993 (the "Dietrich Affidavit") and the Affidavit of Timothy P. Brown, dated December 27, 1993 (the "Brown Affidavit").

4. The purpose of this affidavit is to state my agreement with the conclusion reached in paragraph 9 of the Dietrich Affidavit, (i.e., "There is no indication of any groundwater flow path which would allow flow of groundwater from beneath SFC's industrial site and associated pond areas to reach Mr. Henshaw's property"), to provide the basis for my agreement with that conclusion, and to explain why the criticisms and disagreements expressed in the Brown Affidavit are mistaken.

5. Paragraph 7 of the Brown Affidavit states that "Mr. Dietrich's conclusion is based on measurements at the groundwater's upper surface in the immediate vicinity of the waste ponds, as described in paragraph 8 of his affidavit". Mr. Brown's statement is incomplete, since Mr. Dietrich's conclusion is also based upon the extensive studies that were summarized in the documents referred to in paragraph 7 of the Dietrich Affidavit.

6. Mr. Brown then alleges that the measurements relied on by Mr. Dietrich are inadequate to support his conclusion because they represent too small a portion of the areal groundwater potentiometric surface.

7. Paragraph 3 of the Dietrich Affidavit dealt with groundwater flow at the fertilizer pond area because that is the area of industrial activity at SFC's site which is closest to Mr. Henshaw's property, and because any groundwater flow to the south from the processing areas north of the fertilizer pond area would become part of, and follow the same pathway as, the groundwater flow under the pond areas. Attachments 3 and 4 of the Dietrich Affidavit show that the groundwater flow beneath the fertilizer pond area is generally westward and away from Mr. Henshaw's property.

8. Moreover, extensive information is also available regarding groundwater flow in the processing area north of the fertilizer ponds. Attachment A-2 to this Affidavit contains the first six (6) pages (pages HYD 5-1 to 5-6) of SFC's response to question HYD 5 (SFC's Environmental Responses to the NRC dated September 4, 1992 and October 30, 1992). As stated on page HYD 5-2 and shown on Figure HYD 5-2, the groundwater in the layered horizontal flow system radiates westward, northwestward, and southwestward from the topographically high area occupied by the main process building. This conclusion is based upon information found in the FEI Report and its Addendum. There is no indication of groundwater flow from the main SFC industrial site towards the southeast, where Mr. Henshaw's home is located.

9. Mr. Brown argues that the two (2) areas (i.e., the fertilizer pond areas and the processing areas) represent a small portion of the larger flow field at the SFC site and are insufficient to characterize the groundwater flow which could affect Mr. Henshaw's property (Brown Affidavit, paragraph 7(a)). Mr. Brown is mistaken. The processing areas and fertilizer pond areas are the areas where contamination has been found in soils and groundwater that need to be addressed in site characterization and potential remediation. The extensive investigations performed during the FEI, based upon historical information regarding facility activities, did not identify any other areas that needed to be investigated. In these two (2) areas, SFC has installed over 200 groundwater monitoring wells and taken hundreds of soil samples. The groundwater flow system characterized at the site is a large portion of the groundwater flow regime in the site area and is representative of flow which could be expected in adjacent areas. Thus, groundwater flow in other areas could not bring contamination to Mr. Henshaw's property and there is no need to consider groundwater flow in these other areas to evaluate potential impact on Mr. Henshaw's property.

10. Mr. Brown claims that geological cross-sections of the area, Figures 48 through 54 of the FEI, reveal a complex and unpredictable pattern of hydrologic unit relationships (Brown Affidavit paragraph 7(a)). Mr. Brown is mistaken in his claim. The geology in the site area has been defined in detail based upon lithological data from over 200 borings. Detailed cross-sections are provided in the FEI. The cross-sections shown on Figures 48 through 54 of the FEI present geological unit relationships that are neither unpredictable nor overly complex in the site area. The hydrogeology in the site area is understood and described in detail in the FEI and its Addendum. The rates and direction of groundwater flow, and geological units through which contaminates are transported (via groundwater) have also been defined beneath the site area.

11. Continuing monitoring of groundwater flow and additional investigation of groundwater and soils during site characterization for purposes of decommissioning planning are not being conducted because of concerns regarding groundwater flow or contaminant migration towards the southeast. Rather, these activities are intended to determine more accurately the rates and content of groundwater flow towards the west, northwest, and southwest, as well as to identify residual contamination in groundwater and soil at the site in order to evaluate their potential upon any subsequent use of or intrusion at the site after decommissioning.

12. Mr. Brown refers to a fault zone he claims "likely plays a significant role in the area hydrodynamics" (Brown Affidavit, paragraph 7 (b)). As shown in Mr. Brown's Attachment 9, that fault lies east to southeast of the processing area (about 0.6 miles) and the fertilizer pond area (about 0.75 miles). As discussed above, information developed in the FEI shows that groundwater in these areas will not flow in the direction of that fault, and therefore will not be affected by that fault.

13. Mr. Brown also argues that there have been inadequate measurements of vertical groundwater flow (Brown Affidavit, paragraph 8(d)). Information developed during the FEI evaluated the vertical extent of contaminants in the site area (both in soil and groundwater) and potential groundwater flow zones at deeper depths. The vertical distribution of contaminants in soil was evaluated during the FEI and it was shown that most of the contamination occurred in the upper 5 feet of soil. Below a depth of about 15 feet in the site area, contamination was very localized at the site and at low levels (Attachments A-3 through A-5). The FEI and Addendum investigations also evaluated the vertical extent of contaminants in the site groundwater. This evaluation fully defined the lateral extent of the groundwater contamination in the site area (Attachments A-6 and A-7), and showed impacts to be limited to

the SFC Facility process and fertilizer pond areas. The FEI and Addendum investigations showed that most of the contamination at the site was in the upper groundwater horizon (shallow shale/terrace) and generally lower levels of contamination occurred in the deeper sandstone/shale groundwater horizon (Attachments A-6 and A-7). This information was sufficient to convince the investigators that the possibility of significant contamination in even lower zones was unlikely and investigation to deeper zones was unnecessary.

14. Mr. Brown disagrees with that judgment based upon allegations that seven (7) wells were drilled below 100 feet at the "SFC site" and could have been a conduit for contaminants (Brown Affidavit, paragraph 7(d)). However, when Mr. Brown's Attachment 1 is reviewed, it shows that six (6) of the wells are located across Route 10 about 1 mile southeast of the SFC industrial site. Thus, these wells could not possibly have been a conduit for contaminants from SFC's industrial operations. The seventh well was in fact located in the center of the processing area, and was drilled to a depth of about 400 feet in connection with an early proposed injection well disposal system. This well was known to investigators during the FEI and its history reviewed. This well appeared to be properly drilled, completed, and plugged, and it was concluded that it could not have been a conduit for contaminants to migrate into deeper zones.

15. Mr. Brown's Affidavit (paragraph 7(d)) states that "none of SFC's reports provide any data for depths below 40-50 feet". Mr. Brown is incorrect. In fact, SFC and the OSDH conducted an area-wide groundwater quality survey in May, 1991 of water wells within about a 2-mile radius of the process site. Approximately thirty seven (37) wells were identified in this area, and the OSDH and SFC attempted to sample all wells which were identified. The OSDH and SFC obtained samples from about twenty-eight (28) of these wells. At least nineteen (19) of the water wells are within 2 miles of the site and extend to depths of 50 feet or below (some to depths greater than 200 feet). All nineteen (19) wells extending to depths 50 or below were sampled, including four (4) wells in the vicinity of Mr. Henshaw's property. This data is provided in the FEI and provides groundwater quality data for areas near the Henshaw property. The nearest wells greater than 50 feet deep to Mr. Henshaw's property were SFC-4 and SFC-5, which were completed to depths of 98.8 and 91.5 feet, respectively. Wells SFC-2 and SFC-3 are located closer to Mr. Henshaw's property, and are completed to depths of 47.8 and 42.1 feet, respectively. These wells and other area-wide water wells are shown on

Attachment A-8. Among other things, the wells were sampled for nitrate (NO_3-N) and uranium. No contaminants above drinking water standard were found in any well. The OSDH and SFC attempted to sample Mr. Henshaw's well, but were denied access to his well for sampling.

16. For the reasons I have stated above, Mr. Brown's complaints that the data are inadequate because SFC has not performed any surveys below 50 feet beneath the process buildings (Brown Affidavit, paragraph 7(d) and 8) and insufficient data are available (Brown Affidavit, paragraph 9) lack merit. The groundwater investigation performed previously during the FEI provided detailed and sufficient information to conclude that groundwater flow from the processing areas and fertilizer pond areas will not impact Mr. Henshaw's property located to the southeast. Also, as noted previously, the areal extent of impact to groundwater in the site area has been defined, and is confined to these immediate areas. Because of these facts, it is not necessary to expand the investigations to include any additional areas or to any greater depth.

AFFIDAVIT

State of Oklahoma

County of Cleveland

I, Bert J. Smith, being duly sworn do state that I am the person described in the Affidavit, and that the statements and representations contain therein are true in every respect to the best of my knowledge.

Bert J Smith
(Signature of Applicant)

Subscribed and sworn to before me this 7 day of January, 1994.

Jolene Craddock
Notary Public

My commission expires March 1, 1996.

Attachment A-1

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

Mr. Smith has 14 years experience as a professional hydrogeologist. His experience includes the designing and installing groundwater monitoring wells and well fields; designing, operating and maintaining hydrocarbon recovery systems; and evaluating facility hazardous/solid waste, and UST sites. Mr. Smith also has expertise with aquifer characterization assessments, geophysical studies, groundwater sampling QA/QC plans and implementation, and groundwater modeling and contaminate transport evaluation. In addition, Mr. Smith also performs expert witness testimony and is active in regulatory agency negotiations. His specific project experience includes the following:

ENVIRONMENTAL SITE ASSESSMENTS/AUDITS (ESA/EA)

- Environmental Site Assessment, Industrial Lot, Total Petroleum, Inc., Yukon, OK (Technical Support)
- Environmental Site Assessment, Steel Mill, Sheffield Steel, Oklahoma City, OK (Technical Support)
- Environmental Site Assessment, Office Building, Liberty Bank and Trust Company, Oklahoma City, OK (Technical Support)
- Environmental Site Assessment, Commercial Land, Liberty Bank and Trust Company, Oklahoma City, OK (Technical Support)
- Environmental Site Assessment, 25 Parcels of Land, Liberty Bank and Trust Company, Oklahoma City, OK (Technical Support)
- Environmental Site Assessment, Paint and Coatings Manufacturing Facility, Confidential Client, Confidential Location (Technical Support)
- Phase I Environmental Assessments, Site Inspection, File Review, NORM Survey, Privately Owned Oil Company, Oilfield Lease, Texas and New Mexico Sites (Technical Support)
- Environmental Site Assessment, Oilfield Inspection and Agency File Review, Amarillo, TX, Oakland Oil Company, Oklahoma City, OK (Quality Assurance)
- Comprehensive Environmental Investigation, Petroleum Refinery, Confidential Client, Confidential Location (Quality Assurance)
- Comprehensive Environmental Investigation, Nuclear Fuels Processing Facility, Confidential Client, Confidential Location (Quality Assurance)
- Environmental Site Inspection of Two Oilfield Sites, Gas Processing Plant and Pipeline, Confidential Client, Confidential Location (Quality Assurance)

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

GROUNDWATER/HYDROGEOLOGICAL/GEOLOGICAL/GEOPHYSICAL INVESTIGATIONS

- Groundwater Investigations, Petroleum Refinery, Total Petroleum, Inc., Ardmore, OK and Arkansas City, KS (Quality Assurance)
- Groundwater Investigations, Tire Manufacturing Facility, Dayton Tire Company, Oklahoma City, OK (Project Manager)
- Groundwater Quality Assessment Plan, Tire Manufacturing Facility, Dayton Tire Company, Akron, OH (Project Manager)
- Environmental Consultation Services Pertaining to Litigations Alleging Environmental Impacts to Groundwater, Oilfield Site, Confidential Client, Confidential Location (Technical Support)
- Hydrogeological Investigation, Nuclear Fuels Processing Facility, Confidential Client, Confidential Location (Technical Support)
- Hydrogeological Investigation, Steel Fabricating Facility, Confidential Client, Confidential Location (Technical Coordinator)
- Hydrogeological Investigation, Battery Recycling Manufacturing Facility, Madewell and Madewell, Inc., Jones, OK (Project Manager)
- Hydrogeological Investigation, Chemical, Resin and Solvent Manufacturing Facility, CHEMCENTRAL, Tulsa, OK (Project Manager)
- Hydrogeological Investigation, Energy Company, Confidential Client, Confidential Location (Project Manager)
- Hydrogeological Investigation, Hazardous Waste Management Facility, Residual Technologies, Inc., Tulsa, OK (Project Manager)
- Hydrogeological Investigation, Steel Mill, Confidential Client, Confidential Location (Project Manager)
- Hydrogeological Investigation Plan, Oil and Gas Company, Scipio Gas Plant, Mosherville, MI (Project Manager)
- Hydrogeological Investigation, Natural Gas Plant, Oil and Gas Company, Confidential Client, Confidential Location (Project Manager)
- Hydrogeological Investigation, Oil Company, Confidential Client, Confidential Location (Quality Assurance)
- Surface Soil Investigation, Oil Company, Confidential Client, Confidential Location (Quality Assurance)
- Hydrogeological Investigation, Oilfield Site, Confidential Client, Confidential Location (Quality Assurance)
- Surface Soil Investigation, Oil and Gas Exploration and Production Facility, Confidential Client, Confidential Location (Quality Assurance)
- Groundwater Sampling, Oilfield Services Facility, The Western Company of North America, LA and OK (Quality Assurance)

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

- Groundwater and Soil Sampling, Nuclear Fuels Processing Facility, Confidential Client, Confidential Location (Technical Support, Quality Assurance)
- Soil Sampling, Petroleum Refinery, Total Petroleum, Inc., Ardmore, OK and Arkansas City, KS (Quality Assurance)
- Monitoring Well Design and Installation, Oilfield Services Facility, The Western Company of North America, OK, TX, CO, LA, KS (Project Manager)
- Monitoring Well Design and Installation, Oilfield Services Facility, Halliburton Corporation, OK (Project Manager)
- In-Situ Aquifer Characterizations, Oilfield Services Facility, The Western Company of North America, OK, CO, TX, LA (Project Manager)
- In-Situ Aquifer Characterizations, Nuclear Fuels Processing Facility, Confidential Client, Confidential Location (Quality Assurance)
- Subsurface Geological Mapping, Oilfield Services Facility, The Western Company of North America, OK, LA, TX
- Surface Geophysical Investigations, Oilfield, Oil Corporation, Confidential Client, Confidential Location (Project Manager)
- Surface Geophysical Investigations, Oilfield, Major Oil Company, Confidential Client (Project Manager)
- Surface Geophysical Investigations, Oilfield, Energy Company, Confidential Client, Confidential Location (Project Manager)
- Hydrogeological Assessment and Waste Characterization, Public Utility, Confidential Client, Confidential Location (Quality Assurance)
- Hydrogeological Investigation and Closure Plan, Weatherford Petco, Ratliff, OK (Quality Assurance/Technical Administrator)
- Groundwater Investigation, Monitoring Well Installation, City of Kenton, Oklahoma Corporation Commission, Fuel Division, Oklahoma City, OK (Project Manager)
- Groundwater Investigation, Measure Product Levels in Monitoring Wells, Natural Gas Compressor Station, Pipeline Company, Confidential Client, Confidential Location (Project Manager)
- Groundwater Assessment, Groundwater Sampling and Analysis, Energy Company, Confidential Client, Confidential Location (Project Manager)
- Drill Three (3) Boreholes and Install One (1) Monitoring Well, Sample Analysis, and Report Preparation, Samedan Air Plane Hanger, Samedan Oil Corporation, Ardmore, OK (Technical Administrator)
- Evaluate Existing Monitoring Wells, Plug and Install New Monitoring Wells, American Disposal Services, Alderson, OK (Technical Administrator)
- Groundwater Investigation, Monitoring Well Installation, and Sampling Active Car Wash and Refueling Area, Car Care Facility, Red Carpet Car Wash, Oklahoma City, OK (Technical Administrator)

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

- Groundwater Investigation and Installation of Monitoring Well and Sampling, Municipal Solid Waste Landfill, Canadian County Landfill, El Reno, OK (Quality Assurance)
- Drilling of Soil Borings and Installation of Groundwater Monitoring Wells, Oklahoma Department of Transportation, Kingfisher, OK (Project Manager/Quality Assurance)

- Soil Sampling and Analysis, Substations, Public Utility, Confidential Client, Confidential Location(Quality Assurance)
- Electromagnetic Surveys, Petroleum Refinery, Total Petroleum, Inc., Ardmore, OK and Arkansas City, KS (Quality Assurance)

GROUNDWATER/SOIL REMEDIATION SYSTEM DESIGN

- Soil and Groundwater Remediation, Tire Manufacturing Facility, Dayton Tire Company, Oklahoma City, OK (Project Manager)
- Groundwater Remediation, Chemical and Films Manufacturing Facility, Confidential Client, Confidential Location (Project Manager)
- Vacuum Extraction System, City of Kingfisher, OK (Quality Control)
- Design and Installation of Groundwater Corrective Action System, Toner Manufacturing Facility, Xerox Corporation, Oklahoma City, OK (Project Manager)

HAZARDOUS/SOLID WASTE MANAGEMENT

- Surface Impoundment Closure Plans, Wood Processing Facility, Huffman Wood Preservers, Broken Bow, OK (Quality Assurance)
- Surface Impoundment Closure Plans, Wood Processing Facility, Mixon Brothers Wood Preserving, Inc., Idabel, OK (Quality Assurance)
- Waste Characterization, Carpet Fiber and Dye Manufacturing Facility, Hollytex Carpet Mills, Anadarko, OK (Quality Control)
- Sample Stock Piles of Soils and Construction Debris at Electrical Power Substation, 25 Sites, Public Utility, Confidential Client, Confidential Location (Quality Control)
- Groundwater Sampling and Analysis, Sanitary Landfill, American Disposal Services Inc., Alderson, OK (Quality Control)

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

REGULATORY COMPLIANCE

- General Environmental Regulatory Compliance at all Oklahoma Facilities, Oilfield Services Facility, The Western Company of North America, Houston, TX (Quality Assurance)
- Regulatory Compliance Investigation, Oilfield Services Facility, The Western Company of North America, OK, CO, TX and LA (Project Manager)
- Regulatory Compliance Investigation, Petroleum Refinery, Total Petroleum, Inc., Ardmore, OK and Arkansas City, KS (Technical Administrator)
- Development of Regulatory Compliance Strategies and Responses to Administrative Compliance Orders, Metal Foundry, Confidential Client, Confidential Location (Quality Control)
- Development of Regulatory Compliance Strategies and Responses to Administrative Compliance Orders, Tire Manufacturing Facility, Dayton Tire Company, Oklahoma City, OK (Quality Control)
- Development of Regulatory Compliance Strategies and Responses to Administrative Compliance Orders, Petroleum Refinery, Total Petroleum, Inc., Ardmore, OK (Quality Control)
- Development of Regulatory Compliance Strategies and Responses to Administrative Compliance Orders, Petroleum Refinery, Total Petroleum, Inc., Arkansas City, KS (Quality Control)
- Development of Regulatory Compliance Strategies and Responses to Administrative Compliance Orders, Oilfield Services Facility, The Western Company of North America, OK, TX, and LA (Quality Control)

UNDERGROUND STORAGE TANK (UST) MANAGEMENT/STUDIES

- UST Investigation, Tire Manufacturing Facility, Dayton Tire Company, Oklahoma City, OK (Project Manager)
- UST Investigation, Petroleum Refinery, Confidential Client, Confidential Location (Project Manager)
- Tank Farm Area Remediation, Oilfield Services Facility, The Western Company of North America, Yukon, OK (Project Manager)
- UST Investigation at Numerous Sites in Oklahoma, Texas, and Louisiana for an Oil Field Service Company, Oilfield Services Facility, The Western Company of North America (Project Manager)
- Underground Storage Tank Investigation, Wood Processing Facility, Halliburton Logging Services, Oklahoma City, OK (Project Manager)
- UST Investigation and Site Characterization, Building Supply Manufacturing Facility, Confidential Client, Confidential Location (Project Manager)

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

LITIGATION

- Litigation Support, Review Site Investigation, Environmental Engineering Assessment, Investigation, Valve Manufacturing Facility, Confidential Client, Confidential Location (Project Manager)
- Litigation, EM-31 Survey at Inactive Oilfield Pipe and Supply Yard, Homco International Inc., Oklahoma City, OK (Project Manager)
- Litigation Support, Subsurface Geological Mapping, Oilfield Service Facility, The Western Company of North America, OK, LA, TX (Project Manager)
- Litigation Support, Surface Geophysical Investigation, Major Oil Company, Confidential Client, Confidential Location (Project Manager)
- Litigation Support, Surface Geophysical Investigation, Oilfield Site, Confidential Client, Confidential Location (Project Manager)
- Litigation Support, Surface Geophysical Investigation, Energy Company, Confidential Client, Confidential Location (Project Manager)
- Litigation Support, Borehole Geophysical Investigations, Public Utility, Confidential Client, Confidential Location (Project Manager)
- Litigation Support, Borehole Geophysical Investigations, Freight Trucking and Fueling Facility, Consolidated Freightways, Oklahoma City, OK (Project Manager)
- Provide Litigation Support, Fairfield Oil & Gas Company, Pottawatomie County, OK (Project Manager)

INDUSTRIAL WASTEWATER MANAGEMENT

- Wastewater System Evaluation, Wastewater Characterization, Meat Processing Facility, Hormel, Oklahoma City, OK (Quality Assurance)

MISCELLANEOUS

- Review EPA Investigative Reports of Superfund Documents, and Prepare Critique, Refinery, Confidential Client, Confidential Location (Quality Assurance)
- Computer Modeling of Impact Plume, Well Locations and Construction, Guardian Well Network Plan, Confidential Client, Confidential Location (Quality Assurance)

EMPLOYMENT

1987-Present	Roberts/Schornick & Associates, Inc.
1979-1987	Kerr-McGee Corporation
Graduate Teaching	Assistant - Civil and Environmental Engineering, Washington State University
Research Assistant	- Civil and Environmental Engineering, Washington State University

BERT SMITH
Director, Hydrogeology
Roberts/Schornick & Associates, Inc.

EXPERIENCE
RSA Since 1987 Prior Experience: 8 Years

EDUCATION
B.S., 1975, Geology, Washington State University, Pullman
M.S., 1979, Engineering (Geohydrology Option), Washington State University

SOCIETIES/REGISTRATIONS/CERTIFICATIONS
Certified Professional Geological Scientist (CPGS) No. 7329
Certified Groundwater Professional (CGP) No. 218
OWRB Certified Operators License OP-0597
Activities Include Drilling Groundwater Wells and Groundwater Test Holes, Monitoring Wells, Observation Wells, Heat Exchange Wells, and Geotechnical Borings, and Installing Water Well Pumps

Attachment A-2

Hydrology: Question 5

Provide a concise projection and interpretation of concentrations and extent of nitrate, arsenic, and uranium plumes in the groundwater for 3-, 5-, and -10 year intervals. The bases of the calculations and projections should also be provided. If the concentration level of any component in the groundwater at the river bank exceeds appropriate regulatory limits for the river, provide a local scale analysis to predict contaminant levels in the river.

Response

A response to this question requires a brief review of the current understanding of subsurface conditions at the SFC Facility. The groundwater hydrology at the Facility has been investigated extensively by SFC and its consultants. The results of these investigations are described in the Facility Environmental Investigation Findings Report (SFC 1991) and its Addendum (SFC 1992).

Conceptual Model of Groundwater System

The conceptual model describes previous findings and principal assumptions regarding the groundwater flow system that are important for evaluating a specific issue. In terms of constituent movement away from the SFC Facility, the conceptual model includes the following key points:

- The subsurface profile at the SFC Facility includes a thin layer of terrace deposits that are 0 to 16 feet thick, with an average thickness of 7 feet. The terrace deposits are composed of silt, clay, sand and gravel, but are generally fine-grained. They are underlain by a thick sequence (nearly 400 feet) of the Atoka Formation, a sequence of irregularly bedded, discontinuous layers of sandstone, siltstone, and shale, with thin limestone layers in the lower part. Individual layers of sandstone and shale in the upper part of the Atoka Formation at the Facility appear to be nearly flat-lying and variable in thickness, each ranging from 0 to 20 feet in thickness. Fill material has been placed at various locations at the SFC Facility, although fill generally lies above the water table.

- The SFC Facility is located near the edge of a slope east of the Illinois River Branch of the Robert S. Kerr Reservoir. The terrace deposits and the upper portion of the Atoka Formation have been eroded over time by historical river systems. In this area, the land surface on the steep slopes of the Illinois River valley are covered with a thin layer of unconsolidated sediments. Depending on elevation, the various sandstone/shale layers of the Atoka Formation subcrop beneath the sediments on the steep slope leading down to the Robert S. Kerr Reservoir. This situation is depicted in Figure HYD 5-1.

- Both the terrace deposits and the various sandstone and shale layers may be saturated in specific intervals. The depth to groundwater measured in monitoring wells is generally 5 to 15 feet at the Facility.

- The groundwater system at the Facility consists of several layered horizontal flow systems with limited natural vertical interconnection. Where saturated, the terrace deposits and uppermost shale unit at the site comprise the shallow shale/terrace unconfined groundwater flow system. This is underlain by the deep sandstone/shale confined groundwater flow system. It is expected that even deeper confined flow systems occur below those investigated at the Facility, but their great depth below the active portions of the site and limited interconnection with shallower groundwater flow systems indicate a low potential for groundwater movement between shallow flow systems and deeper flow systems.

- In general, the shale layers are slightly more permeable than sandstone layers because the shale layers exhibit platy fracturing along bedding planes, while the sandstone layers are fine grained and highly cemented with silica. Within a particular flow system, the sandstone tends to form a confining layer and the shale generally transmits groundwater. The geometric mean of hydraulic conductivity for the two uppermost subsurface flow systems estimated from slug tests at the facility are:

    - 2×10^{-5} centimeters per second (cm/sec) for the shallow shale/terrace deposits

    - 7×10^{-5} cm/sec for the deep sandstone/shale

- Groundwater movement in the layered horizontal flow systems generally radiates westward, northwestward, and southwestward from the topographically high area occupied by the Main Process Building. The shallow shale/terrace and deep sandstone/shale groundwater flow systems discharge into the root zone of the soil on the steep slopes above the Illinois River Branch of the Robert S. Kerr Reservoir.

- Because of low hydraulic conductivities, the groundwater discharge through the flow systems at the SFC Facility is low. The rate of groundwater discharge along the steep slopes above the Robert S. Kerr Reservoir is too low to form visible springs or seeps on the ground surface. Discharged groundwater appears to either evaporate or be transpired by the heavy vegetative growth on the slopes.

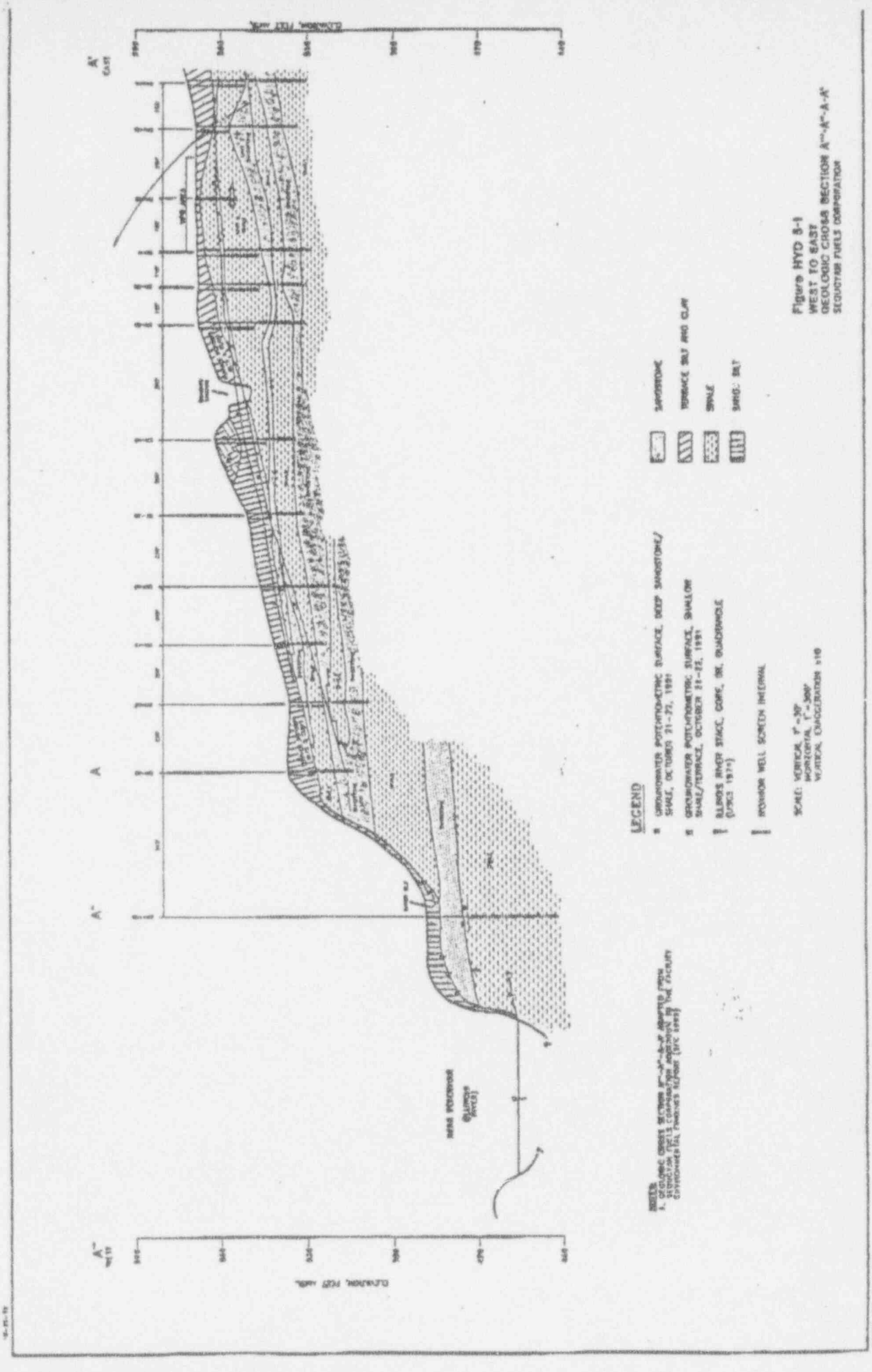


Figure HYD 8-1
WEST TO EAST
GEOLOGIC CROSS SECTION A''-A'-A-A'
SEQUOYAH FUELS CORPORATION

On the basis of this conceptual model, no direct groundwater flow path is believed to exist from either the shallow shale/terrace or deep sandstone/shale groundwater flow systems to the Illinois River Branch of the Robert S. Kerr Reservoir. The groundwater quality data from monitoring wells completed in deeper water bearing zones, such as MW-95A, -97A, and -98A, suggest that the groundwater quality effects of site operations are restricted to the uppermost groundwater flow systems at the Facility.

Groundwater Flow Path and Plume Evaluation

Because of the absence of a confirmed groundwater flow path between the shallow groundwater flow systems and the Illinois River Branch, SFC has evaluated the groundwater quality along specific flow paths from the identified constituent source areas to the discharge points on the steep slopes above the Illinois River Branch. Figure HYD 5-2 is a map showing the identified groundwater flow paths. The heads of the arrows on Figure HYD 5-2 correspond generally with the locations of the discharge point for the flow path, and the tails of the arrows generally correspond to the assumed location of the source areas. The paths are numbered and listed in Table HYD 5-1, along with a description of the path.

Table HYD 5-1
Groundwater Flow Paths Evaluated for Plume Movement

Path	Zone	Constituents Evaluated
1	Deep Sandstone/Shale	Uranium
2	Deep Sandstone/Shale	Uranium
3	Deep Sandstone/Shale	Arsenic
4	Deep Sandstone/Shale	Arsenic
5	Deep Sandstone/Shale	Arsenic and nitrate
6	Deep Sandstone/Shale	Nitrate
7	Deep Sandstone/Shale	Nitrate
8	Shallow Shale/Terrace	Uranium
9	Shallow Shale/Terrace	Arsenic and nitrate

Note: Flow paths are depicted on Figure HYD 5-2.

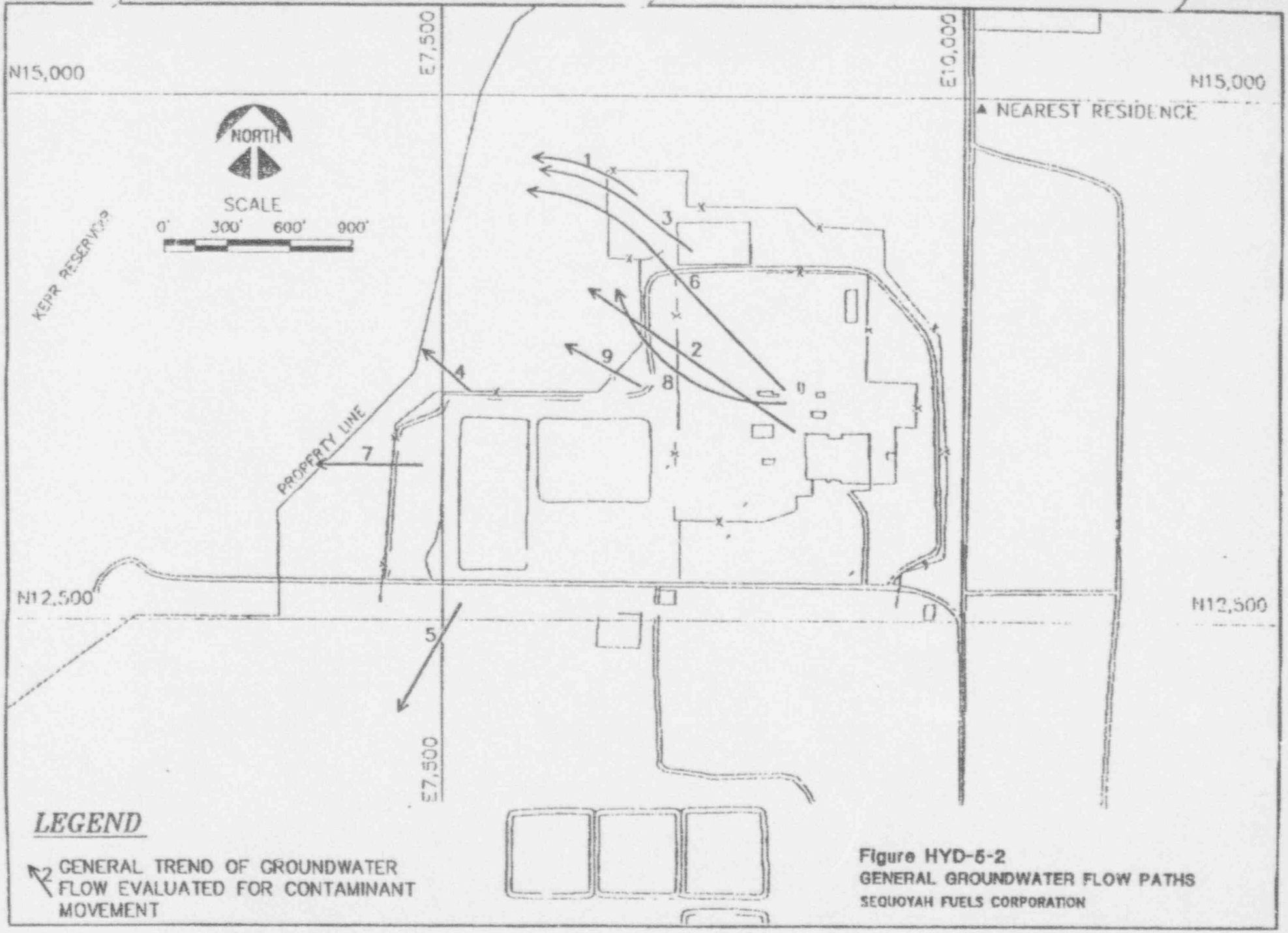


Figure HYD-6-2
GENERAL GROUNDWATER FLOW PATHS
SEQUOYAH FUELS CORPORATION

Flow paths were delineated by reviewing constituent isopleth maps for the site (SFC 1991 and SFC 1992), identifying areas of elevated constituent concentrations at the SFC Facility, and using recent potentiometric surface maps for the Facility to determine potential groundwater flow directions downgradient of the source areas and the Facility. Emphasis was placed on those flow paths that were directed generally westward in the direction of the Illinois River branch, because in most cases this represents the shortest flow path between onsite zones of impact and offsite discharge points.

The fertilizer ponds area was not included as a source area in this analysis and no paths were identified in this area because of the lack of potentiometric surface data at the time these questions were received. Evaluation of this area is continuing and will be submitted upon completion.

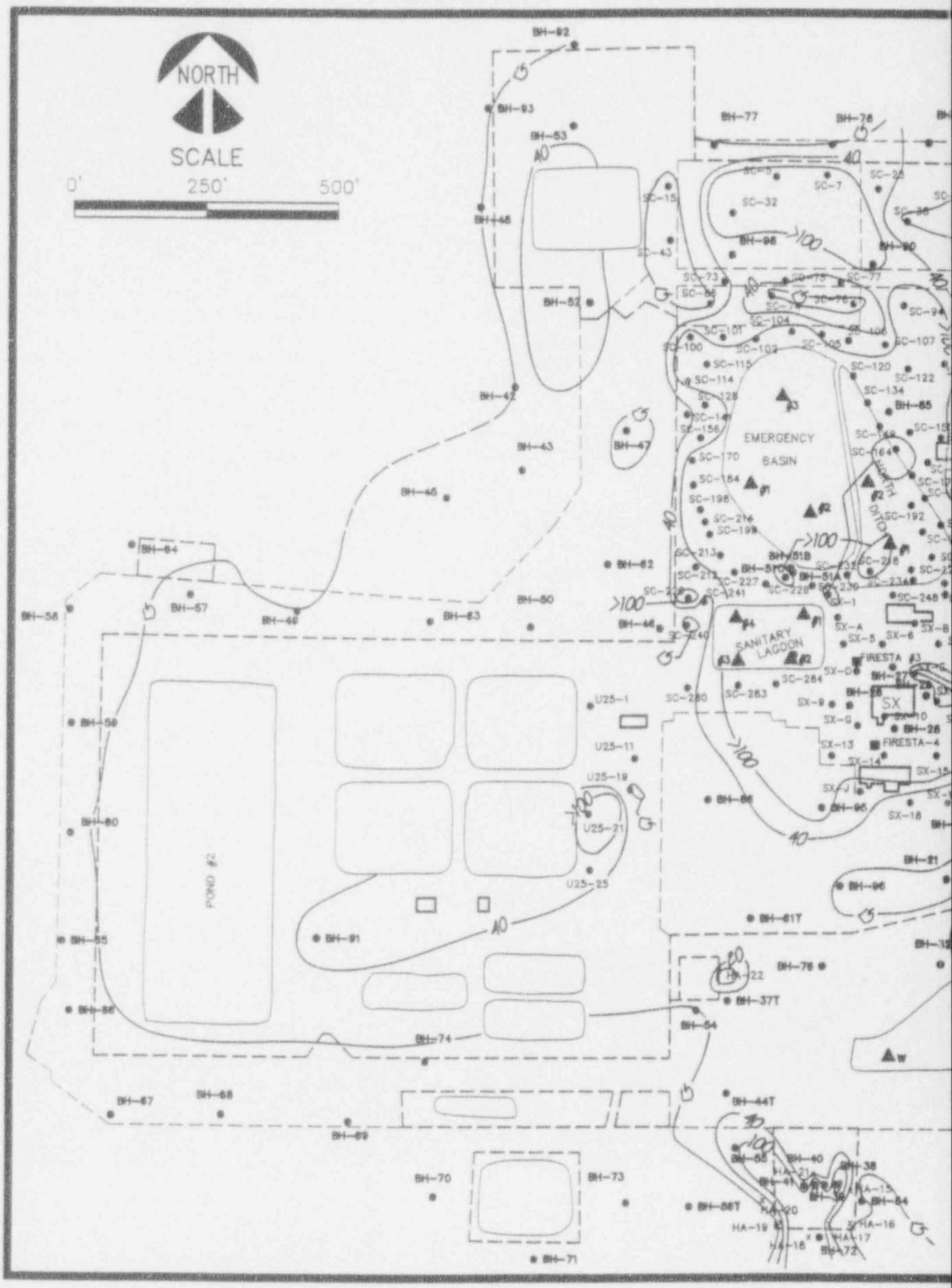
Predictions of Future Constituent Concentrations

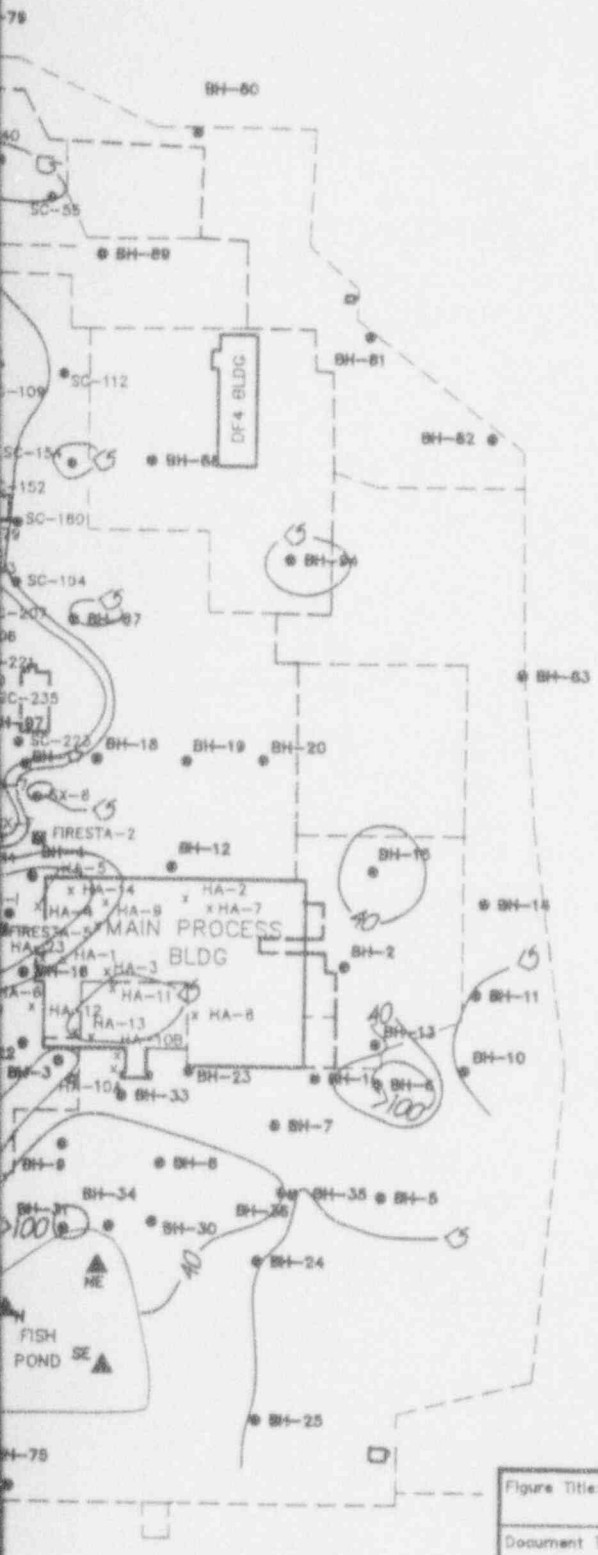
Method Discussion and Input Data

Version 2.0 of the MYGRT code (EPRI 1989) was used to predict future concentrations along the identified flow paths. MYGRT is a quasi-analytical model based on the advection-dispersion retardation-decay equation. It can account for these processes in either one or two dimensions. The derivation for the solution to the partial differential equation for these four processes was derived by Cleary and Ungs (1978) and Javendel, et al. (1984).

The major assumptions of MYGRT version 2.0 are:

- The groundwater velocity is constant over the distance being simulated
- Longitudinal and transverse dispersion is represented by Ficks Law, and is a function of the scale of the problem (i.e., the length being simulated)
- Sorption/desorption is fast relative to the rate of groundwater flow and is represented as a linear, equilibrium partitioning between aqueous and solid phases.
- Sorption, represented by a retardation factor (the ratio of groundwater velocity to constituent velocity), is assumed to be constant over the distance being simulated
- Interference and competition for sorption sites is considered to be negligible
- The constituent in the source area is evenly distributed throughout the thickness of the aquifer


NORTH
SCALE
0'
250'
500'
EMERGENCY BASIN
SANITARY LAGOON
POND #2
FIRESTA #3
FIRESTA-4
SX
BH-92
BH-93
BH-53
BH-48
BH-52
BH-42
BH-43
BH-45
BH-47
BH-64
BH-57
BH-58
BH-49
BH-63
BH-50
BH-62
BH-46
BH-59
BH-60
BH-55
BH-56
BH-91
BH-74
BH-67
BH-68
BH-69
BH-70
BH-73
BH-71
BH-77
BH-78
BH-96
BH-90
BH-85
BH-51B
BH-51A
BH-27
BH-28
BH-26
BH-86
BH-95
BH-21
BH-61T
BH-76
BH-37T
BH-54
BH-44T
BH-55
BH-40
BH-38
BH-41
BH-39
BH-84
BH-56T
BH-72
U25-1
U25-11
U25-19
U25-21
U25-25
HA-22
HA-21
HA-15
HA-20
HA-19
HA-16
HA-17
HA-18
SC-15
SC-43
SC-32
SC-73
SC-86
SC-104
SC-101
SC-100
SC-102
SC-105
SC-107
SC-115
SC-114
SC-120
SC-122
SC-134
SC-128
SC-141
SC-156
SC-170
SC-184
SC-198
SC-216
SC-199
SC-192
SC-213
SC-212
SC-227
SC-241
SC-229
SC-240
SC-248
SC-280
SC-283
SC-264
SX-A
SX-5
SX-6
SX-D
SX-9
SX-G
SX-13
SX-14
SX-J
SX-16
>100
40
80
30
20
10



LEGEND

BH-82 ● LOCATION OF LITHOLOGICAL AND CHEMICAL CHARACTERIZATION BORING

40 ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, UG/G, 0-1 FOOT DEPTH, SEPTEMBER, 1990 TO APRIL, 1991

NOTES:

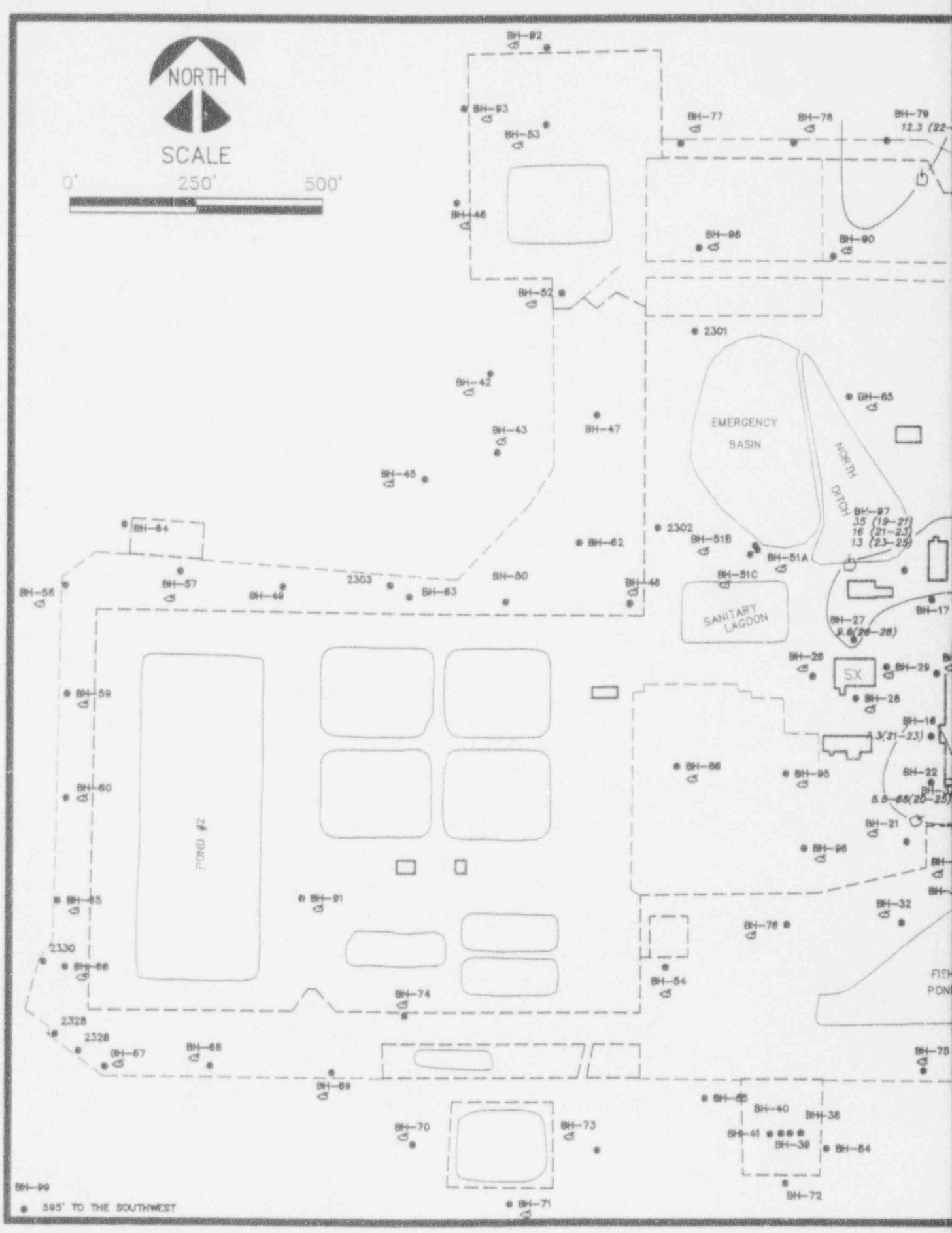
1. ACTUAL URANIUM LEVELS IN SOIL ARE NOT SHOWN ON THIS MAP. REFER TO TABLES 43 AND 44 FOR EXACT LEVELS FOR EACH BOREHOLE.
2. ISOPLETH LINES ARE PRESENTED SOLELY FOR THE INTERPRETATION OF SURFACE SOIL CONDITIONS AND, THEREFORE, ARE TERMINATED AT BOUNDARY CONDITIONS DEFINED BY BASIN OR IMPOUNDMENTS.

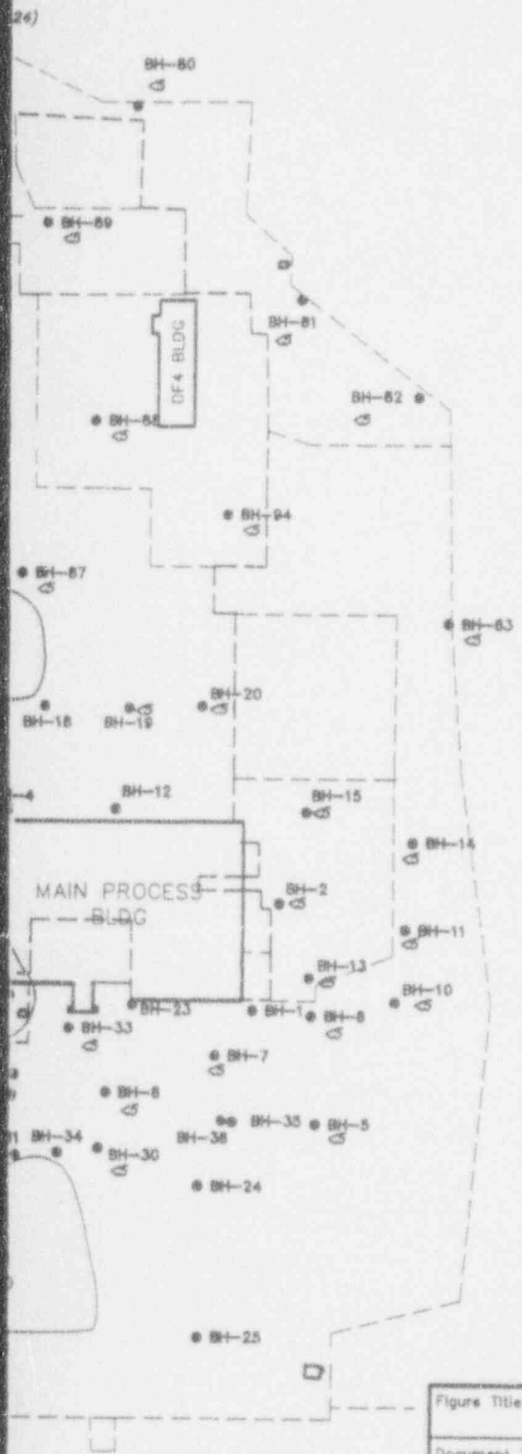
CONTOUR INTERVAL: < 5, 40 AND >100

9401210015-01

Figure Title: ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, 0-1 FOOT DEPTH		Client: SEQUOYAH FUELS CORPORATION	
Document Title: FS FINDINGS REPORT		Location: GORE, OKLAHOMA	
ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 3700 West Robinson, Suite 200 Norman, Oklahoma 73072 (405) 321-5896	DATE: JULY, 1991	PREPARED BY: RL	
	SCALE: 1" = 250'	CHECKED BY: B.J.S.	
	PROJECT NO: 90067 L18	DRAFTED BY: RML	
		FIGURE NO.: 104	

Attachment A-3


NORTH
SCALE
0'
250'
500'
BH-92
BH-93
BH-53
BH-77
BH-78
BH-79
12.3 (22-
BH-46
BH-96
BH-90
BH-52
2301
BH-42
BH-65
EMERGENCY
BASIN
NORTH
DITCH
BH-43
BH-47
BH-45
BH-64
BH-97
35 (19-21)
16 (21-23)
13 (23-25)
2302
BH-62
BH-51B
BH-51A
BH-57
2303
BH-50
BH-58
BH-49
BH-63
BH-48
BH-51C
SANITARY
LAGOON
BH-17
BH-27
2.6(26-28)
BH-28
SX
BH-29
BH-59
BH-16
3(21-23)
BH-86
BH-95
BH-22
BH-60
POND #2
BH-21
BH-96
BH-85
BH-91
BH-32
BH-76
2330
BH-66
BH-54
BH-74
2328
2328
BH-67
BH-68
BH-75
BH-69
BH-40
BH-38
BH-70
BH-73
BH-41
BH-39
BH-84
BH-72
BH-99
595' TO THE SOUTHWEST
BH-71



LEGEND

BH-82 ●
<5.0 — LOCATION OF LITHOLOGICAL AND CHEMICAL CHARACTERIZATION BORING, AND TOTAL URANIUM IN SOIL, UG/G

12.3 (22-24) — FIRST NUMBER, 12.3, IS TOTAL URANIUM IN UG/G. SECOND NUMBER (22-24), IS SAMPLE DEPTH INTERVAL, FEET

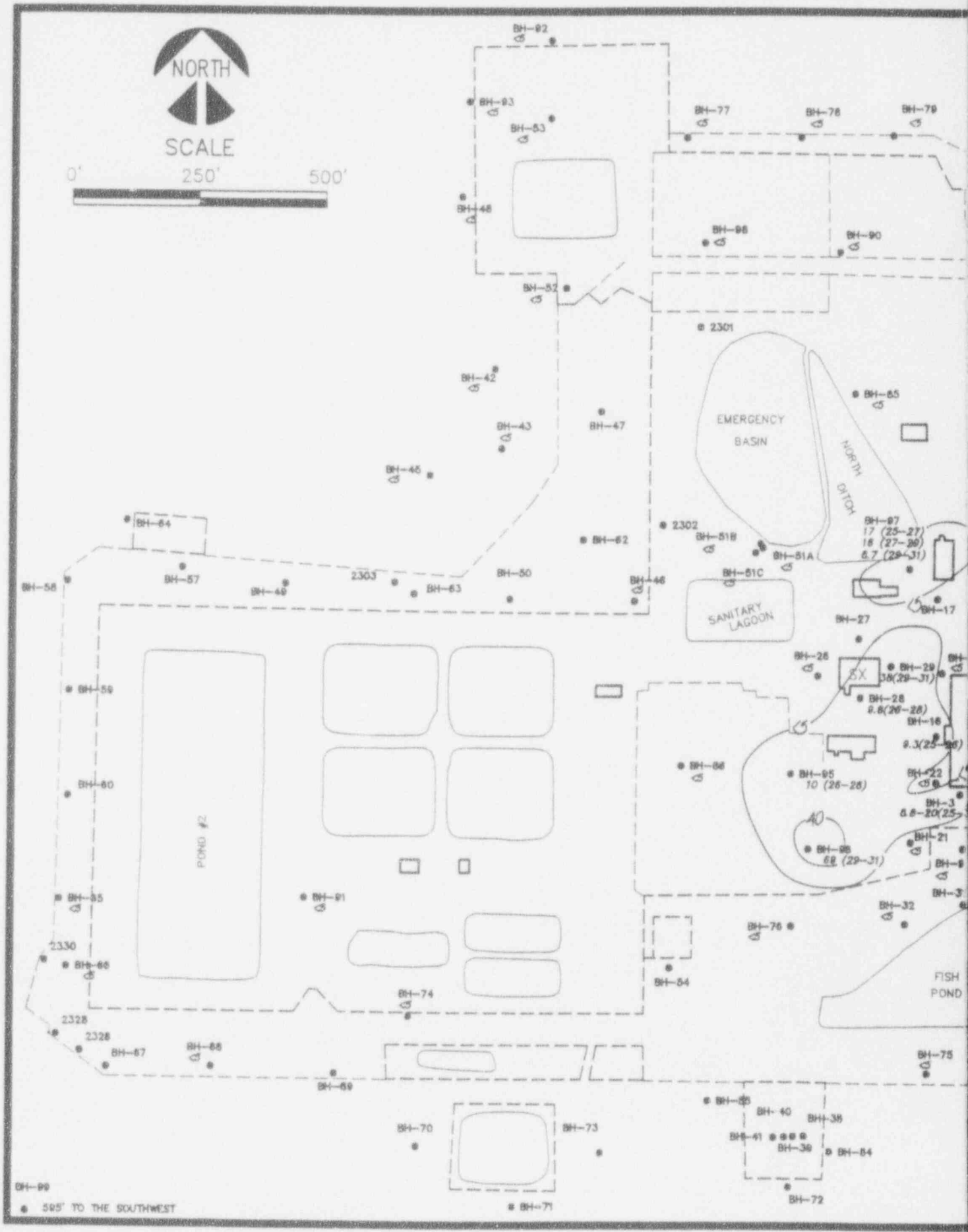
40 — ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, UG/G, SEPTEMBER, 1990 TO APRIL, 1991

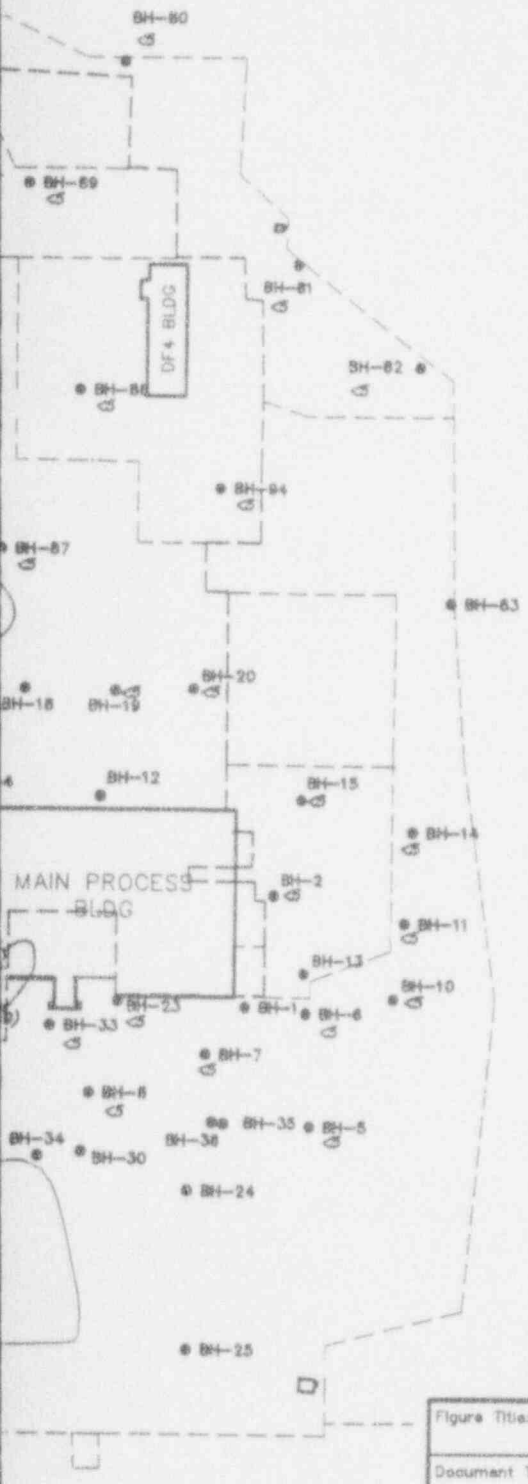
NOTE: IF <5 IS SHOWN, THEN URANIUM IS LESS THAN 5 UG/G IN SOIL OVER THE 20-25 FOOT DEPTH INTERVAL

CONTOUR INTERVAL: <5, 40 AND >100

9401210015-02

Figure Title: ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, 20-25 FEET DEPTH		Client: SEQUOYAH FUELS CORPORATION	
Document Title: FEI FINAL FINDINGS REPORT		Location: GORE, OKLAHOMA	
ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 3700 West Robinson, Suite 200 Norman, Oklahoma 73072 (405) 321-3695		DATE: JULY, 1991	PREPARED BY: RL
		SCALE: 1" = 250'	CHECKED BY: B.J.S.
			DRAFTED BY: RML
		PROJECT NO: 90067 L12	FIGURE NO.: 109


NORTH
SCALE
0'
250'
500'
BH-92
BH-93
BH-53
BH-77
BH-78
BH-79
BH-48
BH-88
BH-90
BH-52
2301
BH-42
BH-43
BH-47
BH-45
BH-85
EMERGENCY
BASIN
NORTH
DITCH
BH-64
BH-57
BH-58
BH-49
2303
BH-63
BH-50
BH-62
BH-46
2302
BH-51B
BH-51A
BH-51C
BH-97
17 (25-27)
18 (27-29)
6.7 (29-31)
SANITARY
LAGOON
BH-17
BH-27
BH-26
BH-29
BH-28
9.8(29-28)
BH-16
BH-59
BH-60
POND #2
BH-86
BH-95
10 (26-28)
BH-22
BH-3
BH-21
BH-96
6.8 (29-31)
BH-9
BH-61
BH-91
BH-32
BH-76
2330
BH-66
BH-54
FISH
POND
BH-74
2328
2328
BH-67
BH-68
BH-69
BH-75
BH-70
BH-73
BH-40
BH-35
BH-41
BH-39
BH-84
BH-72
BH-99
595' TO THE SOUTHWEST
BH-71



LEGEND

BH-82 ●
<5.0 — LOCATION OF LITHOLOGICAL AND CHEMICAL CHARACTERIZATION BORING, AND TOTAL URANIUM IN SOIL, UG/G

17 (25-27) — FIRST NUMBER, 17, IS TOTAL URANIUM IN UG/G. SECOND NUMBER (25-27), IS SAMPLE DEPTH INTERVAL, FEET

40 — ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, UG/G, SEPTEMBER, 1990 TO APRIL, 1991

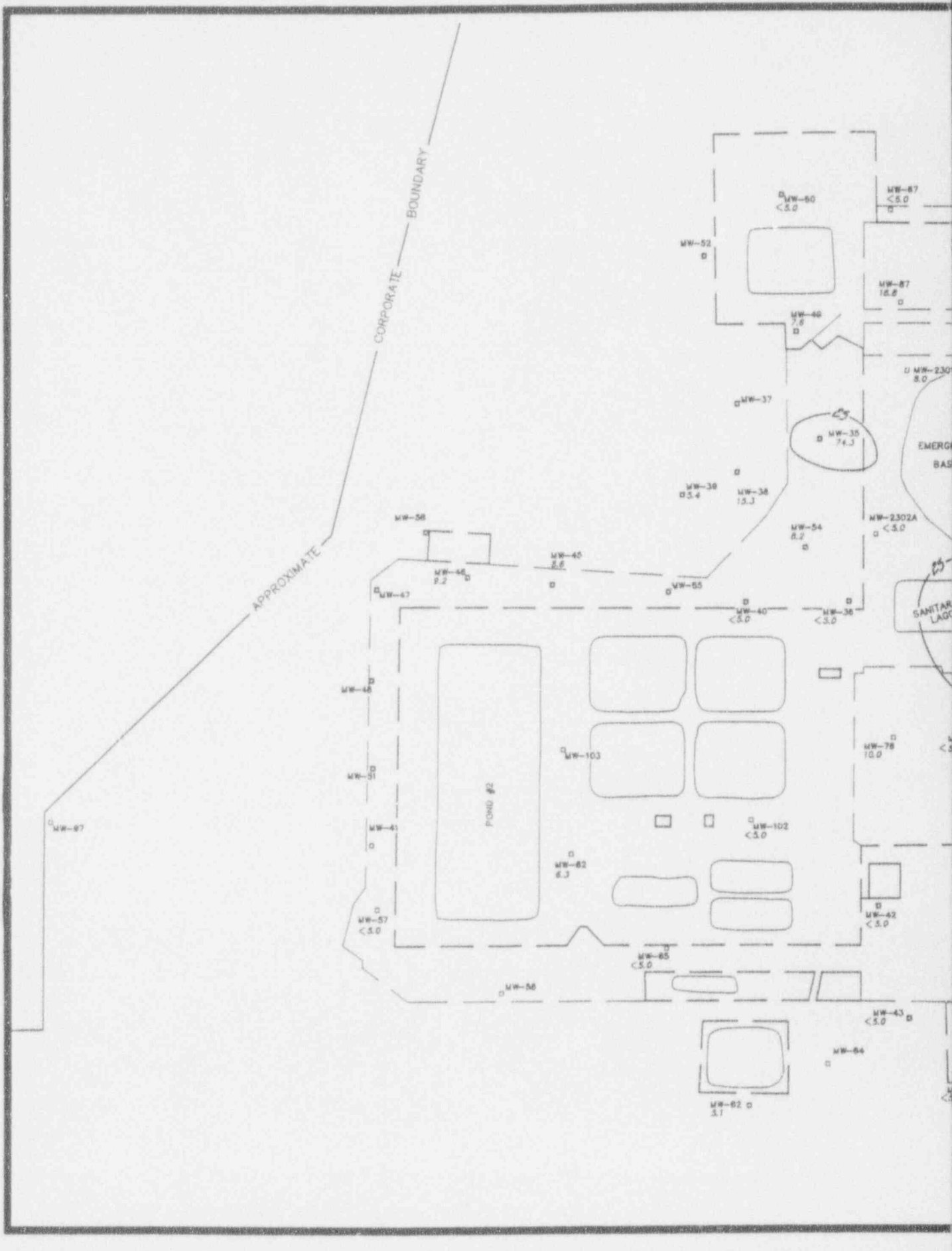
NOTE: IF <5 IS SHOWN, THEN URANIUM IS LESS THAN 5 UG/G IN SOIL OVER THE 25-30 FOOT DEPTH INTERVAL.

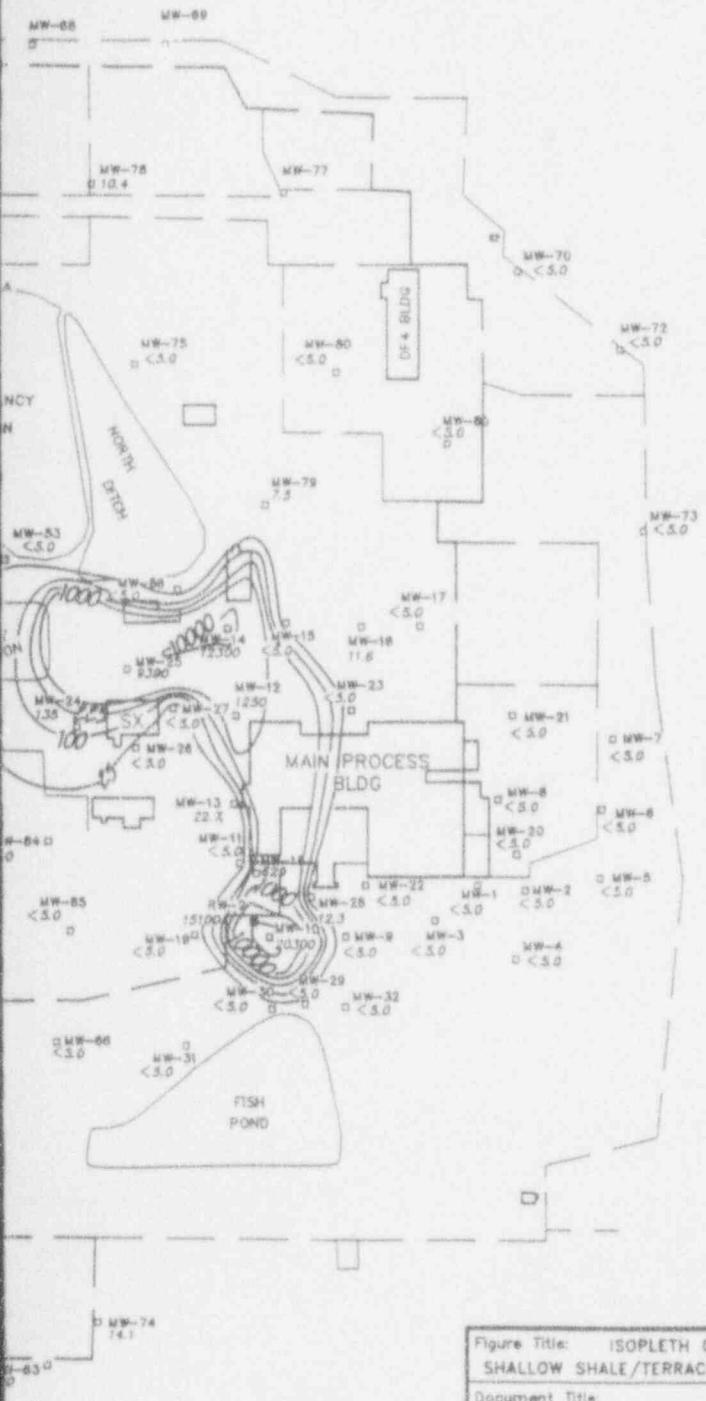
CONTOUR INTERVAL: <5, 40, AND >100

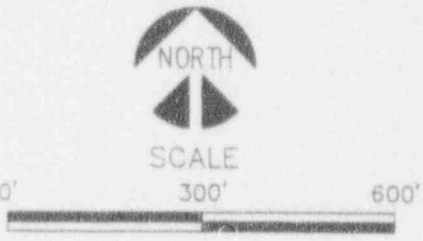
9401210015-03

Figure Title: ISOPLETH OF TOTAL URANIUM LEVELS IN SOIL, 25-30 FOOT DEPTH		Client: SEQUOYAH FUELS CORPORATION	
Document Title: FEB FINAL FINDINGS REPORT		Location: GORE, OKLAHOMA	
ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 2700 West Robinson, Suite 200 Norman, Oklahoma 73072 (405) 321-3896		DATE: JULY, 1991	PREPARED BY: RL
		SCALE: 1"=250'	CHECKED BY: B.J.S.
		PROJECT NO: 90067 L14	DRAFTED BY: RML
			FIGURE NO.: 110

Attachment A-5


APPROXIMATE CORPORATE BOUNDARY
MW-87
<5.0
MW-60
<5.0
MW-52
MW-87
16.8
MW-48
7.8
MW-37
MW-35
74.3
MW-30
5.4
MW-38
15.3
MW-54
8.2
MW-2302A
<5.0
MW-58
MW-46
8.6
MW-45
9.2
MW-47
MW-65
MW-40
<5.0
MW-36
<3.0
MW-49
MW-103
MW-78
10.0
MW-51
POND #2
MW-97
MW-41
MW-102
<5.0
MW-62
6.3
MW-57
<5.0
MW-42
<5.0
MW-65
<5.0
MW-56
MW-43
<5.0
MW-64
MW-62
3.1





LEGEND

MW-72 <5.0 — LOCATION OF SHALLOW SHALE/TERRACE DEPOSITS MONITOR WELL AND TOTAL URANIUM CONCENTRATION IN GROUNDWATER, UG/L, 10/21-27/91

-100- ISOPLETH OF TOTAL URANIUM CONCENTRATION IN SHALLOW SHALE/TERRACE GROUNDWATER, UG/L, 10/21-27/91

FACILITY LICENSE ENVIRONMENTAL ACTION LEVEL IS 225 UG/L FOR URANIUM

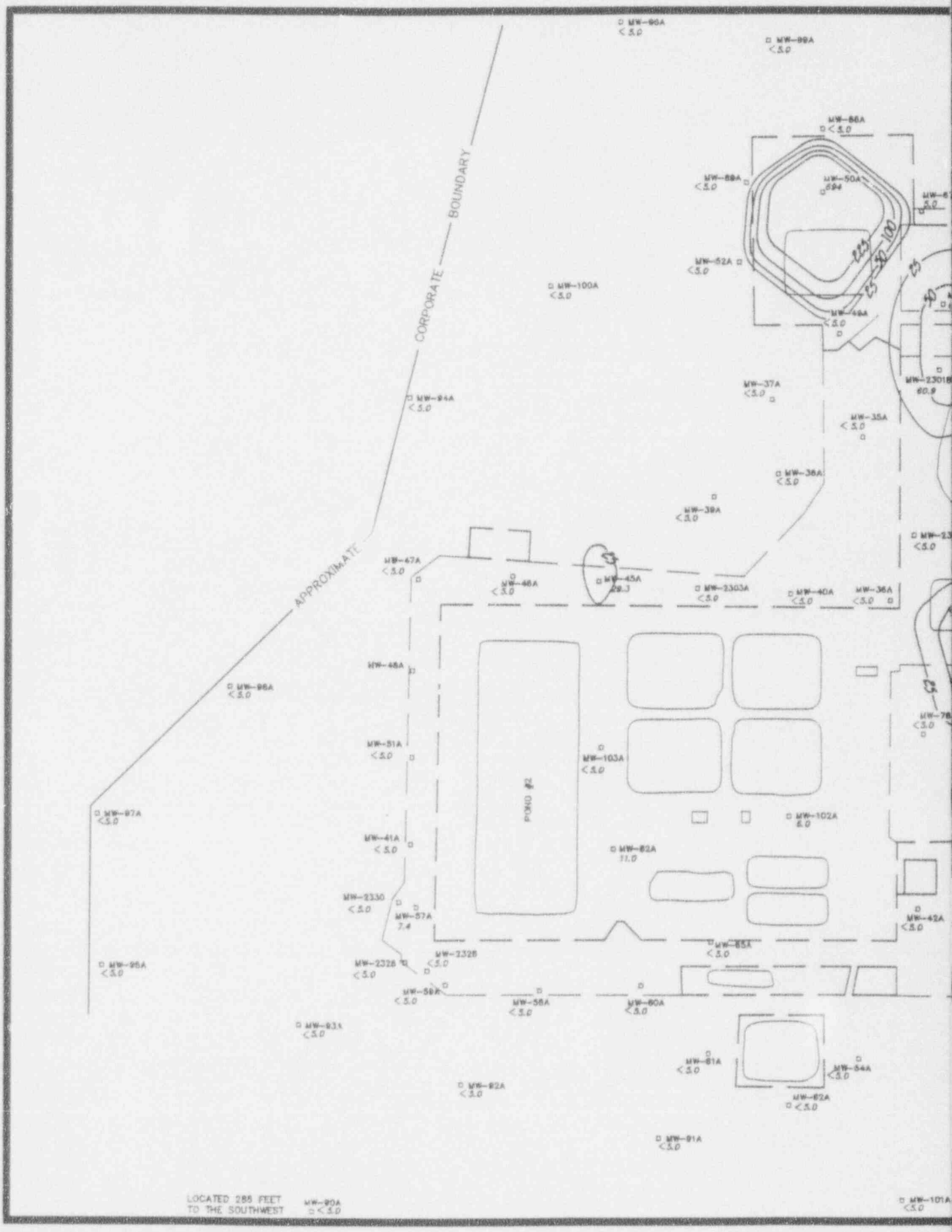
CONTOURS SHOWN: 25, 100, 225, 1000, 10000 AND 20000 UG/L

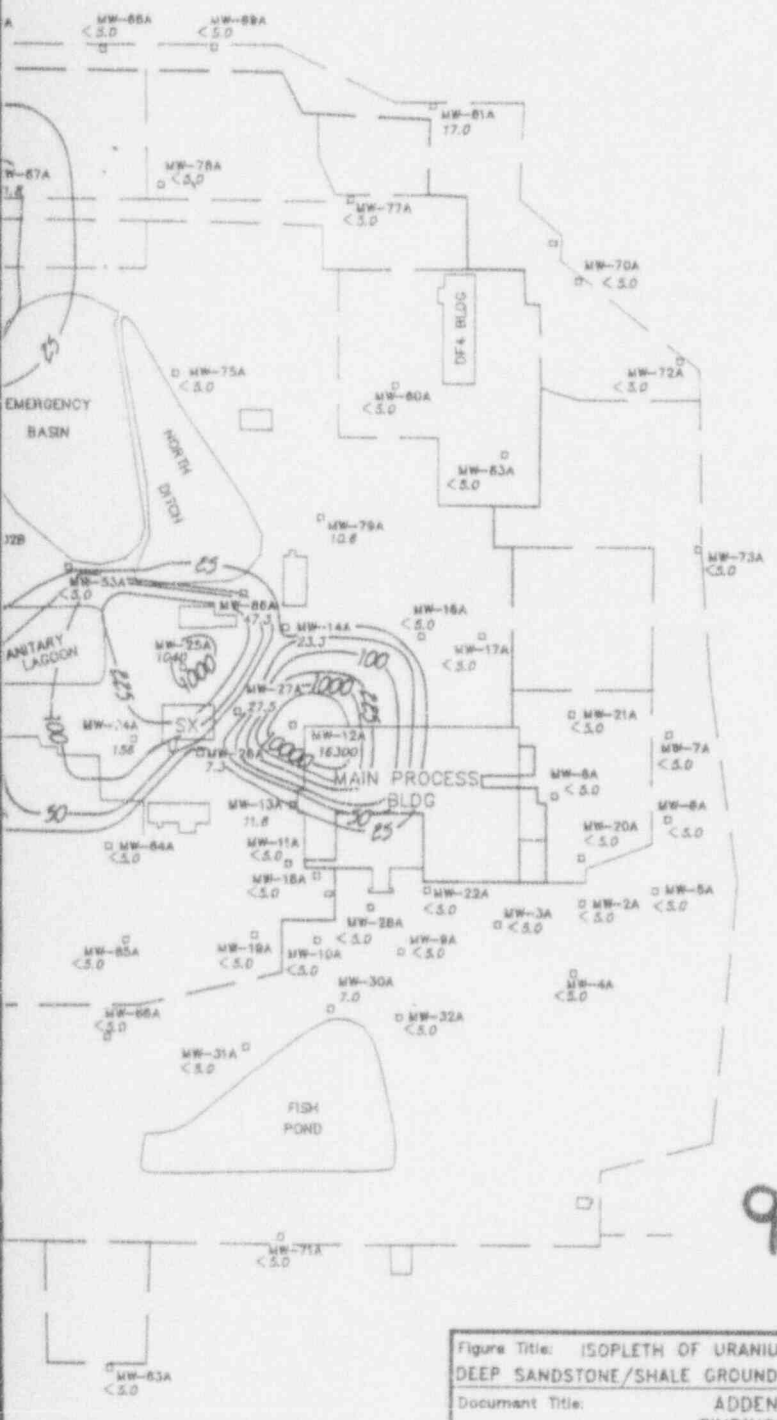
9401210015-04

Figure Title: ISOPLETH OF URANIUM CONCENTRATION, SHALLOW SHALE/TERRACE GROUNDWATER, 10/21-27/91	Client: SEQUOYAH FUELS CORPORATION
Document Title: ADDENDUM FEI FINDINGS REPORT	Location: GORE, OKLAHOMA

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3805

DATE: 1/23/92	PREPARED BY: J.M.B.
SCALE: 1" = 300'	CHECKED BY: B.J.S.
	DRAFTED BY: RML
PROJECT NO: 90067.02 K05	FIGURE NO.:


APPROXIMATE CORPORATE BOUNDARY
POND #2
MW-90A
< 5.0
MW-89A
< 5.0
MW-86A
< 5.0
MW-88A
< 5.0
MW-50A
6.94
MW-52A
< 5.0
MW-100A
< 5.0
MW-49A
< 5.0
MW-37A
< 5.0
MW-94A
< 5.0
MW-35A
< 5.0
MW-38A
< 5.0
MW-39A
< 5.0
MW-47A
< 5.0
MW-48A
< 5.0
MW-45A
29.3
MW-2303A
< 5.0
MW-40A
< 5.0
MW-36A
< 5.0
MW-46A
MW-96A
< 5.0
MW-51A
< 5.0
MW-103A
< 5.0
MW-97A
< 5.0
MW-102A
5.0
MW-41A
< 5.0
MW-82A
11.0
MW-2330
< 5.0
MW-57A
7.4
MW-42A
< 5.0
MW-95A
< 5.0
MW-85A
< 5.0
MW-2328
< 5.0
MW-2328
< 5.0
MW-58A
< 5.0
MW-58A
< 5.0
MW-60A
< 5.0
MW-93A
< 5.0
MW-81A
< 5.0
MW-84A
< 5.0
MW-92A
< 5.0
MW-62A
< 5.0
MW-91A
< 5.0
LOCATED 285 FEET
TO THE SOUTHWEST
MW-90A
< 5.0
MW-101A
< 5.0



LEGEND

MW-72A <5.0 — LOCATION OF DEEP SANDSTONE/SHALE MONITOR WELL AND TOTAL URANIUM CONCENTRATION IN DEEP SANDSTONE/SHALE GROUNDWATER, UG/L, 10/21-27/91

—100— ISOPLETH OF TOTAL URANIUM CONCENTRATION IN DEEP SANDSTONE/SHALE GROUNDWATER, UG/L, 10/21-27/91

FACILITY LICENSE ENVIRONMENTAL ACTION LEVEL IS 225 UG/L FOR URANIUM

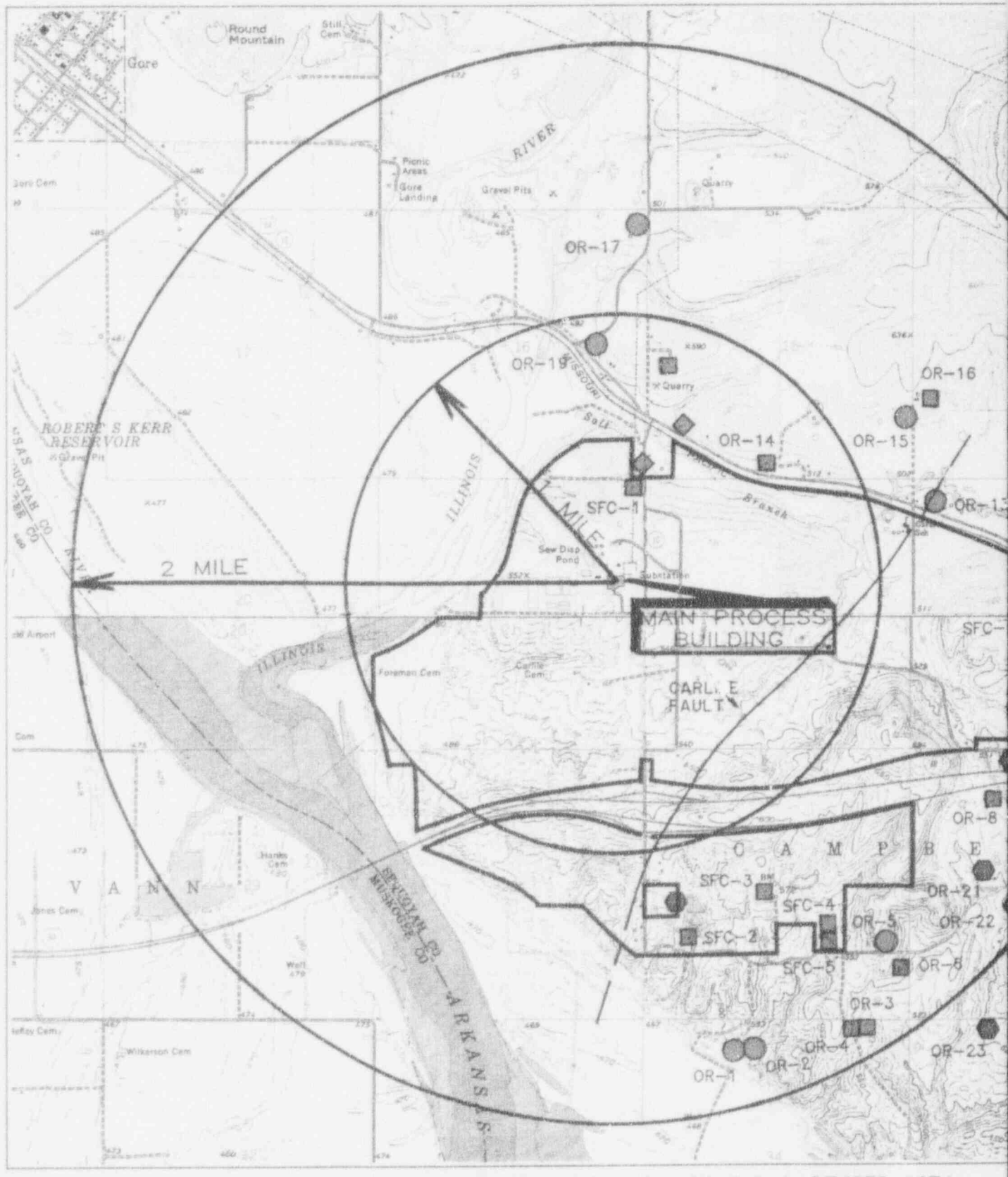
CONTOURS SHOWN: 25, 50, 100, 225, 1000, AND 10000 UG/L

9401210015-05

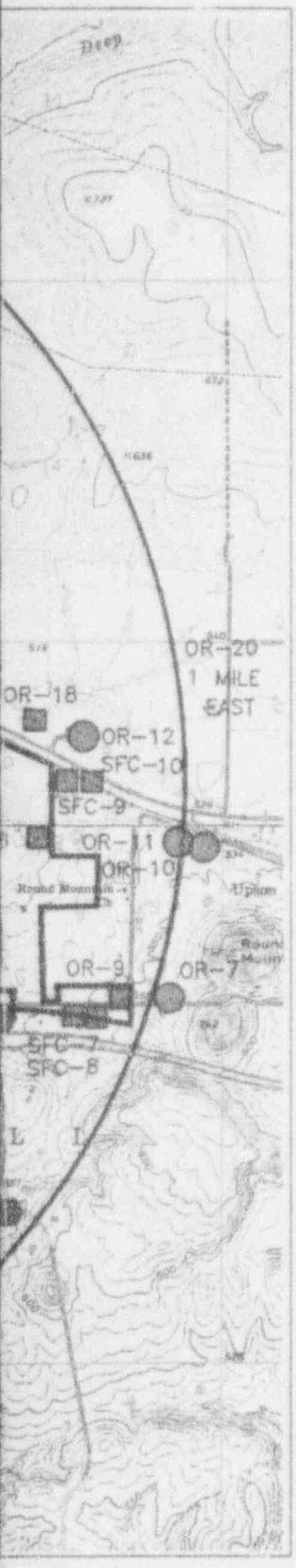
Figure Title: ISOPLETH OF URANIUM CONCENTRATIONS DEEP SANDSTONE/SHALE GROUNDWATER, 10/21-27/91	Client: SEQUOYAH FUELS CORPORATION
Document Title: ADDENDUM FEI FINDINGS REPORT	Location: GORE, OKLAHOMA

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
3700 West Robinson, Suite 200
Norman, Oklahoma 73072
(405) 321-3695

DATE: 1/23/92	PREPARED BY: J.M.B.
	CHECKED BY: B.J.S.
SCALE: 1" = 300'	DRAFTED BY: RML
PROJECT NO: 90067.02 K08	FIGURE NO.: 33



AFTER U.S.G.S. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE GORE, OKLAHOMA, REVISED 1974



T

12

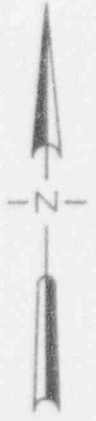
N

LEGEND:

- WATER WELL IN USE
- WATER WELL NOT IN USE
- REFUSED SFC SAMPLE REQUEST ON MAY 9-10, 1991
- UNABLE TO OBTAIN SAMPLE

OR: OFFSITE RESIDENT DOMESTIC WELL

SFC: OLD WATER WELL ON SEQUOYAH FUELS CORPORATION PROPERTY



9401210015-06

SCALE

0 1/2 1 MILE

Figure Title: MAP SHOWING LOCATIONS OF AREA WIDE WATER WELLS		Client: SEQUOYAH FUELS CORPORATION	
Document Title: FEI FINDINGS REPORT		Location: GORE, OKLAHOMA	
ROBERTS/SCHORNICK & ASSOCIATES, INC. Environmental Consultants 3700 West Robinson, Suite 200 Norman, Oklahoma 73072 (405) 321-3840	DATE: 6/27/91	PREPARED BY: J.M.B.	
	SCALE: AS SHOWN	CHECKED BY: B.J.S.	DRAFTED BY: S.A.R.
	PROJECT NO: 90067 F0	FIGURE NO.: 42	