PART C SPECIAL PERMIT CONDITIONS

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1.0 INTRODUCTION

Tinker Air Force Base is required by their RCRA Permit, Section VI, Task I, Part C.1, to submit to the EPA, within 90 days of the effective date of the permit, a report on any and all interim measures taken to mitigate a potential threat to human health and the environment. The following is submitted to meet this request.

2.0 INTERIM MEASURES

This section summarizes the interim measures undertaken at each site describing the objectives of the interim measures; design, construction, and maintenance requirements; schedules for design, construction, and monitoring; schedule for progress reports; and references.

2.1 LANDFILL 6

A. Objective: The cap was installed over landfill 6 to reduce the amount of water infiltrating into the waste resting in the landfill trenches. This would slow the growth of the groundwater plume and help prevent the migration of contaminants into drinking water sources.

B. Design, Construction, Operation, and Maintenance Requirements: The cap design consisted of a two-layer system. The impermeable layer was designed for a maximum permeability of 1×10^{-7} cm/s and a minimum thickness of 18 inches. The top layer was to be constructed of topsoil planted with grass to prevent erosion and protect the clay layer. This design was selected based on freeze-thaw depth, cost, constructability and effectiveness. Maintenance requirements include mowing the grass on the cap and an annual inspection of the cap for damage due to erosion, subsidence, etc. Corrective measures for eroded areas will involve replacing the topsoil and establishing vegetation.

C. Schedules for Design, Construction, and Monitoring: The cap was constructed in January of 1986 as an interim remedial action for landfill 6. The clay materials used for the cover

construction have a minimum liquid limit of 30 percent, are classified as CL or CH under the Unified Soil Classification System, were constructed at a moisture content of optimum or greater, and were compacted at a minimum of 95 percent maximum density. The cap was graded to promote drainage away from the cap. The clay layer was covered by 12 inches of topsoil and vegetated. Additional landfill trenches were later discovered southeast of the capped area and a clay cap extension was constructed in 1988 to completely cover all landfill trenches. The extension was constructed to the same specifications as the original cap. The cap covers an approximate area of 25 acres. Tests on the cap revealed the average permeability to be 1×10^{-8} cm/s. The Hydrologic Evaluation of Landfill Performance (HELP) model was used to evaluate the effectiveness of the cap system. It was determined that the cap system reduced the volume of water infiltrating into the landfill by approximately 70 percent.

A contract to design a system to both intercept the groundwater flow through the trenches and remove water currently trapped in the trenches is expected to be to be awarded in January of 1993.

D. Schedule for Progress Reports: Progress reports and updates

are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Landfill 6 Remedial Investigation, Tinker Air Force Base" U.S. Army Corps of Engineers, Tulsa District 1990

2.2 LANDFILL 5

A. Objective: The construction of the clay cap will minimize the infiltration of water into the landfill trenches and mitigate the migration of contaminants into the surrounding groundwater.

B. Design, Construction, Operation, and Maintenance Requirements: Landfill 5 was covered with a compacted clay cap in August of 1990 as an interim measure. The cap design consisted of a two-layer system. The impermeable layer was designed to be an 18 inch compacted layer of clay with a maximum permeability of 1×10^{-7} cm/s. This layer was designed to be protected from erosion by a 12 inch layer of topsoil planted with grass. This cover system was deemed the most appropriate based on freeze-thaw depth, effectiveness in preventing water

infiltration, constructability and cost. Maintenance requirements include mowing of the grass on top of the cap and an annual inspection of the cap to check for damage from erosion, subsidence, etc. Corrective measures for cap damage will include placement of soil in damaged areas and establishing vegetation.

C. Schedule for Design, Construction and Monitoring: The landfill cap was constructed in August of 1990. Materials used in the cover construction have a minimum liquid limit of 30 percent, are classified as CL or CH under the Unified Soil Classification System, were constructed at a maximum moisture content of optimum or greater, and were compacted to a minimum of 95 percent maximum density (standard proctor) to achieve a maximum permeability of 1×10^{-7} cm/s. The cap was graded to promote drainage away from the cap. Subsequent tests on the cap revealed that the maximum permeability of the cap is 1×10^{-8} cm/s. The clay layer was covered with 12 inches of topsoil and vegetation was planted. The cap covers approximately 5 square acres.

Monitoring wells 6, 7, and 8 were installed along Crutcho Creek to a depth of 22 feet. Well 13 was installed to a depth of 55 feet and penetrates the perched aquifer. Four monitoring wells,

6A, 8A, 13A, an 58A were installed in the landfill trenches. All wells are sampled on a yearly basis.

A contract to design a leachate collection and treatment system is expected to be awarded in January of 1993. It is intended that the system will remove and treat leachate currently trapped in the landfill trenches and will collect any water that percolates through the cap in the future.

D. Schedule for Progress Reports: Progress reports shall be provided quarterly via the Technical Review Committee.

E. References:

1. "Landfill 5 Remedial Investigation Report, Tinker Air Force Base"
   U.S. Army Corps of Engineers, Tulsa District
   1990

2.3 LANDFILL 1

A. Objectives: The construction of the 2 acre clay cap will minimize the surface water infiltration, slow the expansion of the groundwater plume, and help prevent the plume from migrating to TAFB boundaries.

B. Design, Construction, Operation, and Maintenance Requirements: The design and construction of the landfill cap is in accordance with EPA's guidance document: Final Covers on Hazardous Waste Landfills and Surface Impoundments July 89, EPA/530-SW-89-047. The cover selected consists of the following layers in order of construction placement:

- fill layer to achieve the basic 3 to 5 percent initial slope and drainage patterns
- 24 inch layer of compacted clay (placed in 6 inch lifts) meeting the permeability specification of 1x10-7 cm/sec or less
- 40 mil flexible membrane liner
- synthetic drainage net
- filter fabric
- 18 inch layer of fill material
- six inches of top soil with vegetation

Maintenance requirements include mowing the grass on the cap annually or as needed and an annual inspection of the cap surface for signs of erosion. Corrective measures for eroded areas will involve replacing the topsoil and reestablishing vegetation.

C. Schedules for Design, Construction, and Monitoring: The

landfill cap design was completed in July 90 and construction was completed in Feb 91. The monitoring schedule for the landfill includes annual sampling of monitoring wells surrounding the landfill site in order to detect possible migration of contaminants from the landfill into the groundwater. Specific monitoring wells include: MW 1 (perched and top of regional) northwest of the landfill south of Crutcho Creek; MW 61 (perched and top of regional) northwest of landfill north of Crutcho Creek; MW 9 (perched and top of regional) west of the landfill; MW 2 (perched and top of regional) southeast of the landfill.

D. Schedule For Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Installation Restoration Program, Phase I; Records Search"
   Engineering Science
   April 1982

2. "Installation Restoration Program, Phase II, Stage 1, Field Evaluation"
   Radian Corporation
   November 1984

3. "Installation Restoration Program Groundwater Assessment"
United States Army Corp of Engineers, Tulsa District
September 1987

4. "Landfills 1-4 Remedial Investigations, Draft Report"
United States Army Corp of Engineers, Tulsa District
May 1990

5. "Landfill 1 Cover System Specifications"
United States Army Corp of Engineers, Tulsa District
July 1990

2.4 LANDFILL 2

A. Objectives: The construction of the 28 acre clay cap will minimize the surface water infiltration, slow the expansion of the groundwater plume, and help prevent the plume from migrating to TAFB boundaries.

B. Design, Construction, Operation, and Maintenance Requirements: The design of the landfill cap is in accordance with EPA's guidance document: Final Covers on Hazardous Waste Landfills and Surface Impoundments July 89, EPA/530-SW-89-047. The cover selected consists of the following layers in order of construction placement:

- fill layer to achieve the basic 3 to 5 percent initial slope and drainage patterns.
- gas collection layer consisting of a synthetic drainage composite, or two layers of filter fabric sandwiched around a synthetic drainage net.
- a 6 inch layer of compacted clay meeting the permeability specification of 1 x 10-7 cm/sec or less.
- a geosynthetic composite liner consisting of either a sandwich of filter fabric around a bentonite layer, or a bentonite layer attached to a flexible membrane liner.
- a 40 mil flexible membrane liner
- a synthetic drainage net
- filter fabric
- a 24 inch layer of fill material used to protect the other cover components
- 6 inches of topsoil and vegetation

Maintenance requirements include mowing the grass on the cap annually or as needed and an annual inspection of the cap surface for signs of erosion. Corrective measures for eroded areas will involve replacing the topsoil and reestablishing vegetation.

C. Schedules for Design, Construction, and Monitoring: The landfill cap design was completed in Sep 92 with the cap

construction scheduled for FY 93, depending on availability of funds. Prior to cap construction in FY 93, a waste characterization study will be conducted and any contaminant "hotspots" identified will be remediated. A leachate collection and treatment system, scheduled for design and construction in FY 93 (depending on availability of funds), will extract and remediate the trench water in the waste. The monitoring schedule for the landfill includes annual sampling of monitoring wells surrounding the landfill site in order to detect possible migration of contaminants from the landfill into the groundwater. Specific monitoring wells include: MW 5 (perched and top of regional) northeast of the landfill; MW 84 (perched, top of regional, and regional) east of the landfill; MW 79 (perched and top of regional) south of the landfill; MW 60 (perched, top of regional, and regional) south of the landfill.

D. Schedule For Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Installation Restoration Program, Phase I; Records Search"
   Engineering Science
   April 1982

2. "Installation Restoration Program, Phase II, Stage 1, Field Evaluation"
Radian Corporation
November 1984

3. Installation Restoration Program "Groundwater Assessment"
United States Army Corp of Engineers, Tulsa District
September 1987

4. "Landfills 1-4 Remedial Investigations, Draft Report"
United States Army Corp of Engineers, Tulsa District
May 1990.

5. "Shallow Soil Gas Investigation, Landfills 2 & 4"
Tracer Research Corporation
May 1990

6. "Landfills 2 & 4 Cover System Design Analysis and Specifications"
United States Army Corp of Engineers, Tulsa District
September 1992

2.5 LANDFILL 3

A. Objectives: The construction of the 8 acre clay cap will

minimize the surface water infiltration, slow the expansion of the groundwater plume, and help prevent the plume from migrating to TAFB boundaries.

B. Design, Construction, Operation, and Maintenance Requirements: The design and construction of the landfill cap is in accordance with EPA's guidance document: Final Covers on Hazardous Waste Landfills and Surface Impoundments July 89, EPA/530-SW-89-047. The cover selected consists of the following layers in order of construction placement:

- fill layer to achieve the basic 3 to 5 percent initial slope and drainage patterns
- 24 inch layer of compacted clay (placed in 6 inch lifts) meeting the permeability specification of 1 x 10-7 cm/sec or less
- 40 mil flexible membrane liner
- synthetic drainage net
- filter fabric
- 18 inch layer of fill material
- six inches of top soil with vegetation

Maintenance requirements include mowing the grass on the cap annually or as needed and an annual inspection of the cap surface for signs of erosion. Corrective measures for eroded

areas will involve replacing the topsoil and reestablishing vegetation.

C. Schedules for Design, Construction, and Monitoring: The landfill cap design was completed in May 90 and construction was completed in Dec 91. The monitoring schedule for the landfill includes annual sampling of monitoring wells surrounding the landfill site in order to detect possible migration of contaminants from the landfill into the groundwater. Specific monitoring wells include: MW 2 (perched and top of regional) northwest of the landfill; MW 76 (perched and top of regional) southwest of the landfill; MW 4 (perched and top of regional) southeast of the landfill; MW 3 (perched and top of regional) northeast of the landfill.

D. Schedule For Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Installation Restoration Program, Phase I; Records Search"
   Engineering Science
   April 1982

2. "Installation Restoration Program, Phase II, Stage 1, Field

Evaluation"
Radian Corporation
November 1984

3. "Installation Restoration Program Groundwater Assessment"
United States Army Corp of Engineers, Tulsa District
September 1987

4. "Landfills 1-4 Remedial Investigations, Draft Report"
United States Army Corp of Engineers, Tulsa District
May 1990

5. "Landfill 3 Sludge Dump Contaminated Soil Information for Soil Removal and Decontamination"
United States Army Corp of Engineers, Tulsa District
January 1989

6. "Task Order 4, Demonstration of Thermal Stripping of JP-4 and Other VOCs from Soils at Tinker Air Force Base"
Weston
March 1990

7. "Decontamination Certification for Low Temperature Thermal Treatment Process Equipment Contaminated During a Demonstration at Tinker Air Force Base"

Weston

April 1990

8. "Landfill 3 Cover System Design Analysis"

United States Army Corp of Engineers, Tulsa District

June 1990

2.6 LANDFILL 4

A. Objectives: The construction of the 12 acre clay cap will minimize the surface water infiltration, slow the expansion of the groundwater plume, and help prevent the plume from migrating to TAFB boundaries.

B. Design, Construction, Operation, and Maintenance Requirements: The design of the landfill cap is in accordance with EPA's guidance document: Final Covers on Hazardous Waste Landfills and Surface Impoundments July 89, EPA/530-SW-89-047. The cover selected consists of the following layers in order of construction placement:

- fill layer to achieve the basic 3 to 5 percent initial slope and drainage patterns.
- gas collection layer consisting of a synthetic drainage composite, or two layers of filter fabric sandwiched around

a synthetic drainage net.

- a 6 inch layer of compacted clay meeting the permeability specification of 1 x 10-7 cm/sec or less.
- a geosynthetic composite liner consisting of either a sandwich of filter fabric around a bentonite layer, or a bentonite layer attached to a flexible membrane liner.
- a 40 mil flexible membrane liner
- a synthetic drainage net
- filter fabric
- a 24 inch layer of fill material used to protect the other cover components
- 6 inches of topsoil and vegetation

Maintenance requirements include mowing the grass on the cap annually or as needed and an annual inspection of the cap surface for signs of erosion. Corrective measures for eroded areas will involve replacing the topsoil and reestablishing vegetation.

C. Schedules for Design, Construction, and Monitoring: The landfill cap design was completed in Sep 92 with the cap construction scheduled for FY 93, depending on availability of funds. Prior to cap construction in FY 93, a waste characterization study will be conducted and any contaminant "hotspots" identified will be remediated. A leachate collection

and treatment system scheduled for design and construction in FY 93 (depending on availability of funds), will extract and remediate the trench water in the waste. The monitoring schedule for the landfill includes annual sampling of monitoring wells surrounding the landfill site in order to detect possible migration of contaminants from the landfill into the groundwater. Specific monitoring wells include: MW 11 (perched, top of regional, and regional) east of the landfill; MW 83 (perched and top of regional) southwest of the landfill; MW 10 (perched, top of regional, and regional) south of the landfill.

D. Schedule For Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Installation Restoration Program, Phase I; Records Search"
   Engineering Science
   April 1982

2. "Installation Restoration Program, Phase II, Stage 1, Field Evaluation"
   Radian Corporation
   November 1984

3. Installation Restoration Program "Groundwater Assessment"
United States Army Corp of Engineers, Tulsa District
September 1987

4. "Landfills 1-4 Remedial Investigations, Draft Report"
United States Army Corp of Engineers, Tulsa District
May 1990.

5. "Shallow Soil Gas Investigation, Landfills 2 & 4"
Tracer Research Corporation
May 1990

6. "Landfills 2 & 4 Cover System Design Analysis and Specifications"
United States Army Corp of Engineers, Tulsa District
September 1992

2.7 FIRE TRAINING AREA 1

A. Objective: Longterm monitoring of the ground-water at this site was the chosen interim measure. These monitoring wells will be utilized to ensure that any contamination in this area is not migrating off site.

B. Design, Construction, Operation, and Maintenance

Requirements: Longterm monitoring shall consist of installing three clusters of two monitoring wells each to supplement the two existing wells. There shall be three monitoring wells installed in the perched aquifer and three in the top of regional aquifer. The monitoring wells shall be constructed of 304 stainless steel casing and each monitoring well will have a diameter of 4 inches. Screen lengths shall be 10 feet in length with number 1 slot and end cap. Each of the monitoring wells shall be finished off with not less than 3000 psi compressive strength concrete. Each monitoring well shall be constructed in accordance with, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD)." Sep 1986. No maintenance is required for properly installed monitoring wells.

C. Schedule for Design, Construction, Operation, and Maintenance: The design of the monitoring wells was completed in July 1992. Construction of these monitoring wells is expected to be complete in FY 1993, pending funding. The monitoring wells shall be placed on the base monitoring well contract to be sampled and analyzed annually beginning in FY 1993.

D. Schedule for Progress Report: Progress reports are submitted as part of the Technical Review Committee (TRC).

E. References:

1. "Fire Training Area No. 1, Remedial Investigation Report, Tinker AFB."
U.S. Corps of Engineers
Final May 1992

2. "Risk Assessment of Fire Training Area 1, Tinker AFB."
U.S. Corps of Engineers
Draft Report March 1991

3. "Decision Document."
Environmental Management, Tinker AFB
Sep 1992

2.8 FIRE TRAINING AREA 2

A. Objective: The objective of the proposed interim measures is longterm monitoring of the perched and top of regional aquifers in the general area of the site.

B. Design, Construction, Operation, and Maintenance Requirements: Longterm monitoring shall consist of installing four clusters of two monitoring wells each. There shall be four monitoring wells installed in the perched aquifer and four monitoring wells installed in the top of regional aquifer.

There shall be three monitoring wells located downgradient of Fire Training Area 2 in both the top of regional and perched aquifers. These downgradient monitoring wells shall be located at the edge of Fire Training Area 2 boundary. While the single upgradient wells for the top of regional and perched aquifers shall be located beyond the upgradient extent of the potential contamination source. The monitoring wells shall be constructed of 304 stainless steel casing and each monitoring well will have a diameter of 4 inches. Screen lengths shall be 10 feet in length with a number one slot and end cap. Each monitoring well shall be constructed in compliance with, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD)." Sep 1986. During drilling operations to install the new monitoring wells a continuous core shall be taken to provide background information. No maintenance is required for properly installed monitoring wells.

C. Schedule for Design, Construction, Operation, and Maintenance: The design of the monitoring wells was completed in Oct 1992. Construction of the monitoring wells is expected to be complete in FY 1993, pending funding. The monitoring wells shall be placed on the base monitoring well contract to be sampled and analyzed annually beginning in FY 1993.

D. Schedule for Progress Reports: Progress reports are

submitted as part of the Technical Review Committee (TRC).

E. References:

1. "Installation Restoration Program Response Action, Fire Training Area No 2."
U.S. Army Corps of Engineers
Final Dec 1988

2. "Decision Document."
Environmental Management, Tinker AFB.
Jun 1992

2.9 SUPERNATANT POND

A. Objective: Solidification/stabilization (S/S) is being used to "trap" waste the in a cement matrix. Once the cement has cured the waste is locked into a solid matrix and cannot migrate. Longterm monitoring is going to be utilized to ensure that the S/S is performing as it should.

B. Design, Construction, Operation, and Maintenance Requirements: The mix ratio used for the S/S at this site was 250 lbs of portland cement and 40 lbs of fly ash (drying agent) for each cubic yard of soil. The site was excavated to a depth of 8 feet below ground level. All the soil excavated was

stockpiled and sampled. The S/S process was performed on the soil between 4 and 8 feet. The soil was placed into the excavation site in 6 inch lifts, a pre-measured amount of cement and fly ash was then laid down. A recycler was used to thoroughly mix the constituents together. The lift was then compacted to 95% proctor, this process was continued until the 4 foot below ground level was reached. Finally the rest of the excavation site was filled with clean backfill and compacted to a 90% proctor. There are three longterm monitoring wells that are to be installed as part of this design, these new monitoring wells will be complemented by three existing monitoring wells. Two of the monitoring wells are to be installed in the top of regional aquifer and one in the perched aquifer. The installation of these new monitoring was completed in Oct 1992. The new monitoring wells will be incorporated into the base monitoring well contract.

C. Schedule for Design, Construction, Operation, and Maintenance: The S/S design was completed June 1992 and the construction will be completed Oct 1992. The monitoring of these wells will begin Oct 1992 and will be sampled annually.

D. Schedule for Progress Reports: Progress reports shall be provided as part of the Technical Review Committee (TRC).

E. References:

1. "Supernatant Pond, Remedial Investigation Report, Tinker AFB."
U.S. Army Corps of Engineers
Final Oct. 1992

2. "Risk Assessment of Supernatant Pond, Tinker AFB."
U.S. Army Corps of Engineers
Draft Final March 1991

2.10 INDUSTRIAL WASTE PIT NO.1

A. Objective: The objective of the proposed interim measures is longterm monitoring of the top of regional aquifer in the general area of the site. There is no perched aquifer in the vicinity of the site.

B. Design, Construction, Operation, and Maintenance Requirements: There was a Remedial Investigation (RI) performed at this site in FY 91. During which an additional monitoring well was installed to compliment the three existing monitoring wells. A soil gas survey was performed, as well as groundwater sampling and analysis was done to determine the extent and nature of contamination if any. The result of the analysis performed indicated that no significant contamination was

present at this site. Design and construction was completed in FY 91. No further design, construction, operation or maintenance is required.

C. Schedule for Design, Construction and Maintenance: There is no further design or construction scheduled for this site. The monitoring wells shall be placed on the base monitoring well contract to be sampled and analyzed annually beginning in FY 93.

D. Schedule for Progress Reports: Progress reports are submitted as part of the Technical Review Committee (TRC).

E. References:

1. "Installation Restoration Program, Phase II, Stage I"
   Radian Corp.
   Sep 1985

2. "Remedial Investigation, Industrial Waste Pit 1"
   Roy F. Weston Inc.
   Aug 1991

3. "Decision Document"
   Environmental Management, Tinker AFB
   Feb 1992

2.11 INDUSTRIAL WASTE PIT NO.2

A. Objective: The objective of the proposed interim measures is longterm monitoring of the top of regional aquifer in the general area of the site. There is no perched aquifer in the vicinity of the site.

B. Design, Construction, Operation, and Maintenance Requirements: There was a Remedial Investigation (RI) performed at this site in FY 89. During which an additional three clusters of two monitoring wells each were installed to compliment the three existing monitoring well. Ground water samples were taken from all monitoring wells on site and sampled from June 1989 to April 1990. The results of the analysis performed indicated that no significant contamination was present at this site. Design and construction was completed in FY 89. No further design, construction, operation or maintenance is required.

C. Schedule for Design, Construction and Maintenance: There is no further design or construction scheduled for this site. The monitoring wells shall be placed on the base monitoring well contract to be sampled and analyzed annually beginning in FY 93.

D. Schedule for Progress Reports: Progress reports are

submitted as part of the Technical Review Committee (TRC).

E. References:

1. "Installation Restoration Program, Phase II, Stage I"
Radian Corp.
Sep 1985

2. "Remedial Investigation, Industrial Waste Pit 2"
U.S. Army Corps of Engineers
Draft Nov. 1991

3. "Decision Document"
Environmental Management, Tinker AFB
Jan 1992

2.12 RADIOLOGICAL WASTE DISPOSAL SITE 1030W

A. Objectives: The objective of the interim measure currently being conducted at this site is to remove all radium-226 contaminated objects and soil. Excavation of this site will eliminate the possibility of radiologically contaminated objects and soils at this site. All soil and air pathways for human health and environmental risks will be shown to be nonexistent. In addition, this site will be covered by the landfill cap which will cover Landfills 2 and 4.

B. Design, Construction, Operation, and Maintenance Requirements: Design and construction for this measure is to excavate the site and remove any contaminated soils and objects for proper disposal. A confirmatory survey of the site will be conducted after excavation.

Operation for the excavation includes using radiological and geophysical survey instruments to direct the digging. Exhumation is being accomplished with a backhoe, front end loader, and hand shovels. To date, approximately 750 cubic yards of soil have been excavated. It is estimated that another 450 cubic yards of contaminated soil will be generated before the project is completed.

No further design, construction, operation, or maintenance requirements have been identified because all radiologically contaminated objects and soils will be removed. No further action will be proposed at this site.

C. Schedule for Design, Construction, Operation, and Maintenance: Excavation of the site began in July 1992 and should be completed by December 1993. No further design, construction, operation or maintenance is scheduled for this site.

D. Schedule for Progress Reports: The Closure Report for the site is anticipated to be complete by the first quarter of 1993. A Decision Document for the site should be finished by the second quarter of 1993.

E. References:

1. "Installation Restoration Program Phase I - Records Search, Tinker AFB, Oklahoma"
   Engineering Science
   April 1982

2. "Radiological Waste Disposal Sites, Tinker Air Force Base, Oklahoma City, Oklahoma"
   U.S. Army Corps of Engineers, Tulsa district
   1989

3. "Investigation of the Tinker AFB Radioactive Waste Disposal Sites, Phase II, Final Report, Volume I"
   Chem-Nuclear Environmental Services
   December 1990

4. "Closure Report RWDS 1022E & 62598 Tinker Air Force Base"
   CDM Federal Programs Corporation
   January 1992

2.13 RADIOLOGICAL WASTE DISPOSAL SITE 201S

A. Objectives: The objective of the interim measure planned at this site is to remove all radium-226 contaminated soil. Excavation of this site will eliminate the possibility of radiological objects and soils at this site. All soil and air pathways for human health and environmental risks will be shown to be nonexistent.

B. Design, Construction, Operation, and Maintenance Requirements: Design and construction for this measure is to excavate the site and remove any contaminated soils and objects for proper disposal. A confirmatory survey of the site will be conducted after excavation.

Operation for the excavation will include using radiological and geophysical survey instruments to direct the digging. Exhumation will be accomplished with a backhoe, front end loader, and hand shovels.

No further design, construction, operation, or maintenance requirements have been identified because all radiologically contaminated objects and soils will be removed. No further action will be proposed at this site.

C. Schedule for Design, Construction, Operation, and Maintenance: Pending funding, excavation of the site is scheduled for the last quarter of 1992 or the first quarter of 1993. No further design, construction, operation or maintenance is scheduled for this site.

D. Schedule for Progress Reports: A Risk Assessment report is anticipated to be complete by the first quarter of 1993. If the removal action is funded, a report on the removal action will be finished by the second quarter of 1993.

E. References:

1. "Installation Restoration Program Phase I - Records Search, Tinker AFB, Oklahoma"
   Engineering Science
   April 1982

2. "Radiological Waste Disposal Sites, Tinker Air Force Base, Oklahoma City, Oklahoma"
   U.S. Army Corps of Engineers, Tulsa district
   1989

3. "Investigation of the Tinker AFB Radioactive Waste Disposal Sites, Phase II, Final Report, Volume I"
   Chem-Nuclear Environmental Services

December 1990

2.14 RADIOLOGICAL WASTE DISPOSAL SITE 62598

A. Objectives: The objective of this interim measure was to eliminate the possibility of radiological objects at this site. Excavation revealed that there were no radioactive objects or soils at this site. Therefore, all human health and environmental risks have been eliminated. All soil and air pathways for human health and environmental risks have been shown to be nonexistent.

B. Design, Construction, Operation, and Maintenance Requirements: Design and construction for this measure was to excavate the site and remove any contaminated soils and objects for proper disposal. A confirmatory survey of the site after excavation found no radiologic contamination. Results of the survey can be found in CDM Federal Programs Corporation, "Closure Report RWDS 1022E & 62598 Tinker Air Force Base", January 1992.

Operation for the excavation included using radiological and geophysical survey instruments to direct the digging. Exhumation was accomplished with a backhoe and hand shovels.

No further design, construction, operation, or maintenance requirements have been identified because there are no radiologically contaminated objects or soils at this site. No further action is proposed at this site.

C. Schedule for Design, Construction, Operation, and Maintenance: Excavation of this site was completed in July 1991. No further design, construction, operation or maintenance is scheduled for this site.

D. Schedule for Progress Reports: No further progress reports will be written for this site because no further action is proposed. Results of the interim measure can be found in CDM Federal Programs Corporation, "Closure Report RWDS 1022E & 62598 Tinker Air Force Base", January 1992.

E. References:

1. "Installation Restoration Program Phase I - Records Search, Tinker AFB, Oklahoma"
   Engineering Science
   April 1982

2. "Radiological Waste Disposal Sites, Tinker Air Force Base, Oklahoma City, Oklahoma"
   U.S. Army Corps of Engineers, Tulsa district

1989

3. "Investigation of the Tinker AFB Radioactive Waste Disposal Sites, Phase II, Final Report, Volume I"
Chem-Nuclear Environmental Services
December 1990

4. "Closure Report RWDS 1022E & 62598 Tinker Air Force Base"
CDM Federal Programs Corporation
January 1992

2.15 RADIOLOGICAL WASTE DISPOSAL SITE 1022E

A. Objectives: The objective of this interim measure was to eliminate the possibility of radiological objects at this site. Excavation removed three small radioactive objects and six cubic yards of chemically contaminated soils at this site. The Landfill 3 cap constructed in 1991 covered this site. Therefore, all human health and environmental risks have been eliminated. All soil and air pathways for human health and environmental risks have been shown to be nonexistent.

B. Design, Construction, Operation and Maintenance Requirements: Design and construction for this measure was to excavate the site and remove any contaminated soils and objects for proper

disposal. A confirmatory survey of the site after excavation found no radiologic contamination. Results of the survey can be found in CDM Federal Programs Corporation, "Closure Report RWDS 1022E & 62598 Tinker Air Force Base", January 1992.

Operation for the excavation included using radiological and geophysical survey instruments to direct the digging. Exhumation was accomplished with a backhoe and hand shovels.

Maintenance for this site will consist wholly of sampling both an up-gradient well and a down-gradient well for Radium-226 in conjunction with Landfill 3 monitoring. No further design, construction, or operation requirements have been identified because all radiologically contaminated objects and soil have been removed. No further action is proposed at this site.

C. Schedule for Design, Construction, Operation, and Maintenance: Excavation and removal of three radioactive objects was completed in July 1991. No further design, construction, operation or maintenance is scheduled for this site.

D. Schedule for Progress Reports: No further progress reports will be written for this site because no further action is proposed. Results of the interim measure can be found in CDM

Federal Programs Corporation, "Closure Report RWDS 1022E & 62598 Tinker Air Force Base", January 1992.

E. References:

1. "Installation Restoration Program Phase I - Records Search, Tinker AFB, Oklahoma"
   Engineering Science
   April 1982

2. "Radiological Waste Disposal Sites, Tinker Air Force Base, Oklahoma City, Oklahoma"
   U.S. Army Corps of Engineers, Tulsa district
   1989

3. "Investigation of the Tinker AFB Radioactive Waste Disposal Sites, Phase II, Final Report, Volume I"
   Chem-Nuclear Environmental Services
   December 1990

4. "Closure Report RWDS 1022E & 62598 Tinker Air Force Base"
   CDM Federal Programs Corporation
   January 1992

2.16 INDUSTRIAL WASTE TREATMENT PLANT ABANDONED TANKS

A. Objectives: The objective of this interim measure was to eliminate a source of contamination to the soil and groundwater and reduce the risk associated with the site by removing 11 abandoned storage tanks.

B. Design, Construction, Operation, and Maintenance Requirements: The project design called for the removal of the 11 tanks, affected piping and contaminated soil surrounding the tanks. All tanks and removed piping were disposed of at an industrial waste landfill following triple washing with liquid detergent and high pressure water. The concrete tank debris was analyzed by TCLP prior to disposal to insure it was not a hazardous waste. Approximately 3000 cubic yards of soil was removed, analyzed by TCLP and disposed of according to the results of analysis. Approximately 1200 cubic yards of the soil was determined to be a hazardous waste and disposed of at a permitted hazardous waste TSD site.

C. Schedule for Design, Construction, Operation, and Maintenance: Project was completed July through September 1992. There are no operation and maintenance requirements.

D. Schedule for Progress Reports: No progress reports will be

submitted since no further action is proposed.

E. References:

1. "Industrial Waste Treatment Plant Abandoned Waste Tanks. IRP Response Action. Final Report"
U.S. Army Corps of Engineers
January 1989

2. "Industrial Wastewater Treatment Plant Remedial Investigations Report"
U.S. Army Corps of Engineers
October 1991

3. "Industrial Wastewater Treatment Plant, Removal of Waste Tanks and Associated Contaminated Soil"
Battelle Environmental Management Operations
January 1992

2.17 STAINED DRAINAGE DITCH AND DRUMS (NEAR BUILDING 17)

A. Objective: The objective of this interim measure was to remove any contaminated soil or concrete.

B. Design, Construction, Operation, and Maintenance: There were twenty bore holes drilled through the concrete pad to a depth of

5 feet below ground level. Two Composite samples were taken of the concrete and one composite sample from each borehole. These samples were then analyzed using a complete Toxicity Characteristics Leaching Procedure (TCLP). Excavation at this site was performed by first breaking up the concrete pad in an area 50 feet by 60 feet. The broken concrete was then removed and loaded into roll-off containers. The next one foot of soil was then removed from the excavation site and loaded into roll-off containers. Each roll-off that contained soil was sampled and a complete TCLP was performed on the samples. The results of all analysis performed revealed that no contamination was present at this site. No harmful constituents were discovered therefore no further design, construction, or maintenance is required.

C. Schedule for Design, Construction, Operation, and Maintenance: The design of the removal action was completed in July 1992. Excavation and construction were complete at this site in Aug 1992. There is no plan for future monitoring of this site since no contamination was found.

D. Schedule for Progress Reports: No further action is proposed at this site. Therefore, no further progress reports will be written for this site.

E. References:

1. "Decision Document."
Environmental Management, Tinker AFB
Sep 1992

2.18 FUEL FARM

A. Objectives: A fuel plume was discovered at the fuel farm. As a result of this, a fuel recovery system was installed to remove the fuel from the groundwater. The plume originated from leaking underground storage tanks. The tanks were abandoned to remove the source of groundwater contamination.

B. Design, Construction, Operation and Maintenance Requirements: The original recovery system at the fuel farm consisted of four pumps pumping from two locations. Two of the four pumps were for fuel recovery and two pumps being utilized to pump water and thereby depress the water table. The recovered fuel was sent to an 8,000 gallon storage tank where it was collected. The recovered water was also sent to an 8,000 gallon storage tank were it was collected and then sent to the IWTP. The modified recovery system used one automated bailer. The bailer would be lowered into the well, raised and dumped into an oil/water separator, recovered fuel would be placed into a 55 gallon drum, and the recovered water would be sent to a

waste line that went to the IWTP. The underground storage tanks were abandoned by cutting them in half and filling them with sand. This action removed the tanks from being a future source of contamination.

C. Schedule For Design, Construction, Operation, and Maintenance: A fuel recovery system was installed and started operation in June 1987. In May of 1988 the recovery system was modified and 1450 gallons of fuel was recovered. Also a total of 190,000 gallons of water were recovered. No fuel recovery has taken place since 1989. No fuel is located in the area of the recovery system.

D. Schedule for Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "POL Facility Expedited Response Action"
United States Army Corps of Engineers
April 1988

2. "POL Facility Report of Recovery Operations"
United States Army Corps of Engineers
March 1989

2.19 SOLDIER CREEK

A. Objectives: To remove all visible contamination along the creek, to reduce the movement of any contamination off-base, and to reduce any risk associated with any contamination that might have been present in the sediments.

B. Design, Construction, Operation and Maintenance Requirements: The removal action consisted of excavating all visibly contaminated sediments along Soldier Creek. Approximately 7500 cubic yards were removed.

C. Schedule for Design, Construction, Operation, and Maintenance: The interim remedial action was completed in 1986.

D. Schedule for Progress Reports: Progress reports for any further actions taken throughout the RI/FS process will be given at the Technical Review Committee meetings.

2.20 NORTH TANK AREA

A. Objectives: Multiple tasks have been undertaken towards achieving the objective of mitigating and remediating the potential hazards to human health and the environment since discovering the presence of petroleum fuel product above the two

perched groundwater aquifers below this site.

B. Design, Construction, Operation, and Maintenance Requirements: Group one tasks have been directed towards permanent closure of the USTs by either their removal or filling in place with impermeable, inert material, which both eliminates the source of past contamination and the potential for a tank contributing to further contamination. UST 3405 and a sump tank with all associated piping were removed in a past action, and UST 3404 was emptied of its contents and pumped full of an impermeable concrete mixture.

Group two tasks consisted of the installation of monitor wells and petroleum product recovery wells which were installed in 1991. Recovery wells have been removing product at a fairly consistent rate which to date totals over 1200 gallons. Accumulations of contaminated groundwater exceeding 6600 gallons to date are being stored until the Groundwater Waste Treatment Plant (GWTP) is completed, tentatively scheduled for 1st quarter 1993.

Group three tasks consists of evaluation and demonstrations of remediation technologies to enhance recovery operations and in situ remediation of the native soils. Vapor extraction and biorespiration tests were conducted 2nd and 3rd quarter 1992,

and cone penetrometer testing conducted 3rd and 4th quarter 1992.

C. Schedule for Design, Construction, Operation, and Maintenance: Permanent closure of the identified tanks at this site have been either removed or closed in place. To be completed fourth quarter 1992 are the installation of two additional large diameter recovery wells (6 inch) and two lower formation monitoring wells to increase product recovery and to determine the vertical extent of the fuel contamination, and the installation of three additional pumps for fuel recovery and groundwater suppression. A bioventing system (vapor extraction and biorespiration) was planned to be used at the North Tank Area (NTA) to enhance remediation of the soils. Before this system was installed, Vapor Permeability Test was performed to measure the effective air permeability (Ka) of the soil. This test was performed by extracting vapor from an extraction well at a constant rate and monitoring the pressure distribution in the surrounding soils by means of monitoring probes. The blower used for the test failed to achieve a sufficient vacuum, with no changes in pressure indicated at the monitoring point. Conclusions indicated the NTA soils to be unsuitable for bioventing. Cone penetrometer testing was conducted in August and September 1992 and results and evaluation of the tests have not yet been received.

D. Schedule for Progress Reports: Updates and Progress Reports are presented to the regulators quarterly as part of the Technical Review Committee (TRC) and the Technical Working Group (TWG). Written quarterly updates are also provided to the State and Federal regulators.

E. References:

1. "North Tank Area Operable Unit to Building 3001 Design Summary Report"
   United States Army Corps of Engineers
   NOVA Engineering, Inc.
   March 1990

2. North Tank Farm Absorbed Phase, Remedial Design
   Groundwater Technology, Inc.
   1989

3. Soil Vent Test Report - North Tank Area (Bldg 3001)
   Groundwater Technology, Inc.
   1989

2.21 SOUTHWEST TANKS AREA

A. Objectives: All 17 tanks at this site were removed from service prior to 1980 and abandoned in place pursuant to the

applicable rules and regulations at the time of abandonment. Permanent closure of the 17 tanks by removal or filling with an inert material and remediation of the fuel product contaminated soils will be a measure protective of the environment and human health.

B. Design, Construction, Operation, and Maintenance Requirements: All USTs at the site are currently out of service. It has been determined that petroleum hydrocarbons are still present in all tanks at elevated levels. The Site Characterization and the Innovative Technology Demonstration (ITD) Site Characterization investigations performed in 1992 further defined the extent of petroleum hydrocarbon contamination and determined that BTEX compounds were present in concentrations up to 550 ppm and TPH compounds were present in concentrations up to 4320 ppm. As a measure protective of human health and the environment all the tanks shall be permanently closed by removal or abandonment in place.

C. Schedule For Design, Construction, Operation, and Maintenance: Two USTs were permanently closed in place in 1990. Seven more tanks on the east side of the site are scheduled for permanent closure in November of 1992. A contract for the permanent closure of the remaining eight tanks is tentatively scheduled to be awarded in calendar year 1993. An

RI/FS of the soils is tentatively scheduled to be awarded in June of 1993 and a contract for the remediation of the soils is anticipated to be awarded in FY 94.

An ITD soil gas extraction pilot test was performed in October of 1992. Two different types of in-situ sensors were installed in October of 1992 as part of the soil gas monitoring ITD. Demonstration of the in-situ sensors will begin in the first quarter of 1993. An electromagnetic offset logging ITD project is tentatively scheduled to start in December of 1992 and is expected to run for one week. It is anticipated that soil fracturing and bioremediation ITD projects will be started by February of 1993. The soil-fracturing demonstration is expected to last approximately one month and the bioremediation demonstration has an expected duration of two years.

D. Schedule for Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References:

1. "Southwest Tanks Area Site Characterization Report"
   Battelle EMO
   1992

2. "ITD Site Characterization Report, SW Tanks Area"
Battelle EMO
1992

2.22 **BUILDING 3001**

A. Objectives: The objective of the Groundwater Treatment Plant (GWTP) is the control of the contaminant plume and recovery of contaminated groundwater by the installation of extraction wells in and around Building 3001. The extracted groundwater will be treated in a groundwater treatment facility specifically designed to treat the contaminants.

Pit Q-51 was located inside Building 3001 at column line Q-51. The pit was concrete lined, 20 feet long, 8 feet wide, and 10 feet in depth. The 3x3x2 foot sump area inside the pit contained approximately 45 gallons of liquid contaminated with trichloroethylene and cadmium. The objective was to clean the contamination out of the pit and cap it.

In 1984, water wells 18 and 19 were sampled and found to contain TCE and PCE and were taken out of operation. Water well 17 was inoperable in 1987 when it was determined that, because it was downgradient of the contaminant plumes, the well should be plugged. The objective of this interim measure was to prevent

further migration of contaminated water from the upper zones, due to poor condition of the wells.

B. Design, Construction, Operation, and Maintenance Requirements: The Groundwater Treatment Plant Design consists of an air stripper for removal of volatile organics (primarily trichloroethylene) and a chemical reduction/precipitation process for removal of metals (primarily chromium). The plant is designed to operate at 150 gallons/minute provided by a field of 33 extraction wells. The average concentrations expected at the influent tank are 11.0 mg/l TCE and 11.9 mg/l total chromium. The groundwater will be treated to a minimum 5 ug/l TCE and 50 ug/l total chromium and discharged into the industrial reuse system. The construction of the GWTP and associated groundwater extraction system began on November 15, 1991 and will be complete February 15, 1993. The operation and maintenance requirements will be identified in the Operation and Maintenance Manual to be completed by February 14, 1993, of which the draft was delivered to Region VI EPA, CERCLA Branch on October 18, 1992.

The designed remedy for Pit Q-51 included the removal of the 45 gallons of liquid, steam cleaning the pit, backfilling the pit with sand, and capping the pit with a concrete cap.

The design for preventing further migration of contamination into water wells 17, 18, and 19 involved plugging and abandoning the wells in place.

C. Schedules for Design, Construction and Monitoring: The GWTP Design was completed in November 1991 with construction scheduled for completion on February 15, 1993. The groundwater monitoring schedule is being developed as a part of the Operation and Maintenance Manual, to be completed by February 14, 1993.

The Pit Q-51 concrete cap was completed in September 1990.

Water supply wells 18 and 19 were taken out of operation in 1984 and plugged in September 1986. Water supply well 17 was plugged in November 1988.

D. Schedule for Progress Reports: Progress reports and updates are presented quarterly as part of the Technical Review Committee agenda.

E. References

1. "Building 3001 Remedial Investigation"
United States Army Corp of Engineers
January 1988

2. "Building 3001 Feasibility Study"
United States Army Corp of Engineers
August 1989

3. "Building 3001 Supplemental Remedial Investigation"
United States Army Corp of Engineers
October 1991

4. "Building 3001 Record of Decision"
United States Army Corp of Engineers
August 1990

5. "Building 3001 Remedial Action Work Plan"
United States Army Corp of Engineers
May 1992

6. "Building 3001 Groundwater Treatment Plant Final Design"
United States Army Corp of Engineers
November 1991

2.23 WASTE FUEL DUMP SITE

A. Objectives: The objectives were to remove 350 cubic yards of the most highly contaminated soil, backfill with clean soil, rebuild the facility, install monitor wells to monitor for

groundwater contamination, then conduct an in-situ bioremediation project to clean up the remaining contamination.

It was considered important to remove the highly concentrated hydrocarbons as soon as possible because of the threat to both surface water and groundwater. Rainwater runoff drains to Crutcho Creek through monitored NPDES outfalls, while soil contamination has been found within a few feet of the level or which shallow aquifers are expected. The less concentrated hydrocarbon contamination was considered less of a threat because of the very low permeability of the clay soils in the area. To better outline the extent of contamination, a cone-penetrometer project has been initiated. Since the penetrometer is capable of sampling both soil and groundwater, the objectives of this project are to help design the scope of bioremediation and to determine the need for groundwater monitoring.

B. Design, Construction, Operation, and Maintenance Requirements: Using the results of borehole tests, a location was chosen for an extraction pit 22 feet by 36 feet by 12 feet deep in the most highly contaminated part of the area. Those dimensions constitute 352 cubic yards of volume and represent a depth below the deepest known contamination. Because of the high total Petroleum Hydrocarbon (TPH) levels (some above 10,000

ppm), it was necessary to design and construct an aeration site to allow volatiles to escape from the extracted soil. This procedure was coordinated with the Oklahoma City-County Health Department. The Oklahoma State Health Department requires that TPH levels be below 1000 ppm before disposal in a landfill.

The cone penetrometer project was designed to probe to depths of 20-25 feet on a 50 foot grid interval. The grid extends 200-300 feet beyond the initial investigation area at the site. Soil and groundwater samples are being tested for VOCs, TPH, TCLP metals and organics. Five rotary drilled holes to 55 feet are planned to test for contamination in the regional aquifer.

C. Schedules for Design, Construction and Monitoring: The first set of soil samples was taken in October 1990. When these revealed a contamination problem, the second set was taken in December 1990. Analysis of the data, revision of the contract, and coordination with the state followed. Excavation of the pit began in early June 1991. The contaminated soil was aerated until mid July 1991 when TPH levels fell below 1000 ppm. The aerated soil was then disposed of in a local landfill approved of by the Oklahoma State Health Department. Backfilling of the excavation pit was completed by late June 1991. In the fall of 1991, a concrete pad with berms was constructed over the area and waste fuel dump operations were resumed.

The cone penetrometer project began operations in June 1992 and was complete by September 1992. The five rotary drilled holes to test the regional aquifer will be completed late in 1992. Design of the in-situ bioremediation project is scheduled for completion in April 1993. It is expected that operation and monitoring of bioremediation will take place over a two year period.

D. Schedule for Progress Reports: Initial work to remove 352 cubic yards of soil from the extraction pit, backfill, and rebuild the facility were completed in 1991. A report on the cone-penetrometer project is due for publication in November 1992. A design report for the bioremediation project will become available in April 1993. Quarterly reports and a final report will be written for the bioremediation project.

E. References:

1. "EM letter to Oklahoma Water Resources Board"
   30 January 1991

2. "EM letter to Oklahoma City-County Health Department"
   12 March 1991

3. "EM letter to Oklahoma State Department of Health"
   19 March 1991

SECTION II - NEW INVESTIGATIONS

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
CERCLA	Comprehensive Environmental Response Compensation, and Liability Act
CFR	Code of Federal Regulations
DRMO	Defense Reutilization and Marketing Office
DOD	Department of Defense
EPA	Environmental Protection Agency
HSWA	Hazardous and Solid Waste Ammendments
IWTP	Industrial Waste Treatment Plant
IRP	Installation Restoration Program
NE	Northeast
OC-ALC	Oklahoma City Air Logistic Center
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SE	South east
SWMU	Solid Waste Management Units
TAFBR	Tinker Air Force Base Regulation
TN	Tank Number

1.0 INTRODUCTION

The 1984 Hazardous and Solid Waste Amendments (HWSA) to the Resource Conservation, and Recovery Act (RCRA) provide authority for EPA to require comprehensive corrective actions for releases of hazardous waste and constituents from solid waste management units (SWMUs) at facilities subject to the permitting requirements of RCRA Section 3005(e) and at facilities applying for RCRA permits. This authority requires EPA to address the need for corrective action for previously unrelated releases to air, surface water, soil, groundwater, and generation of subsurface gas. Section 3004(u) allows EPA to require corrective actions after permit issuance through a schedule of compliance. Section 3004(v) addresses corrective action beyond facility boundaries. Section 3008(h) provides enforcement authority for corrective actions at interim status facilities. Pursuant to the above cited authorities it is a requirement of the Tinker AFB permit to prepare a report to be submitted within 90 days of permit issuance and a report within 180 days os permit issuance concerning Solid Waste Management Units, Areas of Concern, Hazardous Waste Accumulation Sites, and Product Storage Sites.

2.0 REQUIREMENTS WITHIN 90 DAYS OF PERMIT ISSUANCE

This section discusses the reestablishment of background monitoring wells for SWMU 8, FTA No 2 and SWMU 14, Sludge Drying Beds; the reevaluation of surface water and sediments to Crutcho, Kuhlman, and Elm Creeks; the reevaluation of the groundwater quality at SWMU 14, Sludge Drying Beds; and to provide the regulatory status and a summary of the release potential from five SWMUs and five AOCs.

2.1 Reestablishment of Background Monitoring

Due to elevated levels of metals, above EP Toxicity Concentrations, in the background wells for SWMU 8, FTA No 2 and SWMU 14, Sludge Drying Beds EPA requested that new locations be established in areas unaffected by past industrial activities.

Therefore, new longterm monitoring wells shall be constructed in the perched and top of regional aquifers in the general areas of SWMU 14, Sludge Drying Beds and SWMU 8, FTA2. Longterm monitoring shall consist of installing four clusters of two monitoring wells each. There shall be four monitoring wells installed in the perched aquifer and four monitoring wells installed in the top of regional aquifer. There shall be

three monitoring wells located downgradient of SWMU 14 and SWMU 8 in both the top of regional and perched aquifers. These downgradient monitoring wells shall be located at the edge of SWMU 14 and SWMU 8 boundary. While the single upgradient wells for the top of regional and perched aquifers shall be located beyond the upgradient extent of the potential contamination source. The exact monitoring well locations are not yet known due to the limited groundwater flow data in the vicinity of SWMU 8 and SWMU 14. The monitoring wells shall be constructed of 304 stainless steel casing and each monitoring well will have a diameter of 4 inches. Screen lengths shall be 10 feet in length with a number one slot and end cap. Each monitoring well shall be constructed in compliance with, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD)." Sep 1986. During drilling operations to install the new monitoring wells a continuous core shall be taken to provide background information of the soils in the areas of these two sites.

2.2 Crutcho Creek Reevaluation Plan

EPA requested that a plan be developed to reevaluate the surface water and sediments to Crutcho Creek. A workplan for the reevaluation of Crutcho, Kuhlman, and Elm Creeks was completed and submitted to EPA in April 1992. The Draft

Remedial Investigation for Crutcho and Kuhlman Creeks and Tributaries of Elm Creek was completed and submitted to EPA in May 1992 for review and comment. The Final Remedial Investigation was completed and submitted to EPA in October 1992. See Part C, Section III, 2.7 for a summary of the studies findings.

2.3 Sludge Drying Beds (SWMU 14) Reevaluation Plan

EPA requested that a plan be developed to reevaluate the groundwater quality at the Sludge Drying Beds, including evaluating the current temporary storage activities as a possible source of contamination. The plan is to complete and submit the workplan to EPA for review and comments in FY93 and to complete the investigation in FY94.

2.4 LOCATION AND RELEASE POTENTIAL FOR SWMU 35

EPA requested that SWMU 35, Hazardous Waste Storage Tank, Bldg 230, be located and its release potential be evaluated.

REGULATORY STATUS

No hazardous waste tank is used in conjunction with the paint stripping operation at B/230.

INFORMATION SUMMARY

Unit Description: The paint stripping wastes generated at Post C-24 go directly to the Industrial Waste lift station #6 (renamed to L.S. 21), which 'lifts' waste-to the Industrial Waste Treatment Plant. Personnel in the area still believe the wastes go to a hazardous waste tank located southwest of B/214. This so-called tank is in actuality, Lift Station #3.

Dates of Operation: The lift station has been in operation before 1972.

Release Controls: Lift Station #3 is connected with the fire Department net; a high level alarm.

History of Releases: No releases have been reported at Lift Station #3 or #6.

RELEASE POTENTIAL

Soil/Groundwater: The potential for release of hazardous constituents to soil or ground water is low due to the construction of the lift stations.

Surface Water: The potential for release of hazardous constituents to the surface water is low due to the construction of the lift stations.

Air: The potential for release of hazardous constituents to the air is low due to the construction of the lift stations.

Subsurface Gas: The potential for the generation of subsurface gas is low due to the construction of the lift stations.

2.5 REGULATORY STATUS AND RELEASE POTENTIAL

The following is the regulatory status and a summary of the release potential from four SWMUs and five AOCs.

2.5.1 SWMU #52 - TEMPORARY STORAGE SITE, BLDG 17 (ENVIROPACS)

REGULATORY STATUS

The 4 enviropacs, located outside the south side of Bldg 17, have always been used to accumulate empty paint cans and waste paint. No more than 55 gallons of a hazardous waste stream is stored at one time in the area. The area has been identified as a satellite accumulation area in the Tinker AFB Part B Permit and has been in service since the containers were issued to the base paint contractor in the latter part of 1987.

INFORMATION SUMMARY

Unit Description: This unit consists of 4 steel "Enviropac"

containers. These containers are located on the paved concrete area surrounding Bldg 17.

Wastes Managed: The containers serve as containment for empty paint cans and small amounts of waste paint, generated by a painting contractor in amounts less than 55 gallons. Although the containers were labelled as containing PCBs, no PCBs have been stored in these containers at Tinker AFB. The labels had been inadvertently left on the containers after Tinker received them as surplus. The containers were certified "clean" when received from the Cadin Pine Tree Operation during late 1987, early 1988 time period. This was an operation to move PCB transformer equipment from Canada to the United States.

Release Controls: The enviropacs are kept closed at all times except when wastes are being accumulated or removed. Wastes are accumulated in a 55 gallon drum inside of one of the containers. The enviropac serves as secondary containment for that drum.

History of Releases: There have been no releases of materials stored in this satellite accumulation area.

RELEASE POTENTIAL

Soil/Groundwater: The potential for release of hazardous waste or hazardous constituents to both past and ongoing, is low due to the design and structural integrity, and application of the unit.

Surface Water: The potential for release of hazardous waste or hazardous constituents to surface water, both past and ongoing, is low due to the design, structural integrity, and application of the unit.

Air: The potential for release of hazardous waste or hazardous constituents to air, both past and ongoing, is low due to the design, structural integrity, and application of the unit.

Subsurface Gas: The potential for subsurface gas generation, both past and ongoing, is low due to the design, structural integrity, and application of this unit.

Additional Comments: A basewide inspection of the enviropacs received from the Cadin Pine Tree operation has been conducted in order to obliterate any PCB labels inadvertently left on the containers.

2.5.2 SWMU 58, INGROUND STORAGE TANK #7, BLDG 17

REGULATORY STATUS

This unit has been installed since November 1980.

INFORMATION SUMMARY

Unit Description: This unit is an active in-ground waste storage tank located west of B/214. It is constructed of double wall fiberglass with leak detection sensors between the walls. This 1500 gallon tank is not located in a concrete bunker, however it is located approximately six feet below ground.

Dates of Operation: Personnel at B/214 report that this unit has been in operation since 1985-86.

Wastes Managed: Currently, eye wash and floor water residue are the only wastes draining to this tank. The personnel stopped dumping oil/fuel in the floor drains early 1990.

Release Controls: This tank has both audio and visual alarm system. The visual alarm (red light) is initiated at the 85% full mark. The audio alarm is initiated when sensors between the double layer walls of the tank are tripped.

History of Releases: No releases have occurred.

RELEASE POTENTIAL

Soil/Groundwater: Due to the tank integrity and leak detection controls, the release potential is relatively low.

Surface Water: Due to the tank integrity and leak detection controls, the release potential is relatively low.

Air: Due to the tank integrity and leak detection controls, the release potential is relatively low.

Subsurface Gas: Due to the tank integrity and leak detection controls, the release potential is relatively low.

2.5.3 SWMU #79 - HAZARDOUS WASTE STORAGE TANK, BLDG 3001-G51

REGULATORY STATUS

This underground storage tank, which stores waste PD-680 fluid is regulated under RCRA Subtitle C. Its' integrity was certified in 1991 and a liner was installed with an interstitial leak detection system to bring the system into compliance with 40 CFR part 260. The tank is scheduled to be removed in 1994 and replaced with a certified hazardous waste storage tank.

INFORMATION SUMMARY

Unit Description: This storage tank is located on the west side of building 3001 near post G51. This 2500 gallon steel tank is constructed below ground, with an interstitial leak detection system installed between an internal liner and the original tank. Used stoddard solvent (PD-680) is stored in this tank prior to sale to an off-site contractor for recycling. The tank was tested tight by precision leak testing prior to its' certification by a professional engineer.

Wastes Managed: This unit manages used stoddard solvent (PD-680) prior to resale to an off-site contractor for recycling.

Release Controls: This unit is constructed of steel with an internal liner. The system has a continuous interstitial leak detection monitoring system.

History of Releases: There is no documented history of release from this unit. No visual evidence of release has been noted and inventory reconciliation, as well as leak testing does not indicate a leak has occurred.

RELEASE POTENTIAL

Soil/Groundwater: The potential for release of hazardous waste or hazardous constituents to soils or groundwater is

low, based on the dual-walled construction of the unit with continuous leak detection.

Surface Water: The potential for release of hazardous waste or hazardous constituents to surface water is low, based on the below-ground, dual-walled construction of the unit and the distance to the nearest surface water body.

Air: The potential for release of hazardous waste or hazardous constituents to air is low, based on the closed-top construction of this below-ground unit.

Subsurface Gas: The potential for generation of subsurface gas from this unit is low, based on the dual-walled construction of the unit and the stored substance's low volatility.

2.5.4 SWMU #80 - HAZARDOUS WASTE STORAGE TANK, WEST OF BLDG 3108

REGULATORY STATUS

This underground storage tank was used to store waste calibration fluid and was regulated by RCRA Subtitle C until its removal in 1992. It's integrity was certified in 1991 and a liner installed with an interstitial leak detection system

to bring the system into compliance with 40 CFR Part 260 until the tank was removed.

The tank was removed and destroyed in August 1992, along with two new calibration fluid tanks which had been discovered leaking. The waste tank was tested tight and was therefore not a contributor to the resulting contamination. Consequently, the cleanup is being conducted under RCRA Subtitle I and is not a part of this SWMU.
Closure plans for this tank were sent to Oklahoma Corporation Commission, Oklahoma State Department of Health and Region VI EPA.

INFORMATION SUMMARY

Unit Description: This 30,000 gallon storage tank was located west of building 3108 and stored waste calibration fluid (naphtha) prior to sale to an off-site contractor for recycling. The tank was tested tight and upgraded prior to its removal.

Wastes Managed: This unit managed used calibration fluid (naphtha) prior to resale to an off-site contractor for recycling.

Release Controls: Prior to it removal, this tank was equipped

with an internal liner and continuous interstitial leak detection monitoring system.

History of Releases: There is no documented history of release from this unit and leak testing does not indicate that leaks have occurred.

RELEASE POTENTIAL

Soil/Groundwater: There is no potential for release of hazardous waste or constituents due to the units' removal.

Surface Water: There is no potential for release of hazardous waste or constituents due to the units' removal.

Air: There is no potential for release of hazardous waste or constituents due to the units' removal.

Subsurface Gas: There is no potential for release of hazardous waste or constituents due to the units' removal.

2.5.5 AOC, TEMPORARY STORAGE SITE, MAE 3001

REGULATORY STATUS:

This site was in operation prior to 1985 and closed in 1988.

INFORMATION SUMMARY

Unit Description: 1.3 ton capacity hoppers, maximum of eight hoppers stored blasting media. The hoppers were constructed of metal, lined with plastic.

Dates of Operation: 1985-1988

Wastes Managed: Blasting media, (aluminum oxide, steel and glass beads), was stored in these hoppers.

Release Controls: These hoppers were plastic lined and had lids installed on them in 1986.

History of Releases: No releases have been reported.

RELEASE POTENTIAL

Soil/Groundwater: The release potential to the soil/groundwater would be considered low due to the surrounding asphalt and concrete pavement.

Surface Water: A storm drain was located nearby the storage area and small quantities could have been released to it. However, due to the physical state of the media, release potential would be considered low to the soil and/or groundwater.

Air: Dust particles could have been released during the transfer to the transportation contractor vehicle. This release would be considered a low release potential due to the design of the transfer vehicles.

Subsurface Gas: Due to the physical properties of the blasting media, release potential and possible generation of subsurface gas is low.

ADDITIONAL COMMENTS

This storage site did not contain drums of hazardous materials/waste, and has not been covered by the construction addition to B/3001. The argon tanks and hydrogen tank west of H.T. are now located on the past storage site.

2.5.6 AOC, COOLING TOWER BLOWDOWN, BLDG 3306

REGULATORY STATUS

Currently permitted under NPDES Permit #OK0000809 and WD-79-031 as outfall 003. This discharge also flows through outfall 002 before entering East Soldier Creek.

INFORMATION SUMMARY

Unit Description: Boiler Water Cooling Tower.

Dates of Operation: 1949 to present.

Wastes Managed: none.

Release Controls: Secondary containment around the cooling tower.

History of Releases: N/A

RELEASE POTENTIAL

Soil/Groundwater: N/A

Surface Water: N/A

Air: N/A

Subsurface Gas: N/A

2.5.7 AOC, COOLING TOWER BLOWDOWN, BLDG 212

REGULATORY STATUS

Currently discharges into the industrial wastewater collection system, and is discharged after treatment through permitted outfall 001 under NPDES permit #OK0000809, and WD-79-031.

INFORMATION SUMMARY

Unit Description: Boiler Water CoolIng Tower

Dates of Operation: 1953 to present

Wastes Managed: none.

Release Controls: Secondary containment around the cooling tower.

History of Releases: N/A

RELEASE POTENTIAL

Soil/Groundwater: N/A

Surface Water: N/A

Air: N/A

Subsurface Gas: N/A

2.5.8 AOC, COOLING TOWER BLOWDOWN, BLDG 3108

REGULATORY STATUS

Currently permitted under NPDES Permit #OK0000809 and

WD-79-031 as outfall 004. This discharge also flows through outfall 002 before entering East Soldier Creek.

INFORMATION SUMMARY

Unit Description: Boiler Water Cooling Tower.

Dates of Operation: 1961 to present.

Wastes Managed: none.

Release Controls: Secondary containment around the cooling tower.

History of Releases: N/A

RELEASE POTENTIAL

Soil/Groundwater: N/A

Surface Water: N/A

Air: N/A

Subsurface Gas: N/A

2.5.9 AOC, DIESEL FUEL AREA, NORTH OF BLDG 210

REGULATORY STATUS

This unit has been in operation since construction completion of B/208, the Boiler Plant, 1942.

INFORMATION SUMMARY

Unit Description: The Diesel Fuel Area, north of B/210, is actually a part of B/208 Boiler Plant. The area contains (4) four 20,000 gallon tanks of #2 dieseL fuel used to supply back-up fuel for the boilers. The tanks are made of steel and enclosed in approximately 25′ X 70′X 20′ concrete vault located under ground. The exterior of the concrete roof is asphalt and gravel, this may explain the stained gravel. Physical access to this area is available. These tanks are used for heating oil and exempt according to 40 CRF 280.10.

Dates of Operation: This tank system has been in use since 1942.

Wastes Managed: These tanks contain No. 2 diesel fuel to supply back-up fuel for the boiler plant.

Release Controls: Sumps pump water off tanks and drains to the Industrial Waste lines.

History of Releases: No releases have occurred.

RELEASE POTENTIAL

Soil/Groundwater: The potential for release of contaminants to the soil/groundwater is low due to the concrete vault (containment).

Surface Water: The potential for release of contaminants to surface water is low due to the concrete vault (containment) and sump pump system.

Air: The potential for release of contaminants to the air is low due to the containment system.

Subsurface Gas: The potential for subsurface gas generation is low.

3.0 REQUIREMENTS WITHIN 180 DAYS OF PERMIT ISSUANCE

An evaluation of designated Resource Conservation and Recovery Act (RCRA) accumulation sites was conducted, in support of the RCRA Part B Permit requirements, at Tinker AFB. The RCRA Part B Permit requirement is as stated: "*The Permittee shall investigate and prepare a report on all Temporary Storage Areas and Product Storage Sites, identified in attachment 7 (20 January 1988 Part B Application) and Table II*". Therefore, the types of designated RCRA accumulation sites in this report include the following:

1) Initial Accumulation Points.
2) Accumulation Sites such as: Tank systems, Drum Stage Area, and Product Storage sites.
3) Solid Waste Management Units (see Table 1).

An evaluation of the integrity of the below-ground industrial wastewater sewer lines was also conducted.
The purpose of this evaluation supports not only the Part B Permit requirements but also the RCRA Facility Investigation (RFI) Report. This report evaluated various sites for identification of further investigations under the authority of Section 3004(u) of the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA).

TABLE 1: DESIGNATED ACCUMULATION SITES

TYPE OF SITE	LOCATION	CONTENTS ACCUMULATED	PRESENT ACTIVITY
ACCUMULATION POINTS			
3.1.3.1	B-3703 SOUTHEND	Waste used oils lube oil, hydraulic oil	Active
3.1.3.2	B-2122 SOUTHEND	Glass Beads (Haz & Non Haz)	Active
3.1.3.3	B-210 NORTHEND	Lube Oil, Hyd Oil, PD-680	Active
3.1.3.4	B-289 NW CORNER	Rags, Paints, Thinners	Active
3.1.3.5	B-2121 SOUTHEND	Petroleum Oil, Hyd Oil, JP-4	Active
3.1.3.6	B-3117	Machine Coolant Portable Tanks	Inactive
3.1.3.7	B-1055 SOUTHEAST END	Trichlorofluor oethan,alcohol, thinner, 7808 Oils	Active
3.1.3.8	B-2101 NE CORNER	Oils, JP-4 Antifreeze	Active
3.1.3.9	B-1068	Paint Strippers Paints	Active
3.1.3.10	B-3102 NW CORNER	Used Oil, Freon	Inactive
3.1.3.11	B-3001 P-X16	Used Hydraulic Fluid, Freon	Inactive
3.1.3.12	B-2280 SE CORNER	Spray Cans, MEK, Paint Sludge, Rags, Hydraulic Oils	Inactive
3.1.3.13	B-2122 NORTHEND	Hydraulic Fluid, Freon	Active

TYPE OF SITE	LOCATION	CONTENTS ACCUMULATED	PRESENT ACTIVITY
ACCUMULATION SITES			
3.1.3.14	B-3105 SOUTHWEST SIDE	Used Oils, JP-4, Freon	Inactive
3.1.3.15	B-3106 WEST OF 3001	Many different types	Inactive
3.1.3.16	B-3001 WEST OF HEAT TREAT SHOP	Blasting Media (AL Oxide, glass beads, etc)	Inactive
3.1.3.17	B-3105 NORTHEND	PD-680, Paint Materials, many different kinds	Inactive
3.1.3.18	B-2210 NE CORNER	PD-680, 111 Tricho, Hyd Oils, Alphatil hydrocarbons	Inactive
3.1.3.19	B-1 IN THE U	Product Paint related materials	Active
3.1.3.20	B-2129 WESTEND	Paint Chips	Inactive
TANK SYSTEM SITES			
3.1.3.21	B-3001 P-A103	Alkaline Permanaganate, Alkaline Rust and Scale Remover, Alkaline, Precleaner, Alkaline Cleaner	Active
3.1.3.22	B-16 NE CORNER	Overflow spill tank (acids)	Active
3.1.3.23	B-3108 TN. 3106	Used calibration Fluid	Active

TYPE OF SITE	LOCATION	CONTENTS ACCUMULATED	PRESENT ACTIVITY
3.1.3.24	B-3001, G51 TN. 3001G	Used PD-680	Active
3.1.3.25	B-2210 TN.2210	Used 7808 Oil	Active
3.1.3.26	B-2111 TN. 2117	Water and JP-5 Fuel mixture	Active
3.1.3.27	FAC. NO. 62501AA	Solvents, Motor Oils, and JP-4	Inactive
3.1.3.28	TANK BATTERY FACILITY	Solvent, JP4/5, Hyd Oils	Active
3.1.3.29	B-3001 P-M61	Chrome Waste, Dilute Rinse waste, and Alkaline Cyanide	Active
SOLID WASTE MANAGEMENT UNITS			
3.1.3.30	KUHLMAN CREEK SWMU #27	Oily looking material	Active
3.1.3.31	B-1058 SWMU #45	Oil and grease	Active
3.1.3.32	B-2101 SWMU #61	Oils	Active
3.1.3.33	B-3726 SWMU #30	Different types	Active
3.1.3.34	DRMO SWMU #31	Empty Paint	Inactive
3.1.3.35	B-289 SWMU #36	Wash Water	Active
3.1.3.36	B-976 SWMU #39	Alkaline Wash water w/oils	Active

TYPE OF SITE	LOCATION	CONTENTS ACCUMULATED	PRESENT ACTIVITY
3.1.3.37	B-1030 SWMU #41	Alkaline Wash water w/oils	Active
3.1.3.38	B-1071 SWMU #43	Alkaline Wash water w/oils	Inactive
3.1.3.39	B-1041 SWMU #44	Alkaline Wash water w/oils	Active

3.1 TEMPORARY WASTE STORAGE SITES INVESTIGATION

This section describes each designated site briefly, and general handling procedures, tracking methods for accumulation sites, and containment controls.

3.1.1 GENERAL SITE INFORMATION

The designated accumulation sites, which this report covers, has required similar management practices from the early 1980s until now. Therefore, this section will consolidate those general management practices utilized on base to facilitate hazardous waste, such that clarity of the handling procedures and tracking methods for accumulation is conveyed.

3.1.1.1 HAZARDOUS WASTE HANDLING PROCEDURES

In the early eighties, the establishment of Satellite Accumulation points and Temporary Storage sites was conducted throughout the base. Tinker (OC-ALC) host tenant organizations, so the management of waste with the tenant organizations was somewhat different than OC-ALC. In OC-ALC areas, where small quantities of hazardous waste were generated on an intermittent basis satellite accumulation points were established. A fifty-five gallon drum was normally

used to accumulate wastes and was normally set on wooden pallets to prevent excess rusting. Once the drum became full it was transported to a temporary storage area (90-day facility) where the maintenance quality organization would sample the drums. When the analysis results were complete, final labeling was done and the drum(s) were transported to DRMO. Tenant organizations hazardous wastes were managed through either a base contractor or through DRMO.

The complete management of wastes accumulated in tank systems base-wide in the early eighties is unclear, but hazardous wastes accumulated in tanks were pumped out and disposed of by a base contract managed by the Environmental Branch of Civil Engineering.

The Solid Waste Management Units identified in this report were managed by the immediate organizations, which depended upon a base contractor to pump out the units and dispose of the waste or reclaim it. However, all the manifesting of the hazardous waste was conducted by Civil Engineering and DRMO.

In the late eighties, more stringent environmental requirements were implemented base-wide. In OC-ALC all temporary storage sites (90-day facilities) were deactivated except one which was utilized for the accumulation of drums.

All hazardous waste drums and bulk hazardous waste generated by OC-ALC was monitored and managed by its Maintenance Quality Unit. Tenant organizations managed their drums and bulk waste through the Environmental Branch of Civil Engineering.

In 1989, a new organization, the Environmental Management Directorate, was activated and by mid 1990, it absorbed the Maintenance Quality Unit and all of its responsibility to OC-ALC.

Presently, the Directorate of Environmental Management manages all the waste on Tinker AFB. The management process is such that all designated satellite accumulation points have a serialized drum (plastic or steel) during accumulation. Each drum is labeled and marked, during accumulation, where it sits on an impermeable surface with a wooden pallet. Capped funnels are utilized for bung type drums. When the drum is full, it is transferred to a Temporary Storage Site for analysis and labeling for off-base shipment. Then, it is transferred to DRMO where it is stored until contractual arrangements are met and manifested for shipment to a disposal facility.

The tank system is managed under the RCRA program which Tinker AFB has outlined for local use in TAFBR 19-5. Basically, after 90 days of accumulation of wastes the tank is cleaned out and

accumulation begins again. The solid waste management units mentioned in this report are managed by a base contractor and monitored by the Directorate of Environmental Management. (Ref 1).

3.1.1.2 TRACKING METHOD FOR ACCUMULATION

In pursuant to 40CFR 262.34, generators are required to accumulate hazardous waste on site for less than ninety days. Therefore, the process for tracking portable containers (drums), tank management units is as follows:

3.1.1.2.1 PORTABLE CONTAINERS

Once the container at a Satellite Accumulation Point is approximately eighty percent full, it must be transferred to a Temporary Storage Site within seventy-two hours. When the container arrives at the Temporary Storage Site less than ninety day accumulation time begins. The less than ninety day accumulation time and the quantity of drums accumulated at the accumulation site is tracked by OC-ALC FORM H-170 (JAN 91).(see Table 2 and Ref 1).

TABLE 2: ACCUMULATION SITE HAZARDOUS WASTE LOG SHEET

TINKER AFB HAZARDOUS WASTE LOG FOR TEMPORARY STORAGE SITES

OC-ALC/EM, TINKER AFB OK 73145, FACILITY PERMIT NR: OK 1571724391
STORAGE SITE LOCATION: _____

MONTH OF _____
PAGE _____ OF _____

1. LINE NUMBER	2. BARREL NUMBER	3. DESCRIPTION OF WASTE (AS STATED BY GENERATOR)	4. EPA HAZARDOUS WASTE NUMBER(S)	5. AMOUNT OF WASTE	6. WASTE SOURCE	7. STORAGE START DATE			8. TURN-IN DATE TO DRMO			9. DRMO ASSIGNED DRUM NUMBER	10. COMMENTS
						MO	DAY	YR	MO	DAY	YR		

OC-ALC Form H-170, JAN 91

PREVIOUS EDITION WILL BE USED

3.1.1.2.2 TANK SYSTEMS

The accumulation time and quantities of hazardous waste in tanks are tracked by AF FORM 3136 (Table 3). The less than ninety days begins when the first drop of waste is accumulated in the tank system. Therefore, as the tank accumulate wastes, its daily status is documented and tracked by the above form. The form is designed to monitor the system for ninety days, irrespective of whether the tank system is partially pumped. But, prior to the ninetieth day the tank system is purged of all hazardous waste and accumulation begins again (Ref 1).

3.1.1.2.3 SOLID WASTE MANAGEMENT UNITS

At this time, the solid waste management units in this report are evaluated as accumulation sites that require periodic monitoring during accumulation. So, the monitoring being conducted on the waste accumulation quantities are documented during the emptying and manifesting process.

3.1.2 CONTAINMENT CONTROLS

These controls are pursuant to 40CFR 262.34, which directs to Subpart I for portable containers and Subpart J for tank system compliance. Also, TAFR 19-10 is a local requirement

TABLE 3: DAILY WASTE LO(R STORAGE TANKS

MONTH & YEAR: June 1991 TANK #: 9876 BLDG. & ORG.: 3001, LIPDDF

CURRENT S.A.D.: * 15 Mar 1991 TANK CAPACITY: 1000 GI MONITOR & PHONE: Jones, 45321

DAY	DESCRIPTION OF WASTE	GENERATION		ADDITION		REMOVAL			CURRENT TANK QUANTITY	DAYS LEFT BEFORE DRAINAGE
		PROCESS	ORG.	QTY.	TOTAL	DRAIN(D) LEAK(L)	QTY.	DISPOSAL METHOD		
1	Sodium Hydroxide	Parts cleaning	LIPDOT	50	250				250	15
2									250	14
3				300	550	L	50	DRMO	500	13
4				200	700				700	12
5				50	750	D	200	CONT.	550	11
6						D	550	CONT.	000	10
7									000	
8									000	Clean & Rinse
9									000	
10									000	
11	MEK & Paint	Paint Stripping	LIPCOB	150	150				150	S.A.D.
12				200	350				350	89
13										88
14										87
15										86
16										85
17										84
18										83
19										82

*: Start Accumulation Date (S.A.D.)

AF FORM 2126, PREVIOUS EDITION WILL BE USED

for secondary containment controls for indoor and outdoor accumulation and storage. The following containment controls with their appropriate accumulation site are as follows:

3.1.2.1 PORTABLE CONTAINERS

Drums at satellite accumulation points are set on wooden pallets or in enviropacs, which are supported by an impermeable surface. Some of the bung type drums utilize a capped funnel to prevent excess spillage and emissions release. Open-top drums are kept capped, when not in use. Also, if portable containers are used outside, they must have secondary containment such as enviropacs (Ref 2).

Drums at accumulation sites are contained by dikes, an impermeable surface, or a drainage sump; while, incompatible wastes are separated by dikes or walls.

3.1.2.2 TANK SYSTEMS

The tank systems in this report have varied containment controls, because they are installed differently. However, the basic description of each type of system is in the site evaluation.

3.1.2.3 SOLID WASTE MANAGEMENT UNITS

Basically, all the units have some type of concrete or steel construction in conjunction with lithologic barriers. Pumps and continuous flow on some units prevent high levels of free board, unless some malfunctioning of the unit occurs.

3.1.3 SITE DESCRIPTIONS

All of the site evaluations required by this report are contained in this section. Each site is evaluated to indicate further investigation needed at these sites, if necessary. Also, in the recommended conclusion of each site its site number is identified as in this section.

3.1.3.1 BUILDING 3703 SOUTHEND

Accumulation Point Information Summa: This accumulation point is located inside of building 3703, on the southend, where engine test preparation is conducted. The hazardous waste accumulated at this point is accumulated in a fifty-five gallon drum which sets on a wooden pallet on the concrete floor of the building. This point is utilized as a convenient location to accumulate small amounts of hazardous waste generated from the immediate process. Therefore, once the

fiftyfive gallon drum(s) is full it is transported to a staging area where further management begins.(Ref. 4)

Dates of Operation: This point has been in operation from approximately 1985 to now, as a initial accumulation point (satellite accumulation point).(Ref 4)

Wastes Managed: This point still accumulates waste oils, lubricant oils, and hydraulic fluid. However, these materials are accumulated in drums in separate locations on the southend of the building.(Ref. 4 and 12)

Containment Controls: All of the accumulation points on the southend of the building have capped funnels inserted in the bung opening. This mechanism controls excess spillage on and around the drum and excess emissions released into the immediate work area.(Ref. 4)

History of Releases: There is no data available that documents reported releases at this location.(Ref. 13)

Potential Releases:

Air: The capped funnel serve as a mechanism to reduce the amount of emissions release in the workplace. Therefore, the emissions released in area is minimized.

Soil/Groundwater: All of the points on the southend of the building are placed in containers with sufficient capacity to contain the material, as well as, being stored on a concrete floor that is intact. Therefore, the possibility of contamination to the soil or groundwater is minimized sufficiently.

3.1.3.2 BUILDING 2122 SOUTHEND

Accumulation Point Information Summary: This accumulation point is located inside of building 2122, where the corrosion prevention process is conducted. The drums of hazardous waste are accumulated from a vacuum **pressure outlet** on the booth; when the labeled drum is full it is capped with a lid and placed in a location near-by for less than seventy-two hours. Then it is transported to the staging area for further management. The drum at this point is placed on a wooden pallet on the concrete floor of the building.(Ref. 4)

Dates of Operation: This point has been in operation since approximately 1986 to now. In the early 80's the accumulation point existed outside of the building, where it was used as an accumulation site (90-day facility). Currently, this area is identified as an initial accumulation point.(55-gallon limit) (Ref. 4)

Wastes Managed: This point accumulates used hazardous and nonhazardous blasting media in fifty-five gallon drums.(Ref. 4 and 12)

Containment Controls: The location of this point is where the necessity for containment controls is minimum. However, there are trenches in this location of the building that drain to the Industrial Waste Treatment Plant.(Ref. 4)

History of Releases: There is no data available that documents releases at this location. (Ref. 4 and 13)

Potential Releases

Air: The material accumulated at this point produce minimum volatile emissions, because it is a solid. Although, the finer particles released from the vacuum outlet may cause an inhalation problem when in operation.

Soil/Groundwater: The only release route to the soil or groundwater with this material is, if some of the material gets in the trench drains and its integrity fails or the industrial wastewater system integrity fails. Otherwise, the potential release is minimal.

3.1.3.3 BUILDING 210 NORTHEND

Accumulation Point Information Summary: This point is located outside of building 210 on the north end between building 210 and 209. This location is utilized as a product material storage area and an initial accumulation point. This designated area is surrounded by six inch asphalt diking, where the material sets on a three to four inch thick concrete pad. Also, this site has a asphalt ramp on the east side of the area. This area is approximately 180 square feet with eyewash capability. In that same area there are new containers of PD-680 and hydraulic fluid lying horizontal on racks with dispense valves and secondary containment pans for leakage. This area is approximately 100 square feet on a concrete foundation with six inch concrete diking.(Ref. 4)

Dates of Operation: This site was established in approximately 1985 and is still operational. From 1985 to 1987 this site was identified as a chemical storage area. It is recommended that this site be identified as both a chemical storage area and an initial accumulation point.(Ref. 4)

Wastes Managed: This point still manages lube oil, Hydraulic oil, and PD-680. These material are accumulated in fifty-five gallon drums.(Ref. 4 and 12)

Containment Controls: This designated area is complete with asphalt diking and a concrete pad. The concrete pad, however, does not cover the entire diked area. (Ref 4)

History of Releases: This is no available data that document releases at this location.

Potential Releases

Air: The containers in this are capped when not being used so the volatile emissions released from this area is minimized.

Soil/Groundwater: This area has a concrete foundation and concrete pad that seems to be intact, so the release route to the soil or groundwater is minimized.

3.1.3.4 BUILDING 289 NORTHWEST CORNER

Accumulation Point Information Summary: This point is located outside of building 289 on the northeast side. This designated area is utilized as a convenient location to accumulate hazardous waste from depainting and painting operations. This particular area has a six foot tall fence that surrounds the circular shape accumulation area of approximately 300 square feet. This entire area is elevated, above the normal surrounding area approximately ten inches on a concrete pad.

The hazardous waste accumulated at this point is collected in fifty-five gallon drums that are put in enviropacs for secondary containment.(Ref. 4)

Dates of operations: This site was established approximately in 1987 and is currently operational.(Ref. 4)

Wastes Managed: This site accumulates methyl ethyl ketone rags, paints, and thinners which are placed in fifty-five gallon drums. Once these drums are full, they are transported to the staging area for further management.(Ref 4 and 12)

Containment Controls: This site uses enviropacs to minimize the spillage to the concrete. Presently, this area does not have diking around it. Plans for constructing dikes has been programmed in the future budgets.

History of Releases: There is no available data documenting releases at this site.

Potential Releases

Air: The use of capping the container(s) after usage minimizes the volatile emissions to the immediate air.

Soil/Groundwater: Due to the ten inch concrete pad, the

utilization of enviropacs and the surrounding concrete foundation the potential release to the soil or groundwater is minimized.

Surface Water: This site is located near a storm drain manhole. In order for a release to affect this area the material would also have to exceed the enviropac containment. But in the future it would have to exceed the diking. Therefore, the potential release to the surface water is minimized.

3.1.3.5 BUILDING 2121 SOUTHSIDE

Accumulation Point Information Summary: This site is identified as an initial accumulation point inside of building 2121 on the south end. In the past this site was established outside of the building on the northside where the B-52 moving line utilized it site as a convenient initial accumulation point for hazardous waste. In the late 80's, this site was moved inside building 2121 to accommodate the C-135 moving line for draining aircraft hydraulic systems.(Ref. 4)

Dates of Operations: This site was established in the early 80's but was moved into the building in approximately 1986 and is currently operational.(Ref. 4)

Wastes Managed: All the wastes generated in the early eighties are unknown, but in 1986 petroleum oils, hydraulic oil, and JP-4 fuels were accumulated in fifty-five gallon drums at this site. Once the drum(s) were full, they were transported to the staging area for further management.(Ref. 4 and 12)

Containment Control: In the past, the outside site was set on a concrete foundation with sandbags, used as diking. Presently, this site sets on the upper sloped section of the building concrete floor with wooden pallets under the drum(s).(Ref. 4)

History of Releases: There is no data available documenting releases at this location.(Ref. 4 and 13)

Potential Releases

Air: The containers that are accumulating volatile hazardous waste has capped funnels inserted in the bung opening to minimize excess volatile emissions released in the building.

Soil/Groundwater: Due to the concrete foundation in the accumulation area, potential for releases is minimized.

3.1.3.6 BUILDING 3117

Accumulation Point Information Summary: This site has two portable tanks outside of building 3117, which were utilized to transport machine coolant to and from industrial machines. This site is identified as an initial accumulation point, because the container is portable and used to accumulate and transport hazardous material to and from industrial machines.(Ref. 4)

Dates of Operation: These portable tanks have been utilized since mid 1989 to mid 1991.(Ref. 4)

Wastes Managed: These tanks were utilized as portable containers to accumulate the used machine coolant and refill the industrial machines with new machine coolant. These tanks are internally divided into two cells with hydraulic mechanisms to pump the used machine coolant, from industrial machines, into one cell of the tank. The other cell gravity feeds new machine coolant into the machines. Of course, only one cell of the tank is used at a time to enhance efficiency of the operation.(Ref. 4 and 12)

Containment Controls: These containers do not require any secondary containment features, but there are safety valves on

the tanks.(Ref 4)

History of Releases: There is no available data documenting releases at this location.(Ref. 4 and 13)

Potential Releases:

Air: Due to machine coolant having a low volatile rate the potential for releases is minimum.

Soil/Groundwater: Because these tanks are utilized in a mobile capacity, this increases the potential for soil contamination. There has not been sufficient release of machine coolant to the soil to affect the groundwater.

3.1.3.7 BUILDING 1055 SOUTHEAST SIDE

Accumulation Point Information Summary: Presently, this site is an initial accumulation point located outside on the southeast side of building 1055. This site is utilized as a convenient point for hazardous waste accumulation.(Ref.4)

Dates of Operation: This site was in operation from the early 80's to now.(Ref. 4)

Wastes Managed: In the early 80's to 1988, this site was

utilized as a new hazardous material storage area, where occasionally waste was accumulated. Presently, this site accumulates 7808 Oils, Trichlorofluoroethane, alcohol, thinner, and xylene.(Ref. 4 and 12)

Containment Controls: This site is approximately 200 square feet with surrounding six inch asphalt diking, setting on a concrete foundation with a roof over the area. This area has two ramp entrances where the floor is sloped from east to west downward.(Ref. 4)

History of Releases: There is no available data documenting releases at this site.(Ref 4 and 13)

Potential Release:

Air: The hazardous waste is accumulated in drums, which have, has a capped funnel inserted in the bung opening to minimize vapor emissions to the air.

Soil/Groundwater: Due to this point being on an impermeable concrete foundation with no cracks and surrounded by six inch asphalt diking, potential releases to soil or groundwater are minimized.

3.1.3.8 BUILDING 2101 NORTHEAST CORNER

Accumulation Point Information Summary: This site is a satellite accumulation point located inside of building 2101 on the northeast corner. This particular area is a washdown area for aircraft supporting components.

Dates of Operation: This site has been in operation from approximately 1984 to now.(Ref. 4)

Wastes Managed: In approximately 1988, this site accumulated paints, lacquers, thinners, strippers, and waste oils. But, in 1989, this point no longer accumulated paint strippers and paint thinners. Presently, this point accumulates used oils, JP-4, and antifreeze. Once drums of waste are accumulated, they are managed as stated in section 3.1.1.1.

Containment Controls: This point is located on a concrete foundation where the drums of hazardous waste sit on wooden pallets with funnels inserted in the bung opening to prevent excess spillage outside the container. However, the foundation is oily looking and dilapidated in near-by areas.(Ref.4)

History of Releases: Even though, the foundation looks oily, there is no data available documenting releases at this point.

Potential Releases

Air: This accumulation point has a capped funnel, during accumulation, to minimize the amount of volatile emissions, as well as, spillage. Therefore, the potential emissions released would be minimized.

Soil/Groundwater: This point is located on a concrete foundation which is, however impaired. The potential for release to the local soils and groundwater. The seal joint near the sump at the doorway of the washdown area may be a substance release route, because the concrete is cracked around it.

3.1.3.9 BUILDING 1068

Accumulation Point Information Summary: This site is identified as an initial accumulation point located outside of building 1068 on the southwest corner. This site is utilized as a convenient point to accumulate hazardous waste in a fifty-five gallon drum.

Dates of Operation: This site has been in operation from approximately 1988 to now.(Ref. 4)

Wastes Managed: This site has accumulated paint stripper and

paint related materials in the past; where as, presently it accumulates only the paint related materials. Once the drums of hazardous waste are full, they are transported and further managed in the staging area.(Ref 4 and 12)

Containment Controls: In the past, the drums of hazardous waste accumulated sat on pallets with a concrete foundation. At the time, there was no secondary containment implemented at this site. Presently, the drum at this site is placed in an overpack drum to meet the on-base secondary containment requirements. And, the overpack drum is placed on a pallet supported by two aluminum panels.(Ref. 4)

History of Releases: There is no data available depicting releases at this point. (Ref. 4 and 13)

Potential Releases

Air: Due to the volatile emissions from the paint thinners, wastes are accumulated inside an overpack drum with a lid on top to prevent excess emissions release during accumulation.

Soil/Groundwater: The drum is stored in an overpack which serves as a secondary containment device. The container is located in an area of minimal traffic so accidental spills are unlikely.

3.1.3.10 BUILDING 3102 NORTHWEST CORNER

Accumulation Point Information Summary: This initial accumulation point is located outside of building 3102 on the northeast corner. This site was approximately 100 square feet in close proximity of building 3102, where hazardous wastes were accumulated on a interim basis in steel fifty-five gallon drums. Presently, this site does not exist.

Dates of Operation: This site was in operation from approximately 1985 to 1988.(Ref. 4)

Wastes Managed: This site was utilized to accumulate used oil and freon stored in fifty-five gallon drums. Once the drums of waste were full, they were transported to the staging area for further management. In the early eighties prior to 1985, this point was utilized as an accumulation point.(90-day facility) (Ref 4 and 12)

Containment Controls: The drums at this site were placed on pallets with sandbags surrounding the boundary of the area. Also, this area was supported by a concrete foundation.(Ref. 4)

History of Releases: There is no data available documenting

releases at this point.(Ref. 4 and 13)

Potential Releases

Air: Due to the capped drums, minimal volatile emissions were released.

Soil/Groundwater: Due to the drums being placed on a concrete foundation surrounded by sandbags, the release to the soil or groundwater is minimized.

Surface Water: This site is located near drains, but these drains are approximately twenty feet east and not in a flow path from the site.

3.1.3.11 BUILDING 3001 POST X-16

Accumulation Point Information Summary: This initial accumulation point was located, outside, on the southwest corner of building 3001 at Post X-16. This site was approximately 100 square feet in close proximity of the building 3001. The site was utilized as an interim location to accumulate hazardous waste in steel fifty-five gallon drums.

Dates of Operation: This site was in operation from approximately 1986 to 1989.(Ref. 4)

Wastes Managed: Used hydraulic fluid and Freon was accumulated at this site.(Ref. 4 and 12)

Containment Controls: The drums at this site were placed on wooden pallets, and the accumulation area boundary was surrounded by sandbags. Also, this area was supported by a concrete foundation.

History of Releases: There is no data available documenting releases at this point.(Ref. 4 and 13)

Potential Releases

Air: Due to the drum being capped, the potential release for volatile emissions was minimized. No further potential exists because the site has been deactivated.

Soil/Groundwater: Due to the concrete foundation and surrounding sandbags, the potential release is minimal.

3.1.3.12 BUILDING 2280 SOUTHEAST

Accumulation Point Information Summary: This site was an accumulation point located outside of building 2280 on the southeast corner. This site was utilized as a convenient accumulation site; once the drums were filled and removed from

the building, further management occurred. In the latter part of 1988, the site was obliterated.

Dates of Operation: This site was in operation in approximately the early 80~s to 1988.(Ref. 4)

Waste Managed: At the time of operation, this site managed spray cans, MEK, paint sludge, rags, and hydraulic oil.(Ref. 4 and 12)

Containment Controls: The drums of hazardous waste accumulated at this site were placed on pallets on a concrete foundation and surrounded by sandbags. Presently, the concrete foundation is intact.(Ref 4)

History of Releases: There is no data available documenting releases at this point.(Ref. 4 and 13)

Potential Releases

Air: Present potential is zero since the site no longer exists.

Soil/Groundwater: This site is supported by an intact concrete foundation, and there is no evidence for soil contamination.

3.1.3.13 BUILDING 2122 NORTHEND

Accumulation Point Information Summary: This site is an initial accumulation point located inside the building on the northend where aircraft hydraulic components are cleaned. This site is utilized as a convenient accumulation point for generation of hazardous waste.(Ref. 4)

Dates of Operation: This point has been in operation from 1986 to the present.(Ref. 4)

Wastes Managed: This site has accumulated, hydraulic fluid and freon was accumulated in fifty-five gallon drums. After the drums are full they are transported to the staging area where further management is conducted.(Ref. 4 and 12)

Containment Controls: This point accumulates hydraulic fluid and freon in steel fifty-five gallon drums with a supporting wooden pallet on a concrete foundation. This point has no secondary containment; but, the drums are placed on the rise section of the sloped floor inside the building. If a release occurs, it will flow to the floor drains or be cleaned-up immediately. Presently, there seems to be no visual contamination to the concrete foundation. (Ref. 4)

History of Releases: There is no data available documenting releases at this site.(Ref. 4 and 13)

Potential Releases

Air: Freon has the ability to release volatile emissions but the drums are capped, when not in use, with a funnel inserted in the bung opening to prevent excess emissions release.

Soil/Groundwater: Due to this location being on a concrete foundation, the release potential to the soil or groundwater is minimized.

3.1.3.14 BUILDING 3105 SOUTHWEST SIDE

Accumulation Point Information Summary: This site was an initial accumulation point located outside of building 3105 on the southwest side.(Ref. 4)

Dates of Operation: This site was in operation from approximately 1986 to 1988.(Ref. 4)

Wastes Managed: This site was utilized to accumulate Oils, JP-4, and Freon in fifty-five gallon drums. Once the containers were full, they were transported to the staging area and further managed.(Ref. 4 and 12).

Containment Control: The drums at this site were placed on pallets with sandbags surrounding the boundary of the area. This area was supported by a concrete foundation.

History of Release: There is no data available documenting releases at this site.(Ref 4 and 13)

Potential Release

Presently, this site is inoperable; therefore, no present release potential exists.

3.1.3.15 BUILDING 3106 WEST OF 3001

Accumulation Site Information Summary: During the dates of operation, this site was identified as an accumulation site or a central storage site for new material and hazardous waste. The site was utilized as a location where drums would be stored, when removing drums of hazardous waste from the shop area. But, due to the Flight line requirements, this site was obliterated by late 1988.(Ref. 4)

Dates of Operation: This site was in operation from approximately 1987 to late 1988.(Ref 4)

Wastes Managed: During the time period of operation, this site

stored many different types of hazardous waste(used trichloroethylene, perchloroethylene, freon, PD-680, oils, etc). Once the drums were full they were transported to the staging area and further managed for disposal.(Ref 4 and 12)

Containment Controls: The drums accumulated at this site were placed on wooden pallets with an asphalt foundation approximately 2500 square feet in size. The hazardous waste area was separated from other materials by a six inch asphalt dike. This entire area was surrounded by a chain link fence.(Ref 4 and 1)

History of Releases: There is no data available documenting releases at this site.(Ref. 4 and 13)

Potential Releases

Air: Present potential is zero since the site is no operational.

Soil/Groundwater: This site was located on an asphalt foundation and there is no evidence of soil contamination.

3.1.3.16 BUILDING 3001 (WEST OF THE HEAT TREAT SHOP

Accumulation Site Information Summary: This site contained eight hoppers with 1.3 ton capacity which stored blasting media. The hoppers were constructed of metal and lined with plastic.

Dates of Operation: This site was in operation prior to 1985 and closed in 1988.

Wastes Managed: This site accumulated different types of blasting media, such as aluminum oxide, steel shots, and glass beads.

Containment Controls: These hoppers were lined with plastic. Lids were installed in 1986. The surrounding area is covered with asphalt and concrete pavement.

History of Release: This site has no releases identified or reported. Also, there no data available depicting closure actions or prior closure actions.

Potential Release

Air: Dust particles could have been released during the transfer to the contractor vehicle. However, present release

potential is zero due to deactivation.

Soil/Groundwater: The release potential to the soil and groundwater would be considered minimal due to the surrounding asphalt and concrete pavement.

Surface Water: A storm drain was located nearby the storage area and small quantities could have been released to it. However, due to the physical state of the media, release potential would be considered low.

Subsurface Gas: Due to the physical properties of the blasting media, release potential and possible generation of subsurface gas is low.

3.1.3.17 BUILDING 3105 NORTHEND

Accumulation Site Summary Information: The site is located on the northend of building 3105 in close proximity of the flight line, where it was used as a staging area. This staging area was supported by a concrete foundation where sandbags and asphalt diking were used as secondary containment. Also, this site was surrounded by a six foot chain link fence. Drums were transported to this area to await sampling, The drums were not set on pallets due to their being at this location only a

short time before being transported to the accumulation site. (Ref. 4)

Dates of Operations: This site was in operation from approximately late 1987 until 1990.(Ref. 4)

Wastes Managed: This designated area accumulated PD-680, paint materials, and many different kinds of wastes until approximately 1990. Presently. this site is used to store drum(s) of hazardous waste overnight, but the primary use of this site is to store cleaned and empty steel and plastic drums for reuse. All of these drums are palletized, but some are stacked horizontally, while others are stacked vertically. (Ref. 4 and 12)

Containment Controls: Presently, the concrete foundation and the asphalt diking seems to be intact, but some of the sand bags need to be replaced.(Ref. 4)

History of Releases: There is no data available documenting releases at this site.(Ref. 4 and 13)

Potential Release

Air: Presently, there are few drums stored in this area and the only volatile emissions to the air would be release when

the drum(s) is uncapped, otherwise there are no volatile emissions released from the drums.

Soil/Groundwater: Because, this site has partial asphalt diking and sandbags used as diking, the material would have to exceed the diking in order to become a threat to the soil or groundwater.

3.1.3.18 BUILDING 2210 NORTHEAST CORNER

Accumulation Point Information Summary: This site was located outside on the northeast corner of building 2210, where approximately 100 square feet was utilized to accumulate hazardous waste. The immediate accumulation area was surrounded by six inch concrete diking with an asphalt foundation. Presently, this site no longer exists in this location due to new construction.(Ref. 4)

Dates of Operations: This site was in operation in approximately the early 80's until early 1989. (Ref. 4)

Wastes Managed: This location has accumulated PD-680, 111 Trich, Hydraulic Oil, and Alphatic Hydrocarbons. The hazardous waste accumulated at this site was managed in portable containers. Once the container was full, it was managed as

stated in section 3.1. Presently, wastes accumulated in this area have been relocated to south of building 3108. (Ref 4 and 12)

Containment Controls: At the time of operation, this site was supported by an asphalt foundation with concrete diking. There were no drains in this area . The containers set on wooden pallets to prevent rusting of the bottom of the container.(Ref. 4)

History of Releases: There is no data available that documents releases at this site.(Ref. 4 and 13)

Potential Releases

Presently, this site does not have any release potential, because the site has been deactivated.

3.1.3.19 BUILDING 1, THREE PORTABLE BUILDINGS

Accumulation Site Information Summary: This site consist of three portable buildings, which are located in the U-shape of Building 1. This site is a chemical storage area for product materials and partially used product materials. None of these buildings store hazardous waste in them.

Dates of Operation: This building has been approximately in operation since approximately 1984 to the present. (Ref. 4)

Wastes Managed: There are no wastes managed at this location. Partially used product materials are stored at this location. (Ref. 4 and 12)

Containment Controls: This site is located in a corrugated steel portable building, with secure mechanisms in use. There is no secondary containment in these buildings, except for the walls. (Ref. 4)

History of Releases: There is no data available that documents releases at this particular location. (Ref. 4 and 13)

Potential Release

Air: Due to the product material being in sealed containers, the volatile emissions release are minimal until open.

Soil/Groundwater: This entire area is surrounded and supported by a concrete foundation. Therefore, the release potential is minimal.

Surface Water: There is no surface water in this area, however, if a substantial release occurs in one of the

buildings, release potential is high because of no secondary containment.

3.1.3.20 BUILDING 2129 WESTSIDE

Accumulation Site Information Summary: This site was located on the westside of building 2129, where hazardous waste was accumulated. This area was surrounded by engine cans, with an asphalt foundation. The drums accumulated at this site set on wooden pallets, with a surrounding asphalt dike. Presently this site is inactive. (Ref. 4)

Dates of Operation: This site was approximately in operation in 1984 to 1988. (Ref. 4)

Wastes Managed: This site accumulated drums of paint chips. (Ref. 4)

Containment Controls: This site utilized an asphalt dike and foundation, as well as engine cans to somewhat secure the area. (Ref. 4)

History of Releases: The is no data available that documents any releases at this site . (Ref . 4 and 13)

Potential Releases

Air: Due to the drums being sealed upon arrival to this location, the volatile emissions released during the accumulation was minimal. But, the present potential is zero due to deactivation.

Soil/Groundwater: Although this site had an asphalt foundation the present site does not have evidence of contamination. Therefore, the potential release was minimal.

Surface Water: Due to the dike and foundation the potential release to the surface water was minimal.

Subsurface Gas: Due to the little evidence of soil contamination subsurface gas. Therefore, the subsurface gas release potential is minimal.

3.1.3.21 BUILDING 3001 POST A103

Accumulation Site Information Summary: This site is located inside on the northend of Building 3001, where aircraft parts are chemically cleaned. This area has seven holding tanks in an open pit area. All of these tanks are not used at one time, but any one of the seven tanks can be in use during operation. These tanks are utilized as holding tanks for the spent

materials from the process tanks. The material in the process tanks are released to a holding tank, when the material has served its intended use. (Ref. 4)

Dates of Operation: This site has been in operation since approximately the early 80's until the present. A contract is now being let to remove these tanks and that may be found. (Ref. 4)

Wastes Managed: These tanks are only used for alkaline type wastes, such as alkaline permanganate, alkaline rust and scale remover, alkaline precleaner, and alkaline cleaner.(Ref 4 and 12)

Containment Controls: These holding tanks are setting in a concrete pit approximately 82 feet long by 16.2 feet wide by 9.25 feet deep. This area has the capacity to contain up to 91,740 gallons of materials. The open section of the pit is covered with steel grates. Also, the floors and walls of the pit are constructed with 1.33 feet thick concrete with an outer impermeable membrane. The impermeable membrane on the walls is covered by a protective insulation board, while the impermeable membrane on the floor is covered by three inches of concrete. The outside of this pit is covered by non-expansive fill. (Ref. 4)

History of Releases: There is no data available documenting releases at this site.(Ref. 4 and 13)

Potential Releases

Air: These holding tanks are enclosed in a pit, where the tops of the tanks are sealed. The maximum rate of emissions released from the material in the tank(s) would be when the tank(s) is being pumped out or cleaned out.

Soil/Groundwater: Release to the soil or groundwater would only occur if the pit was to structurally fail. The existence of such contamination is unknown at this site.

3.1.3.22 BUILDING 16 NORTHEAST CORNER

Accumulation Site Information Summary: This underground 1000 gal tank system located on the northeast corner of building 16 is utilized as a secondary containment spill tank for the acid storage rooms in building 16. As a result of the Federal Register publication in Sep 1988, tanks that are emergency spill protection tanks are stated as exclusions from the underground storage tanks requirements. However, this tank is managed under 40CFR 264.32.

In the early 80's, this particular tank served its intended

use, as a spill containment tank, for acid storage rooms. But, in the late 80's the need to expand the acid storage room required this same tank to be relocated further north, where it is utilized as a secondary spill containment tank. (Ref. 4)

Dates of Operation: This tank was in operation from approximately the early 80's until the present. (Ref. 4)

Wastes Managed: This tank accumulates waste acids from the product acid storage rooms, in the event of a spill. When a spill occurs, the material contained in the tank is pumped out in 24 hours along with all the appropriate tracking documentation for releases. (Ref.4 and 12)

Containment Controls: This 1000 gal underground secondary containment tank is placed in a vault structure with 8 inch walls, 10 inch concrete floors, and 8 inch concrete top walls. Also, this tank sets on two curvature supports with tank straps prohibiting rotational movement with a high level alarm system.(Ref. 4)

History of Releases: There is no data available documenting releases at this site.(Ref. 4 and 13)

Potential Releases

Air: The air emission release from this area is minimized, since this is an enclosed system, except when the tank is pumped out. At that time, minimal amounts of irritant vapor emissions would be released.

Soil/Groundwater: The immediate underground soil is presently protected by a vault structure and a tank system which assist in minimizing soil or groundwater contamination. Unless the tank leaks and the vault bottom construction joint fails, then there would be a release to the soil. Presently the complete system is intact.

3.1.3.23 BUILDING 3108 TANK NO. 3106

Accumulation Site Information Summary: This tank system is located south of the third tank battery located directly west of building 3108, where approximately 80 repaired engine parts test stands drain to the tank. This system is a steel underground storage tank, which was installed in 1971. In 1991, an assessment was conducted on the tank to determine the integrity of the tank and upgrade the internal protection system. Also, this tank is schedule to be replaced in 1992 in association with a project to replace the entire storage facility.

Dates of Operation: This tank was installed in 1971 and is presently operational.

Wastes Managed: Used Calibration fluid is accumulated in this tank. When test stand operators dispose of calibration fluid from their stand to the tank. The product is accumulated in the tank for ninety days, then the water is removed from the tank by the base waste disposal contractor. The remaining product is subsequently removed by the DRMO contractor for recycling. (Ref. 12)

Containment Controls: Facility No. 3106 was installed with a sacrificial anode type cathodic protection system. The latest level of cathodic protection on the system was measured to be approximately -.58, below the level needed to adequately protect the tank. During the assessment in 1991, this tank was upgraded to include an internal liner and interstitial monitoring system. (Ref. 14)

History of Releases: There have been two documented releases at this facility. They are as follows: 1). On May 89, a 300 gallon overfill, but the entire contents of the overfill was contained in a concrete pit supporting the tank. 2). On Sep 89, a 100 gallon release to the immediate environment due to an overfill. The waterline in the building broke and drained

to the waste tank pit area causing an overfill in the pit, which caused product to float into the surrounding area. Although, the above releases have occurred at this facility, it is currently in operation. Action is expected to be taken soon to initiate closure actions in conjunction with a project to replace the entire storage site.(Ref. 13)

Potential Release

The potential release is moderate, because a large overfill of the tank pit could expose the environment to contamination.

3.1.3.24 BUILDING 3001 POST G-51, TANK NO. 3001G

Accumulation Site Information Summary: This tank system is located outside of building 3001 at Post G-51, near the southern section of 3001. This system is a 2500 gallon gravity fed underground tank, which was installed in 1943. In 1991 an assessment of the tanks integrity was preformed and the tank internal protection system was upgrade t that time. This tank is schedule to be replaced in 1993 under MCP.

Dates of Operation: This tank was installed in 1943 and is currently operational.

Wastes Managed: This tank accumulates used PD-680 from

cleaning parts operations. Basically, personnel in 3001 shop areas pour small quantities of PD-680 manually into the storage tank, when the parts cleaner is spent. Also, personnel in building 2210 dispose of their spent cleaner in this tank. When used material is ready for disposal, the water is removed by a base contractor, while the remaining product is removed, transported and recycled by a DRMO contractor. (Ref. 4 and 12)

Containment Controls: This facility is a steel constructed underground storage tank with a sacrificial anode cathodic protection systems initially installed. The latest measurements of this system shows the protection level to be approximately -.51, below the level required to cathodically protect the tank. The assessment conducted in 1991 evaluated the tank integrity. The internal liner with an interstitial monitoring system. (Ref. 15)

History of Releases: There has been no known or documented releases at this facility. However, this facility is still operational. (Ref. 13)

Potential Release

Air: Due to the system begin a closed system, volatile emissions are probable released, during the emptying process. However, the emissions released is minimized due to the low

volatilization characteristics of the material.

Soil/Groundwater: The potential for release is low, due to the manual handling of the waste. However, the personnel could spill product when transferring product into the tan~ or when filling the tank with the trucked product from 2210. Also, the area surrounding the tank is asphalt and concrete, making it adequately impervious and lowering the chance for soil and groundwater contamination.

Surface Water: There are storm drains in this area, however, the de minimis quantities that are transferred to the tank preclude an overfill of sufficient quantity to travel to the drains.

3.1.3.25 BUILDING 2210 TANK NO 2210

Accumulation Site Information Summary: This tank system is located at the southeast corner of building 2210, where hazardous waste is gravity fed to an underground tank system. In 1991, an assessment was conducted to evaluate this tank integrity and upgrade the internal protection. This tank is scheduled for replacement in conjunction with a MCP.

Dates of Operation: The tank was installed in 1975 and has

been operational until now.

Wastes Managed: This tank is used to accumulate used 7808 Oils as shop personnel dispense their use product into tank inlet. A base contractor removes the water from the accumulated product and a DRMO contractor removes the remaining product for recycling. (Ref. 4 and 12)

Containment Controls: Facility No. 2210 is a steel constructed gravity fed underground storage tank with, initially installed cathodic protection in the form of a sacrificial anode system. The latest level of cathodic protection for the tank was found to be approximately -1.177, which is adequate to cathodically protect the tank. In 1991, the tanks were upgraded to include an internal liner with an interstitial monitoring system. (Ref. 16)

History of Releases: There have been no known or documented releases at this facility. Also, the construction of the tank precludes having a spill event. However, due to this facility still being in operation, there has been no closure actions or prior closure actions taken at this facility. (Ref. 13)

Potential Releases

Soil/Groundwater: The potential for release is minimal,

because the tank structure is not conducive to accidental spills caused by human error. And the concrete surroundings of the tank would protect the soil and groundwater, if a spill did occur. Because the tank is manually filled, it is nearly impossible for an overfill to occur. Due to the building begin below building grade, the overfill would occur in the building causing minimal soil and groundwater contamination.

3.1.3.26 BUILDING 2111 TANK NO 2117

Accumulation Site Information Summary: This tank system was installed in 1975, south of building 2111. This system was used to store runoff from the tank battery pump stand. In 1991, an assessment was conducted to ovaluate the integrity and internal protection. This tank is scheduled for replacement in 1993 in conjunction with a MCP.

Dates of Operation: This tank system was installed in 1975 and currently operational.

Wastes Managed: Water and JP-5 fuels mixture is accumulated at this site. A concrete pad at the purge facility drains any spilled or washed product directly to this tank. There is little or no actual waste product handled. The purge facility personnel ensure the tank levels are sufficient to prevent

overfill. When the tank becomes full, then the base contractor removes any waste water. The DRMO contractor removes the remaining product for recycling. (Ref. 12)

Containment Controls: Facility No. 2117 is a steel constructed gravity fed underground tank with a capacity of 2500 gallons. The tank was installed with a sacrificial anode type cathodic protection system. The latest cathodic protection level readings was approximately -.61, below the level required to adequately protect the tank. However, in 1991, an assessment was conducted and the tank internal liner and interstitial monitoring system was upgraded. (Ref. 17)

History of Releases: There have been no known or documented spills or releases at this facility. The facility is still in operation. (Ref. 13)

Potential Release

Soil/Groundwater: The potential for release to the soil or ground water is moderate, because only small portions of the area are impermeable to spills or overfills. An overfill could occur due to human error or equipment failure. Because, the tank is the secondary containment for the pump pad, the chance of overfill would depend on the potential for release at the pad itself.

3.1.3.27 FACILITY NO 62501AA INDUSTRIAL WASTE TREATMENT PLANT AREA

Accumulation Site Information Summary: On the original site listing for evaluation this particular site was mistakenly identified as 62509. The correct site is 62501AA.

Site 62501AA was designed and installed in the late 1970's. The original intent was to install a facility to store solvents, motor oil, and JP-4 products. The facility was actually built in 1981-1982.

The installation consisted of four 12,000 gallon aboveground storage tanks (ASTs) located west of the sludge digester at the base Industrial Waste Treatment Plant(IWTP). A pump station was installed below the tanks in a concrete room where trucks were used to could transfer waste materials into the tanks. on the north end of the installation was a sump pit collection station used to the transfer the stored product to the head of the IWTP. The site was secondarily contained by a concrete dike which drained to an oil/water separator. The water from this separator was piped to the IWTP an the waste oils were contained in an 7' x 8' x 5' oil storage vat. The waste oils could then be returned to the storage facility.

The site was used for the reclamation of POL fluids for two to

three years before the process was halted. In approximately 1985, the tanks were used to store miscellaneous industrial waste water until they could be disposed of at the IWTP. This practice ceased in 1988, when the water was removed from three of the four tanks and the remaining sludge was left in the tanks. The fourth tank was to be closed, but was used to temporarily store tetrachloroethylene.

Currently, this site is being reclaimed and modified to house a temporary CERCLA waste storage site in conjunction with the remediation of the 3001 National Priority Listing site. When modifications were initiated in August 1991, approximately 13000 gallons of tetrachloroethylene were removed from one tank. Eighteen barrels of oil sludge and metallic sludge were removed from the remaining three. The tanks were steam cleaned and pressure washed, as well as, all the associated underground facilities (i.e. pump station, oil/water separator and waste oil storage vat). The secondary containment area has also been steamed cleaned and pressure washed.

Continued modifications shall included the closure of all underground facilities and the isolation of the entire site from the IWTP. Closure plans for the underground facilities shall require backfilling the sites with clay, which will then be sealed with a concrete cap. At that time, the facility will

then consist of four ASTs with secondary containment which must be manually pumped but is separate and distinct from all other base facilities. Estimated date of completion of the modifications is February 17, 1992 with operation beginning March 1, 1992. (Ref. 4)

3.1.3.28 TANK BATTERY FACILITY

Accumulation Site Information Summary: The tank battery facility is located southwest of building 2122. This facility is utilized as a waste collection and accumulation turn-around area for Flightline Aircraft Maintenance. Portable containers are pulled onto a circular shape concrete pad to release its waste to a capped inlet. The material then flows down the neoprene 2.5 inch diameter piping to the receiving tanks. These tanks overflow into the holding tanks which are utilized as a accumulation mechanism for large quantities of waste generated in this area. A portion of this area has been identified with shallow contamination which is known as the Waste Fuel Dump Site. This area has been partially remediated, to allow new construction to continue.

The future plan to conduct a Bioremediation project on the area, after the site has been characterize. (Ref. 4)

Dates of Operation: The tank battery facility has been in operation since 1987. (Ref. 4)

Waste Managed: The hazardous waste accumulated at this site consist of solvents, JP-4/JP-5, and hydraulic oils. The material are managed as follows:

Any of the above materials are drained from the aircraft into portable containers. Then, these containers are transported to the fuels turned around area. The material is released into a capped inlet area, which drains the material into two receiving tanks. These tanks are piped into two 2500 gallon holding tanks. Once the holding tanks reach capacity, then a contractor pumps the tanks empty.

Containment Controls: This area, where the material is received is supported by a concrete pad with secondary containment surrounding the capped inlet area. This secondary containment consist of six inch concrete diking and a concrete foundation. The piping to the receiving tanks is neoprene 2.5 inch diameter piping. The secondary containment on the receiving tanks and the holding tanks are constructed of earthen materials. During the VSI on 14 Dec.91, it was identified that the foundation under the receiving tanks is not in a supportive condition, because, After rainfall, the

saturation around the tanks was 100% allowing surface water to remain around the tanks. The earthen diking around the receiving tanks looked supportive. (Ref. 4)

History of Releases: Although, there have been releases at this site, information concerning the actual dates and remedial action taken is unavailable. (Ref. 4 and 13)

Potential Releases

Air: Due to this facility being enclosed by piping and tanks systems, the volatile emissions released from this area are minimized. Also, due to the present contamination and future plans for remediation of the site, the rate of volatile emissions released to the air, is currently unknown.

Soil/Groundwater: All of the tank systems in this location have a direct release pathway to the soil. Due to the past operations at this site, the soil has been contaminated. The nature and extent of the contamination to the soil and groundwater is only partially known as a result of investigation during the recent remedial work conduct at the site.

Subsurface gas: It has not been identified that whether or not this area produces subsurface gas. Although, the mixture of

the certain soils and waste will give off gaseous vapors, it is known that at a depth of approximately 12 feet deep, that such incompatible soils does not exist.

3.1.3.29 BUILDING 3001 POST M-61

Accumulation Site Information Summary: This site is located on the south end of building 3001 at Post M-16. There are for inground sumps, which are utilized as holding tanks for waste material, drained from the process area in the plating shop. These tanks are constructed with adjoining walls of 12 inches thick concrete at varying depths. Presently, there are three holding tanks in use that are used for the accumulation of chrome waste, dilute rinse waste, and cyanide waste. The acid sump, is current;y remedial investigation under the IRP program . The mixed acid sump was taken out of service in 1989. (Ref 4)

Dates of Operation: This site has been in operation since 1972, but from 1972 to 1988 these tanks were identified as holding tanks. Since 1988 they have been utilized as transfer tanks for the Waste Pretreatment system. (Ref. 4)

Wastes Managed: The three tanks which receives waste from the processing area in the plating shop, are used to accumulate

chrome waste, dilute rinse waste, and cyanide waste. Once these tanks receive this material, the flow of wastewater is continuously feed through the pretreatment system. Alkali cyanide material is pumped out by a disposal contractor, due to the concentration of chrome in the material. (Ref. 6)

Containment Controls: The dilute rinse tank is constructed on nonexpansive compacted fill with 12 inch thick concrete walls and has a capacity of 5000 gals; the tank size is 15'X10'X10.5. The cyanide tank and chrome tank have a capacity of 5000 gals each, with dimensions of 10'X10'X7.5, and are also constructed on nonexpansive compacted fill. All three of these tanks have 1/2 inch steel liner and a 3/16 inch koroshel liner. (Ref. 4)

History of Releases: There is no available data documenting releases at this site. (Ref 4 and 13)

Potential Releases

Air: The emissions released from this area are minimized because the tanks are part of the closed loop Pretreatment system.

Soil/Groundwater: The release pathway to the soils is minimized, because the tanks, presently, have adequate

integrity.

3.1.3.30 SWMU NO 27 KUHLMAN CREEK OIL AND GREASE TRAP

Solid Waste Management Unit Information Summary: The Kuhlman Creek Oil and Grease Trap is located on the north side of Kuhlman Creek, south of the intersection of "L" avenue and South Street. This trap is a mechanism, which is utilized to collect oily residual from Kuhlman Creek surface water. The unit is used to ensure any oily residues generated on the apron, ramps and runways do not discharge off-base. The trap facilitate the creek waters, as such:

The creek is diverted upstream so that the waters from the upstream can be piped into the trap at a constant velocity. As the waters flow into the first sluice gate, the oils or contaminates, floating on top, are trapped by the second sluice gate which is position lower than the water level in that section. The floating contaminants are piped to the oil tank. The remaining creek waters, continually flows underneath the second sluice gate and back to the creek. The oil and grease trap is about 15 feet by 30 feet by 8 feet, and has a high steel open-top rectangular tank. The unit is located inside a fenced area approximately 100 feet by 100 feet. Creek Investigations are in progress.

Dates of Operation: This unit was installed in approximately 1973 and remains operational. (Ref. 4)

Wastes Managed: This unit collects any flowing contaminants from Kuhlman Creek. (Ref. 4)

Containment Controls: Waters, normally flow into the trap at a constant velocity. That velocity is continuous throughout the tans allowing contaminants to be skimmed off and the waters to flow back to the creek. This area is fenced off to limit entrance unauthorized personnel repository for waste materials.

History of Releases: There is no data documenting releases from this location. (Ref. 4 and 13)

Potential Releases

Air: The potential for release of hazardous waste or hazardous constituents to the air, is low based on the source of water received by this unit and the period of time this water had been previously exposed to air.

Soil/Groundwater: The potential for release of hazardous constituents to surface water, is high due to the oil/fuel-type sheen that was observed on the out-flow end of

the unit.

Surface Water: The potential for release of a sheen or hazardous constituents to surface water, is high based on the physical location and design of the oil separator.

3.1.3.31 SWMU NO 45 BUILDING 1058, OIL AND GREASE TRAP

Solid Waste Management Unit Information Summary: This unit is designed to separate oil and grease from rinse waters generated during the routine maintenance and washing of aircraft support vehicles. This unit is located, on the west side of Building 1058 in the 507th Reserve Squadron facility. It is constructed completely inground and is surrounded by asphalt paving adjacent to concrete paving. It is constructed completely inground. The construction drawings of the unit are unavailable. Although, this unit separates oil and grease, the remaining wash waters Are drained to sanitary sewer system. (Ref. 4)

Dates of Operation: This unit has been in operation since 1980. (Ref. 4)

Wastes Managed: This unit manages alkaline detergent wash water from aircraft maintenance vehicle washing operations,

mixed with oil, grease, and grit picked up from the aircraft maintenance vehicles. (Ref. 4 and 11)

Containment Controls: The actual construction of this below-ground unit. (Ref. 4)

History of Releases: There is no data available documenting releases at this site. (Ref. 4 and 13)

Potential Releases

Air: The potential for release of hazardous waste or hazardous constituents from this unit is low based on the closedtop construction on the unit and low volatility of wash waters managed in the unit.

Soil/Groundwater: The potential for release of hazardous waste or hazardous constituents to soil and/or groundwater from this unit is moderate, based on the characteristics of the wash waters managed in the unit.

Surface Water: The potential for release of hazardous waste or hazardous constituents to surface water from this unit is low based on it in-ground construction and the location of surface water pathways.

Subsurface Gas: The potential for release/generation of subsurface gas from this unit is low, based on the lack of buried biodegradable organics in the unit and the low volatility of the wastes managed in the unit.

3.1.3.32 SWMU NO 61 BUILDING 2101 VEHICLE MOTOR POOL, USED OIL TANK

Solid Waste Management Units Information summary

This unit was an underground storage tank that received used oil from vehicles serviced at the Vehicle Motor Pool (Building 2101). This tank was located near the north east end of Building 2101, with a capacity of 500-gallons. Presently, the tank has been assessed and closed.

Dates of Operation: The unit has been in operation for approximately 10 years. But, as of Sep 1990, actions has been taken to close the tank. (Ref 4 and 11)

Wastes Managed: Prior to 1990, this tank received waste oil from servicing vehicles.

Containment Controls: Presently, the tank is closed in place. (Ref. 4)

History of releases: Presently, there is no data available documenting releases at this site. However, the closure actions taken with this tank include emptying, sandblasting and filling with sand. The closure actions was taken due to compliance actions. (Ref. 4 and 13)

Potential Releases

Air: In the past, the potential for release of hazardous waste or hazardous constituents to the air, is low based on the closedtop construction of the tank and low volatility for the waste managed.

Soil/Groundwater: The potential for release of hazardous waste or hazardous constituents to soil and groundwater, is high; But, whether, the soils in the immediate area is contaminated it is unknown.

Surface Water: In the past, the potential for release of hazardous waste or hazardous constituents to surface water, is low based on the below-grade construction of the tank and the distance to local surface water bodies.

Subsurface Gas: In the past, the potential for subsurface gas generation, is medium, based on the visual evidence of potential spills and the moderate volatility of the engine

oils.

3.1.3.33 SWMU NO. 30 BUILDING 3726, NEW TEMPORARY HAZARDOUS WASTE STAGING BUILDING

Solid Waste Management Unit Information Summary: Building 3726 is located between B-3770 and B-3728. (See Figure 1) The facility was constructed as a product receiving storage facility. Drums of hazardous waste are received at this building until paperwork processing for shipment is complete. This process is conducted daily with no hazardous waste drums being stored overnight. The building is constructed of corrugated steel with dimensions of 38.5 feet by 198 feet. It has a sloped concrete floor with six inch diking against the walls. The concrete diking is utilized as the secondary containment for this building. (Ref. 4)

Dates of Operation: The facility was utilized as a general storage building, in the early 80's for non-waste materials. Presently it is used as a product storage area and receiving area for wastes. (Ref. 4)

Wastes Managed: The building is designated as a receiving area for hazardous waste prior to storage in other facilities. Its major utilization is receiving, processing, and storage of

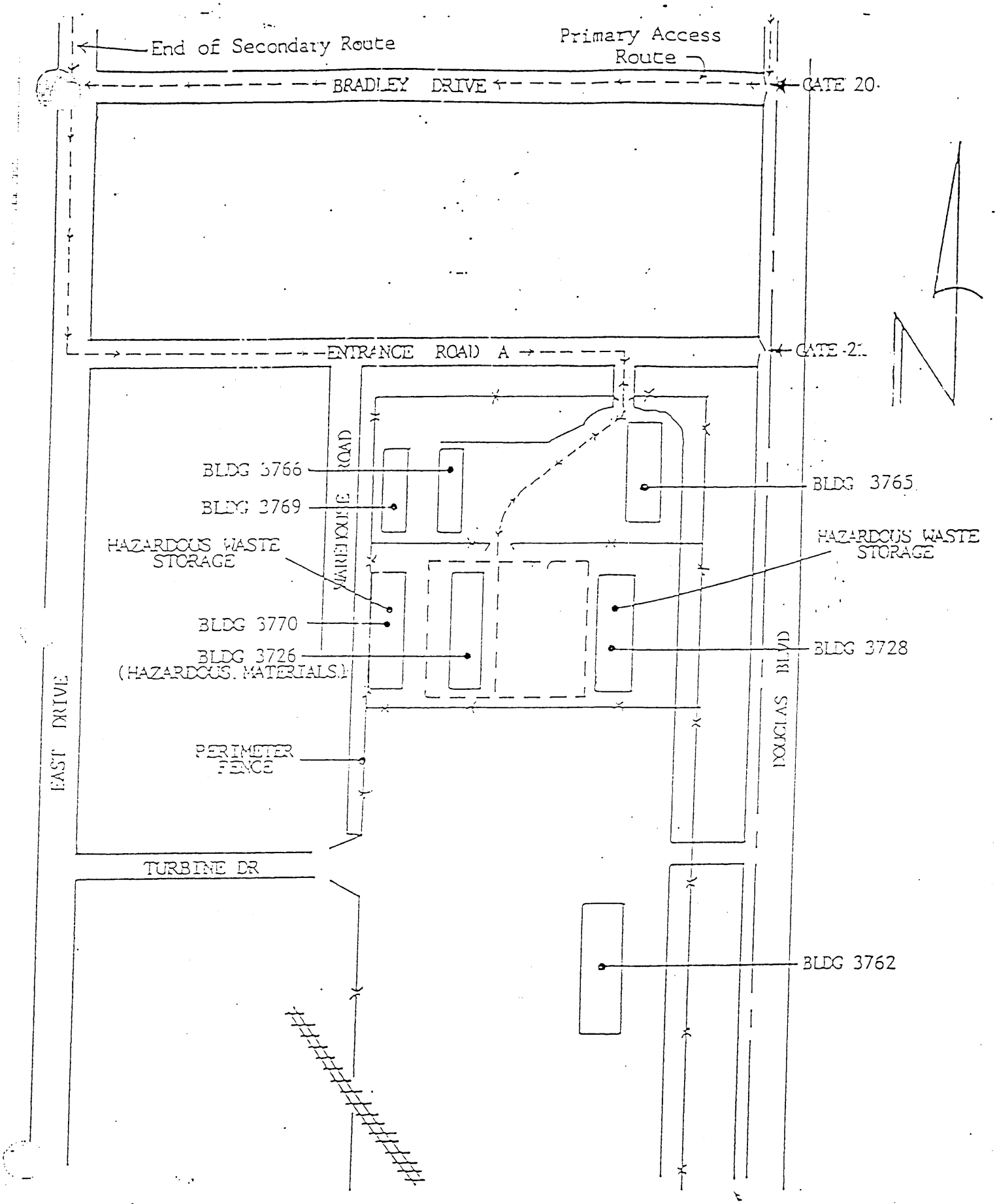

FIGURE 1: DRMO COMPOUND

product materials. (Ref. 4)

Containment Controls: Sloped floors, impermeable surface, and six inch concrete diking are the secondary containment mechanisms. (Ref. 4)

History of Releases: This site has no record of releases or closure actions taken at this site. The site is currently active. (Ref. 4 and 13)

Potential Releases

Air: The potential release of the hazardous waste or hazardous constituents to the air is minimal. Due to drums and product material being sealed.

Soil/Groundwater: The potential for release of hazardous waste or hazardous waste constituents to the soil and groundwater is low due secondary containment measures.

Surface Water: The potential release of hazardous waste or hazardous waste constituents to the surface water is low due to the structural design of the building and the existence or nonexistence of drainage structures in the location.

Subsurface Gas: The potential for subsurface gas generation is

low due to the structure and utilization of the unit.

3.1.3.34 SWMU NO 31 DRMO FACILITY, EMPTY PAINT SOLVENT CAN TRASH DUMPSTER

Solid Waste Management Unit Information Summary: The unit was used from 1987 to Nov 1989. The unit was a metal Browning Ferris Inc. transfer dumpster used to accumulate hold empty paint and solvent containers from varies sources on throughout the Base. Its dimensions were approximately 20 feet long by 10 feet wide by 10 feet deep. This unit was located within the DRMO waste handling facility at the east end. This location was a collection point for all empty paint and solvent cans. The unit is no longer in use, due to better managerial practices.

Dates of Operation: This site was in operation from 1987 to Nov. 1989. (Ref. 4)

Wastes Managed: Historically, the unit was managed by DRMO. Solvent and empty paint containers were collected in the BFI dumpster. Periodically, the dumpster was emptied and dispose of by BFI. (Ref. 4)

Containment Controls: During the time of operation the site

was supported by asphalt paving against a concrete barrier. (Ref.4)

History of Releases: There is no known releases documented or reported at this site. (Ref. 4)

Potential Releases: Presently, the unit is no longer in use, therefore, its effects to the soil, groundwater, air, and surface Water does not exist.

3.1.3.35 SWMU NO. 36 BUILDING 289, MALFUNCTIONING EXHAUST UNIT

Solid Waste Management Unit Information Summary: This unit is a dry well associated with the sir exhaust units that are located on the side of Building 289. The unit is approximately 8 feet deep, 3 feet wide and 3 feet long. It sets below-ground with concrete walls. The unit is utilized as a drainage area for the vitrified clay tile exhaust pipes that are attached to the side of the trenches. These pipes create vacuum pressure on the trenches during aircraft depainting and painting operation for air ventilation. If the trenches get full or the outlet grate, located at the end of the trench, gets clogged, then the wash rack waters flow into the exhaust pipes and drain to, by vacuum pressure, the dry well.

Dates of Operation: This unit has been in operational since approximately 1983. (Ref. 4)

Waste Managed: The unit receives alkaline detergent wash water from aircraft washing operations mixed with oil, grease, and grit picked up from the hanger floor. The unit is periodically pumped out and wastes are properly disposed. (Ref 4)

Containment Controls: This unit is constructed with concrete walls. And, the unit is presently operational. (Ref. 4)

History of Releases: There are no data records documenting releases from this site. (Ref. 4 and 13)

Potential Releases

Air: Due to the steel closed-top on the unit and the diluted wash water, the volatile emissions release is minimal.

Soil/Groundwater: Based on the in-ground structure and the diluted wash waters, the potential release to the soil or groundwater is minimal.

Surface Water: Based on the location of the unit, the potential release to the surface water is minimal.

3.1.3.36 SWMU NO. 39 BUILDING 976, MALFUNCTIONING EXHAUST UNIT DRY WELL

Solid Waste Management Unit Information Summary: This unit is a dry well associated with the Air Exhaust Unit in building 976, where it sets in-ground with concrete walls. The concrete unit is approximately 72 cubic feet that receives wash waters from the exhaust piping attached to the trenches in the floor of the building. These exhaust pipes put a vacuum pressure on the trenches. When the trenches get full or the outlet grate get clogged, wash waters are exhausted through the piping and drained to the dry well.

Dates of Operation: This unit has been operational from approximately 1988 to the present.

Wastes Managed: This unit receives alkaline detergent wash water from aircraft washing operations, mixed with oil, grease, and grit picked up from aircraft and the hanger floor. Periodically, the unit is pumped out. (Ref. 4)

Containment Controls: The reinforced concrete walls and periodic pumping act as release controls for this unit. (Ref. 4)

History of Releases: There is no data available that documents releases at this unit. (Ref. 4 and 13)

Potential Releases

Air: Due to the closed-top construction of the unit and the minimal volatile emissions, the emissions release is minimal.

Soil/Groundwater: The potential release to the immediate soil or groundwater is minimized, due to the construction of the unit and the diluted wash waters managed.

Surface Water: Based on the location and construction of the unit, the potential release to surface water is minimized.

Subsurface Gas: Based on the construction of the unit and the diluted waste waters, the potential release is minimized.

3.1.3.37 SWMU NO. 41 BUILDING 1030, OIL AND GREASE TRAP

Solid Waste Management Unit Information Summary: This unit is a 1000 gal. in-ground concrete open-top tank that is located on the north end of building 230. This tank collects floating oil and grease from wash waters generated in the Aircraft Hanger. The oily layer on the water is skimmed into a adjacent tank, the remaining wash waters continuously flow to the

sanitary sewer distribution system. This unit is approximAtely 5 feet wide by 8 feet long by 10.35 feet deep, and is constructed of 8-inch thick concrete walls. (Ref. 4)

Dates of Operation: This unit has been in operational since 1958. (Ref. 4)

Wastes Managed: This unit manages alkaline detergent wash water from aircraft washing operations, mixed with oil, grease, and dirt from the hanger floor. This unit only receives wash water from building 1030. The oily material accumulated in the Adjacent tank is pumped out and disposed properly. (Ref. 4)

Containment Controls: The unit has 8 inch thick walls and provides containment. However, the integrity of the concrete floor of the tank could not be determined due to wash waters in the tank. (Ref. 4)

History of Releases: Presently, there does not exist any documents or reported releases at this location, except the State Inspections Reports stated in the RCRA Facility Assessment (dated Jun 19, 1989). Also, the unit is still active. (Ref. 4 and 13)

Potential Releases

Air: Due to the continuous flow of wash water and the content of the waters, the volatile emissions is minimal.

Soil/Groundwater: The potential release to the soil or groundwater is minimal, due to the present structural integrity.

Surface Water: Due to the present data available, the potential release to the surface water is minimal.

Subsurface Gas: The potential for subsurface gas generation is minimized due to the continuous flow of wash waters in the tank.

3.1.3.38 SWMU NO. 43 BUILDING 1071, OIL AND GREASE TRAP

Solid Waste Management Unit Information Summary: This unit is an in-ground concrete tank that is located on the southeast end of Building 1071 in the 507th Reserve Squadron area. The unit was utilized as a drainage area for aircraft fuels and oils from the flight line. The oily wastes floated on top, while the remaining waters drained to the sanitary sewer. The oily liquids were skimmed into an adjacent tank. The unit is constructed with 13 inch walls and a 12 inch floor. Presently,

this unit is closed and being dismantled. In the closure actions taken, the drainage units are being rerouted and the adjacent tank was cleaned out and removed. Soil samples were taken to determine contamination extent, if any. The concrete inground structure removed. Presently, the results of the stress vegetation in and around the adjacent tank are being evaluated.

Dates of Operation: This unit have been in operation since 1963 until 1991. (Ref. 4)

Wastes Managed: The unit managed alkaline detergent wash water from aircraft washing operations, mixed with oil, grease, and dirt from the hanger floor. Essentially the unit managed the wash water similar to the unit on the northend of building 1030. But, the unit is presently inactive. (Ref. 4)

Containment Controls: Due to the 13 inch walls and 12 inch concrete floor wall in the tank, the impermeability of the construction materials are utilized as containment of the wash waters. (Ref. 4)

History of Releases: Presently, there is no data available depicting releases at this site. (Ref. 4 and 13)

Potential Release: Presently, this site is inactive and the structure removed. It potential ability to release hazardous waste or constituents to environment has been eliminated. In the past, its capability for a potential release is as follows:

Air: Due to the low volatility of the wastes managed and the unit being an open-top tank, the potential for release is low.

Soil/Groundwater: Although, the unit is being removed, the concrete unit structure seems to be intact. The results of the condition of the vegetation is currently being evaluated, due to possible releases to the soil.

Surface Water: This unit is adjacent to a tributary of Crutcho Creek. Therefore, its potential release to the surface water is high.

3.1.3.39 SWMU NO. 44 BUILDING 1041, OIL AND GREASE TRAP

Solid Waste Management Unit Information Summary: This unit was utilized as a completely in-ground oil water separator which receives the oils and grease from wash waters that are generated during maintenance and washing of aircraft support units. The oily wastes flow into and in-ground tank for

accumulation, where the waste waters continuously flow into the sanitary sewer. This unit will be utilized occasionally, because the facility usage has been diverted.

Dates of Operation: This unit has been in operation since 1976. (Ref. 4)

Wastes Managed: This unit manages alkaline detergent wash water from aircraft maintenance vehicle washing operations, mixed with oil, grease, and dirt from vehicles and the floor of the B1041. Essentially, the unit separates oil and grease from the wash waters and routes the oily liquid and the wash water to its designated outlet. (Ref. 4 and 11)

Containment Controls: This unit have a flow control and is tied into a sanitary sewer wastewater collection system.

History of Releases: The unit discharges wash waters to the sanitary sewer. However, there is no data available depicting releases at this site.

Potential Releases

Air: Due to the unit being inground and the wastes managed, the volatile emissions from the unit is minimal.

Soil/Groundwater: Due to the reduction in the future use af the unit, the potential for a release to the soils will be minimal. However, due to the unit being inground, its potential release capability is highly dependent on the integrity of the unit.

Surface Water: Due to the continuous flow of wash water to the sanitary sewer and the location of the unit, its release potential is minimal.

Subsurface Gas: The subsurface gas generated from this unit is low due to the mechanical structure and the minimal release potential to the soil or groundwater.

3.1.4 MANAGEMENT PRACTICES

This section discusses current-vs-proposed management practices regarding accumulation sites and solid waste management units. The following items discusses current-vs-proposed management practices.

3.1.4.1 INTERNAL PERMITTING PROCESS

The functional concept regarding accumulation sites is being facilitated by an internal permitting process, where by, any

accumulation point or site will require a permit to accumulate hazardous waste on base. This process will enhance the ability to track these sites, as well as, maintain active and inactive data on them. In the past only periodic site visit monitoring occurred.

3.1.4.2 COMPUTER TRACKING

Due to the necessity to track hazardous material and hazardous waste from point of generation to disposal the ability to facilitate hazardous waste data is being enhanced by the implementation of a base-wide data base system. This system will enhance data research, reporting, and process assessment. In the past this was done manually through document research.

3.1.4.3 SOLID WASTE MANAGEMENT UNITS

The management of solid waste management units can be included with the system for tanks that are not regulated under the Underground Storage Tank requirements. This will enhance the ability to assess both tank systems and SWMUs. Presently, this consolidation is not functional.

3.2 INTEGRITY OF BELOW-GROUND INDUSTRIAL WASTEWATER LINES

Tinker began installing sewer lines to handle industrial wastewater in 1962, and have continuously added to the system to the present. The system consists of lines ranging in size from 2 inches in diameter, and are constructed of polyvinyl chloride, vitrified clay, and black iron. The integrity of the system could not be determined, therefore the below-ground industrial wastewater sewer lines, as well as the manholes, are being replaced.

The system that is being installed is a double-walled polypropylene pipe with interstitial monitoring. The inner carrier pipe is rated to 150 pounds per square inch (psi) and has diameters ranging from 2 to 12 inches. The other containment pipe is rated to 45 psi and has diameters ranging from 4 to 24 inches. The leak location/detection system is located between the inner and outer pipe and is capable of continuous monitoring of a sensor string with discrete reporting, including location of leaks, breaks, and shorts. The alarm unit is located at the Industrial Wastewater Treatment Plant and consists of a visual display panel and an audible alarm.

The replacement of the below-ground industrial wastewater lines is being accomplished in four (4) phases. Phase I began in October 1991 and is scheduled to be completed in February 1993. This phase consists of installing approximately 15,900 linear feet of pipe. Figure 2 depicts the location of the lines being installed for phase I.

Phase II began in October 1992 and is scheduled to be complete in November 1993. This phase consists of installing approximately 15,350 linear feet of pipe. Figure 3 depicts the location of the lines being installed for phase II.

Phase III is scheduled to begin in October 1993 and will consist of installing approximately 16,120 linear feet of pipe. Figure 4 depicts the location of the lines to be installed for phase III.

Phase IV is scheduled to begin in October 1994 and will consist of installing approximately 10,810 linear feet of pipe. Figure 5 depicts the location of the lines to be installed for phase IV.

INDUSTRIAL WASTEWATER SEWER LINES

Phase I

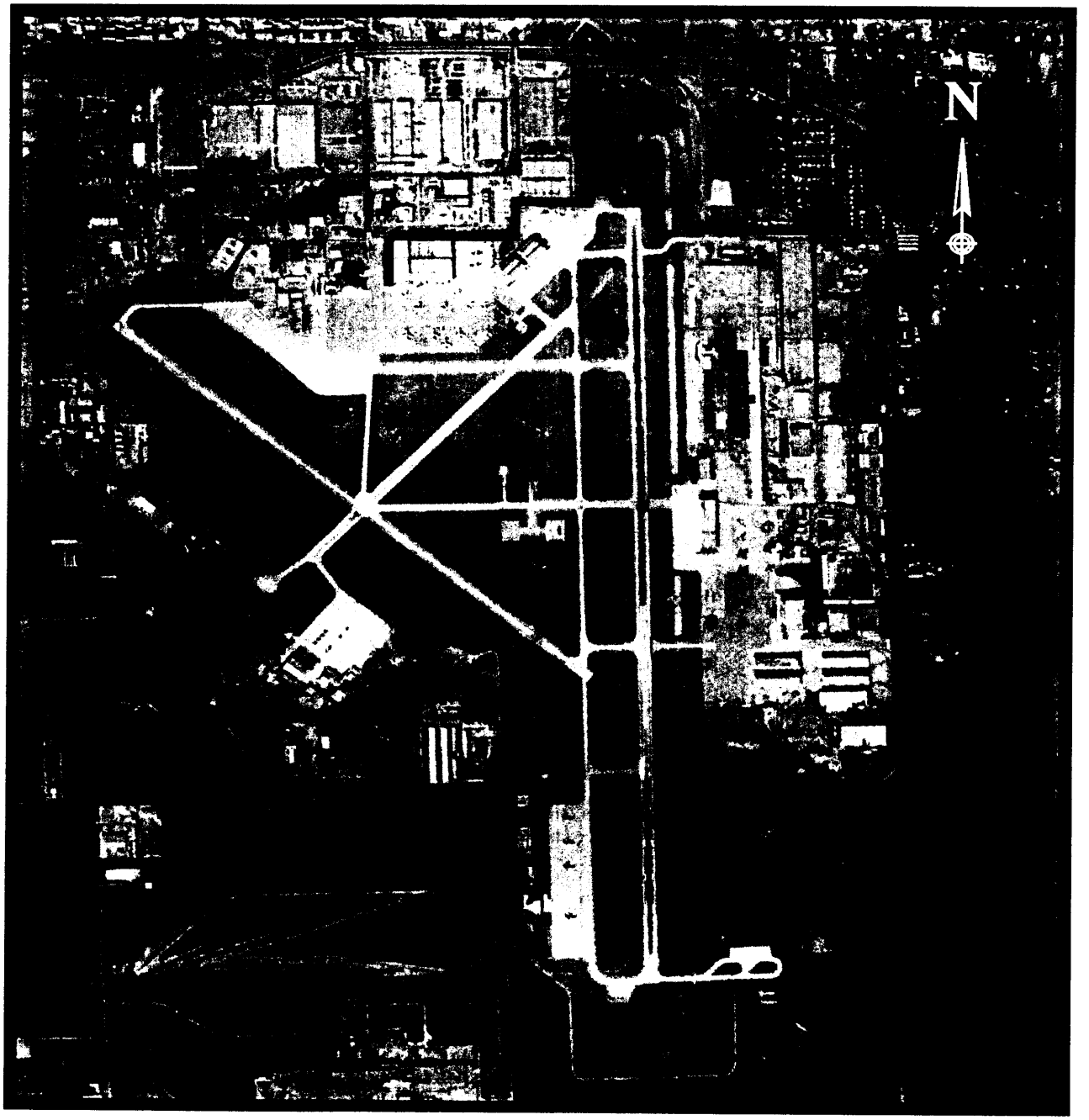

Figure 2

INDUSTRIAL WASTEWATER SEWER LINES

Phase II

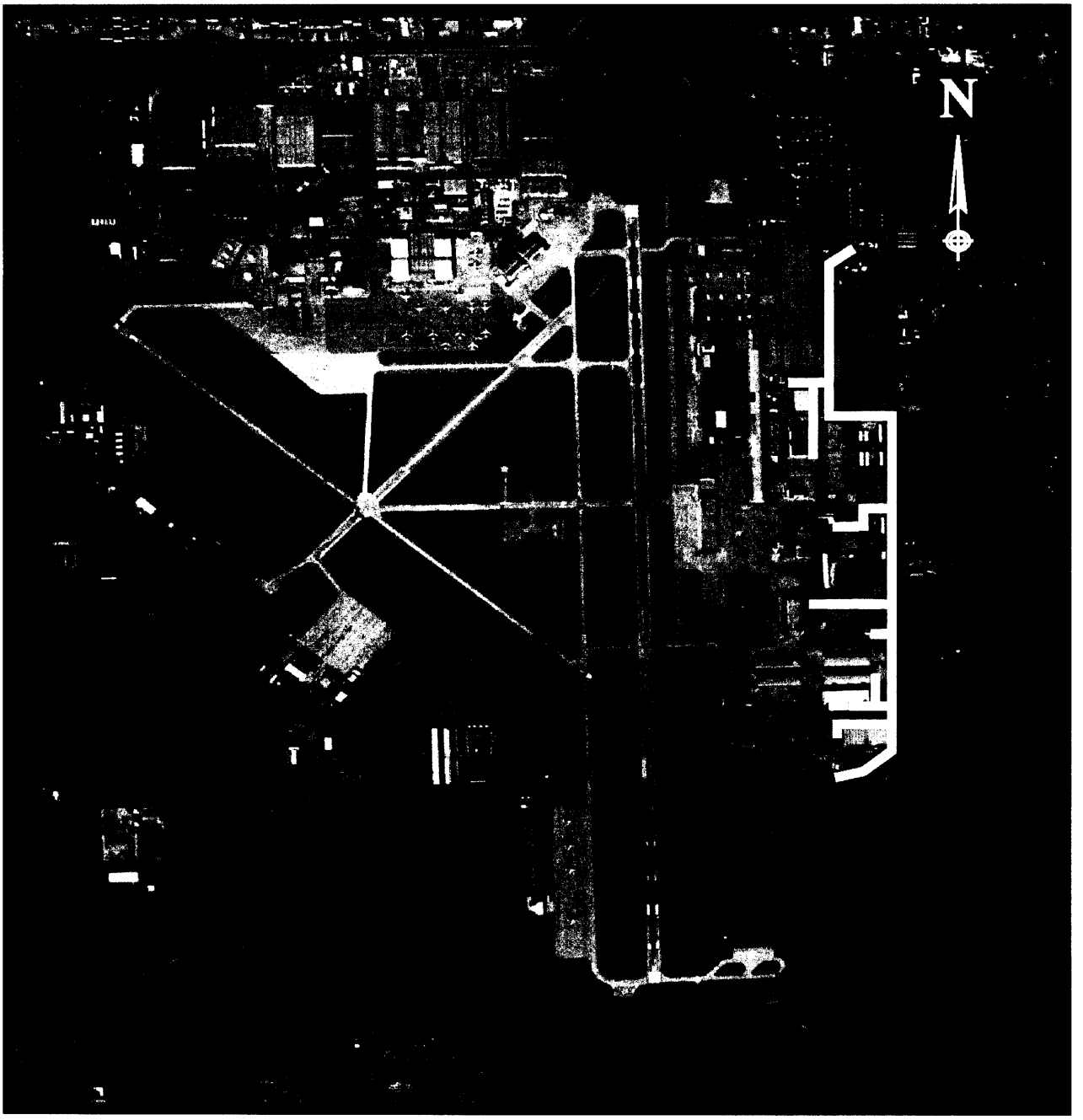

Figure 3

INDUSTRIAL WASTEWATER SEWER LINES

Phase III

Figure 4

INDUSTRIAL WASTEWATER SEWER LINES

Phase IV

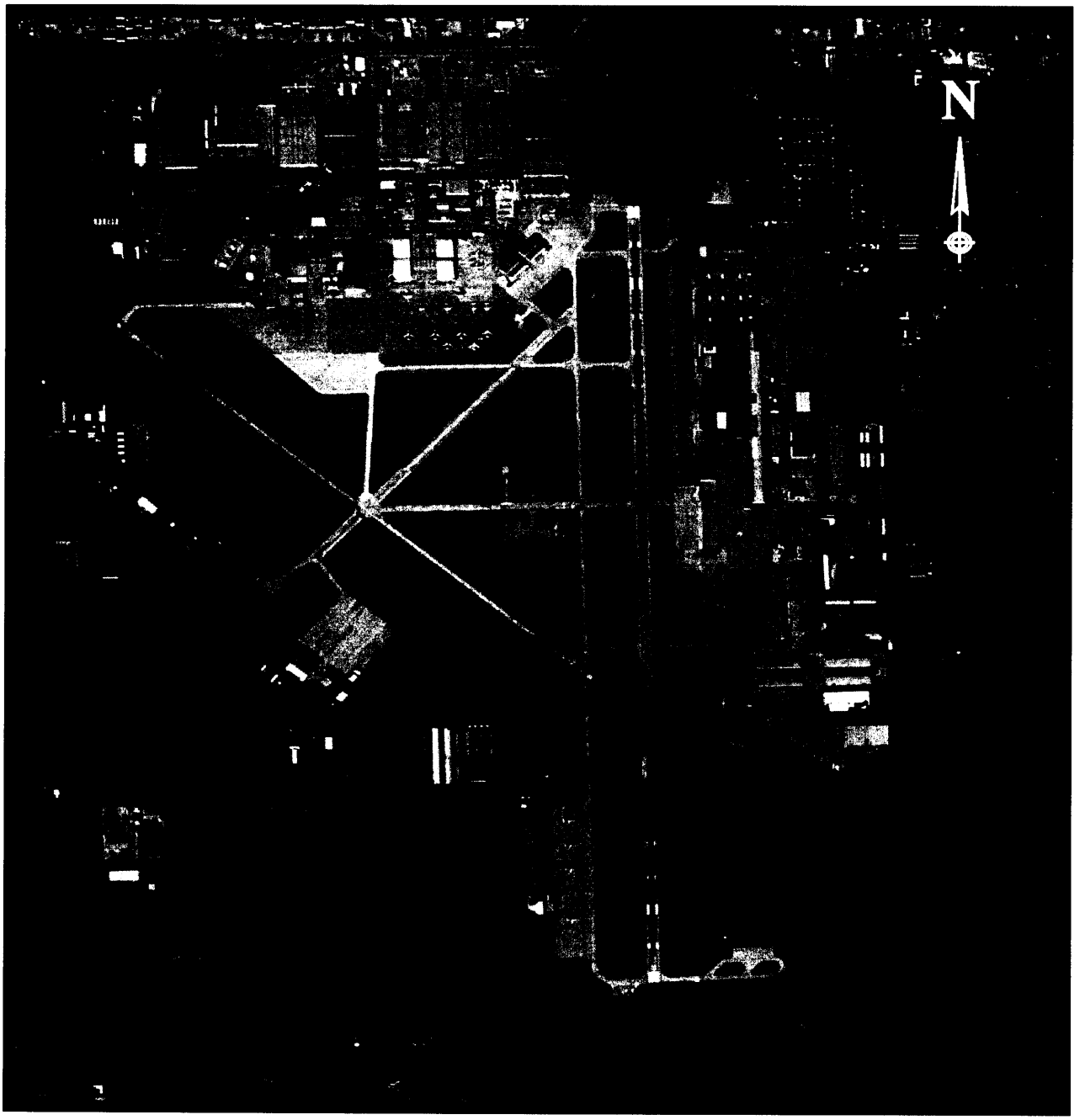

Figure 5

3.3 REFERENCES

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SECTION III - IDENTIFICATION AND SUMMARY OF CURRENT STUDIES

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1.0 INTRODUCTION

Tinker Air Force Base is required by their RCRA Permit, Section VI, Task I, Part C.3, to identify and summarize the requested current studies. The following is submitted to meet this request.

2.0 SUMMARY OF CURRENT STUDIES

This section summarizes the Soldier Creek Investigation, Fuel Farm, Fuel Jettison Areas, North Tank Area, Southwest Tank Area, Building 3001 Progress Reports, and Kuhlman, Crutcho, and Elm Creeks. The summary includes the scope of the study, significant findings thereof, including sampling results.

2.1 SOLDIER CREEK REMEDIAL INVESTIGATION (FFA)

The Soldier Creek Remedial Investigation (RI) for the sediments and surface water was completed in April 1992. The Soldier Creek sediment and surface water investigations were handled in two sampling phases. Sampling was conducted along Soldier Creek from Tinker to Reno Avenue in Midwest City, which is almost three miles north of the base. Every sampling location showed minimal or no contamination in the sediment or surface water in both Phases of the RI with one exception. This exception was on-base sampling location E03 during Phase I only. The following contaminants (with concentrations in mg/kg) were found in the 0-6 inch sediments at that location: methylene chloride (140), 1,2-dichloroethene(total) (180), chloroform (9.2), trichloroethene (4.1), tetrachloroethene (83), chlorobenzene (78), chromium (430), lead (255), and nickel (325). The Risk Assessment determined that the risks associated with the sediment and surface water of Soldier Creek were within EPA carcinogenic and non-carcinogenic guidelines. The proposed action is to continue with a long-term monitoring program.

In the area of Tinker Air Force Base, there is a perched aquifer and the deeper top of regional and regional aquifers. The perched aquifer at Tinker is discontinuous throughout the base. There was contamination found in the groundwater during both

Phases of the RI. However, the groundwater investigations were incomplete. Therefore, the groundwater has been separated out and will be investigated as a separate Operable Unit under the Federal Facilities Agreement.

2.2 FUEL FARM

Two reports have been generated on this site. The first one was entitled POL Facility (Fuel Farm) Expedited Response and is dated April 1988. The second one is POL Facility Report of Recovery Operations - June 1987 to December 1988 and is dated March 1989. These reports present recommendations for remedial action at the Fuel Farm and a report of recovery operations. The facility was formerly an underground fuel storage facility, but has been converted to an above-ground storage site.

The Fuel Farm is located in the north-central part of TAFB. It contained three abandoned groups of buried tanks containing motor fuel, JP-4 jet fuel, and aviation gasoline. The first group consisted of five 18,000-gallon tanks buried four feet below ground surface. The second group consisted of twelve 25,000-gallon tanks buried six feet below ground surface. These two groups of tanks were installed in 1942. The last group contained eight 25,000-gallon tanks also buried six feet below ground surface. This group was installed in 1952. Two major

spills of 6,000 and 10,000 gallons occurred in 1979 and 1980, respectively. The Fuel Farm was an underground storage tank facility until 1986 when it was converted to an above ground tank facility.

Most of the Fuel Farm was found to be underlain by 40 feet of sandstone, in which was encountered a 7- to 9-foot thick shale bed. The shale was generally encountered from 10 to 20 feet below ground surface. To the extreme north and south, this shale bed was absent. Below the upper sandstone (and shale) was found a 15- to 20-foot thick confining shale unit. Below this shale was found another 30- to 35-foot thick sandstone. Ground water was encountered in a perched aquifer zone in the upper sandstone and in the Top of the Regional aquifer zone in the lower sandstone. Flow in the Top of the Regional aquifer zone was determined to be toward the southwest. The perched aquifer was found to be mounded below the tank area, with radial flow away from the tanks in all directions.

Ground-water samples from the perched aquifer were reported to be contaminated with benzene, toluene, and xylene in maximum concentrations of 8400, 890, and 2060 parts per billion (ppb), respectively. Barium, chromium, and lead concentrations were found in maximum concentrations of 6400, 260, and 190 ppb, respectively.

The Top of the Regional aquifer zone was also found to be contaminated. Benzene was found in well 1A, located west of the fuel farm tanks at concentrations ranging from 113 to 582 ppb. Perched aquifer wells 1B and 1C showed concentrations of benzene and xylenes, ranging as high as 8400 and 224 ppb, respectively.

As a result of the first investigation, an emergency interim action was instituted to remove the fuel from the subsurface. Two recovery wells began operating in June 1987. Two above-ground holding tanks were installed for temporary storage of fuel and contaminated water. The interim action also included abandonment of the underground tanks. These tanks were abandoned by cutting them in half and filling them with sand. Ground-water monitoring in the tank area for fuel-related compounds was also conducted during operation of the recovery system.

The second report, POL Facility Report of Recovery Operations - June 1987 to December 1988, presents the initial results of operating the Fuel Farm fuel recovery system. The goal of the recovery operation was to eliminate a fuel product plume floating on the ground water beneath the Fuel Farm. The system began operating in June 1987 as an interim action for the site. The report presents fuel and ground-water recovery quantities, and the results of all ground-water monitoring.

The recovery system was modified in May 1988. One of the recovery wells was removed from operation due to low fuel production. Water discharge from the remaining recovery well was diverted from an above-ground holding tank to an industrial waste treatment plant line. The fuel pump in the operating recovery well was replaced with an automated bailer. The fuel recovered from the well was switched from being stored in an above-ground holding tank to being stored in drums. The two original holding tanks were removed.

A total of 1450 gallons of fuel and 190,000 gallons of water had been recovered by December 31, 1988. The total volume of fuel in the subsurface was revised from 50,000 gallons to 12,500 gallons to account for apparent versus actual product thicknesses observed in wells. Contaminants were detected in ground water at the site in 1988, most notably in the perched aquifer in the immediate vicinity of the product plume. Groundwater samples shall be collected from 13 monitoring wells at this site in the month of November.

2.3 JETTISON AREAS

Two areas are designated for use by Tinker AFB in the event of an in-flight emergency where the reduction of gross weight becomes necessary. The External Stores Jettison Site is

primarily for the jettison of external fuel tanks and unarmed ordnance. The Fuel Jettison area is reserved solely for the jettison of fuel from internal tanks.

The External Stores Jettison Site is located in a north-south oriented segment of the South Canadian River floodplain south of the City of Moore and west of the City of norman, or about 15 miles southwest of Tinker AFB. The site is 2.8 nautical miles long in a north-south direction and is 1 nautical mile wide.

No records have been found indicating the jettison of external stores at this site. It is not believed that the site has ever been used for this purpose.

An Environmental Assessment (EA) was conducted for the external stores jettison area in 1980 and resulted in a Finding of No Significant Impact (FONSI). This EA concluded that after each utilization of the site a minimum of 10% of fuel would be not recoverable as result of a fuel tank jettison. This would result in an average loss of 200 gallons per incident. The maximum worst case release would be 500 gallons after removal efforts were complete. The EA indicated that the external stores jettison site is expected to be used less than once per 10 year span.

Since this facility is located in the floodplain of the South Canadian River, any release would quickly reach the shallow water table, or perhaps be released directly into the river water. However, no monitor or supply wells are located in this area and the river is not used as a drinking water supply.

A site visit was conducted on 30 July 1991. There were no signs of contamination or use across the site. The south east quadrant of the site has had some urban encroachment with approximately 10-13 houses in this area. The majority of the site is undisturbed and typical of floodplain along the South Canadian River. An area posted on the northern boundary of the site was located that identified the area as a nesting site for the Interior least tern (Sterna antillarum) an endangered species.

The fuel jettison area is located southeast of Tinker AFB along the 142 degree radial of the Tinker (TIK) Tacan between 17 and 32 nautical miles. The fuel (JP-4 or JP-5) must be jettisoned above an altitude of 20,000 feet. This area lies mostly above rural agricultural land but encroaches upon Lake Thunderbird at the northwest end.

No records could be found nor could anyone recall an incident involving the use of this facility. Complete vaporization of

fuel is expected at the using altitude; therefore, no impact on soil, surface water, or groundwater is anticipated. A temporary air plume would be present and a small release of ozone depleting chemicals may result.

2.4 NORTH TANK AREA

The North Tank Area (NTA) is an area of approximately 16,000 square feet directly north of Building 3001. The site is comprised of a 20,000 gallon diesel Underground Storage Tank (UST) #3401, a 235,000 gallon fuel oil UST #3404, a 13,000 gallon gasoline UST #3405 removed in 1985, and a 500 gallon inactive waste tank abandoned in place. In 1992, UST 3401 was permanently closed by removal along with all associated piping and UST 3404 was closed in place by filling with an impermeable concrete mixture. Regulators were kept apprised of progress via written quarterly reports and quarterly presentations at the Technical Review Committee and Technical Working Group conferences.

Groundwater monitoring and product recovery wells were installed in 1991 and 1992 upon indications of a groundwater plume in existence covering approximately 25,000 square feet with soil contamination to a depth of eleven feet. At least six recovery wells have been installed in 1991 and 1992 with diameters of 2,

4, and 6 inches in diameter. Approximate total free product recovered to date is in excess of 1200 gallons, and approximate total groundwater recovered for treatment is in excess of 6600 gallons. The contaminated groundwater recovered is being stored until the Groundwater Treatment Plant (GWTP) is completed and operational. The tentative schedule for completion of the GWTP is first quarter 1993 with operations to begin fourth quarter 1993 (estimated).

Remediation of soils is being addressed through evaluation of remediation technologies appropriate to the soils and contaminants at this site. A Biorespiration Test was performed from 22 to 26 March 1992. Equipment brought on site failed to achieve sufficient vacuum for the test. A cone penetrometer was brought on site to better determine the areal and vertical extent of contamination with inconclusive results. A final evaluation and report are pending.

2.5 SOUTHWEST TANKS AREA

The SW Tanks Area consists of 17 abandoned fuel and solvent tanks located southwest of Building 3001 and 3108. The site covers approximately 1 acre. The tanks held gasoline, lubricating oil, naphtha, Stoddard solvent, JP-1 (jet fuel) and PD 680 solvent.

Previous investigations revealed that interbedded sandstone, siltstone and shale of the Garber-Wellington Formation underlie the SW Tanks area. Cross sections presented from these investigations indicate that clay and shale were typically encountered to a depth of 5 to 15 feet below ground surface in the SW Tanks area. This was typically followed by sandstone interbedded with shale and siltstone. It is indicated that the upper 10 feet of the site is primarily weathered red clays of the Garber-Wellington Formation, with interbedded silty clay and silt at depth. Below the upper clay unit, the lithology grades into a lower sandy unit. Some boreholes revealed a transitional, hard thin bed of varying thickness at 10 to 12 feet below ground surface (BGS). The hard layer is a cemented reddish-brown silty clay changing to gray siltstone with depth. Below this hard layer is a sandy unit that extends from 10 to 15 feet BGS to depths greater than 40 feet BGS. This sandy unit is composed of clay, pebbly zones, siltstone, and silty sand interbedded with fine-to coarse-grained reddish-brown sand. This unit should be considered a primary subsurface aquifer system.

Four groundwater zones were identified beneath the site during the Remedial Investigation (RI) conducted by the U.S. Army Corps of Engineers in 1988. From shallowest to deepest they are 1) the perched groundwater zone, an unconfined groundwater system

located 15 to 30 feet BGS; 2) the shallow top-of-regional aquifer zone, a confined aquifer located 50 to 80 feet BGS; 3) the deeper regional aquifer zone, a confined aquifer located 110 to 175 feet below ground surface; and 4) the producing zone of the regional Garber-Wellington Aquifer, located from 250 to 700 feet BGS, from which groundwater is pumped for drinking water at the base. The depth to water in the SW Tanks area ranges from 14 to 20 feet BGS and flow is from the northeast to the southwest. (U.S. Army Corps of Engineers 1989)

Previous studies have indicated the presence of chemical contamination in the subsurface soils at the SW Tanks site. Results from the 1987 A.L. Burke Engineers, Inc. UST investigation suggested that significant vadose zone contamination did not exist in the SW Tanks Area. Soil contamination was observed within the perched groundwater zone at depths exceeding 15 feet. Benzene was detected in soil samples from two boreholes at depths ranging form 20 to 30 feet BGS in concentrations ranging from 8 to 146 ppm. Toluene was detected in eight boreholes at depths from 20 to 30 feet BGS in concentrations ranging from 5 to 2,133 ppm. Total Petroleum Hydrocarbons (TPHs) were detected in nine boreholes at depths of 20 to 30 feet BGS with concentrations ranging from 34 to 19,453 ppm. (A.L. Burke Engineers, Inc. 1987)

The U.S. Army Corps of Engineers investigated the groundwater contamination conditions in the SW Tanks area during the 1988 RI. The perched groundwater system in the area was found to contain BTEX. Metals and solvent-related compounds also detected in the groundwater in this area are believed to have migrated to the SW Tanks Area from contaminated areas located to the northeast beneath Buildings 3108 and 3001. The groundwater is considered an operable unit of the Building 3001 groundwater remediation project.

Results from the 1992 Site Assessment and Characterization Reports conducted by CDM Federal Programs indicated that the most common chemical contaminants present at the site were TPHs and associated TPH compounds such as benzene, ethylbenzene, toluene, and xylene (BTEX). TPHs were present in 75% of the samples analyzed, in concentrations of up to 4,320 ppm. Toluene was the next most common analyte found, with a detection frequency of 21% and concentrations of up to 550 ppm. Benzene was present in two samples with concentrations up to 2.5 ppm. 1,4-Dichlorobenzene was detected in 6 samples with concentrations of up to 5 ppm. (CDM Federal Programs Corporation, 1992)

Two tanks were closed in place in 1990. These were tanks 3130 and 3131. Six tanks are scheduled for closure by removal in

calendar year 1992. These include USTs 3151, 3152, 3153, 3154, 3132, and 3133. A seventh tank, UST 3117-SW, is scheduled for closure by filling and abandonment in place in calendar year 1992. An eighth tank, UST 3145, is targeted for closure by removal in calendar year 1993. The area around the "monolith" (a buried vault that houses abandoned USTs 3140, 3141, 3142, 3143,3144, 3146, and 3147) is currently the target of extensive Innovative Technologies Demonstration (ITD) projects that include insitu sensors evaluation, soil fracturing and bioremediation. The ITD projects are forecast to run through calendar year 1994. The seven tanks housed within the monolith will be closed upon completion of the ITD projects and the remediation of soils in the area is projected to begin by the end of calendar year 1994.

2.6 BUILDING 3001 PROGRESS REPORTS (FFA)

Past industrial activities at the Building 3001 site have resulted in groundwater contamination in the perched water table aquifer and the uppermost zones of Garber-Wellington Formation. Chlorinated solvents and heavy metals are present in the contaminated groundwater. The primary contaminants are trichloroethylene (TCE) and chromium (Cr). A Final Remedial Investigation Report was submitted in January 1988 with the Feasibility Study completed in August 1989.

Past quarterly progress reports sent to Region VI EPA, CERCLA Branch, have outlined the development of the Building 3001 Site. On August 16, 1990 the Record of Decision was signed followed by the commencement of the Remedial Design of the groundwater extraction and treatment system on August 17, 1990. In November 1991, the Remedial Design was completed. The construction of the Groundwater Treatment Plant (GWTP) commenced on November 15, 1991. In support of the GWTP construction, the following draft-final documents were submitted to the EPA on March 25, 1992 for review: Remedial Action Workplan, Construction Quality Assurance Plan, Construction Quality Control Plan, Site Safety and Health Plan, and the Waste Management Plan. Finalized documents were delivered on August 10, 1992. Construction of the vertical groundwater extraction wells was initiated on March 30, 1992 and completed in May 1992. In April 1992, work was initiated on the General System Operation and Maintenance Manual (Volume I). In order to expedite the removal of contaminated groundwater beneath Building 3001, horizontal well design commenced in May 1992. The completed design and the construction is scheduled for First Quarter FY93. The Draft Volatile Organics Removal Process Package was submitted to the EPA on June 10, 1992 for review with the finalized document due in the First Quarter FY93.

The GWTP will be completed by February 15, 1993, in accordance with the Federal Facilities Agreement.

2.7 CRUTCHO, KUHLMAN, AND ELM CREEKS

The Remedial Investigation of Crutcho and Kuhlman Creeks and the tributaries of Elm Creek was completed in October 1992. The principle objectives of this investigation were to 1) confirm the presence or absence of contaminants in creek sediments and surface waters on and contiguous to Tinker Air Force Base, 2) determine the nature and extent of contaminants, if present, and 3) evaluate the actual and/or potential risk to the public health and the environment.

Crutcho Creek originates south of Tinker Air Force Base and flows through the base, toward the North Canadian River. Kuhlman Creek, a tributary of Crutcho Creek, originates in the northern portion of the base. Elm Creek originates in the southern portion of the base and flows south toward the South Canadian River.

Sediment and surface water samples were collected from Crutcho and Kuhlman Creeks, and tributaries of Elm Creek in two separate field phases, baseline and confirmation data collection. Baseline field activities were conducted in July and October 1991. Sediment and surface water samples were collected from 26 locations and analyzed for a broad spectrum of organic and inorganic compounds and contaminant indicators. Confirmation

data collection was performed in February and May 1992. Sediment and surface water samples were collected from 11 creek locations in February 1992 to better define the nature and extent of contaminants identified during the July 1991 baseline field effort. Two of these samples were collected upstream of Tinker Air Force Base to establish background conditions. In May 1992, surface water samples were re-collected from 7 of the 11 locations sampled in February 1992, to monitor seasonal variations in contaminant release.

The sediment samples collected in July 1991 and February 1992 at Crutcho Creek did not contain significant quantities of organic compounds. Two of 18 samples collected from Crutcho Creek contained detectable concentrations of semi-volatile organics. Inorganics were detected at low levels in all sediment samples in Crutcho Creek and included arsenic, barium, chromium, copper, lead, vanadium, and zinc. These inorganics were also detected in the two background samples collected from Crutcho Creek upstream and off of Tinker Air Force Base. The surface water in Crutcho Creek did not contain significant quantities of organic compounds. The inorganics detected in the surface water included: arsenic, barium, calcium, cobalt, lead, magnesium, mercury, sodium, and zinc.

The sediment samples collected from Kuhlman Creek in July 1991

and February 1992 did not contain significant quantities of organic compounds. One sediment sample contained a polychlorinated biphenyl, Aroclor-1260, at detectable concentrations in July 1991 and February 1992. Only one sediment sample contained detectable levels of semi-volatile organics, primarily low level polynuclear aromatic hydrocarbons. Inorganics were detected at low levels in all sediment samples from Kuhlman Creek: arsenic, barium, chromium, copper, lead, vanadium, and zinc. The surface water in Kuhlman Creek did not contain significant quantities of organic compounds. The inorganics detected in the surface water in Kuhlman Creek included: arsenic, barium, calcium, cobalt, lead, magnesium, mercury, sodium, and zinc.

The information generated from the baseline and confirmation data collection activities was used to perform a risk assessment based on current U.S. Environmental Protection Agency guidelines. The objective of this assessment was to determine whether the sediments and/or surface waters in Crutcho and Kuhlman Creeks or the tributaries of Elm Creek at Tinker Air Force Base present any unacceptable public health or environmental risks. The results of the risk assessment for surface water and sediment scenarios did not indicate any unacceptable carcinogenic or noncarcinogenic risks associated with the designated beneficial uses of Crutcho and Kuhlman

Creeks or tributaries of Elm Creek.

Based on the low levels of organic and inorganic compounds detected and the resulting risk assessment, no further action is required.

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LIST OF ACRONYMS

BTX	Benzene, Toluene, Xylene
COE	U.S. Army Corps of Engineers
1,1-DCA	1,1-Dichloroethane
1,2-DCE	1,2-Dichloroethene
FS	Feasibility Study
FPC	Federal Programs Corporation
GC	Gas Chromatograph
HARM	Hazardous Assessment Rating Methodology
IRP	Installation Restoration Program
IWTP	Industrial Waste Treatment Plant
MCL	Maximum Contaminant Limit
NCP	National Contingency Plan
NPL	National Priorities List
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RWDS	Radioactive Waste Disposal Site

SARA	Superfund Amendments and Reauthorization Act
SWMU	Solid Waste Management Unit
SWTP	Sanitary Waste Treatment Plant
TAFB	Tinker Air Force Base
TCA	Trichloroethane
TCE	Trichloroethene
UST	Underground Storage Tank

1.0 INTRODUCTION

The report consists of summaries of all available hydrogeologic and environmental investigations conducted at Tinker Air Force Base (TAFB) in Oklahoma City, Oklahoma. The U.S. Air Force Installation Restoration Program (IRP) for TAFB began in 1981, and numerous remedial investigations, feasibility studies, and response actions have been conducted since that time.

This summary was prepared to meet certain requirements of the TAFB Resource Conservation and Recovery Act (RCRA) permit. Specifically, this summary report was prepared to comply with Section VI (RCRA Facility Investigation Scope of Work), Task I (Description of Current Conditions), Part C (Special Permit Conditions), Item 4 (Identification and Summary of Previous Studies) of the TAFB RCRA permit (U.S. EPA, 1991). Item 4 specifies that the permittee shall develop a reference for all known geologic, hydrogeologic and environmental studies previously performed at the facility, with a summary of the scope of the study, and significant findings thereof. This reference must include an identification of all aquifers beneath the facility and how they are interconnected; the location on one map of all ground-water monitoring wells and the aquifer each well is monitoring; and a description of the horizontal and vertical extent of all plumes of contamination. Additionally, information was requested on wastewater the sanitary sewer lift station, Building 1030 manages; list of underground storage tanks including their location, date of construction, results of pressure tests, identify all tanks where leaks have been detected, and any corrective actions undertaken; and documentation of the integrity of the below-ground industrial wastewater sewer system.

In addition to developing individual summaries of each investigation performed at TAFB, an overall summary of hydrogeologic conditions and contaminant plumes was developed based on all the investigative reports which were reviewed. This summary, contained in Appendix T, is basically a general conceptual model of current hydrogeologic and environmental conditions at TAFB as interpreted by the U.S. Corps of Engineers (COE). The discussion is based on work conducted by the COE, and no additional interpretation was performed.

2.0 BASEWIDE INVESTIGATIONS

Sections 2 and 3 present the individual summaries of all available hydrogeologic/ environmental reports for TAFB. A total of 32 reports (7 basewide and 25 site-specific) was reviewed and summarized. The summaries include a description of the purpose of the particular investigation, a brief background of the site(s) being investigated, a description of the work performed by the investigation, presentation of results, and, where available, discussion of conclusions and recommendations made in the report. The summaries are organized both chronologically and by location in order to best present the investigations which have been conducted. Section 2 presents the basewide investigations. The remaining 25 summaries are presented in Section 3 by location or site, in chronological order within each location/site.

Many of the summaries refer to data tables and figures which are presented in Appendices A-S. These tables and figures were taken directly from the individual reports and were not modified in any way except to include a title, if necessary. Units for chemical parameters are discussed in the summaries as originally reported in each report.

In addition to developing individual summaries of each investigation performed at TAFB, an overall summary of hydrogeologic conditions and contaminant plumes was developed based on all the investigative reports which were reviewed. This summary, contained in Appendix T, is basically a general conceptual model of current hydrogeologic and environmental conditons at TAFB as interpreted by the U.S. Corps of Engineers (COE). The discussion is based on work by the COE, and no additional interpretation was performed.

2.1 INSTALLATION RESTORATION PROGRAM PHASE I - RECORDS SEARCH, ENGINEERING - SCIENCE, APRIL 1992

Report Title: Installation Restoration Program Phase I - Records Search, Tinker Air Force Base, Oklahoma. Final Report, April 1982.

This report was the first step in the environmental site assessment for TAFB. The Records Search was performed in 1981. The report describes the following characteristics of Tinker:

Installation Description: Size, boundaries, organization, mission, history, past shop and base activities concerning waste disposal and pollutant releases.

Geography: Topography, drainage, surface soils, weather data summary.

Geology: Stratigraphic summary table describing the Permian and Quaternary formations beneath Tinker, a map indicating the distribution of the formations, and cross-sections showing the geologic stratigraphy and structure beneath Tinker.

Hydrology: Descriptions of the shallow (perched) and Garber-Wellington aquifers, maps indicating monitor well locations (circa 1982).

Evaluation of Base Facilities: Using a Hazardous Assessment Rating Methodology (HARM), 14 base installations were rated as contamination sources. This list did not include Building 3001.

The Phase I methodology involved interviews with base personnel; file searches; interviews with regulatory agencies; and site inspections. The objectives of the interviews were to gather all information on past and present waste generation, handling, storage and disposal practices at TAFB. As a result, 14 disposal sites were identified as containing hazardous wastes on TAFB. These sites were then assessed using the HARM. The sites included Landfills 1 through 6,

Industrial Waste Pits 1 and 2, radioactive waste disposal sites, and Fire Training Areas Numbers 1 and 2.

The report concluded that sites having a high potential for contaminant migration were Landfill 4, Industrial Waste Pit No. 2, and Landfill 2. Sites determined to have a moderate potential for contaminant migration included Industrial Waste Pit No. 1, Landfills 3, 5, and 6, radioactive waste site 1030W, and Fire Training Area No. 1. Landfill 1, Fire Training Area No. 2, and radioactive waste disposal sites 1022E, 62598, and 201S were determined to have a low potential for contaminant migration. The report recommended that geophysical surveys be conducted at Landfills 3, 4, 5, and 6; Industrial Waste Pits 1 and 2; and Fire Training Area No. 1. The report also recommended that additional ground-water monitoring be conducted at Landfills 2, 3, 4, 5 and 6; and that soil borings be drilled in and around the waste pits and Fire Training Area No. 1. With respect to Soldier Creek, the report recommended only that sediment samples be taken in Phase II.

2.2 INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/ QUANTIFICATION - STAGE 1, RADIAN CORPORATION, SEPTEMBER 1985

Report Title: Installation Restoration Program Phase II - Confirmation/Quantification - Stage 1. Final Report, September 1985.

This report presents the results of IRP Phase II, Stage 1 investigations conducted between November 1983 and March 1984. Of the 14 sites identified in the Phase I records search, eight were studied in Phase II. These included Landfills 1 through 6, Industrial Waste Pits 1 and 2, and the base water supply wells and wells within Building 3001. The purpose of the IRP investigation is to determine if environmental contamination has resulted from solvent storage and waste disposal practices at TAFB. Stage 1 investigations included installation and sampling of 11 wells, sampling of eight existing wells, electromagnetic surveys, coring and soil sampling of two waste disposal sites, sampling of 20 base water supply wells, and investigation of

trichloroethene (TCE) contamination (discovered previously by a TAFB monitoring program in the summer of 1983) in two Building 3001 water supply wells.

Stage 1 investigations confirmed the existing conceptual hydrogeologic model of the site. The areas were found to be underlain by shale and sandstone. Zone 1 (Landfills 1 - 4) and Zone 2 (Landfills 5 and 6) ground-water sampling results are summarized in tables from the report presented in Appendix A. These data show that the landfills have had a limited impact on ground water. However, data collected by the State of Oklahoma for the same wells (analyzed by different analytical methods) and presented in the report show that chlorinated volatile organic compounds may be very important contaminants at these sites.

Zones 3 and 4 (Industrial Waste Pits 2 and 1, respectively) soil and ground-water sampling results are also summarized in tables from the report presented in Appendix A. The geophysical survey was able to identify a well-defined waste disposal area for Industrial Waste Pit 2. However, this was not the case for Industrial Waste Pit 1, which appeared to be a more diffuse waste disposal area. Soil sampling results showed both pit areas to be high in metals and organic contaminants. No contaminants were detected in ground water at Industrial Waste Pit 2 (although contaminants were detected in Well 3G completed in the waste material in the pit) and only limited ground-water contamination was observed at Industrial Waste Pit 1. However, State of Oklahoma data for the same wells (analyzed by different analytical methods) again showed that chlorinated organic compounds may be important at Waste Pit 1.

Results of sampling the base water supply wells (including well 18 located in Building 3001) are summarized in Appendix A on a table from the report. TCE and other organic contaminants were detected in Well 18. Traces of organic contaminants were observed in other supply wells located in the vicinity of Building 3001.

Specific recommendations made in the report were to investigate hydrogeologic conditions and contaminant occurrence near Building 3001 and Landfill 6; to investigate the occurrence of

volatile hydrocarbons and aromatics in all monitoring wells by chemical analysis using EPA methods 601 and 602; and to investigate ground-water quality along Crutcho Creek.

2.3 INSTALLATION RESTORATION PROGRAM PHASE II - CONFIRMATION/ QUANTIFICATION - STAGE 2, RADIAN CORPORATION, OCTOBER 1985

Report Title: Installation Restoration Program Phase II - Confirmation/Quantification - Stage 2. Final Report, October 1985.

This report presents the results of IRP Phase II, Stage 2 investigations conducted between June and October 1984. In Stage 1, eight sites (six landfills and two industrial waste pits), base water supply wells, and Building 3001 wells were investigated. Stage 2 involved continued investigation of Landfill 6 and Building 3001. As part of the Stage 2 investigation, 13 wells were installed near Building 3001 and Landfill 6. Twelve wells (11 new and one existing) were sampled two times and analyzed for organic contaminants; sediment samples were collected for chemical analysis from base streams and drainages; a survey for buried pits and tanks in Building 3001 was conducted; geophysical surveys were conducted to locate two radiological waste storage sites; and water level elevations were measured in base supply wells in Stage 2.

The report indicates that Building 3001 investigations confirmed the existing conceptual hydrogeologic model of the site. The area was found to be underlain by shale and sandstone. The depth to ground water ranged from 35 to 85 feet in the Regional aquifer, with flow toward the southwest. A downward gradient was observed between monitoring wells completed in the shallow part of the Regional aquifer and supply wells completed deeper in the Regional aquifer.

The results of ground-water sampling at Building 3001 are summarized in a table from the report presented in Appendix B. Elevated concentrations of TCE were observed in wells 6A and 6B located east of Building 3001. Benzene and toluene were detected in Well 6G located southwest of the building. Organic contaminants were detected both upgradient and downgradient of Building 3001, the presumed source of contamination. It was concluded in the report that the

origin of the contaminants is not a single, defined source, but rather the cumulative result of 30 years of industrial operations in the building and vicinity.

Landfill 6 investigations also confirmed the existing conceptual hydrogeological model of the site. The area was found to be underlain by the same strata, but with more discontinuous shale lenses. A perched ground-water system was found to exist in this area above the Regional aquifer on top of the shale lenses.

The results of ground-water sampling at Landfill 6 are summarized in a table from the report presented in Appendix B. Well 2A, located just south of the landfill, showed elevated concentrations of TCE, 1-1-dichloroethane (1,1-DCA), and tetrachloroethene (PCE). Well 7F, located north of the landfill, showed elevated concentrations of chloromethane, vinyl chloride, and chloroform. It was concluded in the report that contaminated ground water north of the landfill (and presumably upgradient) was the result of localized flow in the perched system.

Limited contamination was observed in stream sediment samples. Elevated manganese concentrations were observed on Khulman creek near Arnold Street. Cadmium and nickel were found to be elevated on West Soldier Creek south of I-40. Cadmium, lead, zinc, chromium, and nickel were elevated in samples from Soldier Creek. Chromium and lead were observed to be elevated on the Elm Creek tributary. These results are summarized in Appendix B in a table from the report.

The geophysical survey was able to locate radioactive waste disposal site 1022E, but was not able to identify site 62598. The water elevation survey for the base supply wells was not conclusive, apparently due to effects of pumping the wells. The general trend of flow was determined to be from east to west. Water levels in these wells were observed to be 100 to 200 feet lower than in monitoring wells completed in the upper part of the Regional aquifer, indicating a large downward hydraulic gradient in the aquifer.

The report recommended that no further actions were necessary for the radioactive waste disposal sites, base supply wells, or stream sediments. Additional investigations to fully describe and quantify conditions were recommended for buried pits and tanks in Building 3001. The actions recommended were to collect and analyze samples of the contents of selected pits and tanks in Building 3001. Further, the report recommended that remedial action begin for Building 3001 ground water, and that additional monitoring wells be installed near Landfill 6. Finally, the report recommended that additional studies be conducted on the base streams after the investigations on the nearby sites are completed.

2.4 INVESTIGATION OF UNDERGROUND TANKS, A.L. BURKE ENGINEERS, INC., SEPTEMBER 1987

Report Title: Investigation of Underground Tanks, Tinker Air Force Base. Final Report, September 1987.

This report presents the results of a 1985 investigation of abandoned and active underground storage tanks on TAFB. The purpose of the study was to locate underground storage tanks, and to collect and analyze samples of soil and ground water from areas adjacent to abandoned tanks to determine if contamination existed due to tank leakage. The work included a geotechnical investigation of 72 tanks that have been abandoned, were scheduled to be abandoned, or were not in use. Soil, fuel and ground-water samples were collected and analyzed from near the various tanks. Twenty-five monitoring wells were installed at tank areas on TAFB. These areas included the Fuel Farm, the Southwest Tanks area, and the North Tanks area. Based on the results, an environmental risk assessment model was developed to prioritize remedial actions.

The investigation identified and located 88 active tanks, plus and additional 38 abandoned tanks not on the original list of 72. Tanks were identified and located through a review of available plans and drawings, as well as by interviews with base personnel. Most tanks were located near Building 3001 and in the north central part of the base (Fuel Farm). The major contaminants

found in soils and ground water were benzene, toluene, xylene, and solvents. The soils and ground-water results are presented in tables from the report contained in Appendix C.

The most severe contamination of soils and ground water (in the perched aquifer) was located at the Fuel Farm near Building 290; in the Southwest Tanks area; in the North Tank area; in the area southwest of Buildings 203 and 201; and in the area southwest of Building 214. Floating product was identified in the North Tank area and at the Building 290 Fuel Farm. Both fuel and solvents were identified in the Southwest Tanks area.

The report made recommendations for properly abandoning unused tanks, and also recommended additional characterization of the nature and extent of ground-water contamination. Specifically, the report recommended installing and monitoring 24 wells. Finally, the report recommended recovery of the floating fuel product in the North Tank area and Fuel Farm.

2.5 SOIL - GAS INVESTIGATIONS, EPA/EMSLLV, 1987

Report Title: Soil-Gas Investigations, Tinker Air Force Base.

Two soil-gas surveys were conducted in the fall of 1986 at Tank Farm 290. One survey utilized a passive adsorbent charcoal method and the other utilized an active sampling method (soil gas removed under negative pressure). The purpose of the investigation was to test and evaluate an indirect method of detecting and mapping ground-water contamination.

The surveys were conducted over a ground-water contaminant plume (hydrocarbons) of known dimensions and concentrations in order to compare soil-gas measurements to the ground-water data. The study concluded that the two survey methods sampled different horizons (charcoal - near surface, active method - slightly deeper) and therefore obtained different results. The active method was found to be the method more representative of ground-water contamination, as results compared well with the ground water contaminant concentrations measured with an on-site gas chromatograph (GC).

Included in the report are maps showing the depth to water table and ground-water flow direction in the area of Tank Farm 290. Plume maps for benzene, toluene, and total hydrocarbons in perched ground water at Fuel Farm 290 are presented in figures from the report contained in Appendix D.

Several recommendations were made in this report. Further research of the passive technique was recommended including investigation of optimum sampling depth and effects of soil type on sampling success. It was also recommended that studies be performed to compare soil-gas sample results with ground-water analyses performed in an analytical laboratory (instead of those performed using an on-site GC).

2.6 GROUNDWATER ASSESSMENT, U.S. ARMY CORPS OF ENGINEERS, 1987

Report Title: Tinker Air Force Base Groundwater Assessment.

This report presented the results of the initial ground-water assessment conducted for Tinker Air Force Base. The assessment was performed in support of developing a long-term regional ground-water monitoring plan for TAFB. Twenty-five monitoring wells were installed along the base perimeter. Sixty-one wells were sampled for metals and organic compounds between May and November 1986, including the newly-installed perimeter wells, off-base wells, and base supply wells.

Contamination by volatile organic compounds was observed in deep water supply wells located near Building 3001 and in several perimeter wells located in the northwestern section of the base. Detected concentrations of organic compounds are summarized in Appendix E in a table taken from the report. Specifically, TCE was observed at: 7 to 18 ug/l in well 52B completed in the perched aquifer located in the north-central part of the base; 1.6 to 3 ug/l in several wells (40A and 40B) completed in the Regional aquifer in the northwest corner of the base; and 0.7 to 1.9 ug/l in deep base supply wells 15 and 16 located near Building 3001. (The shallower ground

water in the vicinity of Building 3001 is highly contaminated by organic compounds.) No contamination was found in off-base wells.

The report recommended a long-term regional ground-water monitoring plan for the purpose of continued assessment of ground water contamination be implemented. Specific recommendations included the installation of additional perimeter wells in the perched and Regional aquifers, and quarterly sampling of all perimeter wells for one year, followed by semi-annual sampling for one year at which time sampling frequency would be re-evaluated. Analytical parameters recommended included metals and organic compounds.

2.7 GROUNDWATER ASSESSMENT UPDATE, U.S. ARMY CORPS OF ENGINEERS, 1989

Report Title: Tinker Air Force Base Groundwater Assessment Update.

This report presented the results of an additional four quarters of ground-water sampling conducted in support of the continued ground-water assessment at TAFB. Eight additional perimeter wells were installed and added to the monitoring program. Pesticides, PCBs, radionuclides, cyanide and oil and grease analyses were dropped from the original parameter list as they were not detected in the initial sampling round. Samples were collected in the winter of 1987 and 1988, spring 1988, summer 1988, and fall 1988 from perimeter wells, off-base wells, and base supply wells.

Detected concentrations of organic compounds are summarized in a table from the report presented in Appendix F. Contamination by volatile organic compounds was consistently observed in well 52B (TCE ranged from 12 to 27 ug/l), completed in the perched aquifer near Khulman Creek in the north-central part of the base, and observed once in deep water supply wells 15 and 16, located near Building 3001 (TCE ranged from 0.9 to 1.7 ug/l).

Benzene was detected once each in perched aquifer wells 22B and 23B (2.4-2.5 ug/l) located along Soldier Creek in the north eastern part of the base. Benzene (110 ug/l) and toluene (22 ug/l) were also detected once in Regional aquifer well 22A, also located along Soldier Creek. These one-time detections occurred during the same sampling round in October 1987. TCE was also detected in September 1988 in Regional aquifer well 22A at 6 ug/l. TCE and toluene were detected in September 1988 and November 1987, respectively, in Regional aquifer well 24A located on the eastern boundary of the site.

The report concluded that no contamination appears to be migrating off TAFB in ground water. The report recommended that the monitoring program (consisting of semi-annual sampling) be continued.

3.0 SITE-SPECIFIC INVESTIGATIONS

This section presents summaries of the site-specific investigations (basewide investigations are provided in Section 2). The summaries are organized by location and chronologically within each location.

Many of the summaries refer to data tables and figures which are presented in Appendices A-S. These tables and figures are taken directly from the individual reports and were not modified in any way except to include a title, if necessary. Units for chemical parameters are discussed in the summaries as originally reported in each report.

3.1 BUILDING 3001 REMEDIAL INVESTIGATIONS, U.S. ARMY CORPS OF ENGINEERS, JANUARY 1988

Report Title: Building 3001 Remedial Investigations. Final Report, January 1988.

This report presents the results of the Building 3001 remedial investigation conducted in 1986 and 1987 after initial IRP investigations were completed. The purpose of the remedial investigation (RI) was to evaluate the nature and extent of contamination associated with Building 3001 in support of evaluation of remedial alternatives in the feasibility study (FS). The RI included an inventory of: abandoned solvent pits in the building, installation of 73 monitoring wells, sampling of ground-water monitoring wells, aquifer testing, and development of a numerical ground-water flow and transport model. Previous RI work at the building, also summarized in this report, included: earlier IRP investigations, an initial investigation by the COE of 64 abandoned pits in a fire-damaged portion of the building, underground storage tank (UST) investigations in two tank areas, and plugging of base supply wells 18 and 19.

The Building 3001 site includes the building and two adjacent underground storage tank areas (North Tanks area and Southwest Tanks area). The building is used for aircraft maintenance and repair. Ground water beneath the facility is contaminated by solvents (primarily TCE), metals, (primarily chromium), and fuel-related compounds (benzene, toluene, xylene). The site is on EPA's National Priorities List (NPL). Subsurface contamination occurred by leakage from degreasing and paint stripping pits and trenches, leakage from tanks, leakage from storm drains, spills, and discharge of solvents and wastewaters into storm drains leading to Soldier Creek.

The building is underlain by interbedded sandstones, siltstones, and shales of the Garber-Wellington Formation. Four ground-water zones were identified beneath the building during the RI. From shallowest to deepest, these zones are: 1) the perched aquifer zone, an unconfined aquifer located 15 to 30 feet below ground surface; 2) the shallow Top of the Regional aquifer zone, a semi-confined aquifer located 50 to 80 feet below ground surface; 3) the deeper Regional aquifer zone, a confined aquifer located 110 to 175 feet below ground surface; and 4) the deep

Producing zone, the deep zone of the regional Garber-Wellington aquifer located from 250 to 700 feet below ground surface from which ground water is pumped for drinking water at the base. The perched aquifer zone was determined in the RI to be mounded beneath the building from leaky storm drains and recharge from West Soldier Creek. Flow in the Top of the Regional aquifer and underlying Regional aquifer zones was found to be toward the southwest. The vertical gradient between the various zones was determined to be generally downward.

The continued investigation of abandoned pits in Building 3001 located 23 additional pits, with TCE detected in the contents of three pits and trichloroethane (TCA) in one pit. (In an earlier pit inventory, TCE had been detected in one pit and metals were observed in two pits.) The ground-water investigation showed extensive contamination beneath the building, primarily by TCE and chromium. The magnitude of contamination was found to be greatest in the perched aquifer with contaminant concentrations decreasing with depth. The TCE and chromium plume was found to cover about 220 acres and to be confined to the upper 175 feet of stratum below land surface. Benzene, toluene, and xylene were found in ground water beneath the tank areas. Low levels of TCE were found in two deep supply wells (wells 15 and 16). It was concluded in the report that the poor condition of supply wells 18 and 19 (now plugged) located in the building allowed for vertical migration of contaminants from shallow zones to the producing zone.

The perched aquifer was found to be contaminated by solvents, metals and fuels. Highest concentrations of contaminants were found beneath the building and in the two tank areas. Primary contaminants were TCE and chromium, and to a lesser degree, 1,2-dichloroethene (1,2-DCE), PCE, acetone, toluene, benzene, xylene, lead, nickel, and barium. A separate phase fuel product plume (estimated to be about 6,000 to 12,000 gallons) was observed in the North Tanks area. TCE concentrations in the perched aquifer were reported to range from 350,000 micrograms per liter (ug/l) beneath the building to 5 ug/l at the plume limits. The TCE, chromium, benzene, toluene, and xylene plumes in the perched aquifer are illustrated in figures from the report presented in Appendix G. Contaminants detected in the perched aquifer are summarized in a table from the report also included in Appendix G.

The Top of the Regional aquifer was found to be contaminated by solvents and metals. Contaminant concentrations were generally lower in this zone compared to the perched zone. The primary contaminants were TCE, PCE, 1,2-DCE, and chromium. These contaminants, plus chlorobenzene and vinyl chloride, were also detected northeast (upgradient) of the building. Because the chlorobenzene and vinyl chloride were detected upgradient of the building, they were speculated in the report to be due to another source. The maximum concentration of TCE was reported to be 30,000 ug/l beneath the building. The TCE and chromium plumes in the Top of the Regional aquifer are illustrated in figures from the report presented in Appendix G. Contaminants detected in this zone are summarized in Appendix G in a table from the report.

The same contaminants were found in the deeper Regional aquifer as were found in the Top of the Regional aquifer, but at even lower concentrations, and primarily beneath the north section of the building. Contaminants detected in this zone are summarized in a table from the report included in Appendix G. Toluene was also found in this zone in the Southwest Tanks area.

Soil samples were collected from eight borings drilled in the northern part of the building adjacent to abandoned pits. These analyses are summarized in Appendix G in a table from the report. In the North Tanks area, soil samples were collected from one boring location for analysis. Low concentrations of metals were detected, and fuel oil and diesel were identified. These analyses are also summarized in tables from the report presented in Appendix G. Maximum concentrations occurred at a depth of 24 to 33 feet below land surface. Soil contamination was also observed in shallow soils in the Southwest Tanks area.

The report recommended that annual ground-water sampling and analysis be conducted at the site. Quarterly sampling was recommended for a select group of wells. The report also recommended that fuel product be recovered from the water table in the North Tanks area, and that the contents of four abandoned pits in Building 3001 be removed. Finally, further ground-water investigations were recommended northeast of the building in the area of the Industrial Waste Treatment Plant (IWTP) to investigate the possibility of a separate, different source of contamination to the Top of the Regional aquifer zone.

3.2 RISK ASSESSMENT OF THE BUILDING 3001 SITE, U.S. ARMY CORPS OF ENGINEERS, AUGUST 1988

Report Title: Risk Assessment of the Building 3001 Site. Final Report, August 1988.

This report presents the baseline assessment of the public health threat posed by chemical releases from Building 3001 to the Regional ground-water aquifer. Health risks were characterized for both carcinogens and non-carcinogens. The chemicals selected for the evaluation were benzene, TCE, PCE, barium, chromium, lead and nickel. These chemicals were identified as posing the greatest risk to public health.

Identified pathways included ground and surface water. Exposure concentrations were estimated using ground water and air diffusion models. Estimates of human intakes were developed from the predicted exposure concentrations and used to develop carcinogenic and non-carcinogenic risks.

For non-carcinogenic risks, the risk assessment showed that short-term health effects were unlikely from consumption of ground water, but long-term effects from consumption of ground water or fish from Soldier Creek may occur. The carcinogenic risk posed by benzene, TCE, and PCE in ground water was estimated to be 1.2×10^{-5} or one additional incidence of cancer per 83,000 people.

3.3 BUILDING 3001 SUPPLEMENTAL QUARTERLY REMEDIAL INVESTIGATION, U.S. ARMY CORPS OF ENGINEERS, AUGUST 1989

Report Title: Building 3001 Supplemental Quarterly Remedial Investigation. Draft Report, August 1989.

This report presents the results of the supplemental Building 3001 Remedial Investigation. It presents all site data collected between January 1988 and August 1989. The supplemental RI

included the collection of soil samples from inside the building, installation of a new well cluster, sampling of ground-water monitoring wells, and plugging of supply well 17.

Three soil borings were located in the northern part of the building over the location of the highest contaminant concentrations in ground water. The results of the soil analyses are summarized in Appendix H in a table from the report. The highest TCE concentration was observed 15 to 20 feet below ground surface, and no organic contaminants were detected above 10 feet below ground surface.

An additional monitoring well cluster was installed to the southwest of Building 3001. The building well network (which reportedly consists of approximately 100 wells) was sampled on various schedules (quarterly for some wells, annually for others) during the time period of the supplemental RI. The results are summarized for the various aquifers in tables from the report included in Appendix H.

The contaminant plumes showed little change in shape and size, except to be spreading in the directions of ground-water flow (radially for the perched aquifer, and to the southwest for the lower Regional aquifer zones). The report indicates that some wells showed order of magnitude increases in contaminant concentrations between 1986 and 1989 samplings. TCE was reported to increase from 18,000 ug/l to 190,000 ug/l at monitoring well 33A, and from 370 ug/l to 3,700 ug/l at monitoring well 17, both in the perched aquifer. TCE increased from 6,900 ug/l to 32,000 ug/l in well 32B, located in the Top of the Regional aquifer. Finally, TCE was reported to increase from less than 5 ug/l to 110 ug/l in monitoring well 34D located in the Regional aquifer. The report also discusses decreases in contaminant concentrations at some wells between 1986 and 1989 samplings. TCE concentrations were reported to decrease by 50 percent in wells 33B and 34B. The chromium concentration in well 34C was reported to decrease from 1200 ug/l to 20 ug/l, and well 34D was reported to decrease from 440 ug/l to 20 ug/l. The most recent TCE plume maps (FY89) for the three aquifer zones are presented in figures from the report contained in Appendix H.

The report recommended that wells outside of Building 3001 be sampled annually and the wells inside the building be sampled semi-annually.

3.4 BUILDING 3001 FEASIBILITY STUDY, U.S. ARMY CORPS OF ENGINEERS, AUGUST 1989

Report Title: Building 3001 Feasibility Study. Report, August 1989.

A feasibility study was conducted in 1988 and 1989 to identify, evaluate, and compare alternatives for remediation of contaminated ground water at Building 3001. The alternatives developed and considered involved the collection, treatment, and disposal of contaminated ground water at the building. Two alternatives for ground-water removal/collection were developed and evaluated in detail: extraction from only exterior wells; and extraction from both exterior and interior wells. Four alternatives for treatment and disposal were considered and subject to detailed analysis:

1. use of the existing Industrial Waste Treatment Plant (IWTP) to treat the ground water (with modification for air stripping) with industrial reuse of the treated water,

2. use of the existing IWTP with discharge to Soldier Creek,

3. construction of a new treatment plant to treat the ground water with industrial reuse of the treated water, and

4. construction of a new treatment plant with discharge to Soldier Creek.

A no-action alternative was also developed and retained for detailed analysis, as required by the NCP and SARA. Finally, six management control alternatives were also developed and evaluated in the FS. Following initial screening, a numerical rating scheme was used to perform the detailed evaluation of alternatives. In the detailed evaluation, alternatives were evaluated based on engineering feasibility, public health impacts, environmental impacts, institutional requirements, and cost.

Since no demand has been identified for industrial reuse of the treated water, the alternatives involving the industrial reuse option were deemed to be technically infeasible. The various alternatives were found to be relatively indistinguishable from one another based on the criteria of public health impact, environmental impact, and institutional requirements. The cost evaluation showed that alternatives involving the use of a modified IWTP have significantly lower costs than the alternatives involving construction of a new treatment plant.

Due to uncertainties associated with future IWTP load conditions, discharge compliance considerations, and the results of other ongoing studies, an alternative for ground-water treatment and disposal was not recommended in the report.

3.5 BUILDING 3001 PROPOSED PLAN, U.S. ARMY CORPS OF ENGINEERS, 1990

Report Title: Building 3001 Proposed Plan.

The proposed plan describes options for remediating ground-water contamination under Building 3001 at TAFB. Three alternatives for ground-water collection were evaluated, and four alternatives for ground-water treatment and disposal were considered. The preferred alterative would involve pumping of ground water by both exterior and interior wells and treatment of the ground water at a newly constructed treatment facility by air stripping and metals precipitation processes. The treated water would be reused in base industrial operations.

3.6 BUILDING 3001 RECORD OF DECISION, U.S. ARMY CORPS OF ENGINEERS, 1990

Report Title: Building 3001 Record of Decision.

The Record of Decision (ROD) for Building 3001 addresses ground water beneath Building 3001, pit Q-51, and the North Tank area. The ROD includes: discussions of the site background and contamination; a summary of the risk assessment; a description of the remedial alternatives

considered; a summary of the comparative analysis of alternatives; a description of the selected remedy; a responsiveness summary; and an index for the administrative record for the site.

The selected alterative for ground water involves collection, treatment and disposal of the contaminated ground water. Ground water will be extracted from both exterior and interior wells from the perched, Top of the Regional, and Regional aquifer zones. A new treatment facility will be constructed to treat the ground water, and treated water will be reused in base industrial operations.

The selected alterative for pit Q-51 involves removal and disposal of its contents, and cleaning and backfilling of the pit.

The selected alternative for the North Tank area includes: recovery and disposal of fuel product from the water table; treatment of the ground water at the new treatment facility; extraction of vapors from surrounding soils; and removal and closure of tanks.

The actions for pit Q-51 and the North Tank area are considered interim. The actions for ground water are considered final.

3.7 SOIL VENT TEST REPORT - NORTH TANK AREA, BUILDING 3001, GROUNDWATER TECHNOLOGY INC., AUGUST 1989

Report Title: Soil Vent Test Report - North Tank Area, Building 3001. August 1989.

This report presents the results of a soil vent pilot test conducted in the North Tank area. The test was conducted in July 1989 to refine the design specifications developed for an in-situ soil vent system to be installed in the North Tank area. The test was designed to determine the effective radius of influence generated from a single vapor extraction well and to determine if the adsorbed hydrocarbons in the unsaturated zone could be effectively vented from the subsurface.

Three, two-inch diameter PVC wells were used for the test (one extraction well and two observation wells, located from 20 to 50 feet part). Soil gas was extracted and vented to the air using an extraction pump, and pressure changes were monitored in the observation wells. An organic vapor detector was used to monitor effluent concentrations being vented from the extraction well. The test was conducted for 255 minutes at extraction flow rates varying from 20 to 100 percent of the extraction pump capacity.

The test results suggested that only a limited effective radius of influence was generated by the extraction well - less than 20 feet. The soils were found to be less permeable than originally anticipated. The results also showed that flow rates must remain elevated (near 100 percent of blower capacity) to effectively vent the fuel vapors from the unsaturated zone. This is due to the lower volatility of the types of fuels (fuel oil and diesel) present in the subsurface.

As a result of this test, the original design of the soil vent system was modified to utilize extraction trenches rather than individual well points. The modified design presented in the report involves using horizontally positioned monitoring well screens backfilled in narrow trenches. Lateral trenches were chosen to increase the radius of influence from an individual location and provide the overall radius of influence needed to effectively vent the area of concern.

3.8 NORTH TANK FARM ADSORBED PHASE, REMEDIAL DESIGN, GROUNDWATER TECHNOLOGY, INC., SEPTEMBER 1989

Report Title: North Tank Farm Adsorbed Phase, Remedial Design. September 1989.

This report outlines a soil vent system design for the North Tank farm at TAFB. This design addresses the second phase of the remediation for the North Tank farm, which is remediation of the residual product adsorbed to the soil in the unsaturated zone. (The first phase is recovery of the free phase product from the subsurface.)

Two approaches to the design were initially considered:

1. extraction by multiple well points located on 20-foot centers

2. extraction by trenches placed on 50- to 60-foot centers.

Both original approaches were found to have significant drawbacks with respect to cost and implementability. Thus, a modified design was presented in the report involving the use of horizontal extraction wells. In this design, Building 3001, pipelines, and utilities would not be an obstruction to the desired access. The report concluded that this design has the potential to offer a substantially improved rate of remediation compared to vertical well points because the generated air sweep can be directed across the most highly contaminated zone present as a horizontal plane near the water table surface.

No specific recommendations were made in the report.

3.9 NORTH TANK AREA (NPL SITE) OPERABLE UNIT TO B3001 DESIGN SUMMARY REPORT, U.S. ARMY CORPS OF ENGINEERS, MARCH 1990

Report Title: North Tank Area (NPL Site) Operable Unit to B 3001 Design Summary Report. Final Report, March 1990.

This report presents a summary of the site remedial investigation and the options considered for interim remedial action. The North Tank area is an operable unit of the Building 3001 NPL site. The report also presents an interim remedial action design for the site.

The North Tank area Operable Unit is immediately north of Building 3001. Building 3001 is located in the northwest portion of Tinker Air Force Base, Oklahoma. The site covers approximately 16,400 square feet and contains three buried tanks: a 235,000-gallon fuel oil tank; an active 20,000-gallon diesel tank; and a 500 to 600-gallon storage tank. A 13,000-gallon

gasoline tank was removed in 1985. Due to leaking tanks, the area has a floating fuel plume on the perched ground-water table and fuel vapors in the soil. The perched ground-water aquifer is contaminated by dissolved-phase benzene, toluene, and xylene (BTX) plumes that are contained within the Building 3001 contaminant plume. Removal of the floating fuel product must be completed prior to implementing remedial action for the ground water.

Several different technologies were assessed during the selection process to determine the recommended interim remedial action for the site. These technologies included free-floating fuel removal, fuel vapor extraction, capping of the area, removal of fuel-contaminated soil, pumping and treating the contaminated ground water, and abandonment of the tanks. The action recommended in the report includes free-floating fuel recovery, vapor extraction, and tank abandonment. A hydrocarbon-only pump and a water-table depression pump will be used in conjunction to remove the floating fuel layer. The vapor phase fuel will be removed by a vapor phase extraction system with horizontal extraction borings. The inactive tanks will be abandoned, cleaned, demolished and backfilled when vapor recovery is complete. Extracted ground water will be treated by the Building 3001 ground-water treatment system.

Advance Final Design Analysis for this project was prepared by NOVA Engineering, Inc. (March 1990). Design specifications for this project were also prepared by NOVA Engineering (July 1990, two volumes).

3.10 POL FACILITY (FUEL FARM) EXPEDITED RESPONSE ACTION, U.S. ARMY CORPS OF ENGINEERS, APRIL 1988

Report Title: POL Facility (Fuel Farm) Expedited Response Action. April 1988.

This report presents recommendations for remedial action at the Fuel Farm. The facility was formerly an underground fuel storage facility, but is being converted to an above-ground storage site. Included in the report are the results of investigations conducted at the site, evaluations of the various alternatives considered, and the recommended remedial action plan.

The Fuel Farm is located in the north-central part of TAFB. It contains three abandoned groups of buried tanks containing motor fuel, JP-4 jet fuel, and avgas. The first group consists of five 18,000-gallon tanks buried four feet below ground surface. The second group consists of twelve 25,000-gallon tanks buried six feet below ground surface. These two groups of tanks were installed in 1942. The last group contains eight 25,000-gallon tanks also buried six feet below ground surface. This group was installed in 1952. Two major spills of 6,000 and 10,000 gallons occurred in 1979 and 1980, respectively. The Fuel Farm operated until 1986. The underground tanks have been cleaned and backfilled with sand and bentonite.

Preliminary investigations at the site were performed by A.L. Burke Engineers, Inc. in 1985 (See Section 2.4). A major plume of fuel was identified in the fuel farm area. The site was further investigated in 1986 by the COE. The purpose of the COE investigation was to characterize and define the extent of hydrocarbon and ground-water contamination in support of developing a remedial action plan. As part of this investigation, ten monitoring wells were installed along with additional temporary wells to determine the extent of the fuel plume (the temporary wells were grouted and backfilled after the investigation). The wells were sampled for chemical analysis. Soils were also sampled from soil borings made in the area.

Most of the Fuel Farm was found to be underlain by 40 feet of sandstone, in which was encountered a 7- to 9-foot thick shale bed. The shale was generally encountered from 10 to 20 feet below ground surface. To the extreme north and south, this shale bed was absent. Below the upper sandstone (and shale) was found a 15- to 20-foot thick confining shale unit. Below this shale was found another 30- to 35-foot thick sandstone. Ground water was encountered in a perched aquifer zone in the upper sandstone and in the Top of the Regional aquifer zone in the lower sandstone. Flow in the Top of the Regional aquifer zone was determined to be toward the southwest. The perched aquifer was found to be mounded below the tank area, with radial flow away from the tanks in all directions.

Fuel depths were found to vary from a few hundredths of a foot to more than four feet. A fuel isopach map from the report is included in Appendix I. A volume of approximately 50,000 gallons was estimated to be floating on top of the perched water table.

Groundwater samples from the perched aquifer were reported to be contaminated with benzene, toluene, and xylene in maximum concentrations of 8400, 890, and 2060 parts per billion (ppb), respectively. The plume of contaminated ground water was found to generally follow the shape of the fuel plume. Plume maps for benzene, toluene, and xylene from the report are presented in Appendix I. Barium, chromium, and lead concentrations were found in maximum concentrations of 6400, 260, and 190 ppb, respectively, greatly exceeding maximum concentration limits (MCLs). Metal concentrations are summarized in a table from the report contained in Appendix I.

The Top of the Regional aquifer zone was also found to be contaminated. Benzene was found in well 1A, located west of the fuel farm tanks at concentrations ranging from 113 to 582 ppb. Perched aquifer wells 1B and 1C showed very high concentrations of benzene and xylenes, ranging as high as 8400 and 224 ppb, respectively. The contamination in this area was postulated in the report to be due to another source because of its isolated occurrence west of the Fuel Farm, and will be investigated as part of the investigation of "Four Fuel Sites" near Buildings 201 and 214. Metals concentrations detected in the Top of the Regional aquifer zone are summarized in a table from the report included in Appendix I.

As a result of this investigation, an emergency interim action was instituted to remove the fuel from the subsurface. Two recovery wells began operating in June 1987. Two above-ground holding tanks were installed for temporary storage of fuel and contaminated water. The interim action also included abandonment of the underground tanks. Ground-water monitoring in the tank area for fuel-related compounds was also conducted during operation of the recovery system.

Permanent control measures were developed and evaluated in this report. Measures considered were those appropriate for a site which had been contaminated with fuel, but which had all the

free product removed from the water table (fuel would remain in the vadose zone and soluble fuel components would remain in the ground water). Following an initial screening of technologies for soils and ground water, four alternatives were developed and subjected to detailed evaluation. They were: 1) no further action; 2) limited ground-water pumping; 3) in-situ bioreclamation; and 4) enhanced vapor recovery from the unsaturated zone.

Soil control technologies considered during the initial screening included both excavation and removal of contaminated soil and enhanced vapor recovery. Because of safety hazards and high costs, excavation and removal of site soils was not considered in the detailed analysis of alternatives.

The recommended alternative presented in the report was limited ground-water pumping with treatment at the industrial waste treatment plant. The engineering feasibility of vapor recovery at this site was determined to be questionable and the cost not justified, thus this technology was not part of the recommended action.

3.11 POL FACILITY REPORT OF RECOVERY OPERATIONS - JUNE 1987 TO DECEMBER 1988, U.S. ARMY CORPS OF ENGINEERS, MARCH 1989

Report Title: POL Facility Report of Recovery Operations - June 1987 to December 1988. March 1989.

This report presents the initial results of operating the Fuel Farm fuel recovery system. The goal of the recovery operation is to eliminate a fuel product plume floating on the ground water beneath the Fuel Farm. The system began operating in June 1987 as an interim action for the site. The report presents fuel and ground-water recovery quantities, and the results of all ground-water monitoring.

The recovery system was modified in May 1988. One of the recovery wells was removed from operation due to low fuel production. Water discharge from the remaining recovery well was

diverted from an above-ground holding tank to an industrial waste treatment plant line. The fuel pump in the operating recovery well was replaced with an automated bailer. The fuel recovered from the well was switched from being stored in an above-ground holding tank to being stored in drums. The two original holding tanks were removed.

A total of 1450 gallons of fuel and 190,000 gallons of water had been recovered by December 31, 1988. The total volume of fuel in the subsurface was revised from 50,000 gallons to 12,500 gallons to account for apparent versus actual product thicknesses observed in wells. Contaminants continued to be detected in ground water at the site, most notably in the perched aquifer in the immediate vicinity of the product plume. Chemical results are summarized in a table from the report presented in Appendix J. The Top of the Regional aquifer zone was found to contain very low concentrations of benzene.

The report recommended that the system continue to be operated, and the ground water continue to be monitored, with an evaluation performed annually.

3.12 INDUSTRIAL WASTE PIT NO. 2 REMEDIAL INVESTIGATIONS, U.S. ARMY CORPS OF ENGINEERS, NOVEMBER 1990

Report Title: Industrial Waste Pit No. 2 Remedial Investigations. Draft Report, November 1990.

This report presents the results of investigations conducted at Industrial Waste Pit No. 2. The purpose of the investigation was to assess the nature and extent of contamination associated with the use of the pit for disposal of industrial wastes. Investigations were conducted in 1987 and 1989.

Industrial Waste Pit No. 2 is located in the southeast corner of the base. The pit was operated from 1958 to 1965. It was filled, graded, and abandoned in 1965. During its operation the pit received such wastes as waste oils, cyanides, chromates, phenols, solvents and waste acids and alkalies.

Previous investigations conducted by Radian Corporation (see Section 2.2) in 1984 showed soil contamination within the pit boundaries to a depth of 15 feet. Contaminants included volatile organics, metals, and fuels. Ground water at the site was not shown to be contaminated and it was recommended that no further action be taken at the site.

The U.S. Army Corps of Engineers remedial investigation involved the installation of three additional monitoring wells in the Top of the Regional aquifer zone in March 1989 to better define any ground water contamination at the site. The installation of the wells was in response to a request by the State of Oklahoma which was reviewing a proposed no-action plan for the site during their earlier investigation. One well was installed upgradient of the site, and two were installed downgradient. No perched ground water was encountered, thus the wells were installed in the Top of the Regional aquifer zone. It should be noted that perched ground water was encountered by Radian Corporation beneath the site during their earlier investigation. The COE wells, plus two pre-existing wells completed by Radian Corporation in perched ground water, were sampled quarterly between June 1989 and April 1990.

In addition, the COE augured eight soil borings in January 1987 at the limits of a drainage ditch near the pit. These borings were drilled and sampled in support of a proposed excavation in the area. No pit-related contaminants were detected in the soil samples.

Contaminated ground water was present in well MW 16, located within the pit boundaries in the perched aquifer . Contaminants included metals and organic compounds. MW 15, also completed in the perched aquifer but outside the pit boundaries, showed only low levels of contaminants, most of which appeared to be laboratory and equipment contaminants, and all of which were below MCLs.

Sampling showed no significant contamination in the Top of the Regional aquifer zone. All organic compounds detected were in low concentrations and appeared to be laboratory and equipment contaminant artifacts.

Sampling results from the report are summarized in tables from the report presented in Appendix K. No further actions were recommended for this site.

3.13 DESIGN COST COMPARISON STUDY, LANDFILLS 1, 2, 3, AND 4, B&V WASTE SCIENCE AND TECHNOLOGY CORP., 1989

Report Title: Design Cost Comparison Study, Landfills 1, 2, 3, and 4.

This report was prepared to evaluate cover systems for Landfills 1 through 4, and to investigate the need for relocation of utility systems within the vicinity of the landfills. The report also summarized existing information for the landfills.

Landfills 1, 2, 3, and 4 were used to dispose of various industrial and solid wastes generated at TAFB between 1942 and 1968. The four landfills are located in the same general area at the southwest corner of TAFB. The total area of the landfills is approximately 50 acres.

Landfill 1 was operated from 1942 to 1945, and covers 2.5 acres. It has a well-established and maintained grass cover with relatively flat slopes. Differential settlement within the waste trenches is evident at the surface. Surface-water runoff discharges to Crutcho Creek which borders the north side of the landfill. Subsurface investigations have shown the landfill to be underlain by silty sandstone.

Landfill 2 was operated from 1945 to 1952, and covers 27.5 acres. Differential settlement of the waste trenches is also evident by surface depressions. A former radiological waste disposal site is located in Landfill 2. The west side of the landfill consists of rugged, sloping terrain with uncontrolled mixed vegetation. The southeast side of the landfill has a well-maintained grass cover. Most surface-water runoff flows to a former recreation pond (drained in 1985) in the eastern portion of the landfill and then to Crutcho Creek . Subsurface investigations have shown the landfill to be underlain by shale.

Landfill 3 was operated between 1952 and 1961, and covers 8 acres. It contains two primary trench areas, one containing sludge from Building 3001 industrial operations, and the other containing lead-contaminated soil. Contaminated soils and sludges were scheduled for removal in 1989 prior to construction of the cover system . A radiological waste disposal site is located just northwest of the landfill. The majority of the site is covered with grass and native vegetation. The landfill slopes gently northward towards Crutcho Creek. Subsurface investigations show the landfill to be underlain by shale.

Landfill 4 was operated from 1961 to 1968 and covers 12.4 acres. Drummed wastes, including solidified solvents and metal shavings, may be buried in this landfill. A sludge dump area has also been identified in the central portion of the landfill. Methane gas and other organic vapors have been detected at the landfill surface. The surface of the landfill is sloping with a mixture of native vegetation and areas that are void of vegetation. Differential settlement within the waste trenches is evident. Surface runoff drains to swales leading to Crutcho Creek. The landfill is underlain by shale.

According to the report, ground water beneath the landfills has been determined to occur as an upper perched water table that occurs near the surface in Landfills 2 and 4; a lower intermediate perched aquifer that intersects some of the landfill trenches and flows northeast toward Crutcho Creek; and in the Top of the Regional aquifer zone, which flows to the southwest. The report indicates that preliminary ground-water investigations show that ground water beneath Landfills 1-4 is contaminated. Investigations are ongoing to further define the hydrogeology and nature and extent of contamination.

Engineered cover systems are to be constructed over each landfill to control infiltration of precipitation and surface-water runon and runoff. Eight alterative cover systems, consisting of various combinations of natural and synthetic capping materials, were selected for evaluation. The alternatives were evaluated based on cost and performance criteria. The recommended alternative presented in the report was a natural soil cover system consisting of a soil fill material to achieve required top and side slopes overlain by a low-permeability clay to act as a water

barrier layer. Over the clay would be placed a sand layer for drainage and a gravel layer for gas control. Organic top soil would be placed over the gravel for a cover layer. This alternative was the least expensive alternative. All alternatives evaluated provided acceptable technical effectiveness.

3.14 LANDFILL 3 SLUDGE DUMP CONTAMINATED SOIL - INFORMATION FOR SOIL REMOVAL AND DECONTAMINATION, IRP RESPONSE ACTION, U.S. ARMY CORPS OF ENGINEERS, JANUARY 1989

Report Title: Landfill 3 Sludge Dump Contaminated Soil - Information for Soil Removal and Decontamination. IRP Response Action Final Report, January 1989.

This report presents the results of subsurface investigations conducted in May 1988 at the Landfill 3 sludge dump. The information was generated to support development of an experimental, low-temperature thermal extraction process to be used to remove volatile organic compounds and petroleum hydrocarbons from the contaminated soil.

The sludge dump area is located in the south-central portion of the landfill. The dump operated between 1961 and 1968. It is reported to contain waste oils and liquids from industrial operations at Building 3001, and waste fuels and sludge from the Fuel Farm. Preliminary investigations described in this report showed that a 10- to 12- inch layer of hydrocarbons was floating on the water table in a well in the sludge dump area. Soils and ground water were found to be contaminated by solvents and hydrocarbons. A thick, black, sludge layer was determined to be present about ten feet below ground surface. It was concluded in the initial studies that additional investigations were warranted.

Seventeen borings were drilled at the sludge dump as part of the May 1988 investigation to determine the boundary of the dump. Eight soil samples were collected for laboratory analysis. Borings were drilled to depths below any visible signs of sludge contamination.

The horizontal and vertical boundaries of the sludge-contaminated soil within Landfill 3 were reported to be delineated by the results of the May 1988 investigation. The report estimated that 900 cubic yards of sludge-contaminated soil were present in the sludge dump area. The sludge was found from 2 to 15 feet below ground surface and ranged from 1- to 12-feet thick. The sludge was found to be underlain by a shale layer to a depth of about 25 feet below land surface. A sandstone unit was encountered beneath the shale unit. The only ground water encountered was at a depth of about 30 feet below ground surface in the sandstone unit. Thus it appears that no perched aquifer exists beneath this part of Landfill 3.

Soil samples were found to be contaminated by organic compounds and metals. Results are summarized in tables from the report contained in Appendix L.

No recommendations were made in the report.

3.15 LANDFILL 1 COVER DESIGN - DESIGN ANALYSIS AND SPECIFICATIONS AND LANDFILL 3 COVER DESIGN - DESIGN ANALYSIS AND SPECIFICATIONS, B&V WASTE SCIENCE AND TECHNOLOGY CORP., 1990

Report Title: Landfill 1 Cover Design - Design Analysis and Specifications and Landfill 3 Cover Design - Design Analysis and Specifications.

These reports provide the detailed designs and specifications for the cover systems to be constructed on Landfills 1 and 3.

3.16 LANDFILL 5 REMEDIAL INVESTIGATION REPORT, U.S. ARMY COPS OF ENGINEERS, NOVEMBER 1990

Report Title: Landfill 5 Remedial Investigation Report. Draft Report, November 1990.

This report presents the results of investigations performed at Landfill 5 since 1986 by the U.S. Army Corps of Engineers. It presents the same data and draws the same conclusions as a

previous COE report on the landfill (Landfill 5 Response Action) dated December 1989. This 1990 report contains a better presentation of the data as well as the results of 1989 sampling. It also discusses the August 1990 interim action in which an 18-inch thick compacted clay cap and a 12-inch thick top soil layer were placed on the landfill.

Solid waste samples were collected from four borings drilled through the landfill trenches. Two water samples were collected from the trenches (leachate). Monitoring wells were installed upgradient and downgradient of the landfill and sampled in May 1986, February 1987, September 1988, and September 1989.

Chemical results are summarized in tables from the report contained in Appendix M. The waste materials and leachate sampled were reported to contain metals and organic compounds (primarily ketones and fuel-related compounds). The waste material was encountered from 3 to 7.5 feet below ground surface and was about 16- to 17-feet thick.

The chemical quality of the perched ground water was determined by the sampling of five wells. The organic compounds detected in the perched ground-water samples were mainly halogenated solvents. The chemical quality of the Top of the Regional aquifer zone was determined by sampling four wells. The contaminants found in this zone were similar to those found in the perched aquifer.

The organic compounds reported in the perched and Top of the Regional aquifer ground-water zones included acetone, 1,2-DCE, TCE, and bis(2-ethyhexyl)phthalate. The organic compounds reported in the trench water included acetone, 2-butanone, 4-methyl-2-pentanone, ethylbenzene, xylene, 2-methylphenol, 4-methylphenol, and benzoic acid. The organic contaminants found in the ground water are mainly halogenated solvents, while the organic contaminants found in the waste are mainly ketones and fuel-related compounds. The ground-water contamination does not appear to be related to the contaminants present in the trenches.

Vertical migration of leachate was concluded in the report to be limited by shale beds at the bottom of the landfill trenches. The contamination in the perched and Top of the Regional aquifers was not found to be characteristic of contamination found in the trenches. Also, contaminants in the downgradient monitoring wells were found to be of the same magnitude as those detected in the upgradient monitoring wells. Therefore, it was concluded in the report that the contamination in the perched and Top of the Regional aquifer ground-water zones appears to be from a different source than the leachate from Landfill 5.

Based on the results of the RI, the report recommended that no further action be taken at the site.

3.17 HYDROGEOLOGIC INVESTIGATION, LANDFILL NO. 6, CH2M HILL, MARCH 1986

Report Title: Hydrogeologic Investigation, Landfill No. 6. Final Report, March 1986.

This report presents the results of hydrogeologic investigations conducted at Landfill 6 in January 1985. The purpose of the investigation was to further define the hydrogeology of the site and make recommendations for a ground-water monitoring program.

Landfill 6 was used between 1970 and 1979 to dispose of general refuse and small quantities of industrial waste, such as paint buckets and insecticide cans. In addition, industrial waste treatment sludges were reportedly disposed intermittently in the landfill. Wastes were placed in parallel trenches about 25 feet deep. In January 1986, the landfill was capped with clay to minimize infiltration.

Previous investigations at the site included the installation of five wells in the summer of 1984 by Radian Corporation (See Section 2.3). Sampling of these wells showed low levels of volatile organic compounds beneath the landfill (vinyl chloride, TCE, and chloroform).

In the CH2M Hill investigation, three borings were drilled to 150 feet below land surface in order to assess site hydrogeology, and four wells were installed on the landfill margins. It was found that ground water occurs beneath the landfill in a shallow discontinuous, perched aquifer and in a deeper, fully-saturated aquifer (Top of the Regional aquifer zone). The perched aquifer was noted to occur on top of a shale bed beneath all of the landfill except the northwest corner. The perched aquifer was determined to occur from 8 to 30 feet below land surface. Flow in the perched aquifer was determined to be to the west/northwest. Since the perched aquifer was not present in the northwest corner, it was concluded that perched ground water must discharge to the lower aquifer in this area. The lower Top of the Regional aquifer zone was found at 66 to 103 feet below ground surface, with flow determined to be to the west/southwest.

Recommendations for a ground-water monitoring program were also included in this report.

3.18 LANDFILL 6 REMEDIAL INVESTIGATION REPORT, U.S. ARMY CORPS OF ENGINEERS, SEPTEMBER 1990

Report Title: Landfill 6 Remedial Investigation Report. Draft Report, September 1990.

This report presents the results of remedial investigations conducted at Landfill 6 between 1986 and 1989. The purpose of the investigation was to assess the extent and magnitude of contamination associated with past disposal practices at Landfill 6. Previous investigations by Radian Corporation (See Section 2.3) found contamination in both the perched and Top of the Regional aquifers beneath the site.

Landfill 6 was used for waste disposal from 1970 to 1979. The waste consisted of general refuse, industrial waste, and industrial waste treatment sludges from TAFB operations. Landfill 6 is not located on TAFB property. It is located near the southeast corner of the base on land leased from Oklahoma City. The landfill covers about 25 acres. For several years, highly permeable river sand, clay, and sand/rock were used to cover the waste each day. After closure, the trenches were covered with compacted soil and revegetated. The landfill was capped in 1986,

and a cap extension was constructed in 1988 after the discovery of additional trenches by the investigations presented in this report.

The remedial investigation consisted of the following activities: a ground-penetrating radar survey to locate disposal trenches; installation of 17 additional monitoring wells in both the perched and Top of the Regional aquifers; sampling of the 25 wells at the site between 1986 and 1989; drilling and sampling of 20 borings located in the landfill trenches; collection and analysis of five leachate samples, and collection and analysis of six stream sediment samples from a tributary which runs along the east and south sides of the landfill and eventually discharges to Stanley Draper Lake.

Landfill 6 was found to be underlain by sandstone interbedded with shale. It is located in the transition zone at the contact between the Hennessey Formation shale and the Garber-Wellington Formation. Ground water was encountered in a perched zone in which flow was determined to be in a west/northwest direction. The depth to water in the perched ground-water zone was found to be from 11 to 48 feet below ground surface. Ground water was also encountered in the Top of the Regional aquifer zone, in which flow was found to be in a west/southwest direction. The depth to water in the Top of the Regional aquifer zone was found to be from 68 to 99 feet below ground surface.

Chemical results are summarized in tables from the report presented in Appendix N. The wastes in Landfill 6 were reported to contain metals (primarily barium, cadmium, lead, and zinc) and organic compounds (primarily xylenes, acetone, and 2-butanone). Waste was encountered at depths varying from 2 to 30 feet below ground surface. Contaminants were spread throughout the landfill at varying concentrations (xylenes ranged from 170,000 micrograms per kilogram (ug/kg) to less than 6 ug/kg). Barium was reported to be extremely elevated in boring L6-17 (150,000 ug/kg).

The perched aquifer was found to be contaminated by metals and organic compounds. The trench leachate contained barium, cadmium, and zinc concentrations exceeding MCLs. Organic

compounds detected included methylene chloride, 2-butanone, 4-methyl-2-pentanone, and toluene. The majority of contamination in the perched aquifer was found in the western portion of the landfill. The primary metals contaminants were arsenic, barium, and cadmium, with barium having the highest frequency of occurrence and concentration. The concentrations of barium were reported to range from 2,000 ug/l to 26,000 ug/l in 1989. The barium plume in the perched aquifer is illustrated on a figure taken from the report included in Appendix N. The perched aquifer was also found to be contaminated by volatile and semi-volatile organic compounds including methylene, chloride, acetone, 1,1-DCA, TCE, fuel-related compounds, phthalates, and 1,4-dichlorobenzene.

The Top of the Regional aquifer zone was found to be contaminated by similar compounds as those found in the perched aquifer, but at lower concentrations. The primary metals contaminant was found to be barium. The barium plume in the Top of the Regional aquifer zone is illustrated on a figure taken from the report included in Appendix N. Organic compounds detected included methylene chloride, acetone, TCE, benzene, toluene, 1,4-dichlorobenzene, and phthalates (the phthalates were postulated to be laboratory contaminants).

Stream sediment samples contained some metals in concentrations slightly above background levels. Methylene chloride and acetone were also detected in samples from the western tributary.

The report concluded that past waste disposal practices at Landfill 6 have resulted in contamination of the perched aquifer and Top of the Regional aquifer zone (to a much lesser degree) by heavy metals and organic compounds. The report also concluded that leachate continues to be produced in the trenches due to flow of perched ground water through the landfill.

No recommendations were made in the report.

3.19 SUPERNATANT POND REMEDIAL INVESTIGATIONS, U.S. ARMY CORPS OF ENGINEERS, DECEMBER 1990

Report Title: Supernatant Pond Remedial Investigations. Draft Report, December 1990.

The purpose of this investigation was to assess the nature and extent of contamination associated with past disposal activities at the Supernatant Pond. The field investigation was conducted between July 1989 and July 1990.

The Supernatant pond encompasses 25,000 square feet and was used for impounding sewage effluent between 1954 and 1970, and for disposal of miscellaneous liquid wastes between 1970 and 1984. It was filled with soil and construction debris in 1984. The miscellaneous liquid wastes included petroleum hydrocarbon sludges, solvents, and cyanide-contaminated liquids. The pond is located in the southwestern part of the base, 200 feet north of a tributary to Crutcho Creek. The pond was not lined. It would overflow during heavy rains into a ditch on the east side of the pond that led to the Crutcho Creek tributary.

The remedial investigation included a soil-gas survey with collection and analysis of 22 samples; drilling of 13 soil borings which were completed as shallow piezometers in the first water-bearing zone encountered; collection and analysis of seven soil samples; installation of two wells in the perched and Top of the Regional aquifers; and sampling of the wells and piezometers in October/ November 1989 and May 1990.

The pond was found to overlie the Hennessey Formation (shale interbedded with siltstone and sandstone). Drilling showed that the former pond area was underlain by 5 to 7 feet of fill (clay, silt, sand and construction debris), followed by clay and weathered shale to 15 feet, sandstone to 32 feet, shale between 32 and 55 feet, and sandstone below 55 feet. The upper sandstone and overlying shale/clay fill were considered to comprise the perched aquifer. The lower sandstone was determined to comprise the Top of the Regional aquifer.

The perched aquifer water table was found to be mounded under the pond. Overall flow in the perched aquifer was found to be to the south/southwest toward Crutcho Creek. The gradient in the Top of the Regional aquifer was determined to be northward, based on three wells. No wells were located downgradient of the pond in the Top of the Regional aquifer.

The soil-gas survey showed very low concentrations of TCA, TCE and total hydrocarbons at several locations. However, these compounds were not detected in soil or ground water. Low levels of contamination were reported to be present in soils within the pond boundaries at depths between 4 and 7 feet below land surface. This zone was observed to be stained and corresponded to the pond bottom. Maximum concentrations of contaminants detected in soils are summarized in Appendix O in a table taken from the report. The contaminants include cyanide, metals, acetone, and chlorobenzene.

Ground water from the perched aquifer exhibited concentrations of total organic carbon, radionuclides, and metals exceeding background levels and drinking water standards. Very low concentrations of volatile and semi-volatile organic compounds were also reported in perched aquifer piezometers located in and adjacent to the pond. Maximum concentrations are summarized in a table from the report contained in Appendix O. Analysis of ground water downgradient of the pond did not show concentrations of total organic carbon, radionuclides, or metals above background levels or drinking water standards. No organic compounds were detected above detection limits downgradient of the pond.

Water quality in the Top of the Regional aquifer was not directly assessed in this investigation because only an upgradient well was sampled. However, it should be noted that radionuclide and metals concentrations in this well exceeded drinking water standards.

The report concluded that the Supernatant Pond does not presently pose a hazard to health or the environment. The report recommended that a risk assessment be conducted to determine if future risks may exist in the absence of remedial action. The report also recommended that a feasibility study be performed to evaluate remedial alternatives for the contaminated soil.

3.20 FIRE TRAINING AREA NO. 1 REMEDIAL INVESTIGATIONS, U.S. ARMY CORPS OF ENGINEERS, NOVEMBER 1990

Report Title: Fire Training Area No. 1 Remedial Investigations. Draft Report, November 1990.

This report presents the results of investigations conducted at Fire Training Area No. 1. The purpose of this investigation was to assess the nature and extent of contamination associated with the use of the training area. Investigations were conducted in February 1987, June and July 1987, June 1989, and August 1989.

Fire Training Area No. 1 is located on the west side of TAFB. The active fire training/burning area was an unlined, diked circular-shaped area with a diameter of about 125 feet. The site was used between 1950 and 1962. Fire-fighting exercises consisted of dowsing an old aircraft with flammable liquids, igniting a fire, and extinguishing the fire. Excess liquids were allowed to percolate into the soil.

Twenty-seven soil borings were drilled at the site during the course of the investigations to a maximum depth of 28 feet below land surface. Two monitoring wells were installed in the perched aquifer zone upgradient and downgradient of the site. Soil samples were collected from the borings for analysis. Ground- water samples were collected for analysis from the monitoring wells and piezometers installed in soil boreholes.

The site was found to be underlain by 5 to 8 feet of clay, followed by 6 feet of shale, and 20 feet of sandstone. The perched aquifer was encountered at a depth of 5 feet below ground surface. The direction of ground-water flow in the perched aquifer was determined to be to the southwest, toward Crutcho Creek. The perched water table was concluded to occur in the upper clay/shale units, while the lower sandstone unit was concluded to comprise the Top of the Regional aquifer zone beneath the site. The gradient in the Top of the Regional aquifer zone is northward in this area.

The sampling results indicated that some contamination has occurred at this site. Soil contamination was found to be greatest in the upper 15 feet at the site. The primary organic compound detected in soil samples was bis(2-ethylthexyl phthalate), which was detected in 46 of 55 samples. This compound was reported to be present in samples from borings within the training area and samples from borings located as far as 100 feet outside the designated training area. This compound is a commonly-used plasticizer and also a common laboratory contaminant artifact. It was detected at concentrations ranging from 120 to 11,000 ug/kg. At such elevated concentrations, its presence was postulated in the report to be the result of burning aircraft. Soil results are summarized in Appendix P in tables from the report.

Groundwater contamination in the perched aquifer consisted of generally low concentrations of volatile organic compounds. The contaminant most frequently encountered and at the greatest concentrations was 1,2-DCE. Well MW 61A, located downgradient of the area, reportedly showed 1,2-DCE concentrations as high as 540 ug/l in 1987. This compound was also detected in upgradient well MW 61B completed in the Top of the Regional aquifer zone at a concentration of 9 ug/l.

Ground-water samples were analyzed in 1987 and 1989. Based on these two sampling episodes, the report concludes that there appears to have been a reduction in contaminant concentrations between 1987 and 1989. Total concentrations of organic compounds were lower by 1 to 2 orders of magnitude. Also, some compounds identified at high levels in 1987 were not present in 1989 results. These results are summarized in tables from the report presented in Appendix P.

For the 1987 ground-water sampling, four compounds were detected above MCLs. These compounds were: vinyl chloride (MCL=2 ug/l) which appeared in 3 of 5 samples at concentrations of 3, 17, and 71 ug/l; 1,2-DCE (MCL=5 ug/l) which appeared in 2 of 5 samples at concentrations of 15 and 540 ug/l; TCE (MCL=5 ug/l) which appeared in 3 of 5 samples at concentrations of 17, 17, and 32 ug/l; and benzene (MCL=5 ug/l) which appeared in 2 of 5 samples at concentrations 7 and 9 ug/l. In 1989 two compounds were detected above in MCLs. 1,2-DCE appeared in 2 of 5 samples at concentration of 8 and 150 ug/l, and TCE was detected

at a concentration of 20 ug/l. The maximum concentrations of 1,2-DCE and TCE appeared in MW 61A in both sampling rounds.

The report concluded that some vertical migration of contaminants may have occurred at this site. However, based on the results of the remedial investigation, no further actions were recommended for the site.

3.21 FIRE TRAINING AREA NO.2, IRP RESPONSE ACTION, U.S. ARMY CORPS OF ENGINEERS, DECEMBER 1988

Report Title: Fire Training Area No. 2. IRP Response Action. Final Report, December 1988.

This report presents the results of investigations conducted at Fire Training Area No. 2. The purpose of this investigation was to assess the nature and extent of contamination associated with the use of Fire Training Area No. 2. The investigation was conducted in June 1987.

Fire Training Area No. 2 is located northwest of the control tower. It was used between 1962 and 1966 as a training area for base fire fighters. It is a diked, unlined pit in which fuel was ignited and extinguished using a protein-based foam. Excess liquids were allowed to percolate into the soil. The upper soils were reportedly excavated, sampled, and determined to be clean; however, this could not be confirmed by records.

Seven borings were drilled in and around the old training area to a depth of 7 feet. Samples were obtained for analysis from three borings. The Hennessey Formation shale was encountered below the area at 4 feet below land surface. No perched ground water was encountered. The soils appeared undisturbed, and no staining or odors were observed.

Some contamination was observed in the shallow soils beneath the site. Results from the report are summarized in Appendix Q in tables from the report. Group I contaminants consisted of common field and laboratory contaminant artifacts. Their presence in the samples was postulated

to be related to field handling of samples. Group II contaminants consisted of only tetrahydrofuran, which was detected in every sample tested (including the laboratory blank). Group III contaminants included metals, which were determined to be near background levels. Group IV contaminants (non-priority pollutant compounds) detected were determined to possibly be related to the use of the site as a fire training area.

The report concluded that no further testing be conducted at this site because no toxicologically-significant contamination was found. The report also concluded that an evaluation of remedial alternatives was not necessary for the site, because of the lack of contamination. A no-action plan was recommended for the site.

3.22 SLUDGE DRYING BEDS IRP RESPONSE ACTION, U.S. ARMY CORPS OF ENGINEERS, JANUARY 1989

Report Title: Sludge Drying Beds IRP Response Action. Final Report, January 1989.

The purpose of this investigation was to evaluate the extent of contamination beneath eight abandoned sludge drying pits at the old wastewater treatment plant on TAFB. The drying pits are located in the west-central portion of the base, west of Patrol Road and north of the equipment storage area. Seven of the eight pits are concrete lined. All of the pits have been used periodically for the storage of liquid and solid wastes form various industrial operations since the wastewater treatment plant was abandoned.

The study was apparently conducted in the fall of 1987 as evidenced by the October 1987 dates on the laboratory analysis reports. The investigation consisted of drilling 11 soil borings through the bottom of the drying beds using a solid-stem auger to a depth of 6 feet, and collecting soil samples from the auger flights in the 0- to 3-foot and 3- to 6-foot intervals. The samples were analyzed for metals, semi-volatiles, and volatiles using IRP-approved QA/QC procedures. Results were grouped as listed organics, non-listed organics, and metals.

Results of the analyses are summarized in tables taken from the report presented in Appendix R. Only sporadic detections of listed and non-listed organics were found. Metal concentrations were found to be below action levels. However, common field and laboratory analytical solvents and phthalates were detected in the listed organics. These were thought to be laboratory or field contaminant artifacts or inadvertent contamination. Laboratory blanks also indicated contamination by methylene chloride and several non-listed organics, further supporting this contention.

The report recommended that no remedial treatment of the soils underlying the drying beds be performed due to lack of toxicologically-significant contamination. However, if the drying beds are ever removed, it was recommended that soils surrounding the EF-6 pit be tested for EP toxicity prior to disposal since elevated concentrations of silver, cadmium and chromium were found in the 0- to 3-foot interval beneath this bed.

3.23 INDUSTRIAL WASTE TREATMENT PLANT ABANDONED WASTE TANKS, IRP RESPONSE ACTION, U.S. ARMY CORPS OF ENGINEERS, JANUARY 1989

Report Title: Industrial Waste Treatment Plant Abandoned Waste Tanks. IRP Response Action. Final Report, January 1989.

This report presents the results of investigations conducted at the Industrial Waste Treatment Plant (IWTP) Abandoned Waste Tanks. The investigation was conducted in July 1987 in support of removing the 11 abandoned, above-ground, concrete storage tanks. There are two cyanide tanks, two chromium tanks, four "strong dump" tanks, one acid tank, one alkali tank, and one phenol holding tank. All the tanks received a variety of wastes during their operation.

Soil investigations were conducted around the tanks to determine if any contamination existed. Thirteen soil borings were drilled and sampled to a depth of 6 feet below the bottom of each tank. Significant results are presented in a table from the report contained in Appendix S.

The report concluded that soils around tank groups 1-4 were free from contamination (tank groups 1-4 are the cyanide tanks, chromium tanks, and "strong dump" tanks). Phenol was detected at 2 parts per million (ppm) in the uppermost sample collected near the phenol tank. Soils around the acid and alkali tanks were found to be contaminated by organic compounds and cyanide.

The report made recommendations for removal of the tanks, and excavation and disposal of soils. Specifically, it was recommended that tank groups 1-4 be removed and backfilled with no special treatment of the underlying soils. It was recommended that the top foot of soil from beneath the phenol tank be removed and disposed in a RCRA-permitted landfill. Finally, the report recommended that the soil beneath and around the acid/alkali tanks be excavated to a depth of 15 feet and disposed in a permitted hazardous waste landfill.

3.24 RADIOLOGICAL WASTE DISPOSAL SITES, REPORT OF RECORD SEARCH PERFORMED IN 1989 (PHASE I), U.S. ARMY CORPS OF ENGINEERS, 1989

Report Title: Radiological Waste Disposal Sites, Report of Record Search Performed in 1990 (Phase I).

This report provides the results of a records search performed in 1989 to gather all available information on TAFB radioactive waste disposal sites. Information on five sites was presented in the report. The information presented includes the results of previous investigations conducted at the five sites. A map of the base with the site locations is included in the report. The summaries are:

- **RWDS 201S**: located 9 feet south of the addition to Building 201 and 12 feet west of Building 205. A 1971 radiological survey indicated readings slightly greater than background. A 1988 survey of ionizing radiation indicated no radioactivity.

- **RWDS 1022E**: located northwest of Landfill 3. A 1971 radiological survey indicated radioactivity just slightly above background. A 1988 survey detected no

radiation above background at the ground surface, but some beta radiation was detected in ground water near the site. A geophysical survey conducted during the IRP Phase II (Stage 2) (see Section 2-3) investigation revealed an anomaly consistent with a buried metal object.

- **RWDS 62598**: located north of Crutcho Creek, south of Facility 1025, and west of Reserve Road. No mention of radioactive readings was made in the 1971 survey. The 1988 survey found no radioactivity. A geophysical survey indicated no buried metal objects.

- **RWDS 1030W**: located on Landfill 2, approximately 1700 feet west and 550 feet north of Building 1030. The existence of the site was determined to be in question. The 1971 radiological survey indicated radioactive readings twice that of background, and the 1988 survey found no radioactivity above background. The ground water at the site showed alpha and beta levels below background.

- **RWDS at Douglas Blvd. & 59th St.**: located in a ravine on the east side of a tributary to Elm Creek. No visual evidence of the site was found. Apparently no radiological surveys were conducted. A geophysical survey was planned for 1989.

No recommendations for further work were made in this report.

3.25 INVESTIGATION OF THE RADIOACTIVE WASTE DISPOSAL SITES, PHASE II, CHEM-NUCLEAR ENVIRONMENTAL SERVICES, DECEMBER 1990

Report Title: Investigation of the Tinker Air Force Base Radioactive Waste Disposal Sites, Phase II. Final Report, December 1990.

This report describes the results of non-intrusive (surface) radiological and geophysical surveys of five separate radiological waste disposal sites identified in the Phase I records search. The surveys were conducted by Chem-Nuclear in 1990. Summaries of the site reports follow:

- **RWDS 201S**: located 9 feet south of the addition to Building 201 and 12 feet west of Building 205. The radiological survey indicated readings in three areas significantly greater than background (a map is provided in the report). The geophysical survey detected anomalies that were associated with the elevated radioactive readings. The buried radioactive objects are most likely located about 6 to 8 feet below ground surface.

- **RWDS 1022E**: located northwest of Landfill 3. The site contains many buried metal objects with the possibility that at least one of the objects has an elevated radiation level. Further investigation was recommended involving intrusive radiological surveys.

- **RWDS 62598**: located north of Crutcho Creek, south of Facility 1025, and west of Reserve Road. A geophysical anomaly was discovered and may be a lead still reportedly buried at the site. The lead still was reportedly used in the early 1950s to volatilize a radium paint solvent and became contaminated with radium after 4 to 5 years of operation, when it was buried at site 1030W. However, no elevated radioactivity was reported (the lead of the still may be shielding the environment from the radiation).

- **RWDS 1030W**: located on Landfill 2 approximately 1800 feet northwest of Building 1030. The site contains several areas of elevated radioactivity and it is probable that the contamination is migrating off site. Both the radiological and geophysical surveys indicate that the contamination roughly follows a former trench which runs between a picnic area and the old Pistol Pond. Subsurface contamination may extend to a depth of 26 feet.

- **RWDS 4000 (at Douglas Blvd. & 59th St.)**: located in a ravine on the east side of a tributary of Elm Creek. No visual evidence of the site was apparent, no elevated radioactivity was present, and no geophysical anomalies were detected.

Based on the radiologic and geophysical surveys, the report concluded that sites 201S and 1030W definitely contain radioactive material below the ground surface as well as numerous subsurface buried metal objects. It was further concluded that site 1022E probably also contains buried radioactive material. No elevated radioactivity was found at sites 62598 and 4000; however, without intrusive investigations, no definite conclusions could be drawn about these two sites.

The report recommended that further investigations be conducted at site 1022E consisting of intrusive radiological sampling. Site 62598 was recommended to be excavated in an effort to recover the object detected during the geophysical surveys, with soil sampling for radioactivity conducted during excavation. The report also recommended that no further investigations were warranted at site 4000. Finally, based on the Phase II investigation results, remediation was

recommended for sites 201S and 1030W. Remedial activities recommended for these two sites included fencing, soil excavation, and soil sampling.

4.0 SANITARY SEWER LIFT STATION, BLDG 1030

To determine whether the Sanitary Sewer Lift Station, Building 1030, manages wastewater from industrial operations which may contain hazardous constituents, a sample of the wastewater was collected on 12 November 1992 and sent to Ana-Lab, a contract laboratory, for analysis. The results of the analysis showed that all toxicity characteristic leachate procedure (TCLP) compounds were below detectable limits. Other test concluded that it was non-corrosive, non-reactive, and had a flash point greater than 212° F. A copy of the analysis can be found on pages 4-2 through 4-10.

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Analytical Chemistry • Utility Operations

11/30/92

Department of the Air Force
OC-ALC/EMC
Engineering Building
Tinker AFB, OK 73145
Attention: Dan Luton

Sample Identification: GM920379
Collected By: Mary E Parker
Date & Time Taken: 11/12/92 1617
Other Data: B 1030, N Side
Bottle Data: 3 -- Unpreserved Glass Quart with Teflon Lid (17)
2 -- 40 ml Glass Vial (Zero Headspace) with a Teflon Lined Lid (04)
Lab Sample Number: 225219 **Received:** 11/13/92 **Client:** TAFB

PARAMETER	RESULTS	UNITS	ANALYZED	EQL	METHOD	BY
TCLP Liquid-Liquid Extraction	280->1	ml->ml	1405 11/17/92			GE
TCLP Liq-Liq Extr. W/Hex Exch.	280->1	ml->ml	1400 11/17/92			GE
TCLP ZHE Volatile Extraction	1.7% Sol	Completed.	1600 11/18/92			LM
Flash Point (Reg. Limit 140.0)	>212	Degrees F	1615 11/16/92		40 CFR 261.21	DSH
TCLP Extraction	Aqueous		0755 11/16/92			RJH
Corrosivity (Reg. Limit 6.4)	0.5	mmpy	1530 11/17/92	.1	SW-846	DSH
Esterification of Sample Extract	Completed.		0930 11/18/92		EPA Method 8150	KB
Reactivity with Water	NON-REACTIVE		1745 11/16/92			CRH
Reactivity	Non-reactive		1100 11/19/92		SW-846	SK
pH	7.1	SU	1730 11/16/92		EPA Method 150.1	DSH
Reactivity Cyanide (RL 200)	ND	mg/l	1500 11/18/92	10		WMB
Reactivity Distillation	Distilled		0930 11/14/92			CRH
Reactivity Sulfide (RL 500)	ND	mg/l	1750 11/16/92	100		BWP
TCLP Benzene (Reg. Limit 0.5)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP Gamma-BHC (Lindane) (.4)	ND	mg/l	1500 11/17/92	0.00014		KB
TCLP Carbon Tetrachloride (.5)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP Chlordane (Reg. Limit 0.03)	ND	mg/l	1500 11/17/92	0.0005		KB

Continued

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PARAMETER	RESULTS	UNITS	ANALYZED	EQL	METHOD	BY
TCLP Chlorobenzene (Limit 100)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP Chloroform (Reg. Limit 6.0)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP 1,4 Dichlorobenzene: RL 7.5	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP 1,2-Dichloroethane (RL .5)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP 1,1-Dichloroethene (.7)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP 2,4-Dinitrotoluene (.13)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP Endrin (Reg. Limit 0.02)	ND	mg/l	1500 11/17/92	0.00021		KB
TCLP Heptachlor (Limit .008)	ND	mg/l	1500 11/17/92	0.00011		KB
TCLP Heptachlor Epoxide (.008)	ND	mg/l	1500 11/17/92	0.003		KB
TCLP Hexachlorobenzene (.13)	ND	mg/l	2333 11/23/92	0.18	EPA Method 625	GO
CLP Hexachlorobutadiene (.5)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP Hexachlorethane (Limit 3)	ND	mg/l	2333 11/23/92	0.036		GO
TCLP Nitrobenzene (Limit 2)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP Pentachlorophenol (100)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP Tetrachloroethylene (.7)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP Toxaphene (Reg. Limit 0.5)	ND	mg/l	1500 11/17/92	0.0086		KB
TCLP Trichloroethylene (.5)	ND	mg/l	0540 11/19/92	2.5	EPA Method 624	PM
TCLP 2,4,6-Trichlorophenol (2)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP Vinyl Chloride (.2)	ND	mg/l	0540 11/19/92	5.0	EPA Method 624	PM
TCLP 2,4 D (Reg. Limit 10)	ND	mg/l	1130 11/18/92	0.043		KB
TCLP 2,4,5-Trichlorophenol (400)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
TCLP 2,4,5-TP (Silvex) (RL 1)	ND	mg/l	1130 11/18/92	0.0061		KB
TCLP Total Cresols (Reg Lim 1)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
CLP MEK (Reg. Limit 200)	ND	mg/l	0540 11/19/92	25	EPA Method 624	PM

Continued

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PARAMETER	RESULTS	UNITS	ANALYZED	EQL	METHOD	BY
TCLP Methoxychlor (RL 10)	ND	mg/l	1500 11/17/92	0.0064		KB
TCLP Pyridine (Reg. Limit 5)	ND	mg/l	2333 11/23/92	0.036	EPA Method 625	GO
Metals Digestion - TCLP 3010	Digested 50/10	A/S	1800 11/19/92		EPA Method 3010	KLG
Metals Digestion - TCLP 7470	Digested	A/B/S	1800 11/16/92			KDC
TCLP Silver (Reg. Limit 5.0)	ND	mg/l	1433 11/23/92	.05	EPA Method 6010	LW
TCLP Arsenic (Reg. Limit 5.0)	ND	mg/l	1433 11/23/92	1	EPA Method 6010	LW
TCLP Barium (Reg. Limit 100.0)	ND	mg/l	1433 11/23/92	1.0	EPA Method 6010	LW
TCLP Cadmium (Reg. Limit 1.0)	ND	mg/l	1433 11/23/92	.05	EPA Method 6010	LW
TCLP Chromium (Reg. Limit 5.0)	ND	mg/l	1433 11/23/92	.1	EPA Method 6010	LW
TCLP Mercury (Reg. Limit 0.2)	ND	mg/l	1100 11/17/92	.001	EPA Method 7470	LW
TCLP Lead (Reg. Limit 5.0)	ND	mg/l	1433 11/23/92	.5	EPA Method 6010	LW
TCLP Selenium (Reg. Limit 1.0)	ND	mg/l	1433 11/23/92	1	EPA Method 6010	LW

Quality Assurance for the SET with Sample 225219

Sample #	Description	Result	Units	Dup/Std Value	Spk Conc.	Percent	Time	Date	By
			Flash Point (Reg. Limit 140.0)						
225294	Duplicate	>212	Degrees F	>212		100	1615	11/16/92	DSH
			Corrosivity (Reg. Limit 6.4)						
	Blank	.0001	gms				1530	11/17/92	DSH
225219	Duplicate	.4	mmpy	.6		140	1530	11/17/92	DSH
			Reactivity with Water						
225219	Duplicate	NON-REACT		NON-REACT		100	1745	11/16/92	CRH
			pH						
	Standard	Calibrate	SU	7.0			1730	11/16/92	
	Standard	Calibrate	SU	4.0			1730	11/16/92	
	Standard	Calibrate	SU	10.0			1730	11/16/92	
	Standard	6.0	SU	6.0		100	1730	11/16/92	DSH
	Standard	8.0	SU	8.0		100	1730	11/16/92	DSH
	Standard	9.0	SU	9.0		100	1730	11/16/92	DSH
225219	Duplicate	7.06	SU	7.1		101	1730	11/16/92	DSH
225240	Duplicate	8.35	SU	8.36		100	1730	11/16/92	DSH
			Reactivity Cyanide (RL 200)						
	Blank	<.02	mg/l				1500	11/18/92	WMB
	Standard	.051	mg/l	.050		102	1500	11/18/92	WMB

Continued

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Sample #	Description	Result	Units	Dup/Std Value	Spk Conc.	Percent	Time	Date	By
			TCLP Silver (Reg. Limit 5.0)						
	Blank	<.01	mg/l				1433	11/23/92	LW
	Blank	<.01	mg/l				1433	11/23/92	LW
	Standard	.21	mg/l	.20		105	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	1.0	mg/l	1.0		100	1433	11/23/92	LW
	Standard	1.0	mg/l	.96		104	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		1.0	97	1433	11/23/92	LW
225219	Spike		mg/l		1.0	107	1433	11/23/92	LW
225318	Spike		mg/l		1.0	101	1433	11/23/92	LW
225319	Spike		mg/l		1.0	100	1433	11/23/92	LW
225320	Spike		mg/l		1.0	95	1433	11/23/92	LW
225321	Spike		mg/l		1.0	85	1433	11/23/92	LW
225533	Spike		mg/l		1.0	88	1433	11/23/92	LW
225394	Spike		mg/l		1.0	95	1433	11/23/92	LW
			TCLP Arsenic (Reg. Limit 5.0)						
	Blank	<.2	mg/l				1433	11/23/92	LW
	Blank	<.2	mg/l				1433	11/23/92	LW
	Standard	.98	mg/l	1.0		102	1433	11/23/92	LW
	Standard	5.1	mg/l	5.0		102	1433	11/23/92	LW
	Standard	11	mg/l	10		110	1433	11/23/92	LW
	Standard	5.2	mg/l	5.0		104	1433	11/23/92	LW
	Standard	5.0	mg/l	5.0		100	1433	11/23/92	LW
	Standard	5.1	mg/l	5.0		102	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		10	106	1433	11/23/92	LW
225219	Spike		mg/l		10	104	1433	11/23/92	LW
225318	Spike		mg/l		10	97	1433	11/23/92	LW
225319	Spike		mg/l		10	105	1433	11/23/92	LW
225320	Spike		mg/l		10	96	1433	11/23/92	LW
225321	Spike		mg/l		10	101	1433	11/23/92	LW
225533	Spike		mg/l		10	96	1433	11/23/92	LW
225394	Spike		mg/l		10	99	1433	11/23/92	LW
			TCLP Barium (Reg. Limit 100.0)						
	Blank	<1.0	mg/l				1433	11/23/92	LW
	Blank	<1.0	mg/l				1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	5.2	mg/l	5.0		104	1433	11/23/92	LW
	Standard	11	mg/l	10		110	1433	11/23/92	LW
	Standard	5.3	mg/l	5.0		106	1433	11/23/92	LW
	Standard	5.0	mg/l	5.0		100	1433	11/23/92	LW
	Standard	4.7	mg/l	5.0		106	1433	11/23/92	LW
225318	Duplicate	1.7	mg/l	1.6		106	1433	11/23/92	LW

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Sample #	Description	Result	Units	Dup/Std Value	Spk Conc.	Percent	Time	Date	By
224883	Spike		mg/l		10	108	1433	11/23/92	LW
225219	Spike		mg/l		10	108	1433	11/23/92	LW
225318	Spike		mg/l		10	100	1433	11/23/92	LW
225319	Spike		mg/l		10	103	1433	11/23/92	LW
225320	Spike		mg/l		10	97	1433	11/23/92	LW
225321	Spike		mg/l		10	98	1433	11/23/92	LW
225533	Spike		mg/l		10	98	1433	11/23/92	LW
225394	Spike		mg/l		10	97	1433	11/23/92	LW
			TCLP Cadmium (Reg. Limit 1.0)						
	Blank	<.01	mg/l				1433	11/23/92	LW
	Blank	<.01	mg/l				1433	11/23/92	LW
	Standard	.56	mg/l	.52		107	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	2.7	mg/l	2.5		108	1433	11/23/92	LW
	Standard	2.4	mg/l	2.5		104	1433	11/23/92	LW
	Standard	2.5	mg/l	2.5		100	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		1.0	105	1433	11/23/92	LW
225219	Spike		mg/l		1.0	113	1433	11/23/92	LW
225318	Spike		mg/l		1.0	100	1433	11/23/92	LW
225319	Spike		mg/l		1.0	105	1433	11/23/92	LW
225320	Spike		mg/l		1.0	90	1433	11/23/92	LW
225321	Spike		mg/l		1.0	101	1433	11/23/92	LW
225533	Spike		mg/l		1.0	98	1433	11/23/92	LW
225394	Spike		mg/l		1.0	101	1433	11/23/92	LW
			TCLP Chromium (Reg. Limit 5.0)						
	Blank	<.02	mg/l				1433	11/23/92	LW
	Blank	<.02	mg/l				1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	5.4	mg/l	5.0		108	1433	11/23/92	LW
	Standard	11	mg/l	10		110	1433	11/23/92	LW
	Standard	5.4	mg/l	5.0		108	1433	11/23/92	LW
	Standard	5.0	mg/l	5.0		100	1433	11/23/92	LW
	Standard	4.7	mg/l	5.0		106	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		10	107	1433	11/23/92	LW
225219	Spike		mg/l		10	110	1433	11/23/92	LW
225318	Spike		mg/l		10	98	1433	11/23/92	LW
225319	Spike		mg/l		10	101	1433	11/23/92	LW
225320	Spike		mg/l		10	94	1433	11/23/92	LW
225321	Spike		mg/l		10	99	1433	11/23/92	LW
225533	Spike		mg/l		1.0	97	1433	11/23/92	LW
225394	Spike		mg/l		10	98	1433	11/23/92	LW
			TCLP Mercury (Reg. Limit 0.2)						
	Blank	.001	mg/l				1100	11/17/92	LW

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Sample #	Description	Result	Units	Dup/Std Value	Spk Conc.	Percent	Time	Date	By
	Standard	.024	mg/l	.025		104	1100	11/17/92	LW
	Standard	.009	mg/l	.010		111	1100	11/17/92	LW
	Standard	.011	mg/l	.010		110	1100	11/17/92	LW
	Standard	.011	mg/l	.010		110	1100	11/17/92	LW
	Standard	.010	mg/l	.010		100	1100	11/17/92	LW
	Standard	.011	mg/l	.010		110	1100	11/17/92	LW
225219	Duplicate	ND	mg/l	ND		100	1100	11/17/92	LW
224985	Duplicate	.002	mg/l	.001		167	1100	11/17/92	LW
225219	Spike		mg/l		.010	106	1100	11/17/92	LW
224985	Spike		mg/l		.010	118	1100	11/17/92	LW
			TCLP Lead (Reg. Limit 5.0)						
	Blank	<.1	mg/l				1433	11/23/92	LW
	Blank	<.1	mg/l				1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	5.4	mg/l	5.0		108	1433	11/23/92	LW
	Standard	12	mg/l	10		118	1433	11/23/92	LW
	Standard	5.2	mg/l	5.0		104	1433	11/23/92	LW
	Standard	4.9	mg/l	5.0		102	1433	11/23/92	LW
	Standard	5.0	mg/l	5.0		100	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		10	112	1433	11/23/92	LW
225219	Spike		mg/l		10	118	1433	11/23/92	LW
225318	Spike		mg/l		10	105	1433	11/23/92	LW
225319	Spike		mg/l		10	109	1433	11/23/92	LW
225320	Spike		mg/l		10	102	1433	11/23/92	LW
225321	Spike		mg/l		10	107	1433	11/23/92	LW
225533	Spike		mg/l		10	105	1433	11/23/92	LW
225394	Spike		mg/l		10	107	1433	11/23/92	LW
			TCLP Selenium (Reg. Limit 1.0)						
	Blank	<.2	mg/l				1433	11/23/92	LW
	Blank	<.2	mg/l				1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	1.1	mg/l	1.0		110	1433	11/23/92	LW
	Standard	.96	mg/l	1.0		104	1433	11/23/92	LW
	Standard	5.0	mg/l	5.0		100	1433	11/23/92	LW
	Standard	4.8	mg/l	5.0		104	1433	11/23/92	LW
	Standard	4.6	mg/l	5.0		108	1433	11/23/92	LW
225318	Duplicate	ND	mg/l	ND		100	1433	11/23/92	LW
224883	Spike		mg/l		1.0	99	1433	11/23/92	LW
225219	Spike		mg/l		1.0	93	1433	11/23/92	LW
225318	Spike		mg/l		1.0	90	1433	11/23/92	LW
225319	Spike		mg/l		1.0	98	1433	11/23/92	LW
225320	Spike		mg/l		1.0	94	1433	11/23/92	LW
225321	Spike		mg/l		1.0	106	1433	11/23/92	LW
225533	Spike		mg/l		1.0	88	1433	11/23/92	LW
25394	Spike		mg/l		1.0	100	1433	11/23/92	LW

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Blank For GC TCLP Herbicide

11/18/92- Shift 1 Analyzed by KB

Parameter	Value	EQL
TCLP 2,4 D (Reg. L	ND	0.500
TCLP 2,4,5-TP (Sil	ND	0.500

Standard For GC TCLP Herbicide

11/18/92- Shift 1 Analyzed by KB

Parameter	Minimum	Maximum	Conc.	Calc.	EQL	%Diff.
TCLP 2,4 D (Reg. L	50.000	150.000	15.000	15.000	0.500	0%
TCLP 2,4,5-TP (Sil	50.000	150.000	10.000	10.000	0.500	0%

Blank For GC TCLP Pesticide

11/17/92- Shift 1 Analyzed by KB

Parameter	Value	EQL
TCLP Gamma-BHC (Lin	ND	0.500
TCLP Heptachlor (Li	ND	0.500
TCLP Heptachlor Epo	ND	0.500
TCLP Endrin (Reg. L	ND	0.500
TCLP Methoxychlor (	ND	0.500
TCLP Chlordane (Reg	ND	0.500
TCLP Toxaphene (Reg	ND	0.500

Standard For GC TCLP Pesticide

11/17/92- Shift 1 Analyzed by KB

Parameter	Minimum	Maximum	Conc.	Calc.	EQL	%Diff.

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TCLP Gamma-BHC (Lin	50.000	150.000	5.000	5.400	0.500	8%
TCLP Heptachlor (Li	50.000	150.000	5.000	5.100	0.500	2%
TCLP Heptachlor Epo	50.000	150.000	5.000	5.100	0.500	2%
TCLP Endrin (Reg. L	50.000	150.000	5.000	5.200	0.500	4%
TCLP Methoxychlor (	50.000	150.000	5.000	5.200	0.500	4%
TCLP Chlordane (Reg	50.000	150.000	5.000	5.400	0.500	8%
TCLP Toxaphene (Reg	50.000	150.000	10.000	10.000	0.500	0%

Decafluorotriphenylphosphine

11/23/92- Shift 1 Analyzed by GO

Mass	Ref. Mass	Minimum	Maximum	%Mass	Report
51	Of Of 198	30.000	60.000	47.8	PASS
68	Of Of 69	0.000	2.000	0.8	PASS
69	Of Of 198	0.000	100.000	51.6	PASS
70	Of Of 69	0.000	2.000	0.8	PASS
197	Of Of 198	40.000	60.000	59.5	PASS
	Of Of 198	0.000	1.000	0.0	PASS
198	Of Base Pe	100.000	100.000	100.0	PASS
199	Of Of 198	5.000	9.000	5.8	PASS
275	Of Of 198	10.000	30.000	18.4	PASS
365	Of Of 198	1.000	100.000	2.2	PASS
441	Of Of 443	0.000	100.000	60.2	PASS
442	Of Of 198	40.000	100.000	79.3	PASS
443	Of Of 442	17.000	23.000	17.7	PASS

Bromofluorobenzene

11/18/92- Shift 1 Analyzed by GO

Mass	Ref. Mass	Minimum	Maximum	%Mass	Report
50	Of 95	15.000	40.000	18.0	PASS
75	Of Of 95	30.000	60.000	42.6	PASS
95	Of Base Pe	100.000	100.000	100.0	PASS
96	Of Of 95	5.000	9.000	8.1	PASS
173	Of Of 174	0.000	2.000	0.0	PASS
174	Of Of 95	50.000	100.000	67.8	PASS
175	Of Of 174	5.000	9.000	5.8	PASS
176	Of Of 174	95.000	101.000	99.5	PASS
	Of Of 176	5.000	9.000	8.1	PASS

Continued

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* The EQL represents the EPA Estimated (practical) Quantitation Limit. Note that EPA states the actual limits are matrix dependent.
Reported results for TCLP analysis are corrected upward to reflect matrix spike recoveries.

I certify that the results were generated using the above specified methods.

C.H. Whiteside, Ph.D., President

5.0 REPORT ON UNDERGROUND STORAGE TANKS

This report shall summarize information on Underground Storage Tanks (USTS) at Tinker AFB, including facility number, date of construction, location, known actions and regulatory status, as required by section VI, Task I, c.4.b.ii of the RCRA permit.

5.1 List of Underground Storage Tanks

1. #1b, constructed 1943, located N. of Lake Draper, used as emergency generator tank, removed prior to UST regulations.

2. #34, constructed in 1942, located N of base, removed in 1978.

3. #36, constructed in 1944, located at water well on Midwest Blvd., used as emergency generator tank, removed prior to UST regulations.

4. #37, constructed in 1944, located at water well on Midwest Blvd., used as emergency generator tank, removed prior to UST regulations.

5. #42x, constructed in 1989, located at vortac facility N of I-40, used as emergency generator tank, no action to date, deferred from leak testing under 40 CFR part 280.

6. #11702, constructed in 1984, located SE of B-117, used to contain fire fighting foam, no action to date, exempt under 40 CFR part 280.

7. #201a, constructed in 1942, located W of B-201 in U, used as emergency generator tank, abandoned prior to 1980, identified under base IRP program as one of the Four Fuel Sites.

8. #201b, constructed in 1942, located N of B-201, used to store waste solvent, abandoned prior to 1980, identified under base IRP program as one of the Four Fuel Sites.

9. #204, constructed in 1944, located S of B-201, used to store solvent, abandoned prior to 1980, identified under base IRP program as one of the Four Fuel Sites.

10. #208a, constructed in 1977, located E of B-208, used to store #2 Heating Oil for on site boiler room. Tanks are vaulted. (Listed as AOC, Diesel Fuel Area, N of B-210). Exempt from 40 CFR part 280.

11. #208b, same as 208a.

12. #208c, same as 208a.

13. #208d, same as 208a.

14. #210, constructed in 1942, located S of B-210, used as an emergency generator tank, removed prior to UST regulations.

15. #211, constructed in 1943, located E of B-210, used to store solvent, removed prior to UST regulations.

16. #212, constructed in 1944, located E of B-210, used to store mogas, removed prior to UST regulations.

17. #214, constructed in 1944, located W of B-214, used for waste recovery, permanently closed in place.

18. #226, constructed in 1979, located SE of B-228, used to store diesel fuel, permanently closed in place.

19. #228, constructed in 1943, located S of center of B-228, used for waste recovery, permanently closed in place.

20. #230, constructed in 1942, located SE of B-230, used as emergency generator tank, deferred from leak testing under 40 CFR Part 280.

21. #231a, constructed in 1943, located between B-244 and B-230, used to store de-icing fluid, temporarily out of service under 40 CFR part 280.

22. #240, constructed in 1942, located NW of the center of B-240, used as emergency generator tank, deferred from leak testing under 40 CFR part 280.

23. #241, constructed in 1952, located E of water tank 243, used as emergency generator tank, deferred from leak testing under 40 CFR part 280.

24. #247, constructed in 1944, located SE of wash rack at B-247, used as emergency generator tank, removed prior to UST regulations.

25. #248, constructed in 1982, located between B-244 and B-230, used to store de-icing fluid, temporarily out of service under 40 CFR part 280.

26. #249, constructed in 1943, located 100′ W of B-230, used as emergency generator tank, removed in 1977 prior to UST regulations.

27. #250, constructed in 1944, located under B-251 parking lot, removed in 1979 prior to UST regulations.

28. #256, constructed in 1944, located under B-251 parking lot, tank was filled with sand in 1979 prior to UST regulations.

29. #259, constructed in 1944, located under B-251 parking lot, tank was filled with sand in 1979 prior to UST regulations.

30. #260, constructed in 1985, located W of B-260 junction dock, used as emergency generator tank, deferred from leak testing under 40 CFR part 280.

31. #264, constructed in 1967, located S of B-228, originally installed as part of a pritchard hydrant system, currently used as fuel storage for ground power support, leak tested once a year IAW 40 CFR part 280 using the Tracer Test method.

32. #266, same as #264.

33. #269, constructed in 1980, located S of B-228, used as fuel storage for ground power support, shall be tested yearly beginning 1993 IAW 40 CFR part 280.

34. #271, constructed in 1986, located under the POL parking lot, used as an oil/water separator, exempt from 40 CFR part 280.

35. #284, constructed in 1976, located SE of B-284, used as an emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

36. #286, constructed in 1974, located NE of water tank #243, used to store fuel for transient alert ground power, leak tested yearly IAW 40 CFR part 280 using the Acutest method.

37. #287, same as #286.

38. #291, constructed in 1943, located N end of B-290 fuel yard, used as waste fuel/water storage tank, filled with sand and demolished in place as part of the B-290 fuel yard removal project completed in 1986 by the Corps of Engineers.

39. #292, constructed in 1943, located E end of B-290 fuel yard, used to store fuel, filled with sand and demolished in place as part of the B-290 fuel yard removal project completed in 1986 by the Corps of Engineers.

40. #293, same as #292.

41. #294, same as #292.

42. #295, same as #292.

43. #298, constructed in 1942, located NE of B-230, used as part of the hydrant defuel system, abandoned prior to the UST regulations and filled with sand.

44. #301, same as #292.

45. #302, same as #292.

46. #303, same as #292.

47. #304, same as #292.

48. #305, same as #292.

49. #306, same as #292.

50. #307, same as #292.

51. #308, same as #292.

52. #309, same as #292.

53. #310, same as #292.

54. #311, same as #292.

55. #312, same as #292.

56. #313, same as #292.

57. #314, same as #292.

58. #315, same as #292.

59. #316, same as #292.

60. #317, same as #292.

61. #318, same as #292.

62. #319, same as #292.

63. #320, same as #292.

64. #347, constructed in 1989, located at the new B-290 POL yard, used as a fuel recovery tank, operated IAW 40 CFR part 280.

65. #402, constructed in 1975, located at the Area A service station, used as a fuel storage tank, placed out of service in 1990 when the station was closed due to leaking USTs. Currently, the entire site is in the further investigation and fuel recovery phase of Subpart F under 40 CFR part 280.

66. #411, constructed in 1943, replaced in 1982, located at the Area A service station, used as a fuel storage tank, closed along with #402.

67. #414, constructed in 1942, located S of B-414, used as a waste recovery tank, abandoned prior to the UST regulations.

68. #438, constructed in 1942, located at the Area A service station, used as a fuel storage tank, closed in 1989 when found to be leaking. Currently, the entire site is in the further investigation and fuel recovery phase of Subpart F under 40 CFR part 280.

69. #439, same as #438.

70. #482, constructed in 1978, located at the Phillips hydrant system, used as an oil/water separator for the hydrant system, exempt from 40 CFR part 280.

71. #487, constructed in 1978, located at the Phillips hydrant system, used as an emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

72. #504a, constructed in 1985, located N of B-506, used as an emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

73. #504b, same as #504a.

74. #547, constructed in 1942, located at present site of B-504, used to store mo-gas, removed prior to UST regulations.

75. #680, constructed in 1953, located N of 4th St. at K Ave, used as fuel storage at the old BX service station, abandoned and filled with sand in 1970.

76. #681, same as #680.

77. #682, same as #680.

78. #734, constructed in 1942, located between 2nd St N and 2nd St. S, approximately 100 yds E of Air Depot Blvd., used to store mo-gas, removed in 1969 prior to 40 CFR part 280.

79. #738, constructed in 1970, located N of B-740 at the BX service station, used to store fuel for military personnel usage, to be leak tested annually IAW 40 CFR part 280.

80. #739, same as #738.

81. #740, same as #738 except stores waste oils.

82. #741, same as #738.

83. #743, same as #738.

84. #886, constructed in 1942, located W of B-773, used to store fuel for military vehicles, leak tested annually IAW 40 CFR part 280 using the Acutest method.

85. #887, constructed in 1954, replaced in 1984, located W of B-773, used to store fuel for military vehicles, to be leak tested annually IAW 40 CFR part 280.

86. #906, constructed in 1980, located S of taxiway XII, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

87. #908, constructed in 1944, located by main runway N of taxiway X, used as emergency generator fuel storage tank, abandoned and removed in 1983.

88. #916, constructed in 1981, located at Vortac Rd. E of B-923, used as emergency generator fuel storage tank, removed when Vortac was removed prior to 1988.

89. #923, constructed in 1985, located at Vortac Rd. E of B-923, used to store diesel fuel, removed when Vortac was removed prior to 1988.

90. #928, constructed in 1964, located 100 yds E of B-18, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

91. #930, constructed in 1965, located by middle marker S of 74th St., used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

92. #932, constructed in 1981, located at fire training area W of tower, used to store fuel used for training burns, to be leak tested IAW 40 CFR part 280.

93. #933, constructed in 1979, located NW of B-3001, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

94. #934, constructed in 1943, located by old outer marker, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

95. #935, constructed in 1970, located on Tower Rd at B-935, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

96. #942, constructed in 1979, located at the SW corner at SW end of runway, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

97. #971, constructed in 1984, located S of Alert AWAC AGE shop at B-985, used to store fuel waste, closed in 1989, site currently under investigation for fuel contamination IAW 40 CFR part 280.

98. #972, constructed in 1984, located S of Alert AWAC AGE shop at B-985, used to store fuel for ground support crews, leak tested annually IAW 40 CFR part 280 using the Acutest method.

99. #973, same as #972.

100. #974, same as #972.

101. #981, constructed in 1984, located N of Alert AWAC A/C ramp, used as oil/water separator, exempt from 40 CFR part 280.

102. #988, constructed in 1984, located E of Alert AWAC guard gate, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

103. #995, constructed in 1984, located S of Alert AWAC pump house, used as oil/water separator, exempt from 40 CFR part 280.

104. #996, constructed in 1984, located at W outside fence of Alert AWAC hydrant system, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280, under temporary closure IAW 40 CFR part 280, to be replaced with aboveground tank.

105. #1002, constructed in 1986, located E of B-1010 (3rd Mob), used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

106. #1008, constructed in 1967, located E of B-1010, used to store fuel, leak tested annually IAW 40 CFR part 280 using the Acutest method.

107. #1009, same as #1008.

108. #1010, constructed in 1967, located S of B-1010, used as oil/water separator, exempt from 40 CFR part 280.

109. #1024, constructed in 1944, located E of rifle range, used for fuel storage, abandoned and filled with sand in 1971.

110. #1032, constructed in 1983, located SE of B-1032, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

111. #1041, constructed in 1969, located NW of B-1041, used as oil/water separator, exempt from 40 CFR part 280.

112. #1060, constructed in 1973, located N of B-1041, used for ground support vehicles for 507th TAC wing, to be leak tested annually IAW 40 CFR part 280.

113. #1061, same as #1060.

114. #1071, constructed in 1973, located SE of B-1071, used as oil/water separator, exempt from 40 CFR part 280.

115. #1092, constructed in 1983, located N of B-1041, used for ground support vehicles for 507th TAC wing, to be tested annually IAW 40 CFR part 280.

116. #1100, constructed in 1962, located E of B-1100, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280. Abandoned and removed in 1980.

117. #1107, constructed in 1988, located W of B-1105, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

118. #1111, constructed in 1967, located on Pond Road, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

119. #1116, constructed in 1973, located N of B-1112, used as a miscellaneous storage tank, removed during construction of Navy facility.

120. #1124, constructed in 1974, located SW of B-1124, used as an emergency generator fuel storage tank, removed during the demolition of B-1124 for construction of Navy facility.

121. #2101, constructed in 1953, located 100′ N of B-2101, used to store waste oil, leak tested in 1989, found to be tight but tank was no longer needed. Permanently closed in 1990.

122. #2102a, constructed in 1977, located S of B-2102, used to store #2 heating oil, exempt from 40 CFR part 280.

123. #2102b, constructed in 1953, located S of B-2102, used as an emergency generator fuel storage tank, abandoned and removed in 1970.

124. #2104, constructed in 1953, located 100′ SW of B-2101, used to store Mo-gas, abandoned and permanently closed in place in 1967.

125. #2105, same as #2104.

126. #2106, constructed in 1953, located between B-2101 and B-2103, used to store mo-gas at the old service station, abandoned and permanently closed in place in 1968.

127. #2107, same as #2106.

128. #2109, constructed in 1956, located S of B-2101, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

129. #2114, constructed in 1970, located S of B-2121, used to store purged fuel from aircraft in association with the purging hydrant system. Deferred from leak testing under 40 CFR part 280. However will be tested in 1991 to ensure integrity.

130. #2115, same as #2114.

131. #2117, same as #2112, except contains waste fuel from hydrant system. Regulated under Subtitle C, integrity tested and secondary containment installed in 1991.

132. #2119, constructed in 1943, located W of B-2119, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

133. #2123a, constructed in 1980, located E of B-2123, used to store diesel to support fire departments main pump station (pumping water to fire hydrants). To be tested annually IAW 40 CFR part 280.

134. #2123b, same as #2123a.

135. #2123c, same as #2123a.

136. #2123d, same as #2123a.

137. #2127, constructed in 1943, located E of B-2127, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

138. #2210, constructed in 1975, located at SE corner of B-2210, used to store used 7808 oil, regulated under Subtitle C, integrity tested and secondary containment installed in 1991.

139. #2228, constructed in 1974, located NE of B-2129 wood mill, used to store mo-gas, removed prior to UST regulations.

140. #2230, same as #2228.

141. #3001e, constructed in 1977, located outside boiler room of B-3001, used to store #2 heating oil, exempt from 40 CFR part 280.

142. #3001g, constructed in 1943, located in S dog leg of B-3001 NE of B-3108, used to store used PD-680, regulated under Subtitle C, integrity tested and secondary containment installed in 1991.

143. #3002, constructed in 1979, located outside boiler room, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

144. #3003, constructed in 1979, located on the E side of autodin, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

145. #3010, constructed in 1956, located NW of B-3001 across the road, used to store diesel, permanently closed in 1990.

146. #3011, same as #3010 except stored JP-5 purge fluid.

147. #3012, same as #3010 except stored av-gas.

148. #3017, constructed in 1965, located N of B-3001 next to dock, used to store waste, abandoned in the 70's,

identified under the base IRP program as part of the North Tank Fuel Site.

149. #3018, constructed in 1985, located N of computer room, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

150. #3019, same as #3018.

151. #3100, constructed in 1971, located W of B-3108 across the road, used to store new calibrating fluid, to be leak tested annually IAW 40 CFR part 280.

152. #3104, constructed in 1971, located W of B-3108 across the road, used to store new calibrating fluid, found to be leaking in 1991, currently complying with Subpart F of 40 CFR part 280.

153. #3106, constructed in 1971, located W of B-3108 across the road, used to store waste calibrating fluid, regulated under Subtitle C, integrity tested and secondary containment installed in 1991.

154. #3115, constructed in 1979, located SW of B-3234, used as water/fuel storage tank, to be tested IAW 40 CFR part 280.

155. #3130, constructed in 1943, located SW of B-3108, used to store PD-680, permanently closed in 1990, identified under the base IRP program as part of the Southwest Tank Area.

156. #3131, same as #3130.

157. #3132, constructed in 1943, located NE of B-3105, used to store solvent, permanently closed in 1968, identified under the base IRP program as part of the Southwest Tank Area.

158. #3133, same as #3132.

159. #3140, constructed in 1943, located across the road from B-3108, used to store av-gas, permanently closed in 1968, identified under the base IRP program as part of the Southwest Tank Area.

160. #3141, same as #3140.

161. #3142, same as #3140.

162. #3144, same as #3140.

163. #3145, constructed in 1946, located across the road SW of B-3108, used to store solvent, identified under the base IRP program as part of the Southwest Tank Area.

164. #3146, same as #3145 except constructed in 1943.

165. #3147, same as #3134 except constructed in 1943.

166. #3151, constructed in 1949, located S of 3108, originally used to store JP-1, identified under the base IRP program as part of the Southwest Tank Area.

167. #3152, same as #3151 except used to store Naptha.

168. #3153, same as #3151.

169. #3154, same as #3151 except used to store Naptha.

170. #3202, constructed in 1943, located S of pump stations at B-3202, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

171. #3220x, constructed in 1989, located outside of door 146 at B-3220, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

172. #3234, constructed in 1974, located NE of B-3234, used as an oil/water separator, exempt from 40 CFR part 280.

173. #3401, constructed in 1968, located NW of B-3001, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280. To be leak tested in 1991, however, to ensure integrity due to its' close proximity to the IRP North Tank Fuel Site.

174. #3404, constructed in 1943, located NW of B-3001, used to store #2 heating oil, field constructed bulk storage tank, removed from service prior to 1980 under base IRP, identified as part of the North Tank Fuel Site,

175. #3405, constructed in 1946, located NW of B-3001, used to,store mo-gas, removed in 1982. Currently identified under base IRP as part of the North Tank Fuel Site.

176. #3703, constructed in 1954, located W side of 'U' area at B-3703, used as an oil/water separator, exempt from 40 CFR part 280.

177. #3714, constructed in 1963, located N of pump slab in Area C fuel yard, used to store water/fuel from slab, leaktested annually IAW 40 CFR part 280.

178. #3730, constructed in 1954, located in Area C Fuel Yard, closed in 1989, tank removed in 1990 as part of corrective action under Subpart F of 40 CFR part 280. Currently complying with Subpart F investigations and fuel recovery requirements.

179. #3731, same as #3130.

180. #3732, same as #3130.

181. #3733, same as #3130.

182. #3734, same as #3130.

183. #3735, same as #3130.

184. #3801, constructed in 1945, located at water well on Douglas Blvd., used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280, removed prior to UST regulations.

185. #3802, same as #3801.

186. #3803, same as #3801

187. #4006, constructed in 1951, located E of water wells, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

188 #4007, constructed in 1977, located NE of B-4007, used to store #2 heating oil, exempt from 40 CFR part 280.

189. #4029, constructed in 1973, located SW of B-4029, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

190. #4044, constructed in 1954, located at area D water well, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

191. #5802a, constructed in 1977, located N of B-5802, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280, removed in 1981.

192. #5802b, constructed in 1977, located N of B-5802, used to store #2 heating oil, exempt from 40 CFR part 280.

193. #5808, constructed in 1981, located S of hospital, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

194. #6002, constructed in 1962, located E to shop area, used to store waste oil, to be removed IAW 40 CFR part 280.

195. #7001, constructed in 1969, located SW of B-7001, used as oil/water separator, exempt from 40 CFR part 280.

196. #20281, constructed in 1980, located SE of B-280, used as emergency generator fuel storage tank, deferred from leak testing under 40 CFR part 280.

197. #21401, constructed in 1987, located W of B-214, used to contain fuel for missile test cells, leak detection in compliance with 40 CFR part 280 installed at installation.

198. #21402, same as #21401.

199. #21403, same as #21401.

200. #21404, same as #21401.

201. #21405, same as #21401.

202. #21406, same as #21401.

203. #21407, same as #21401.

204. #21601e, constructed in 1990, located N of B-16, used as the secondary containment for spills in the hazardous paint and acid storage area. Exempt from 40 CFR part 280.

205. #21602e, same as #21601e.

206. #21603e, same as #21601e.

207. #21604e, same as #21601e.

208. #21605e, same as #21601e.

209. #21606e, same as #21601e.

210. #21607e, same as #21601e.

211. #21701, constructed in 1984, located NE of B-117, used to store waste oil, to be leak tested IAW 40 CFR part 280.

212. #62516, constructed in 1973, located E of Industrial Waste Treatment Plant, used to store diesel, permanently abandoned in 1983.

213. #62926, constructed in 1989, located E of 926, used as an oil/water separator, exempt from 40 CFR part 280.

5.2 LEAK TESTING RESULTS

The following is a summary of the leak testing results from 1989 through the present and a summary of any corrective actions.

TABLE 1

UNDERGROUND STORAGE TANK LEAK TESTING AND CORRECTIVE ACTION

			---Leaktesting Results----				
#	Tank #	Active	1989	1990	1991	1992	Corrective action**
1.	1b	no	-	-	-	-	none
2.	34	no	-	-	-	-	none
3.	36	no	-	-	-	-	none
4.	37	no	-	-	-	-	none
5.	42x	yes	deferred	-	-	-	none
6.	11702	yes	exempt	-	-	-	none
7.	201a	no	-	-	-	-	IRP
8.	201b	no	-	-	-	-	IRP
9.	204	no	-	-	-	-	IRP
10.	208a	yes	exempt	-	-	-	none
11.	208b	yes	exempt	-	-	-	none
12.	208c	yes	exempt	-	-	-	none
13.	208d	yes	exempt	-	-	-	none
14.	210	no	-	-	-	-	none
15.	211	no	-	-	-	-	none
16.	212	no	-	-	-	-	none
17.	214	no	-	-	-	-	none
18.	226	no	-	-	-	-	none
19.	228	no	-	-	-	-	none
20.	230	yes	deferred	-	-	-	none
21.	231a	no	pass	-	-	-	none
22.	240	yes	deferred	-	-	-	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
23.	241	yes	deferred	-	-	-	none
24.	247	no	-	-	-	-	none
25.	248	no	-	-	-	-	none
26.	249	no	-	-	-	-	none
27.	250	no	-	-	-	-	none
28.	256	no	-	-	-	-	none
29.	259	no	-	-	-	-	none
30.	260	yes	deferred	-	-	-	none
31.	264	yes	-	pass	pass	*	none
32.	266	yes	-	pass	pass	*	none
33.	269	yes	due 1993	-	-	-	none
34.	271	yes	exempt	-	-	-	none
35.	284	yes	deferred	-	-	-	none
36.	286	yes	-	-	pass	pass	none
37.	287	yes	-	-	pass	pass	none
38.	291	no	-	-	-	-	IRP
39.	292	no	-	-	-	-	IRP
40.	293	no	-	-	-	-	IRP
41.	294	no	-	-	-	-	IRP
41.	295	no	-	-	-	-	IRP
43.	298	no	-	-	-	-	IRP
44.	301	no	-	-	-	-	IRP
45.	302	no	-	-	-	-	IRP
46.	303	no	-	-	-	-	IRP
47.	304	no	-	-	-	-	IRP
48.	305	no	-	-	-	-	IRP
49.	306	no	-	-	-	-	IRP
50.	307	no	-	-	-	-	IRP
51.	308	no	-	-	-	-	IRP
52.	309	no	-	-	-	-	IRP

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
53.	310	no	-	-	-	-	IRP
54.	311	no	-	-	-	-	IRP
55.	312	no	-	-	-	-	IRP
56.	313	no	-	-	-	-	IRP
57.	314	no	-	-	-	-	IRP
58.	315	no	-	-	-	-	IRP
59.	316	no	-	-	-	-	IRP
60.	317	no	-	-	-	-	IRP
61.	318	no	-	-	-	-	IRP
62.	319	no	-	-	-	-	IRP
63.	320	no	-	-	-	-	IRP
64.	347	yes	upgraded	-	-	-	none
65.	402	no	-	-	-	-	yes
66.	411	no	-	fail	-	-	yes
67.	414	no	-	-	-	-	none
68.	438	no	fail	-	-	-	yes
69.	439	no	fail	-	-	-	yes
70.	482	yes	exempt	-	-	-	none
71.	487	yes	deferred	-	-	-	none
72.	504a	yes	deferred	-	-	-	none
73.	504b	yes	deferred	-	-	-	none
74.	547	no	-	-	-	-	none
75.	680	no	-	-	-	-	none
76.	681	no	-	-	-	-	none
77.	682	no	-	-	-	-	none
78.	734	no	-	-	-	-	none
79.	738	yes	-	-	pass	*	none
80.	739	yes	-	-	pass	*	none
81.	740	no	-	-	fail	-	yes
82.	741	yes	-	-	pass	*	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
83.	**743**	**yes**	-	-	pass	*	none
84.	**886**	**yes**	-	-	pass	*	none
85.	**887**	**yes**	pass	pass	pass	*	none
86.	**906**	**yes**	deferred	-	-	-	none
87.	**908**	**no**	-	-	-	-	none
88.	**916**	**no**	-	-	-	-	none
89.	**923**	**no**	-	-	-	-	none
90.	**928**	**yes**	deferred	-	-	-	none
91.	**930**	**no**	-	-	-	-	none
92.	**932**	**no**	-	-	-	-	IRP
93.	**933**	**no**	-	-	-	-	none
94.	**934**	**yes**	deferred	-	-	-	none
95.	**935**	**yes**	deferred	-	-	-	none
96.	**942**	**no**	-	-	-	-	none
97.	**971**	**no**	-	-	-	-	none
98.	**972**	**yes**	-	pass	pass	pass	none
99.	**973**	**yes**	-	pass	pass	pass	none
100.	**974**	**yes**	-	pass	pass	pass	none
101.	**981**	**yes**	exempt	-	-	-	none
102.	**988**	**yes**	deferred	-	-	-	none
103.	**995**	**yes**	exempt	-	-	-	none
104.	**996**	**no**	-	-	-	-	none
105.	**1002**	**yes**	deferred	-	-	-	none
106.	**1008**	**yes**	-	pass	pass	*	none
107.	**1009**	**yes**	-	pass	pass	*	none
108.	**1010**	**yes**	exempt	-	-	-	none
109.	**1024**	**no**	-	-	-	-	none
110.	**1032**	**yes**	deferred	-	-	-	none
111.	**1041**	**yes**	exempt	-	-	-	none
112.	**1060**	**yes**	-	-	pass	*	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
113.	1061	yes	-	-	pass	*	none
114.	1071	yes	exempt	-	-	-	none
115.	1092	yes	-	-	pass	*	none
116.	1100	no	-	-	-	-	none
117.	1107	yes	deferred	-	-	-	none
118.	1111	yes	deferred	-	-	-	none
119.	1116	no	-	-	-	-	none
120.	1124	no	-	-	-	-	none
121.	2101	no	pass	-	-	-	none
122.	2102a	yes	exempt	-	-	-	none
123.	2102b	no	-	-	-	-	none
124.	2104	no	-	-	-	-	none
125.	2105	no	-	-	-	-	none
126.	2106	no	-	-	-	-	none
127.	2107	no	-	-	-	-	none
128.	2109	yes	deferred	-	-	-	none
129.	2114	yes	deferred	-	pass	-	yes
130.	2115	yes	deferred	-	pass	-	yes
131.	2117	yes	subtitle C	-	pass	-	none
132.	2119	yes	deferred	-	-	-	none
133.	2123a	yes	deferred	-	-	-	none
134.	2123b	yes	deferred	-	-	-	none
135.	2123c	yes	deferred	-	-	-	none
136.	2123d	yes	deferred	-	-	-	none
137.	2127	yes	deferred	-	-	-	none
138.	2210	yes	subtitle C	-	pass	-	none
139.	2228	no	-	-	-	-	none
140.	2230	no	-	-	-	-	none
141.	3001e	yes	exempt	-	-	-	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
142.	3001g	yes	subtitle C	-	pass	-	none
143.	3002	yes	deferred	-	-	-	none
144.	3003	no	-	-	-	-	none
145.	3010	no	-	-	-	-	none
146.	3011	no	-	-	-	-	none
147.	3012	no	-	-	-	-	none
148.	3017	no	-	-	-	-	IRP
149.	3018	yes	deferred	-	-	-	none
150.	3019	yes	deferred	-	-	-	none
151.	3100	no	-	-	fail	-	yes
152.	3104	no	-	-	fail	-	yes
153.	3106	no	subtitle C	-	pass	-	none
154.	3115	no	-	-	-	-	none
155.	3130	no	fail	-	-	-	IRP
156.	3131	no	fail	-	-	-	IRP
157.	3132	no	-	-	-	-	IRP
158.	3133	no	-	-	-	-	IRP
159.	3140	no	-	-	-	-	IRP
160.	3141	no	-	-	-	-	IRP
161.	3142	no	-	-	-	-	IRP
162.	3144	no	-	-	-	-	IRP
163.	3145	no	-	-	-	-	IRP
164.	3146	no	-	-	-	-	IRP
165.	3147	no	-	-	-	-	IRP
166.	3151	no	-	-	-	-	IRP
167.	3152	no	-	-	-	-	IRP
168.	3153	no	-	-	-	-	IRP
169.	3154	no	-	-	-	-	IRP
170.	3202	yes	deferred	-	-	-	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
171.	3220x	yes	deferred	-	-	-	none
172.	3234	yes	exempt	-	-	-	none
173.	3401	yes	deferred	-	pass	-	none
174.	3404	no	-	-	-	-	IRP
175.	3405	no	-	-	-	-	IRP
176.	3703	yes	exempt	-	-	-	none
177.	3714	yes	pass	pass	pass	*	none
178.	3730	no	fail	-	-	-	yes
179.	3731	no	pass	-	-	-	yes
180.	3732	no	pass	-	-	-	yes
181.	3733	no	pass	-	-	-	yes
182.	3734	no	fail	-	-	-	yes
183.	3735	no	pass	-	-	-	yes
184.	3801	no	-	-	-	-	none
185.	3802	no	-	-	-	-	none
186.	3803	no	-	-	-	-	none
187.	4006	yes	deferred	-	-	-	none
188.	4007	yes	exempt	-	-	-	none
189.	4029	yes	deferred	-	-	-	none
190.	4044	yes	deferred	-	-	-	none
191.	5802a	no	-	-	-	-	none
192.	5802b	yes	exempt	-	-	-	none
193.	5808	yes	deferred	-	-	-	none
194.	6002	no	-	-	-	-	yes
195.	7001	yes	exempt	-	-	-	none
196.	20281	yes	deferred	-	-	-	none
197.	21401	yes	upgraded	-	-	-	none
198.	21402	yes	upgraded	-	-	-	none
199.	21403	yes	upgraded	-	-	-	none

#	Tank #	Active	1989	1990	1991	1992	Corrective action**
200.	**21404**	**yes**	upgraded	-	-	-	none
201.	**21405**	**yes**	upgraded	-	-	-	none
202.	**21406**	**yes**	upgraded	-	-	-	none
203.	**21407**	**yes**	upgraded	-	-	-	none
204.	**21601e**	**yes**	exempt	-	-	-	none
205.	**21602e**	**yes**	exempt	-	-	-	none
206.	**21603e**	**yes**	exempt	-	-	-	none
207.	**21604e**	**yes**	exempt	-	-	-	none
208.	**21605e**	**yes**	exempt	-	-	-	none
209.	**21606e**	**yes**	exempt	-	-	-	none
210.	**21607e**	**yes**	exempt	-	-	-	none
211.	**21701**	**yes**	due 1993	-	-	-	none
212.	**62516**	**no**	-	-	-	-	none
213.	**62926**	**yes**	exempt	-	-	-	none

* Tanks tested, results pending

** Corrective Actions

IRP - Not regulated under 40 CFR part 280. IRP Corrective actions listed under Part c, Section 1, Part c, section III, and/or Part c, Section IV, paragraph 2.0.

Yes - Corrective actions listed under this section (Part C, Section IV, paragraph 5.3)

5.3 CORRECTIVE ACTIONS

#	Tank #	Corrective Measures and/or References
7.	201a.	See C.1. Implementation of Interim Measures.
8.	201b.	See C.1. " " " "
9.	204.	See C.1. " " " "
21.	231a.	**A. Objectives:** To permanently close this site by removal of an out-of-service deicing fluid tank as protective of human health and the environment 2nd quarter 1992. **B. Design, Construction, Operation and Maintenance Requirements:** Pursuant to the current EPA and Oklahoma Corporation Commission (OCC) Rules and Regulations, this tank was removed by excavation in satisfaction of rules pertaining to permanent closure of out of service USTs. As prior history indicated that this tank had been previously utilized as an aircraft defueling tank, sampling and analysis were expanded to include BTEX, TPH, and Total Lead. Petroleum contaminants were found in the backfill soils. These soils were excavated with the tank

and properly disposed following EPA recommended guidance, API's "Removal and Disposal of Used Underground Petroleum Storage Tanks", OCC's "Procedures for the Management of Petroleum Contaminated Soils", and the Oklahoma State Department of Health (OSDH) Solid Waste Management Service guidelines. The excavation was backfilled with clean soils and the site permanently closed. As the sources of contamination were removed along with all contaminated soils, no further monitoring or maintenance is indicated.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the removal and permanent closure of UST 231A were completed in June 1992. No further action is required for this site.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to give them the opportunity to be on site at their discretion. No further progress reports shall be submitted as this site has been closed. A Closure Report dated 24 July 1992 was completed and submitted to the EPA and the OCC.

Disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Management Service.

25. 248. **A. Objectives:** To permanently close this site by removal of an out-of-service deicing fluid tank as protective of human health and the environment 2nd quarter 1992.

B. Design, Construction, Operation and Maintenance Requirements: Pursuant to the current EPA and Oklahoma Corporation Commission (OCC) Rules and Regulations, this tank was removed by excavation in satisfaction of rules pertaining to permanent closure of out of service USTs. While prior history did not indicate a use other than for unregulated deicing fluid, sampling and analysis were expanded to include BTEX, TPH, and Total Lead. All concentrations were within regulatory parameters. The tank was excavated and properly disposed following EPA recommended guidance, API's "Removal and Disposal of Used Underground Petroleum Storage Tanks", OCC's "Procedures for the Management of Petroleum Contaminated Soils", and the Oklahoma State Department of Health (OSDH) Solid Waste

Management Service guidelines. The excavation was backfilled with clean soils and the site permanently closed. As the source of potential contamination was removed, no further monitoring or maintenance is indicated.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the removal and permanent closure of UST 248 were completed in June 1992. No further action is required for this site.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to give them the opportunity to be on site at their discretion. No further progress reports shall be submitted as this site has been closed. A Closure Report dated 24 July 1992 was completed and submitted to the EPA and the OCC. Disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Management Service.

38-64.	291-295	See C.1 Implementation of Interim Measures See C.3 Identification & Summary of Current Studies
	298,	" " " "
	301-347	" " " "
65.	402	See C.1. Implementation of Interim Measures.
66.	411	" " " "
68.	438	" " " "
69.	439	" " " "

81. 740 **A. Objectives:** Waste oil UST 740 failed leaktesting in 1991 and was subsequently removed from service after being emptied. The site was permanently closed in place June 1992 by filling the tank and associated piping with concrete as protective of human health and the environment.

B. Design, Construction, Operation and Maintenance Requirements: Pursuant to the current EPA and Oklahoma Corporation Commission (OCC) Rules and Regulations, this site was permanently closed in place in satisfaction of the rules pertaining to permanent closure of out of service USTs. Sample results from soil borings indicated the presence of unleaded gasoline in the backfill soils not from UST 740. An Initial

Abatement Report was submitted to regulators 22 June 1992, and followed by an Initial Site Characterization Report in July 1992. Three soil borings were made with two borings converted to monitor wells with no free product present.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the permanent closure in place of UST 740 were completed June 1992. Monitor wells were installed and will be checked periodically for free product. Nearby fuel dispensing tanks are scheduled to be leak tested 4th quarter 1992.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to have the opportunity to be on site at their discretion. No further progress reports will be submitted as this site has been closed. A Closure Report was completed 02 July 1992 and submitted to the EPA and the OCC. Final disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Service.

151. 3100 **A: Objectives:** This UST failed leak testing in 1991 and this site was permanently closed by tank removal 2nd quarter 1992 as protective of human health and the environment.

B. Design, Construction, Operation and Maintenance Requirements: Pursuant to the current EPA and Oklahoma Corporation Commission Rules and Regulation this tank was removed by excavation in satisfaction of rules pertaining to permanent closure of out of service USTs. All associated contaminated soils were removed and disposed pursuant to the current EPA and OCC Rules and Regulations, and the Oklahoma State Department of Health Solid Waste Service guidelines. The tank and all contaminated soils were excavated and disposed of properly following EPA recommended guidance, API's "Removal and Disposal of Used Underground Petroleum Storage Tanks", OCC's "Procedures for the Management of Petroleum Contaminated Soils", and Oklahoma State Department of Health (OSDH) Solid Waste Service guidelines. The excavation was backfilled with clean soils and the site permanently closed. As the sources of contamination (the UST) was removed along with all contaminated soils, no

further monitoring or maintenance is indicated.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the tank and contaminated soils removal and permanent closure of this site have been completed. No further action is required for this site.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to have the opportunity to be on site at their discretion. No further progress reports will be submitted as this site has been closed. Final disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Service. An Initial Site Characterization Report was completed 02 July 1992 and the Closure Report was completed 03 August 1992. Reports were submitted to the EPA and the OCC.

152. 3104 Same as #3100.

153. 3106 **A. Objectives:** An Out of service waste storage tank under split jurisdiction of both the OCC, OSDH and the EPA. This tank was part of the 3100-3104-3106 tank battery removal as a measure

protective of human health and the environment. No contamination was found to be associated with this tank.

B. Design, Construction, Operation, and Maintenance Requirements: Pursuant to the current EPA and Oklahoma Corporation Commission Rules and Regulation this tank was removed by excavation in satisfaction of rules pertaining to permanent closure of out of service USTs. The tank removal and disposal were performed following EPA recommended guidance, API's "Removal and Disposal of Used Underground Petroleum Storage Tanks", OCC's "Procedures for the Management of Petroleum Contaminated Soils", and Oklahoma State Department of Health (OSDH) Solid Waste Service guidelines. The excavation was backfilled with clean soils and the site permanently closed. As the source of potential contamination (the UST) was removed, no further monitoring or maintenance is indicated.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the removal and disposal of the tank satisfying permanent closure requirements have been completed. No further action is required for

this site.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to have the opportunity to be on site at their discretion. No further progress reports will be submitted as this site has been closed. Final disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Service. The Closure Report was completed 03 August 1992 and submitted to the EPA and the OCC.

169.	3401	See C.1 Implementation of Interim Measures. See C.3 Identification & Summary of Current Studies
170.	3404	See C.1 and C.3
171.	3405	See C.1 and C.3
173.	3714	See C.1 Implementation of Interim Measures.
174.	3730	" " " "
175.	3731	" " " "
176.	3732	" " " "
177.	3733	" " " "
178.	3734	" " " "
179.	3735	" " " "

190. 6002 **A. Objectives:** An out of service waste oil storage tank site was permanently closed 2nd quarter 1992, by removal, as a measure protective of human health and the environment.

B. Design, Construction, Operation and Maintenance Requirements: Pursuant to the current EPA and Oklahoma Corporation Commission Rules and Regulation this tank was removed by excavation in satisfaction of rules pertaining to permanent closure of out of service USTs. During removal, the fill pipe was found to be broken and leaking waste oil. The tank and all contaminated soils were excavated and disposed of properly following EPA recommended guidance, API's "Removal and Disposal of Used Underground Petroleum Storage Tanks", OCC's "Procedures for the Management of Petroleum Contaminated Soils", and Oklahoma State Department of Health (OSDH) Solid Waste Service guidelines. The excavation was backfilled with clean soils and the site permanently closed. As the sources of contamination were removed along with all contaminated soils, no further monitoring or maintenance is indicated.

C. Schedules for Design, Construction, and Monitoring: All tasks associated with the removal and permanent closure of UST 6002 were completed in June 1992. No further action is required for this site.

D. Schedule for Progress Reports: Notices to all regulatory agencies were made as required with progress reports given verbally to the OCC to give them the opportunity to be on site at their discretion. No further progress reports will be submitted as this site has been closed. A Closure Report dated 29 July 1992 was completed and submitted to the EPA and the Oklahoma Corporation Commission. Final disposition of all contaminated soils was made with the approval of the OSDH Solid Waste Service.

6.0 INTEGRITY OF BELOW-GROUND INDUSTRIAL WASTEWATER LINES

Tinker began installing sewer lines to handle industrial wastewater in 1962, and have continuously added to the system to the present. The system consists of lines ranging in size from 2 inches in diameter, and are constructed of polyvinyl chloride, vitrified clay, and black iron. The integrity of the system could not be determined, therefore the below-ground industrial wastewater sewer lines, as well as the manholes, are being replaced.

The system that is being installed is a double-walled polypropylene pipe with interstitial monitoring. The inner carrier pipe is rated to 150 pounds per square inch (psi) and has diameters ranging from 2 to 12 inches. The other containment pipe is rated to 45 psi and has diameters ranging from 4 to 24 inches. The leak location/detection system is located between the inner and outer pipe and is capable of continuous monitoring of a sensor string with discrete reporting, including location of leaks, breaks, and shorts. The alarm unit is located at the Industrial Wastewater Treatment Plant and consists of a visual display panel and an audible alarm.

The replacement of the below-ground industrial wastewater lines

is being accomplished in four (4) phases. Phase I began in October 1991 and is scheduled to be completed in February 1993. This phase consists of installing approximately 15,900 linear feet of pipe. Figure 1 depicts the location of the lines being installed for phase I.

Phase II began in October 1992 and is scheduled to be complete in November 1993. This phase consists of installing approximately 15,350 linear feet of pipe. Figure 2 depicts the location of the lines being installed for phase II.

Phase III is scheduled to begin in October 1993 and will consist of installing approximately 16,120 linear feet of pipe. Figure 3 depicts the location of the lines to be installed for phase III.

Phase IV is scheduled to begin in October 1994 and will consist of installing approximately 10,810 linear feet of pipe. Figure 4 depicts the location of the lines to be installed for phase IV.

INDUSTRIAL WASTEWATER SEWER LINES

Phase I

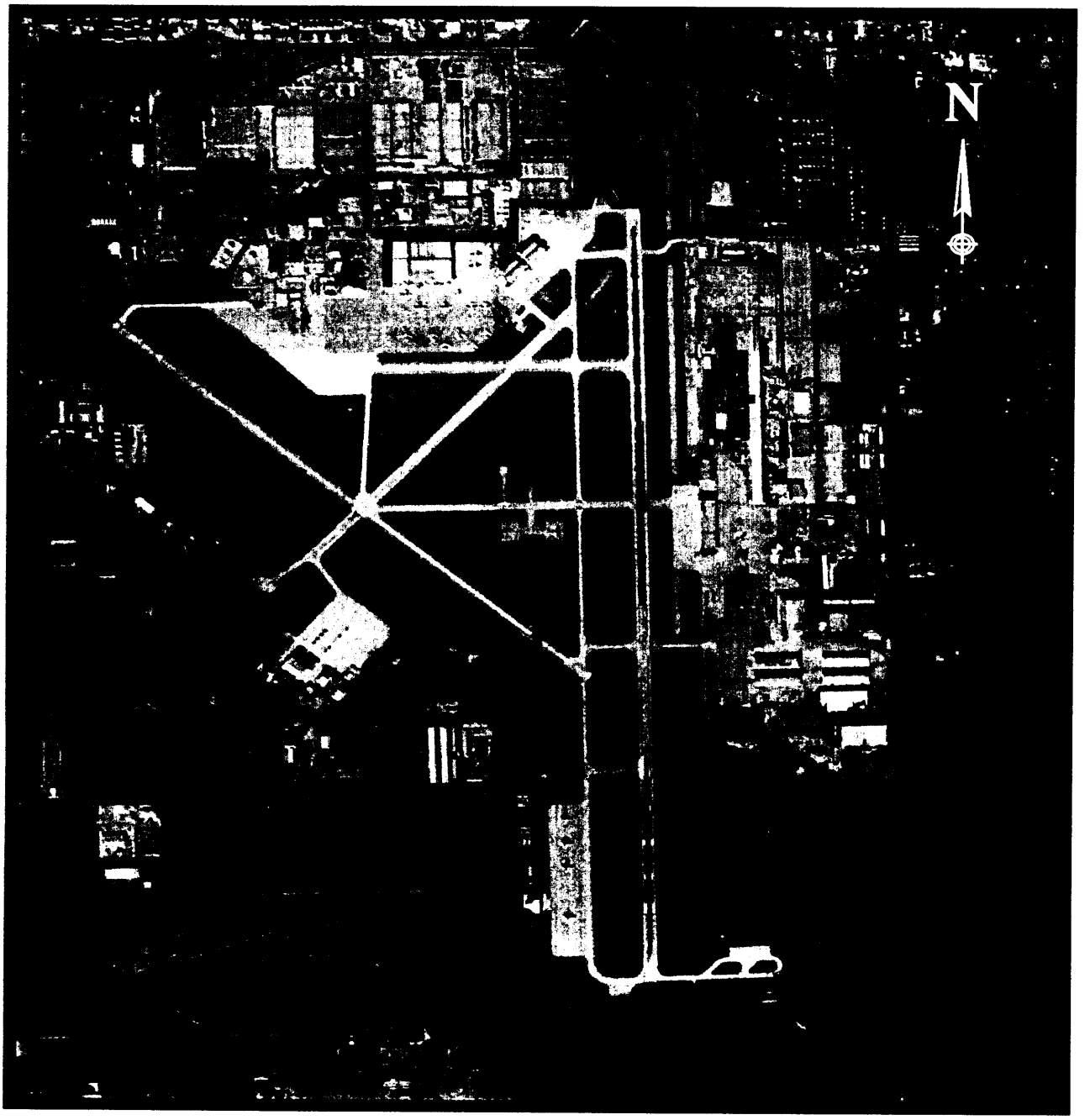

Figure 1

INDUSTRIAL WASTEWATER SEWER LINES

Phase II

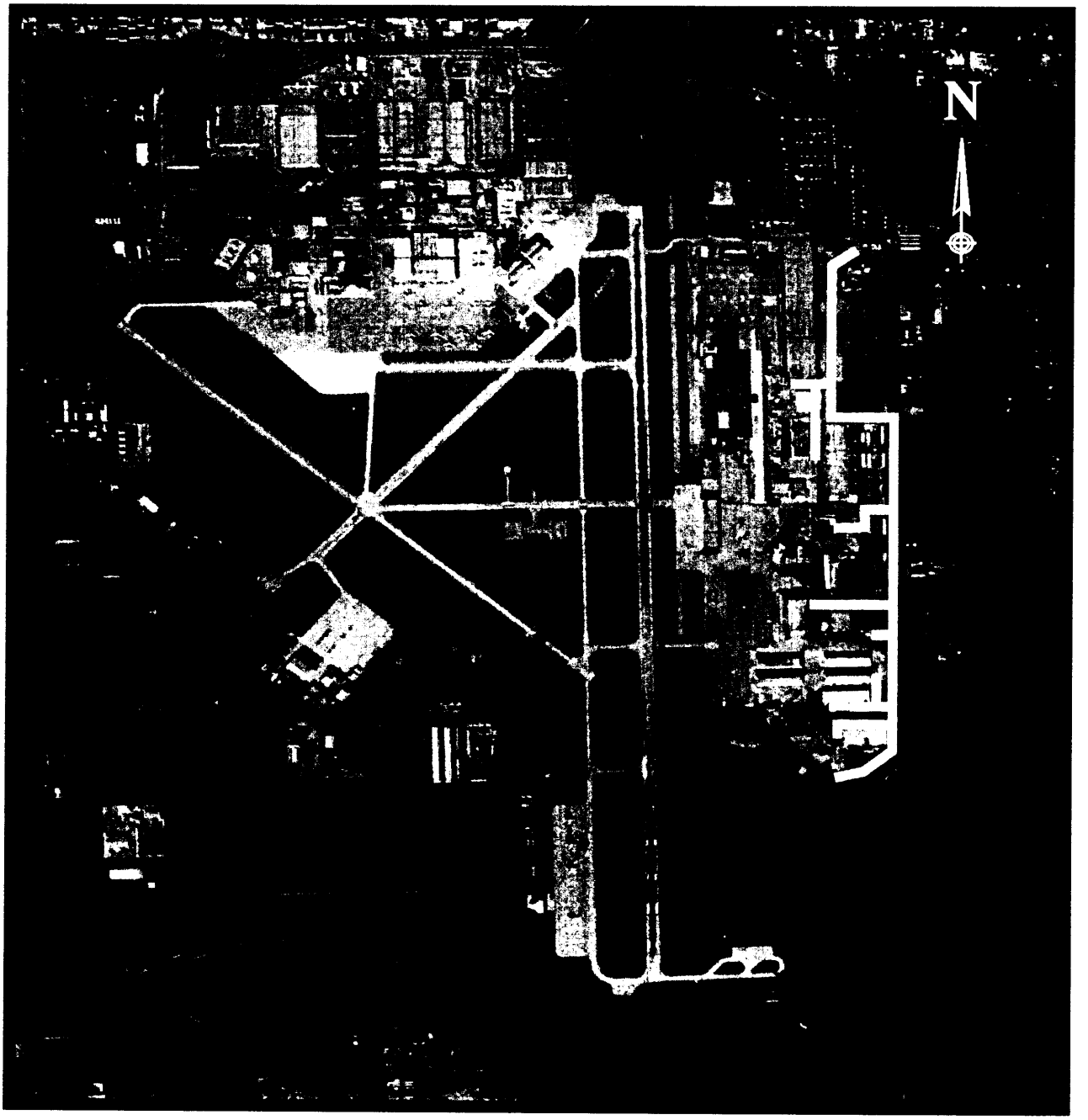

Figure 2

INDUSTRIAL WASTEWATER SEWER LINES

Phase III

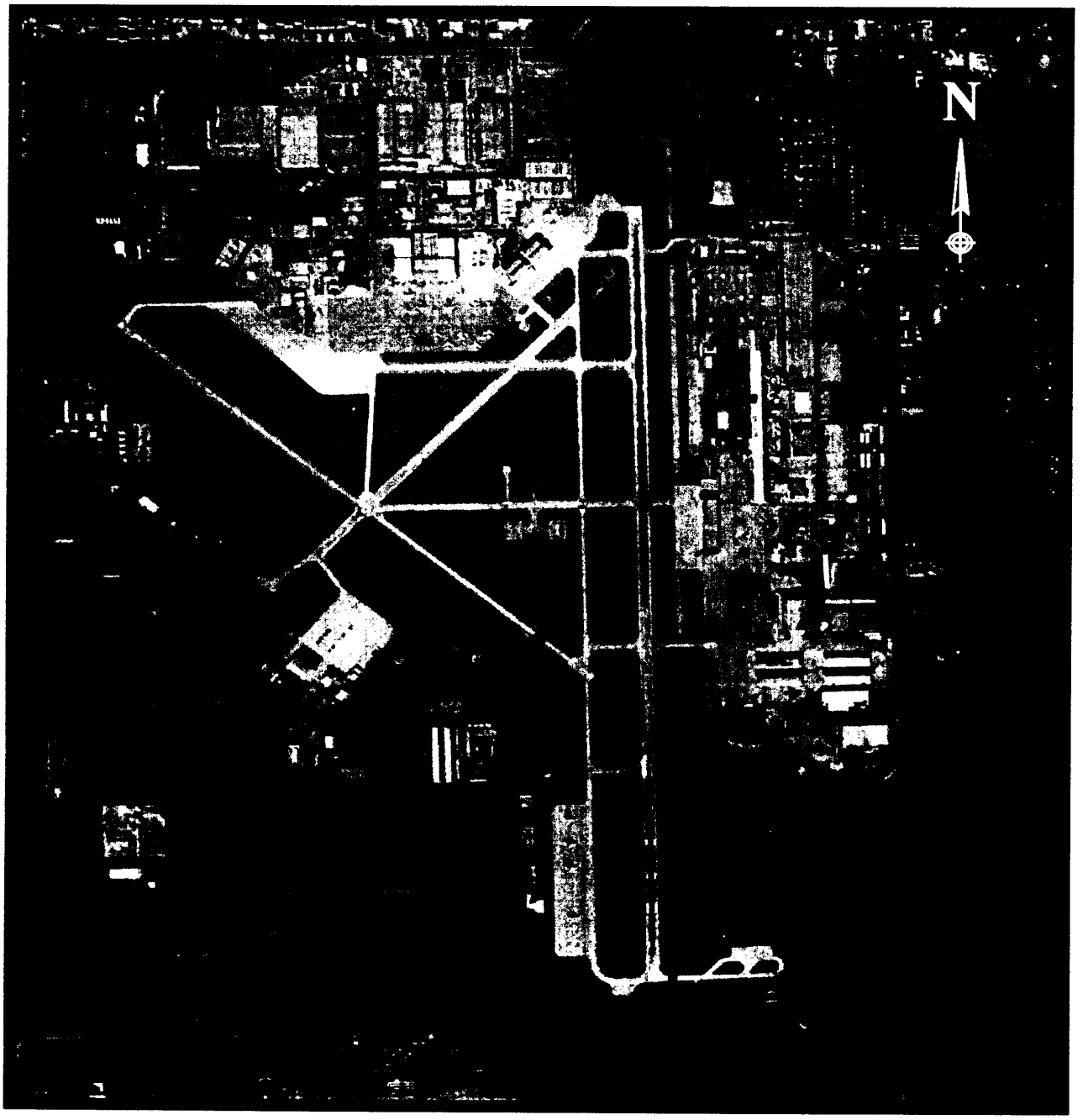

Figure 3

INDUSTRIAL WASTEWATER SEWER LINES

Phase IV

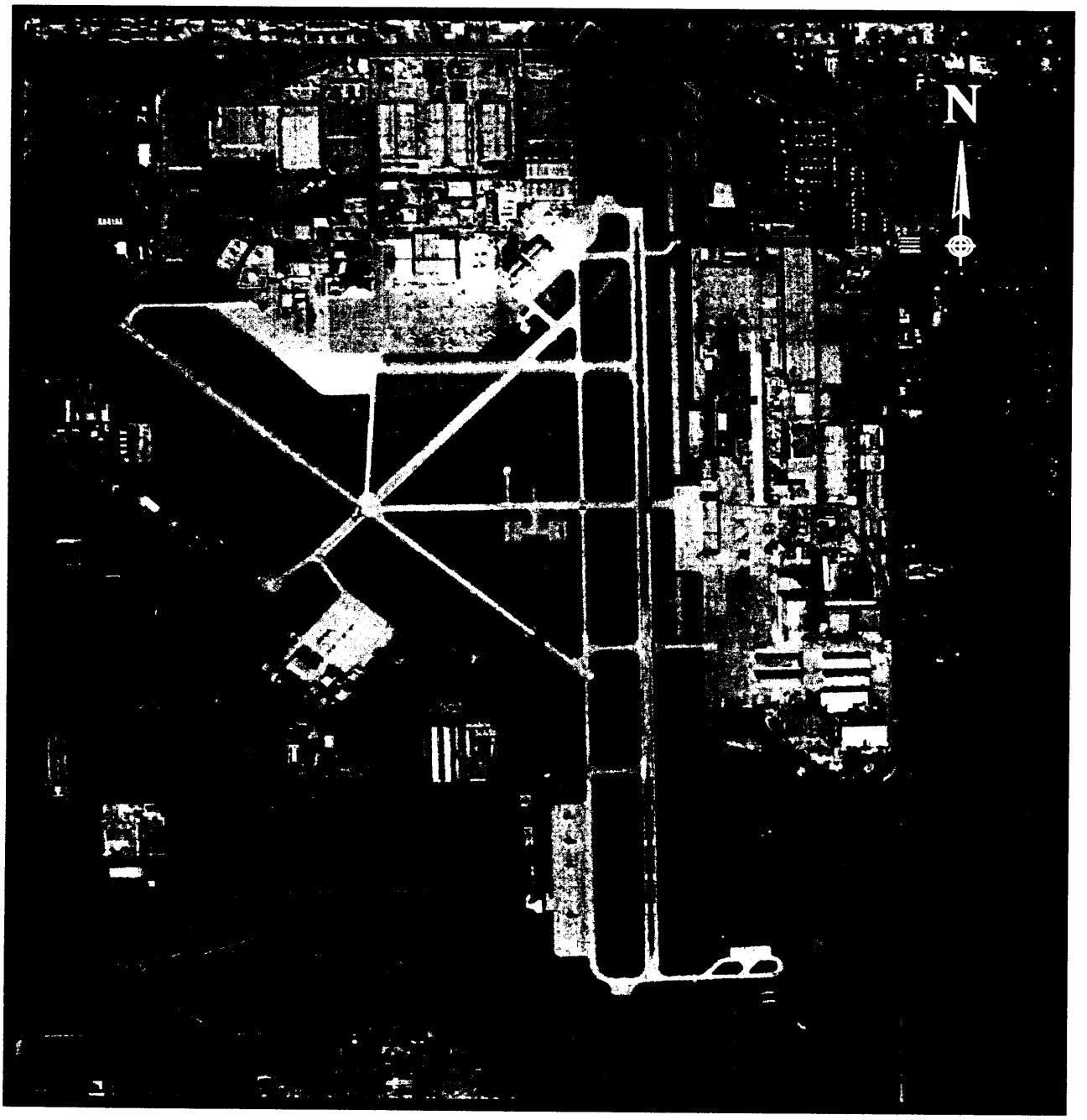

Figure 4

REFERENCES

PRC Environmental Management, Inc., 1989. Tinker Air Force Base RCRA Facility Assessment.

U.S. Environmental Protection Agency (EPA), 1991. Tinker Air Force Base RCRA Permit.

APPENDICES

DISCLAIMER

The tables and figures contained in these Appendices were copied directly from the reports that were summarized in this document. The quality of the reproductions is only as good as the quality of the original reports available to CDM/FPC, many of which were copies of original documents. These tables and figures were not modified in any way except to add notes to titles for clarification purposes.

APPENDIX A

Selected Tables from Installation Restoration Program
Phase II - Confirmation/Quantification - Stage 1

TABLE 4-3. RESULTS OF CHEMICAL ANALYSES, ZONE 1, TINKER AFB (Landfills 1-4)

Parameter (mg/L)	Monitor Well 1A	1B	1C	1	2	3	4	5	6	7	8	Leachate	Pond
Cadmium	0.008	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Cyanide	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.02	<.01	<.01
Chromium	0.008	0.007	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	0.005	0.023	<.001
Copper	0.009	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Iron	0.025	<.008	0.017	<.008	<.008	<.008	<.008	<.008	<.008	<.008	0.021	5.0	0.25
Mercury	0.0005	0.0006	0.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0002	<.0005	<.0005
Manganese	0.23	0.013	0.007	0.76	0.71	1.2	1.1	0.053	0.26	2.3	0.110	0.33	0.010
Nickel	0.008	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	<.003	0.73	<.003
Oil & Grease	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002	<.002
Phenol	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.21	<.005
Total Organic Carbon	5	<1	<1	9	37	17	33	5	14	7	2	340	5
Total Organic Halogen	0.08	0.06	0.06	0.05	0.04	<.01	0.20	<.01	<.01	<.01	0.03	1.5	<.01
Zinc	<.003	<.003	<.003	<.003	<.003	<.003	0.044	<.003	<.003	<.003	0.015	<.003	<.003
Herbicides													
2,4-D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-TP (Silvex)	<5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides (EPA Method 608)	ND[1]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acid/Neutral Extractable Organic Priority Pollutants (Modified EPA Method 625)	ND	ND	ND	-[2]	ND	-	ND	-	-	-	-	-	-

[1] ND = Not Detected.
[2] - = Not Analyzed.

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TABLE 4-4. RESULT OF CHEMICAL ANALYSES, ZONE 2, TINKER AFB
(Landfills 5 and 6)

Parameter mg/l (except as noted)	Well 2A	Well 2B
Barium	0.21	0.45
Cadmium	0.006	<.002
Cyanide	<.01	<.01
Chromium	<.001	<.001
Copper	<.001	<.001
Iron	0.23	<.008
Mercury	0.0004	<.0005
Nickel	<.003	<.003
Oil & Grease	<0.10	<0.10
Lead	<.002	<.002
Phenol	<.005	<.005
Total Organic Carbon	<1	9
Total Organic Halogen	<.01	<.01
Zinc	0.34	<.003
Herbicides		
2,4-D	ND	ND
2,4,5-TP (silvex)	ND	ND
Pesticides (EPA Method 608)	ND	ND
Acid/Neutral Extractable Organic Priority Pollutants (Modified EPA Method 625)		
butyl benzyl phthalate	ND	2.3 μg/L

TABLE 4-6. RESULTS OF SOILS ANALYSES, ZONE 3, TINKER AFB
(Industrial Waste Pit 2)

Parameter (µg/g, except as noted)	Soil Sample									
	3Aa	3Aa (alt)	3Ab	3Bb	3Bd	3Be	3Ca	3Cb	3Fb	3Fc
Cadmium	3.2	2.0	0.49	0.25	0.20	<.15	23	1.2	0.25	<.020
Cyanide	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Chromium	8.9	6.2	4.5	3.8	2.9	4.0	750	5.7	15	4.0
Copper	7.1	4.1	11	5.6	5.6	5.7	130	13	5.1	2.3
Mercury	4.0	4.5	4.1	3.5	3.4	4.0	3.5	3.5	3.8	3.8
Nickel	38	13	13	7.2	5.4	6.0	40	11	7.9	5.7
Oil & Grease (mg/g)	2	5	2	0.5	1.5	0.5	6	1	1.5	1
Lead	5.2	2.5	2.9	2.5	1.8	1.9	41	3.3	9.2	1.6
Phenol	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Total Organic Carbon (%)	0.11	0.32	0.02	0.02	0.02	0.04	0.52	0.03	0.19	0.02
Total Organic Halogen	<1	12	<1	<1	<1	<1	14	<1	<1	<1
Zinc	9.2	3.0	12	5.9	5.0	8.2	36	7.6	16	5.7

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TABLE 4-7. RESULTS OF MODIFIED EPA METHOD 625 ANALYSIS, SOIL SAMPLES 3 Ca, ZONE 3, TINKER AIR FORCE BASE (Industrial Waste Pit 2)

Compound	Concentration (μg/g)
1,2-dichlorobenzene	44
1,3-dichlorobenzene	1.5
1,4-dichlorobenzene	6.6
di-n-butyl phthalate	3.0

TABLE 4-8. RESULTS OF GROUND-WATER SAMPLE ANALYSES, ZONE 3, TINKER AFB
(Industrial Waste Pit 2)

Parameter (mg/L, except as noted)	Well 3E	Well 3F	Well 3G
Cadmium	<.002	<.002	2.2
Cyanide	<.01	<.01	<.01
Chromium	<.001	<.001	12
Copper	<.001	<.001	0.15
Mercury	0.0004	0.0006	<.0005
Nickel	<.003	<.003	82
Oil & Grease	<0.10	<0.10	70
Lead	<.002	<.002	3.3
Phenol	<.005	<.005	80[1]
Total Organic Carbon	<1	3	4000
Total Organic Halogen	<.01	<.01	3.4
Zinc	0.016	0.024	29
Acid/Neutral Extractable Organic Priority Pollutants (modified EPA Method 625)			
1,2-dichlorobenzene	ND	ND	20
phenol	ND	ND	220

[1]Probable low bias due to interferences with colorimetric procedure, large dilution required for analysis.

TABLE 4-10. RESULTS OF SOILS ANALYSES, ZONE 4, TINKER AFB

Parameter (µg/g, except as noted)	Soil Sample									
	4B.5	4B.6	4C.5	4D.2	4E.2	4E.3	4E.4	4E.5	4F.2	4F.3
Cadmium	<.21	<.20	1.7	17	1.7	340	<.20	1.5	2.7	5.0
Cyanide	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	4.9	8.5	11	42	9.1	78	5.6	6.3	230	32
Copper	4.2	7.1	8.5	16	15	47	3.8	9.2	24	9.7
Mercury	10	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Nickel	3.0	11	8.3	11	14	39	5.4	9.6	22	8.0
Oil & Grease	780	410	290	206	1070	140	240	550	200	150
Lead	6.4	8.9	8.4	85	2.9	660	7.4	0.99	150	18
Phenol	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
Total Organic Carbon (%)	0.12	0.10	0.08	0.15	0.10	0.13	0.10	0.12	0.08	0.05
Total Organic Halogen	0.20	<.10	<.10	<.10	<.10	<.10	<.10	<.10	<.10	<.10
Zinc	5.3	9.4	7.4	57	14	1400	6.6	7.8	75	17
Acid/Neutral Extractable Organic Priority Pollutants (modified EPA Method 625)	-	-	-	-	-	None Detected	-	-	-	-

- = Not Analyzed.

(Industrial Waste Pit 1)

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TABLE 4-11. RESULTS OF CHEMICAL ANALYSES, ZONE 4, TINKER AFB
(Industrial Waste Pit 1)

Parameter (mg/L, except as noted)	Well 4A	Well 4F	Well 4G
Cadmium	<.002	(dry)	<.002
Cyanide	<.01		<.01
Chromium	0.014		<.001
Copper	0.021		<.001
Mercury	0.0004		<.0002
Nickel	0.009		0.008
Oil & Grease	<0.10		<0.10
Lead	0.006		0.022
Phenol	<.005		<.005
Total Organic Carbon	<1		43
Total Organic Halogen	0.06		<.01
Zinc	1.2		1.4
Acid/Neutral Extractable Organic Priority Pollutants (modified EPA Method 625)			
phenol	ND		1.0 μg/L

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TABLE 4-13. EPA METHOD 601 COMPOUNDS DETECTED IN BASE WATER SUPPLY WELLS (ZONE 5)

Compound (µg/L)	5	9	14	16	18	18 (resample)	19	19 (resample)
Methylene Chloride					1.1		0.6	
1,1-Dichloroethene					0.2			
1,1-Dichloroethane					1.4			
trans-1,2-Dichloroethene	1.7			1.2	31.7	32.8		
Chloroform		2.1						
1.2-Dichloroethane					25.8			
1,1,1-Trichloroethane					1.8			
Bromodichloromethane		0.4						
Trichloroethylene			0.7	2.2	1750	1530		
Tetrachloroethylene			0.3	0.7	30.1		7.8	2.8
Chlorobenzene					7.9			

APPENDIX B

Selected Tables from Installation Restoration Program
Phase II - Confirmation/Quantification - Stage 2

TABLE 4-4. EPA METHOD 601 SAMPLING RESULTS, BUILDING 3001
(All Concentrations Reported in ppb)

Parameter (date sampled)	EPA Toxicity[1] (ppb)	Well 6A		Well 6B		Well 6C		Well 6D			Well 6E		Well 6F		Well 6G		
		July 17	Aug 1	July 18	Aug 1	July 18	July 31	July 16	July 31	Aug 1	July 30	Aug 14	July 30	Aug 14	July 16	July 30	Aug 1
									- duplicates -							- duplicates -	
Chloroethane	0 (9.4)										none	none		none	1.1		0.6
Methylene Chloride	0 (1.9)		1.4	0.9				2.0							1.9		0.6
Trichlorofluoromethane	-	1.2		2.7		3.9	0.4	1.8	22.0				0.5		7.6	1.7	
1,1-Dichloroethane	0 (0.33)	1.7	0.8						2.0								
1,1-Dichloroethane	0 (9.4)	1.4	1.3	1.4		0.3	0.2	1.7		1.8							
trans-1,2-Dichloroethene	-	18.1		33.2		2.9		0.4								3.8	
Chloroform	0 (1.9)		9.9		19.6	0.7	1.6			0.8					4.6		1.6
1,2-Dichloroethane	0 (9.4)	2.6	2.0				0.3								4.9		
1,1,1-Trichloroethane	18,400 ppm	4.2	2.5	0.2													
1,2-Dichloropropane	87	0.3	0.2														
Trichloroethylene	0 (27)	642.0	444.0	102.0	52.8	4.9	3.1	0.6		0.5			0.1		1.3	0.9	0.6
1,1,2,2-Tetrachloroethane	0 (1.7)		2.7														
Tetrachloroethylene	0 (8)	4.7		1.7		0.7	0.2										
Chlorobenzene	488			1.3				20.5	21.8	34.5							
1,2-Dichlorobenzene	400			1.1				8.4	11.0	10.3							

[1] From Table 4-1.

TABLE 4-5. EPA METHOD 624/625 SAMPLING RESULTS, BUILDING 3001
(All Concentrations Reported in ppb)

Method/Parameter Date Sampled	EPA Toxicity[1] (ppb)	Well 6A 7/17	Well 6B 7/18	Well 6C 7/18	Well 6D 7/16	Well 6D 7/31	Well 6E 7/30	Well 6F 7/30	Well 6G 7/16	Well 6G 7/30
EPA 625 (Acid Extractables)		none	none	none	none	none	none	none	none	none
EPA 625 (Base/Neutrals)		none	none			none	none	none		none
bis(2-ethylhexyl)phthalate	-				13				12	
di-n-octyl phthalate	-			44					12	
EPA 624 (Volatiles)				none				none		
benzene	0 (6.6)								47	39
chlorobenzene	488				21	30				
trans-1,2-dichloroethene	-		48							11
methylene chloride	0 (1.9)								21	
toluene	14,300 ppm						61		670	1886
trichloroethylene	0 (27)	779	134							

[1] From Table 4-1.

RADIAN CORPORATION

TABLE 4-7. EPA METHOD 601 SAMPLING RESULTS, LANDFILL 6

Parameters (Date Sampled)	EPA Toxicity[1] (ppb)	Well 7A July 31	Well 7A Aug 15	Well 7C July 30	Well 7C Aug 14 - duplicates -	Well 7C Aug 15 - duplicates -	Well 7F July 17	Well 7F July 31	Well 7G July 18	Well 7G Aug 1	Well 2A July 31	Well 2A Feb 15[2]
Chloromethane	0 (1.9)				none	none	63.8			none		
Vinyl Chloride	0 (20)						10.8					
Chloroethane	0 (9.4)						15.3	13.3				
Methylene Chloride	0 (1.9)						6.0	6.8			11.5	
Trichlorofluoromethane	-	2.2	0.2	0.5			4.4		2.6		12.2	3.8
1,1-Dichloroethane	0 (9.4)		0.6				2.3				29.9	25.0
trans-1,2-Dichloroethene	-		0.4									
Chloroform	0 (1.9)						15.9	19.2			7.8	
1,2-Dichloroethane	0 (9.4)		0.2									
1,1,1-Trichloroethane	18.4 ppm										3.5	4.2
1,2-Dichloropropane	87										0.6	
Trichloroethylene	0 (27)		0.5				0.9	0.6	0.4		61.0	30.4
1,1,2,2-Tetrachloroethane	0 (1.7)											
Tetrachloroethylene	0 (8)										22.5	12.2
Chlorobenzene	488						5.7	4.5				
1,2-Dichlorobenzene	400							6.5				
1,4-Dichlorobenzene	400						6.0					

[1] From Table 4-1.
[2] GC-MS data from Oklahoma State Environmental Lab.

TABLE 4-8. EPA METHODS 624/625 SAMPLING RESULTS, LANDFILL 6

Method/Parameters Date Sampled	EPA Toxicity[1] (ppb)	Well 7A 31 July 84	Well 7C 31 July 84	Well 7F 17 July 84	Well 7G 18 July 84
EPA 625 (Acid Extractables)		none	none	none	none
EPA 625 (Base/Neutrals)		none	none		none
1,4-dichlorobenzene	400			12	
bis(2-ethylhexyl)phthalate	-			8	
diethyl phthalate	-			32	
EPA 624 (Volatiles)			none		none
benzene	0 (6.6)			8	
trans-1,2-dichloroethene	-			21	
ethylbenzene	1.4 ppm			18	
toluene	14.3 ppm	6			

[1]From Table 4-1.

TABLE 4-16. RESULTS OF STREAM SEDIMENT ANALYSIS, TINKER AFB IRP PHASE II STAGE 2

Sampling Station (see Figure 4-13)	1	2	3	4	4	5	6	7	8	9	9
Sample Number	T-SED-01	T-SED-02	T-SED-03	T-SED-04	T-SED-05 (duplicate)	T-SED-25	T-SED-24	T-SED-23 (follow-up sample)	T-SED-20 (follow-up sample)	T-SED-21	T-SED-22
Laboratory Batch Number	84-06-166	84-06-166	84-06-166	84-06-166	84-06-166	84-06-206	84-06-206	84-06-113	84-06-113	84-06-206	84-06-206
Date of Sample	6/19/84	6/19/84	6/19/84	6/19/84	6/19/84	6/21/84	6/21/84	7/19/84	7/19/84	6/21/84	6/21/84
Parameter[1,2]											
Silver	<1.8	<1.7	<2	<2	<2	<2	<2	<1	<1	<2	<2
Arsenic	0.35	0.41	0.31	0.36	0.52	0.64	2.3	<0.1	<0.1	1.5	2.7
Barium	480	.240	290	410	450	310	480	610	230	390	370
Cadmium	<.050	<.41	4.7	2.2	<.063	2.4	2.7	0.97	2.4	3.0	1.5
Total Cyanide	<.01	<.01	<.01	<.01	<.01	<.02	<.02	<.01	<.01	<.02	<.02
Chromium	11	55	320	43	48	51	150	30	38	80	71
Copper	2.8	5.7	24	3.6	5.9	8.3	13	8.2	15	12	11
Fluoride	0.5	0.33	0.33	0.23	0.30	0.54	0.38	33	8	0.23	0.31
Mercury	0.049	0.061	0.051	0.060	0.038	0.094	0.090	0.23	0.37	0.06	0.12
Manganese	900	920	270	410	630	310	720	520	470	790	1000
Nickel	9.7	7.8	9.5	15	13	12	14	8.5	7.0	10	8.3
Nitrate	1.4	<.6	<.6	<.6	<.6	1.4	<.1	3.2	1.9	<.1	0.46
Lead	10	0.36	23	14	21	11	45	8.7	55.8	49	23
PCBs[3]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.025	0.036	<0.5	<0.5
Phenolics	<.01	0.18	0.11	0.05	0.02	<.01	<0.01	<0.01	<0.01	<0.01	<0.01
pH	7.10	6.90	7.10	6.75	6.71	6.39	7.34	7.30	7.30	7.26	6.34
Selenium	0.55	0.61	0.39	0.48	0.53	0.71	0.63	<.002	<.002	0.65	0.48
Total Organic Carbon	0.52	0.38	0.63	1.03	0.42	1.32	0.44	0.30	1.30	1.48	1.01
Zinc	18	24	54	24	24	22	42	20	53	33	31

(Continued)

TABLE 4-16. (Continued)

Sampling Station (see Figure 4-13)	10	11	12	13	14	15	15	16	17	18	19
Sample Number	T-SED-19	T-SED-26	T-SED-07	T-SED-08	T-SED-15	T-SED-13	T-SED-18 (duplicate)	T-SED-14	T-SED-11	T-SED-12	T-SED-16
Laboratory Batch Number	84-06-206	84-06-206	84-06-190	84-06-190	84-06-190	84-06-190	84-06-190	84-06-190	84-06-190	84-06-190	84-06-190
Date of Sample	6/21/84	6/21/84	6/20/84	6/20/84	6/20/84	6/20/84	6/20/84	6/20/84	6/20/84	6/20/84	6/20/84
Parameter[1,2]											
Silver	<2	<2	<2	<2	<2.8	<2	<2	<2	<2	<2	<2
Arsenic	0.81	1.6	1.9	2.1	0.28	1.6	0.51	0.54	0.66	0.31	0.62
Barium	330	320	430	480	330	220	200	320	170	410	220
Cadmium	3.9	1.8	1.1	0.36	30	1.3	4.9	0.70	50	12	1[illegible]
Total Cyanide	<.02	<.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Chromium	68	13	37	12	140	190	120	27	1300	130	300
Copper	12	4.3	5.1	4.4	52	230	54	3.8	45	160	6[illegible]
Fluoride	0.2	<.1	0.22	0.20	0.16	0.20	0.31	0.37	0.31	0.23	0.3[illegible]
Mercury	0.45	0.036	0.038	0.048	1.6	1.0	0.33	0.034	0.35	0.10	0.1[illegible]
Manganese	250	500	1000	940	140	250	250	530	790	330	170
Nickel	7.4	3.7	9.5	9.4	19	43	12	6.4	230	83	170
Nitrate	2.8	<.1	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6	<.6
Lead	40	17	27	15	530	140	97	7.1	46	700	52
PCBs[3]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.20
Phenolics	<.01	<.01	0.13	0.10	0.06	0.10	0.10	0.11	0.04	0.09	0.14
pH	7.62	7.68	7.19	7.32	7.01	7.19	7.15	7.25	7.73	7.54	7.16
Selenium	0.67	0.63	0.93	1.0	0.21	0.93	0.31	0.21	0.28	0.12	0.32
Total Organic Carbon	0.81	0.25	0.41	0.59	3.80	1.32	0.65	0.25	0.87	0.43	1.68
Zinc	43	11	32	17	160	210	77	16	83	88	60

(Continued)

TABLE 4-16. (Continued)

Sampling Station (see Figure 4-13)	20	21	22	23	24
Sample Number	T-SED-06	T-SED-10	T-SED-09	T-SED-27	T-SED-28 (follow-up sample)
Laboratory Batch Number	84-06-166	84-06-190	84-06-190	84-06-206	84-06-113
Date of Sample	6/19/84	6/20/84	6/20/84	6/21/84	7/19/84
Parameter[1,2]					
Silver	<2	<2	<2	<2	<1
Arsenic	0.49	0.91	3.5	1.0	<.1
Barium	520	230	380	240	110
Cadmium	2.4	0.54	1.6	2.1	0.83
Total Cyanide	<.01	<.01	<.01	<.02	<.01
Chromium	5100	80	33	35	12
Copper	23	25	10	0.12	5.0
Fluoride	0.62	0.31	0.51	<0.01	2.5
Mercury	0.049	0.33	0.19	0.30	0.25
Manganese	710	180	4700	290	250
Nickel	47	12	11	5.9	5.9
Nitrate	2.14	<.6	<.6	1.9	3.2
Lead	100	39	44	64	8.1
PCBs[3]	<0.5	<0.5	<0.5	<0.5	<0.025
Phenolics	0.09	0.11	0.08	<.01	<.01
pH	8.53	7.03	7.24	7.16	6.37
Selenium	0.61	0.32	1.8	0.43	<.002
Total Organic Carbon	2.28	0.41	0.54	0.85	0.85
Zinc	68	66	35	49	8.3

(Continued)

[1]In addition to these parameters, analyses for RCRA pesticides and herbicides were performed. Results were everywhere less than detection limits noted.

RCRA Herbicides
2,4-D (<0.2 μg/g)
2,4,5-TP (Silvex) (<0.2 μg/g)

RCRA Pesticides
Lindane (<0.002 μg/g)
Endrin (<0.002 μg/g)
Methoxychlor (<0.002 μg/g)
Toxaphene (<0.02 μg/g)

[2]Expressed in μg/g unless specified otherwise.

[3]In contrast to the information supplied in Appendix H, the actual detection limit for PCBs is 0.5 μg/g (0.025 μg/g for Batch 84-07-113).

APPENDIX C

Selected Tables from Investigation of Underground Tanks
Tinker Air Force Base

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)

A. S. of Bldg. 3108 (10 tanks with 100 octane or solvent) (Figure 2)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
B-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-1 17'	<1.0	<1.0	<1.0	<1.0	<0.1
B-1 25'	<1.0	550.0	85.8	1117.8	<0.1
B-2 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-2 16'	<1.0	<1.0	<1.0	<1.0	<0.1
B-2 25'	146.0	732.0	110.0	1438.0	<0.1
B-3 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-3 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-4 25'	<1.0	168.0	25.0	310.0	<0.1
B-5 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-5 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-5 25'	<1.0	1535.0	<1.0	14318.0	0.22
B-6 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-6 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-7 25'	<1.0	2133.0	<1.0	19453.0	<0.1
B-8 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-8 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-8 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 10'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-9 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-10 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-10 27'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-11 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 10'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-12 20'	<1.0	<1.0	<1.0	<1.0	<0.2*
B-12 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-13 25'	<1.0	<1.0	<1.0	<1.0	<0.1

* NOTE: Variance in detection limit due to matrix interference.

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
B-14 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-14 25'	<1.0	220.0	113.0	1140.0	<0.1
B-15 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-15 15'	<1.0	<1.0	<1.0	<1.0	<0.1
B-15 20'	<1.0	313.0	53.0	614.0	<0.1
B-15 25'	<1.0	277.0	33.0	432.0	<0.1
B-16 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-16 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-16 24'	<1.0	<1.0	<1.0	<1.0	<0.1
B-17 8'	<1.0	<1.0	<1.0	<1.0	<0.1
B-18 20'	<1.0	30.0	<1.0	729.0	0.4
B-18 25'	52.0	1191.0	<1.0	11691.0	0.9
B-18 30'	8.0	5.0	<1.0	127.0	<0.1
B-18 35'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 20'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 25'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 30'	<1.0	<1.0	<1.0	<1.0	<0.1
B-19 35'	<1.0	<1.0	<1.0	<1.0	<0.1
B-20 20'	<1.0	<1.0	<1.0	34.0	<0.1
B-20 25'	<1.0	<1.0	<1.0	<1.0	<0.1
M-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
M-1 15'	<1.0	18.4	6.9	393.3	<0.1
M-1 20'	<1.0	809.0	120.0	1944.0	<0.1
M-1 25	<1.0	1480.0	207.7	3165.0	<0.1
M-6 8'	<1.0	<1.0	<1.0	<1.0	<0.1
M-6 15'	<1.0	<1.0	<1.0	<1.0	<0.1
M-6 20'	<1.0	<1.0	<1.0	<1.0	<0.1

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
B. SW OF Bldg. 214 (Tank of unknown size and contents) (Figure 6)					
BA-1 8'	<1.0	<1.0	<1.0	<1.0	0.4 CHLOROFORM 0.9 TOTAL
BA-1 17'*	<1.0	<1.0	<1.0	<1.0	<0.1
BA-1 20'	<1.0	<1.0	<1.0	30.0	<0.1
BA-1 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-2 8'** ***	<1.0	<1.0	<1.0	<1.0	<0.1
BA-2 15'* **	16.0	28.0	18.0	1114.0	<0.1
BA-2 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-2 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-2 35'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-3 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-3 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-3 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-3 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-4 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-4 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-4 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BA-4 25'	<1.0	<1.0	<1.0	<1.0	<0.1
C. W. of Bldg. 201 (Diesel 500 gal tank) (Figure 6)					
BB-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BB-1 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BB-1 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BB-1 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BB-2 8'	<1.0	<1.0	<1.0	190.0	
BB-2 15'	<1.0	<1.0	<1.0	5.0	
BB-2 20'	<1.0	<1.0	<1.0	<1.0	

* Analyzed for volatile organics (EPA 8240) due to high air monitoring reading and unknown tank contents. Results: 56 ppm acetone and 38 ppm freon for BA-1 17', 84 ppm freon for BA-2 15'; no other volatile organics were detected.

** Analyzed for heavy metals, Results: 1.36 ppm Ba (BA-2 8'), and 9.61 ppm Ba (BA-2 15'); Ar, Cd, Cr, Pb, Hg, Se, and Ag were not detected.

*** BA-2 is labeled MA-1 on Figure 6 (drawing DE-F-7357, in to back cover). This boring was made a monitoring well due to high air monitoring readings during the drilling operations.

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
D. Between Bldg. 201 and 203 (Waste solvent 1500 gal tank) (Figure 6)					
BC-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BC-1 15'*	<1.0	<1.0	<1.0	<1.0	2.4 TOTAL
					0.2 CHLOROFORM
					0.7 TRICHLOROETHYLENE
BC-1 20'	<1.0	<1.0	<1.0	<1.0	0.1 TRICHLOROETHYLENE
BC-1 25'*	<1.0	<1.0	<1.0	<1.0	5.2 TOTAL
					0.3 CHLOROFORM
					0.7 TRICHLOROETHYLENE
BC-2 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BC-2 15'	<1.0	<1.0	<1.0	<1.0	0.1 CHLOROFORM
					0.8 TRICHLOROETHYLENE
					0.9 TOTAL
BC-2 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BC-2 25'	<1.0	<1.0	<1.0	<1.0	<0.1
E. Between Bldg. 208 and 210 (Fuel tank 1000 gal) (Figure 6)					
BD-1 8'	<1.0	<1.0	<1.0	<1.0	
BD-1 15'	<1.0	<1.0	<1.0	<1.0	
BD-1 21'	<1.0	<1.0	<1.0	<1.0	
BD-1 25'	<1.0	<1.0	<1.0	<1.0	
BD-2 8'	<1.0	<1.0	<1.0	<1.0	
BD-2 15'	<1.0	<1.0	<1.0	<1.0	
BD-2 20'	<1.0	<1.0	<1.0	<1.0	
BD-2 25'	<1.0	<1.0	<1.0	<1.0	
F. E. End of Bldg. 210 (Kerosene 7000 gal tank) (Figure 6)					
BE-1 8'	<1.0	<1.0	<1.0	<1.0	
BE-1 20'	<1.0	<1.0	<1.0	<1.0	
BE-1 25'	<1.0	<1.0	<1.0	<1.0	
BE-2 8'	<1.0	<1.0	<1.0	<1.0	
BE-2 15'	<1.0	<1.0	<1.0	<1.0	
BE-2 20'	<1.0	<1.0	<1.0	<1.0	
BE-2 25'	<1.0	<1.0	<1.0	<1.0	

* Analyzed for heavy metals. Results: 0.70 ppm Ba (BC-1 15'), 4.75 ppm Ba (BC-1 25'); Ar, Cd, Cr, Pb, Hg, Se and Ag were not detected.

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS
G. Fuel Yard (25 tanks, various sizes, aviation and regular gasoline) (Figure 6)				
BF-1 8'	<1.0	<1.0	<1.0	150.0
BF-1 15'	<1.0	<1.0	<1.0	<1.0
BF-1 20'	<1.0	<1.0	<1.0	<1.0
BF-1 25'	<1.0	<1.0	<1.0	<1.0
BF-2 8'	<1.0	<1.0	3.1	170.1
BF-2 15'	<1.0	<1.0	<1.0	<1.0
BF-2 20'	<1.0	<1.0	<1.0	<1.0
BF-3 8'	<1.0	<1.0	<1.0	<1.0
BF-3 15'	45.6	<1.0	<1.0	52.3
BF-3 20'	<1.0	<1.0	<1.0	<1.0
BF-3 25'	<1.0	<1.0	<1.0	<1.0
BF-4 8'	<1.0	<1.0	<1.0	7.9
BF-4 15'	<1.0	<1.0	<1.0	<1.0
BF-5 8'	<1.0	<1.0	<1.0	<1.0
BF-5 15'	<1.0	<1.0	<1.0	<1.0
BF-7 8'	<1.0	<1.0	<1.0	53.0
BF-7 15'	<1.0	<1.0	<1.0	<1.0
BF-8 8'	<1.0	4.4	<1.0	136.0
BF-8 15'	<1.0	597.0	<1.0	20965.0
BF-9 8'	<1.0	<1.0	<1.0	<1.0
BF-9 15'	<1.0	<1.0	<1.0	<1.0
BF-10 20'	<1.0	<1.0	<1.0	<1.0
BF-10 25'	<1.0	<1.0	<1.0	<1.0
BF-10 30'	<1.0	<1.0	<1.0	<1.0
BF-11 15'	<1.0	<1.0	<1.0	<1.0
BF-11 20'	<1.0	<1.0	<1.0	<1.0
BF-11 25'	<1.0	<1.0	<1.0	<1.0
BF-11 30'	<1.0	<1.0	<1.0	<1.0
BF-12 15'	<1.0	<1.0	<1.0	<1.0
BF-12 20'	<1.0	<1.0	<1.0	<1.0
BF-12 25'	<1.0	<1.0	<1.0	<1.0
BF-12 30'	<1.0	<1.0	<1.0	<1.0
BF-13 8'	2.0	2.0	<1.0	359.0
BF-13 15'	<1.0	<1.0	<1.0	<1.0
BF-13 20'	<1.0	<1.0	<1.0	<1.0
BF-13 25'	<1.0	<1.0	<1.0	<1.0
MF-1 8'	<1.0	<1.0	<1.0	100.0
MF-1 15'	<1.0	<1.0	<1.0	<1.0
MF-1 20'	<1.0	<1.0	<1.0	<1.0
H. N. of Bldg. 5802 (Boiler Fuel Tank, 1200 gal.) (Figure 8)				
BG-1 8'	<1.0	<1.0	<1.0	<1.0
BG-1 15'	<1.0	<1.0	<1.0	<1.0
BG-1 20'	<1.0	<1.0	<1.0	<1.0
BG-1 25'	<1.0	<1.0	<1.0	<1.0

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS
BG-2 8'	<1.0	<1.0	<1.0	<1.0
BG-2 15'	<1.0	<1.0	<1.0	<1.0
BG-2 20'	<1.0	<1.0	<1.0	<1.0
BG-2 25'	<1.0	<1.0	<1.0	<1.0
I. Offsite wells--Diesel Tanks of 500 gal next to each well (Figures 14, 15, 16, 17, 18)				
BH-1 8'	<1.0	<1.0	<1.0	<1.0
BH-1 15'	<1.0	<1.0	<1.0	<1.0
BH-1 20'	<1.0	<1.0	<1.0	<1.0
BH-1 25'	<1.0	<1.0	<1.0	<1.0
BH-2 8'	<1.0	<1.0	<1.0	<1.0
BH-2 15'	<1.0	<1.0	<1.0	<1.0
BH-2 20'	<1.0	<1.0	<1.0	<1.0
BH-2 25'	<1.0	<1.0	<1.0	<1.0
BH-3 8'	<1.0	<1.0	<1.0	<1.0
BH-3 15'	<1.0	<1.0	<1.0	<1.0
BH-3 20'	<1.0	<1.0	<1.0	<1.0
BH-3 25'	<1.0	<1.0	<1.0	<1.0
BH-4 8'	<1.0	<1.0	<1.0	<1.0
BH-4 15'	<1.0	<1.0	<1.0	<1.0
BH-4 20'	<1.0	<1.0	<1.0	<1.0
BH-4 25'	<1.0	<1.0	<1.0	<1.0
BH-5 8'	<1.0	<1.0	<1.0	21.0
BH-5 15'	<1.0	<1.0	<1.0	58.0
BH-5 20'	<1.0	<1.0	<1.0	13.0
BH-5 25'	<1.0	<1.0	<1.0	6.0
BH-6 8'	<1.0	<1.0	<1.0	<1.0
BH-6 15'	<1.0	<1.0	<1.0	<1.0
BH-6 20	<1.0	<1.0	<1.0	<1.0
BH-6 25'	<1.0	<1.0	<1.0	<1.0
BH-7 8'	<1.0	<1.0	<1.0	<1.0
BH-7 15'	<1.0	<1.0	<1.0	<1.0
BH-7 20'	<1.0	<1.0	<1.0	<1.0
J. Tank #3003 N. of Bldg. 3001 (Diesel, 5000 gal) (Figure 4)				
BI-1 8'	<1.0	<1.0	<1.0	400.0
BI-1 15'	<1.0	<1.0	<1.0	<1.0
BI-1 20'	<1.0	<1.0	<1.0	3.0
BI-1 25'	<1.0	<1.0	<1.0	9.0
BI-2 8'	<1.0	<1.0	<1.0	258.0
BI-2 15'	<1.0	<1.0	<1.0	<1.0
BI-2 19	<1.0	<1.0	<1.0	<1.0
BI-2 25'	<1.0	<1.0	<1.0	<1.0

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

K. Tanks 2106 and 2107 on the W. side of Bldg. 2101 (Waste oil, 500 gal each) (Figure 11)

BJ-1 8'	<1.0	<1.0	<1.0	<1.0
BJ-1 15'	<1.0	<1.0	<1.0	<1.0
BJ-1 20'	<1.0	<1.0	<1.0	<1.0
BJ-1 25'	<1.0	<1.0	<1.0	<1.0
BJ-2 8'	<1.0	<1.0	<1.0	<1.0
BJ-2 15'	<1.0	<1.0	<1.0	<1.0
BJ-2 20'	<1.0	<1.0	<1.0	<1.0
BJ-2 25'	<1.0	<1.0	<1.0	<1.0

L. N. of Bldg. 1001 (Unknown Tank size and contents) (Figure 9)

BK-1 8'	<1.0	<1.0	<1.0	<1.0
BK-1 15'	<1.0	<1.0	<1.0	<1.0
BK-1 20'	<1.0	<1.0	<1.0	<1.0
BK-1 25'	<1.0	<1.0	<1.0	<1.0
BK-2 8'	<1.0	<1.0	<1.0	<1.0
BK-2 15'	<1.0	<1.0	<1.0	<1.0
BK-2 20'	<1.0	<1.0	<1.0	<1.0
BK-2 25'	<1.0	<1.0	<1.0	<1.0

M. Fuel tanks near Bldg. 4010 (2-8500 gal tanks) (Figure 13)

BL-1 8'	<1.0	<1.0	<1.0	<1.0
BL-1 15'	<1.0	<1.0	<1.0	<1.0
BL-1 20'	<1.0	<1.0	<1.0	<1.0
BL-1 25'	<1.0	<1.0	<1.0	<1.0
BL-2 8'	<1.0	<1.0	<1.0	<1.0
BL-2 15	<1.0	<1.0	<1.0	<1.0
BL-2 20'	<1.0	<1.0	<1.0	<1.0
BL-2 25'	<1.0	<1.0	<1.0	<1.0
BL-3 8'	<1.0	<1.0	<1.0	<1.0
BL-3 15'	<1.0	<1.0	<1.0	<1.0
BL-3 20'	<1.0	<1.0	<1.0	<1.0
BL-3 25'	<1.0	<1.0	<1.0	<1.0

N. Tank 3405 N. of Bldg. 3001 (Mogas 13,000 gal tank) (Figure 3)

BM-1 8'	<1.0	<1.0	<1.0	5.0
BM-1 15'	<1.0	<1.0	<1.0	3301.0
BM-1 20'	<1.0	<1.0	<1.0	6495.0
BM-1 25'	<1.0	<1.0	<1.0	7770.0
BM-2 8'	<1.0	<1.0	<1.0	<1.0
BM-2 15'	<1.0	<1.0	<1.0	2106.0
BM-2 20'	<1.0	<1.0	<1.0	18033.0
BM-2 25'	<1.0	<1.0	<1.0	40038.0
MM-1 8'	<1.0	<1.0	<1.0	<1.0
MM-1 15'	<1.0	<1.0	<1.0	<1.0
MM-1 20'	<1.0	<1.0	<1.0	<1.0

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
MM-2 8'	<1.0	<1.0	<1.0	<1.0	
MM-2 15'	<1.0	<1.0	<1.0	10,050.0	
MM-2 20'	<1.0	<1.0	<1.0	26,173.0	
MM-2 25	<1.0	<1.0	<1.0	60,229.0	
MM-3 8'	<1.0	<1.0	<1.0	281.0	
MM-3 15'	<1.0	<1.0	<1.0	253.0	
MM-3 20'	<1.0	<1.0	<1.0	5.0	
MM-3 26.5'	<1.0	<1.0	<1.0	48,936.0	
O. West of Bldg. 740 at 2nd and N. Sts. (Gasoline 12000 gal) (Figure 7)					
BN-1 8'	<1.0	<1.0	<1.0	<1.0	
BN-1 15'	<1.0	<1.0	<1.0	<1.0	
BN-1 20'	<1.0	<1.0	<1.0	<1.0	
BN-1 25'	<1.0	<1.0	<1.0	<1.0	
BN-2 8'	<1.0	<1.0	<1.0	<1.0	
BN-2 15'	<1.0	<1.0	<1.0	<1.0	
BN-2 20'	<1.0	<1.0	<1.0	<1.0	
BN-2 25'	<1.0	<1.0	<1.0	<1.0	
P. S. of Bldg. 3215 (Waste tank, 500 gal) (Figure 5)					
BO-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-1 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-1 19'	<1.0	<1.0	<1.0	<1.0	0.3 TOTAL 0.2 CHLOROFORM
BO-1 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-2 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-2 14'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-2 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BO-2 25'	<1.0	<1.0	<1.0	<1.0	<0.1
Q. S. of Bldg. 2101 (Two Gasoline tanks 1000 gal each) (Figure 11)					
BP-1 8'	<1.0	<1.0	<1.0	<1.0	
BP-1 20'	<1.0	<1.0	<1.0	<1.0	
BP-1 25'	<1.0	<1.0	<1.0	<1.0	
BP-2 8'	<1.0	<1.0	<1.0	<1.0	
BP-2 15'	<1.0	<1.0	<1.0	<1.0	
BP-2 20'	<1.0	<1.0	<1.0	<1.0	
BP-2 30'	<1.0	<1.0	<1.0	<1.0	
BP-4 8'	<1.0	<1.0	<1.0	<1.0	
BP-4 15'	<1.0	<1.0	<1.0	<1.0	
BP-4 20'	<1.0	<1.0	<1.0	<1.0	
BP-4 25'	<1.0	<1.0	<1.0	<1.0	

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
R. S. of Bldg. 201 (Unknown contents and size; near radioactive site) (Figure 6)					
BR-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BR-1 15'*	<1.0	<1.0	<1.0	<1.0	<0.1
BR-1 20'	<1.0	<1.0	<1.0	<1.0	0.2 TOTAL 0.05 CHLOROFORM 0.15 TRICHLOROETHYLENE
BR-1 25'	<1.0	<1.0	<1.0	<1.0	0.3 TOTAL
BR-2 8'*	<1.0	<1.0	<1.0	3880.0	0.2 TRICHLOROETHYLENE
BR-2 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BR-2 25'	<1.0	<1.0	<1.0	37.0	0.1 TRICHLOROETHYLENE
S. Tacan Annex (Diesel 2000 gal) (Figure 10)					
BT-1 8'	<1.0	<1.0	<1.0	<1.0	
BT-1 15'	<1.0	<1.0	<1.0	<1.0	
BT-1 20'	<1.0	<1.0	<1.0	<1.0	
BT-1 25'	<1.0	<1.0	<1.0	<1.0	
BT-2 8'	<1.0	<1.0	<1.0	<1.0	
BT-2 15'	<1.0	<1.0	<1.0	<1.0	
BT-2 20'	<1.0	<1.0	<1.0	<1.0	
BT-2 25'	<1.0	<1.0	<1.0	<1.0	
T. Tanks #3132 and 3133, NE of Bldg. 3105 (Naphtha <3800 gal> and Stoddard Solvent <3800 gal>) (Figure 2)					
BU-1 8'	<1.0	<1.0	<1.0	<1.0	
BU-1 15'	<1.0	<1.0	<1.0	<1.0	
BU-1 20'	<1.0	<1.0	<1.0	<1.0	
BU-1 25'	<1.0	<1.0	<1.0	<1.0	
BU-2 8'	<1.0	<1.0	<1.0	<1.0	
BU-2 15'	<1.0	<1.0	<1.0	<1.0	
BU-2 20'	<1.0	<1.0	<1.0	<1.0	
U. E. of Bldg. 110 (Diesel, 500 gal) (Figure 6)					
BV-1 8'	<1.0	<1.0	<1.0	<1.0	
BV-1 15'	<1.0	<1.0	<1.0	<1.0	
BV-1 20'	<1.0	<1.0	<1.0	<1.0	
BV-1 25'	<1.0	<1.0	<1.0	<1.0	
BV-2 8'	<1.0	<1.0	<1.0	<1.0	
BV-2 15'	<1.0	<1.0	<1.0	<1.0	
BV-2 20'	<1.0	<1.0	<1.0	<1.0	
BV-2 25	<1.0	<1.0	<1.0	<1.0	

* Analyzed for heavy metals. Results: 0.54 ppm Ba (BR-1 15'), 0.82 ppm Ba (BR-2 8'); Ar, Cd, Cr, Pb, Hg, Se, and Ag were not detected.

TABLE 4-3. LABORATORY RESULTS OF SOIL SAMPLES (ppm)
(CONTINUED)

SAMPLE I.D.	BENZENE	TOLUENE	XYLENES	TOTAL HYDROCARBONS	TOTAL HALOCARBONS
V. NE of Bldg. 230 (Fuel tank, 12000 gal) (Figure 6)					
BW-1 8'	<1.0	<1.0	<1.0	<1.0	
BW-1 15'	<1.0	<1.0	<1.0	<1.0	
BW-1 20'	<1.0	<1.0	<1.0	<1.0	
BW-2 8'	<1.0	<1.0	<1.0	<1.0	
BW-2 12.5'	<1.0	<1.0	<1.0	<1.0	
W. SW Corner of Bldg. 210 (Tank of unknown contents and size) (Figure 6)					
BX-1 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-1 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-1 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-1 25'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-2 8'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-2 15'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-2 20'	<1.0	<1.0	<1.0	<1.0	<0.1
BX-2 25'	<1.0	<1.0	<1.0	<1.0	<0.1

TABLE 4-5. LABORATORY RESULTS OF GROUND WATER SAMPLES (ppb)

A. Fuel Yard

Volatile Organics	Well Number (1)										
	MF-1C	MF-2	MF-4	MF-6	MF-7	MF-8	MF-10	MF-11	MF-12	MF-13	MF-14
Benzene	6723	86	597	<5	<5	4920	<5	<5	1580	2200	<25
1, 1, 1-Trichloroethane	<25	135	<25	<5	<5	<125	<5	<5	<125	<250	<25
Aliphatic Hydrocarbons	NR*	560	NR*	NR*	NR*	125400	NR*	NR*	841240	NR*	NR*
Methylene Chloride	<25	<25	8000	<5	<5	<125	<5	<5	<125	<250	<25
Total Xylenes	<25	<25	<25	11	<5	1988	<5	<5	160000	5750	<25
Toluene	<25	<25	<25	<5	<5	<125	<5	<5	<125	9800	30
Chlorobenzene	<25	<25	<25	<5	<5	398	<5	<5	14200	<250	<25
Ethylbenzene	<25	<25	<25	<5	<5	617	<5	<5	11293	950	<25
Ethyl Methyl Benzene	NR*	NR*	NR*	NR*	NR*	67400	NR*	NR*	NR*	NR*	NR*
Trichloroethene	<25	<25	<25	<5	<5	<125	<5	6	<125	<250	<25

NR* = Not Reported

(1) Well numbers MF-5 and MF-9 not used. Well number MF-3 contained only hydrocarbon material with no water (see Table 4-6).

TABLE 4-5. LABORATORY RESULTS OF GROUND WATER SAMPLES (ppb)
(CONTINUED)

B. Area Southwest of Building 3108

	Well Number						
Volatile Organics	M-1	M-2	M-3	M-4	M-5	M-6	M-7
Benzene	1225	83	853	767	45	1535	55
Toluene	47120	125	41715	9134	227	21075	50
Total Xylenes	1659	<25	496	74	<25	205	<25
Trans-1,2-Dichloroethene	<25	<25	310	<25	<25	55	885
1,2-Dichloroethane	<25	<25	80	<25	<25	<25	<25
Trichloroethene	<25	<25	366	225	340	90	260
2-Hexanone	<50	<50	2320	<50	<50	<50	<50
Aliphatic Hydrocarbons	NR*	NR*	NR*	5400	440	NR*	NR*

TABLE 4-5. LABORATORY RESULTS OF GROUND WATER SAMPLES (ppb)
(CONTINUED)

C. Other Areas of TAFB

Volatile Organics	Well Number (2)			
	MA-1 (B. 214)	MM-1 (B. 3001)	MM-2 (B. 3001)	MU-1 (B. 3105)
Benzene	7946	<25	<25	<25
Toluene	2815	<25	<25	<25
Total Xylenes	2150	<25	115	<25
Vinyl chloride	4025	<50	<50	<50
1,1-Dichloroethene	500	<25	<25	<25
1,1-Dichloroethane	615	<25	<25	<25
Trans-1,2-dichloroethene	175910	<25	<25	<25
1,1,1-Trichloroethane	3468	<25	<25	<25
Trichloroethene	838	<25	<25	<25
Ethylbenzene	420	<25	<25	<25

(2) Well number MM-3 contained only hydrocarbons; water was not present (see Table 4-6).

APPENDIX D

Selected Figures from Soil-Gas Investigations
Tinker Air Force Base

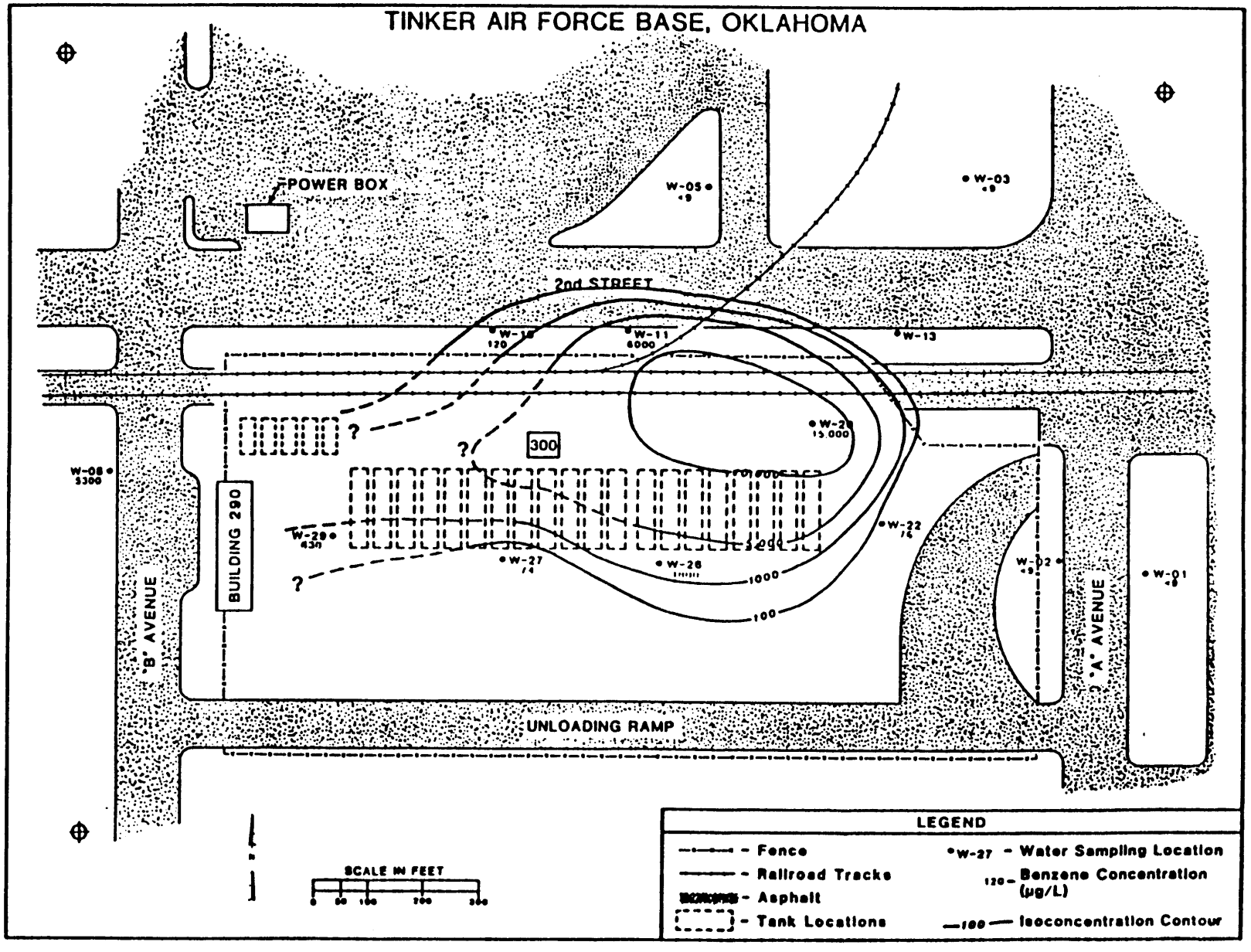


Figure 10. Concentrations of benzene in ground water.

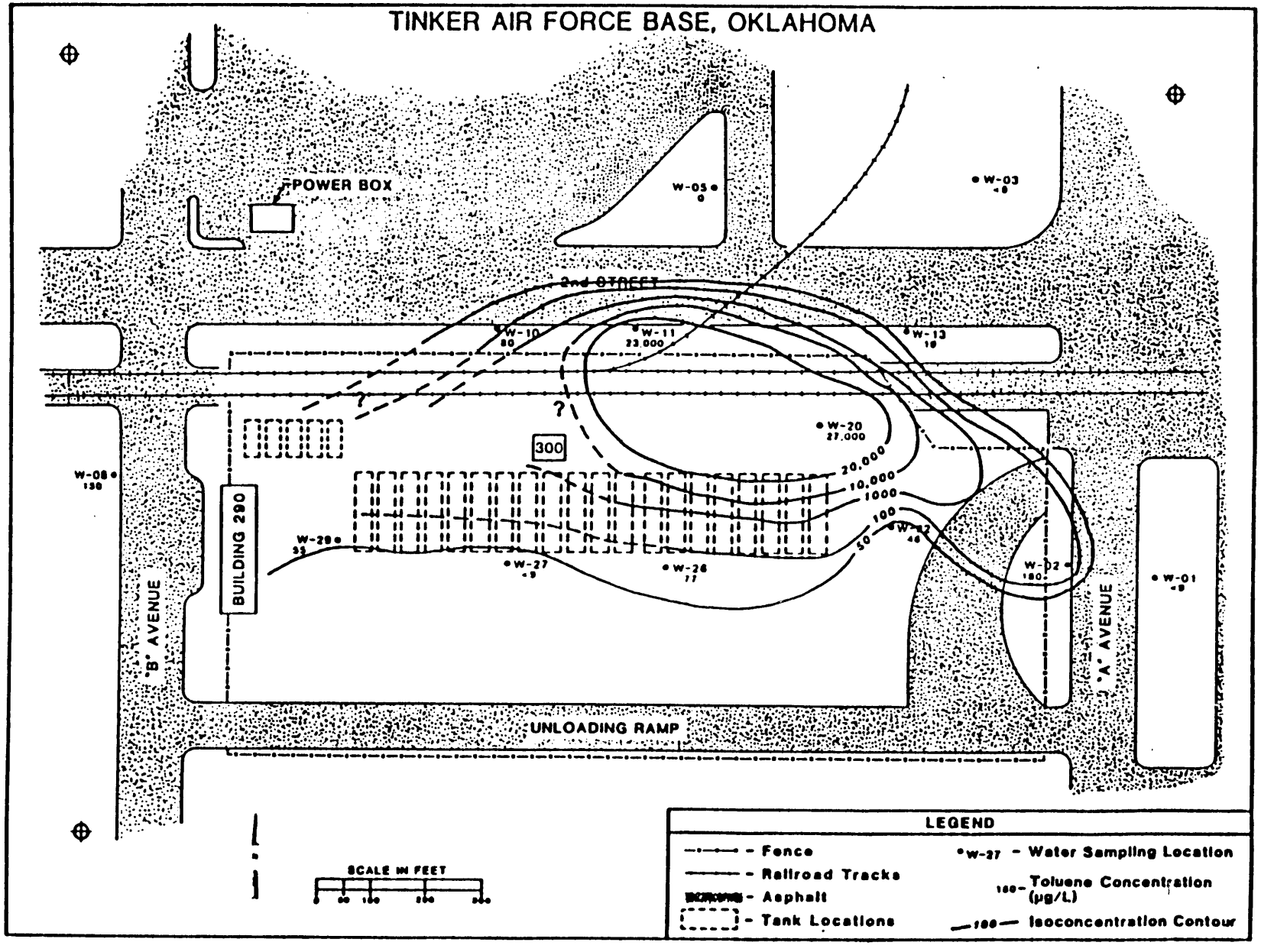


Figure 11. Concentrations of toluene in ground water.

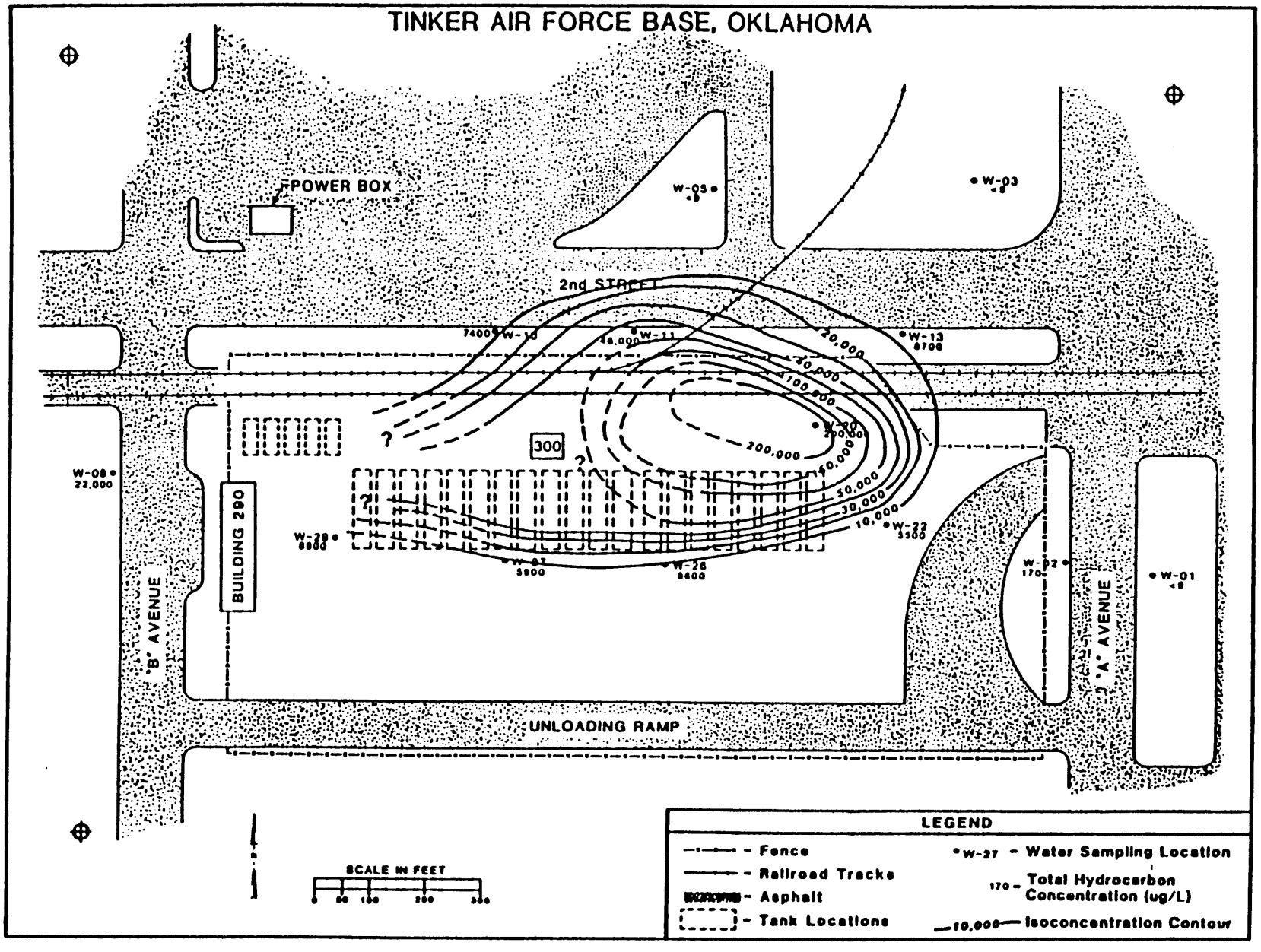


Figure 12. Concentrations of total hydrocarbons in ground water.

APPENDIX E

Selected Table from Tinker Air Force Base
Groundwater Assessment

Table 6-2
Organic compounds detected
ug/l

PERCHED AQUIFER - PERIMETER WELLS

	52B
trichloroethylene, 6/11/86	7.0
trichloroethylene, 2/3/87	18.0

REGIONAL AQUIFER - PERIMETER WELLS AND OFFBASE WELLS

	40A	40B	46A	OB2
chloroform			13.0	
trichloroethylene	3.0	1.6		
chloroform, 8/13/86				220.0
chloroform, 11/25/86				<10.0

PRODUCING ZONE - OFFBASE WELLS AND BASE WATER SUPPLY WELLS

	OB9	15WS	16WS
chloroform*	3.9		
dichlorobromomethane*	2.2		
tetrachloroethylene			0.7
1,2-dichloroethane			1.9
trichloroethylene		0.7	1.9

* found by State Health Department

APPENDIX F

Selected Table from Tinker Air Force Base
Groundwater Assessment Update

Table 3
Organic compounds present in wells
results in ug/l

perched water table

22B	benzene	2.4	(10/87)
23B	benzene	2.5	(10/87)
52B	trichloroethylene	7	(6/86), 18 (2/87), 22 (1/88)
		27	(5/88), 21 (7/88), 12 (9/88)
	1,2-dichloroethylene	1.9	(2/87), 3 (1/88)
72	chlorobenzene	5.0	(9/88)

Table 3 (cont.)
Organic compounds present in wells
results in ug/l

regional water table.

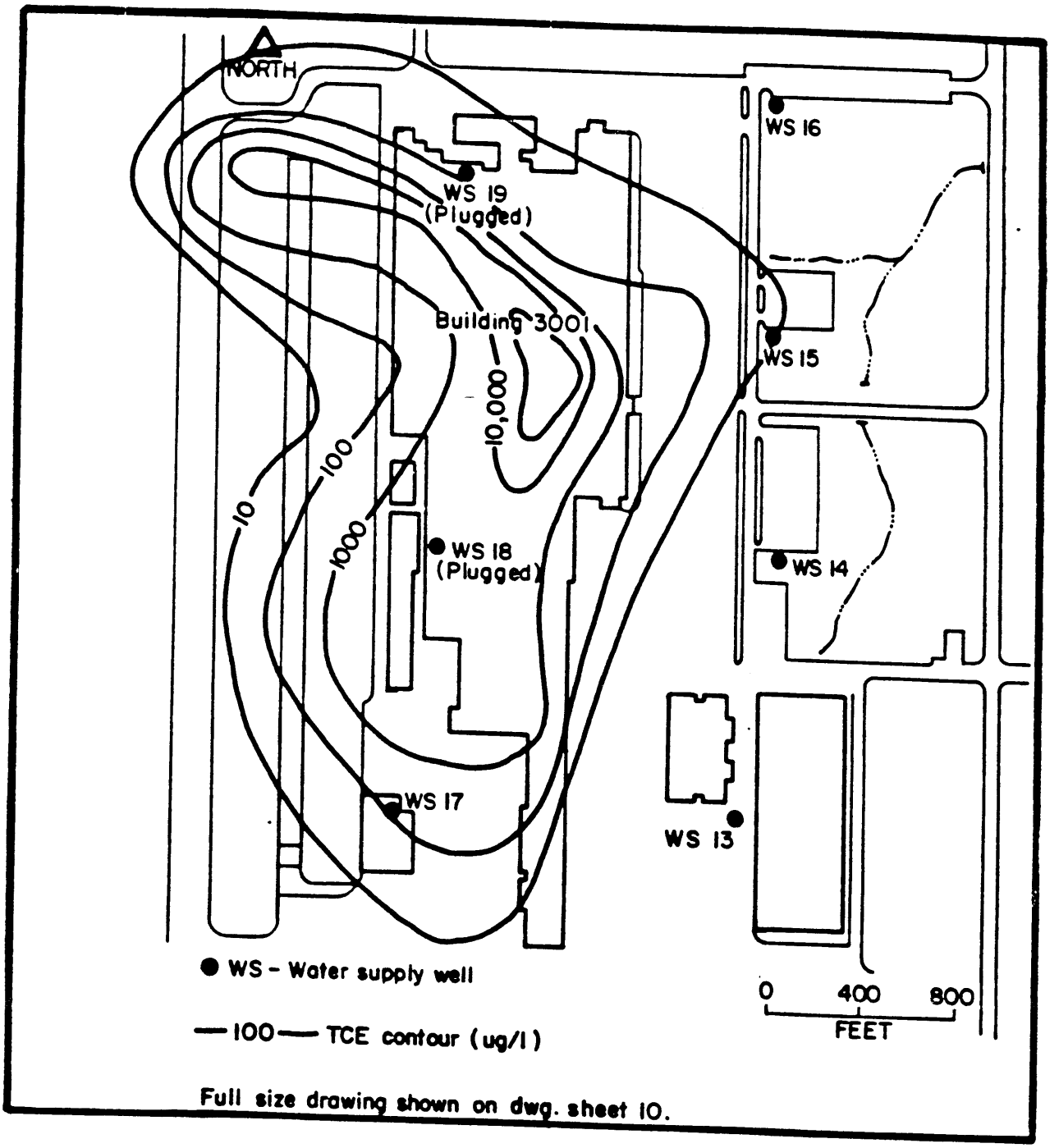
22A	chlorobenzene	2.5	(10/87),	9.0	(9/88)
	trichloroethylene			6.0	(9/88)
	styrene	6.4	(10/87)		
	ethyl benzene	5.3	(10/87)		
	benzene	110	(10/87)		
	toluene	22	(10/87)		
24A	trichloroethylene			9.0	(9/88)
	benzoic acid			48	(9/88)
	toluene	11	(11/87)		
40A	trichloroethylene	3.0	(1/87)		
40B	trichloroethylene	1.6	(1/87)		
42A	toluene	0.3	(1/88)		

producing zone

1WS	toluene	1.0	(3/88)		
14WS	trichloroethylene	0.4	(12/87)		
15WS	trichloroethylene	0.7	(9/86)	0.9	(12/87)
16WS	trichloroethylene	1.9	(9/86)	1.7	(12/87)
	1,2-dichloroethylene	1.9	(9/86)	1.4	(12/87)
	tetrachloroethylene	0.7	(9/86)	0.6	(12/87)
21WS	toluene	1.0	(3/88)		

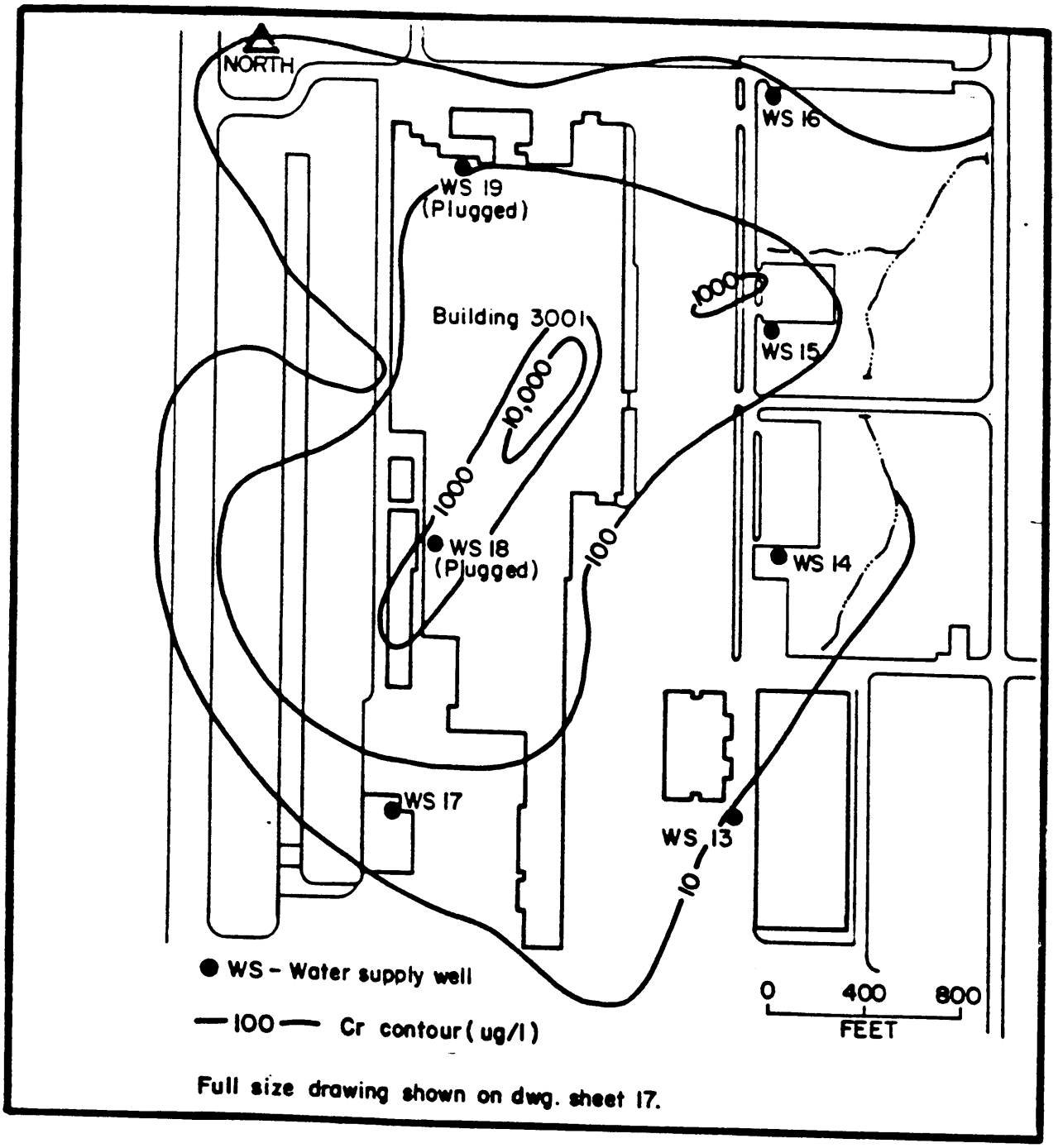
Appendix G

Selected Tables and Figures from Building 3001 Remedial Investigation

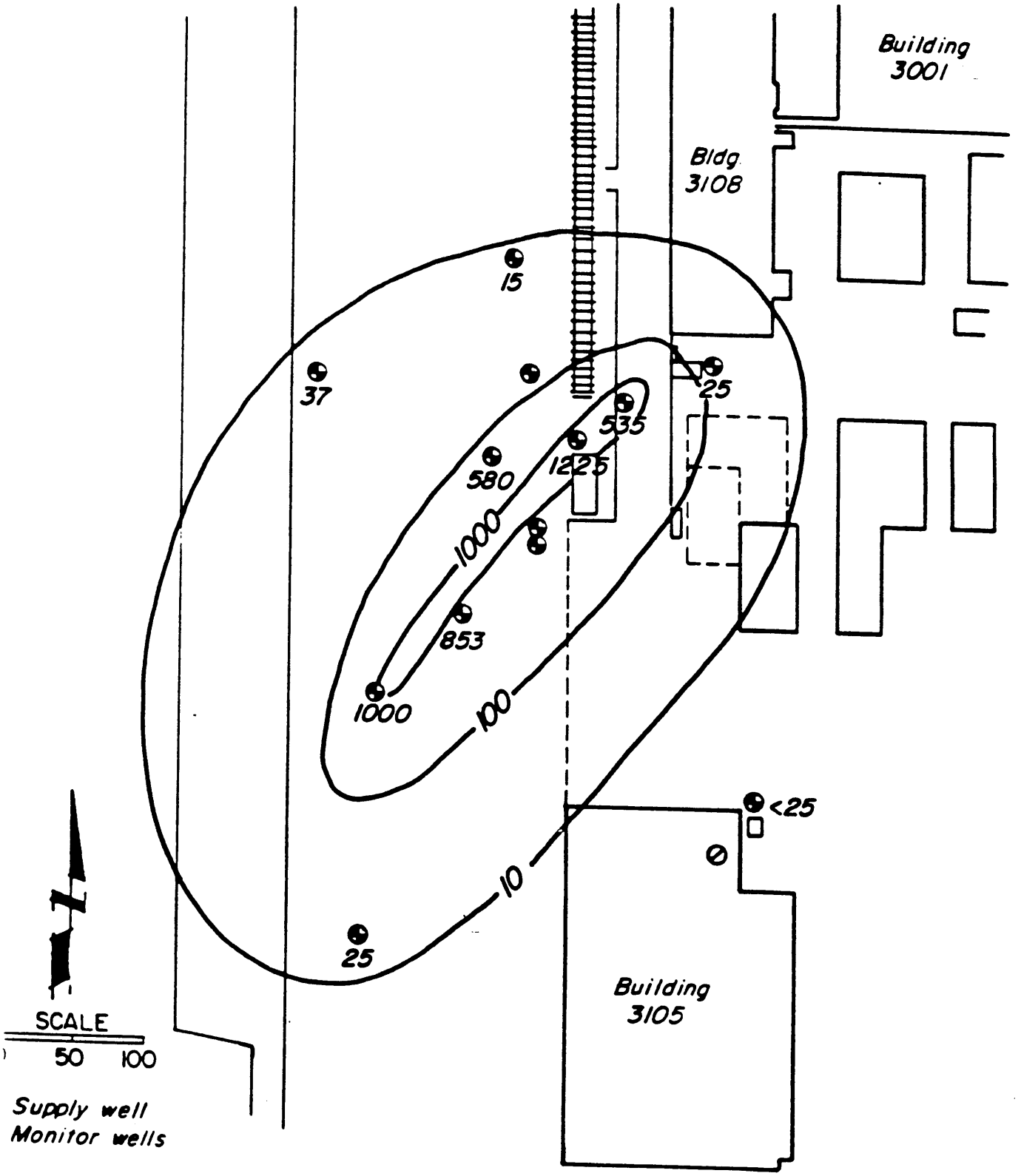


TCE PLUME IN PERCHED AQUIFER

FIGURE 1-5

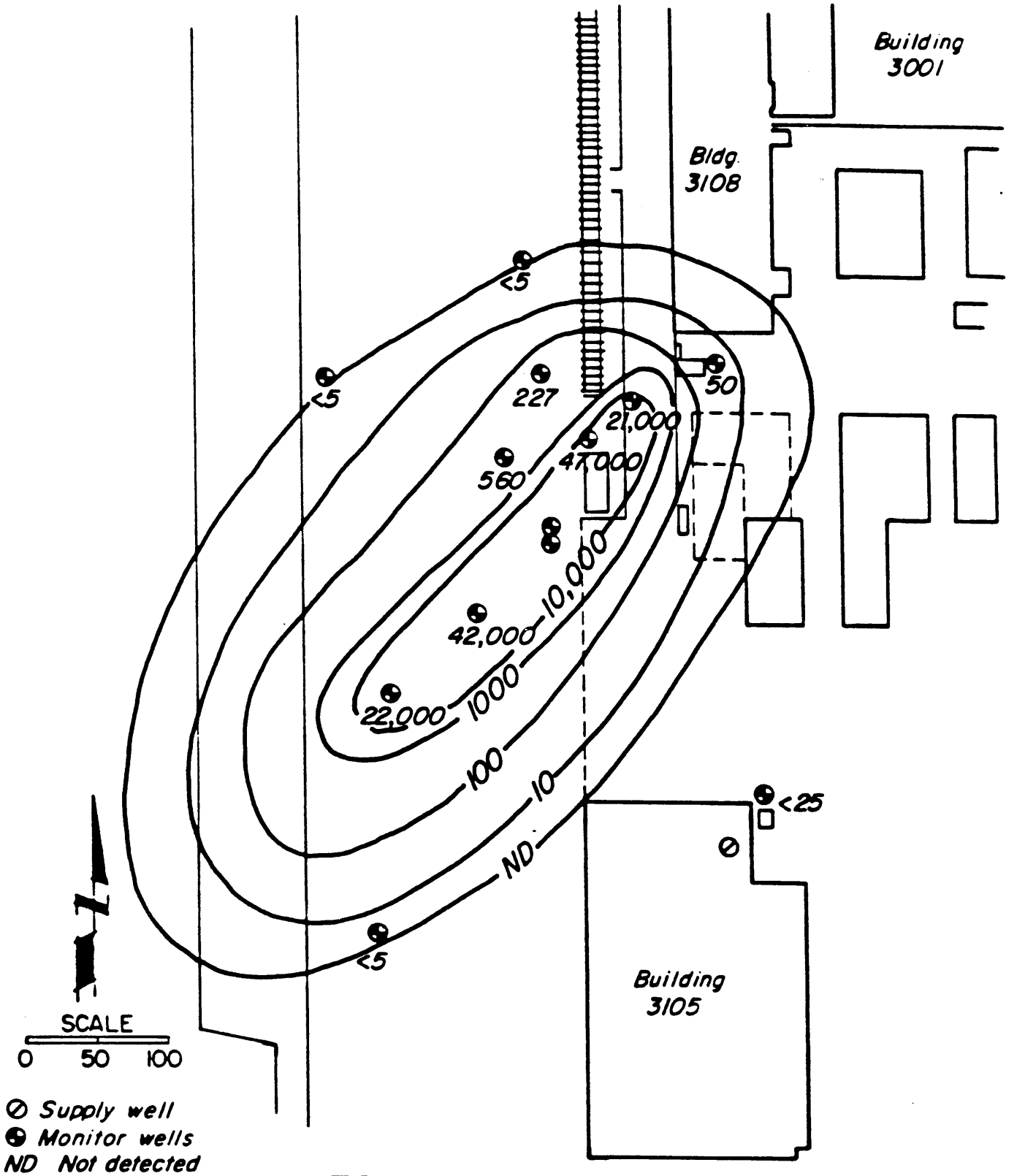


CR PLUME IN PERCHED AQUIFER
FIGURE 1-6



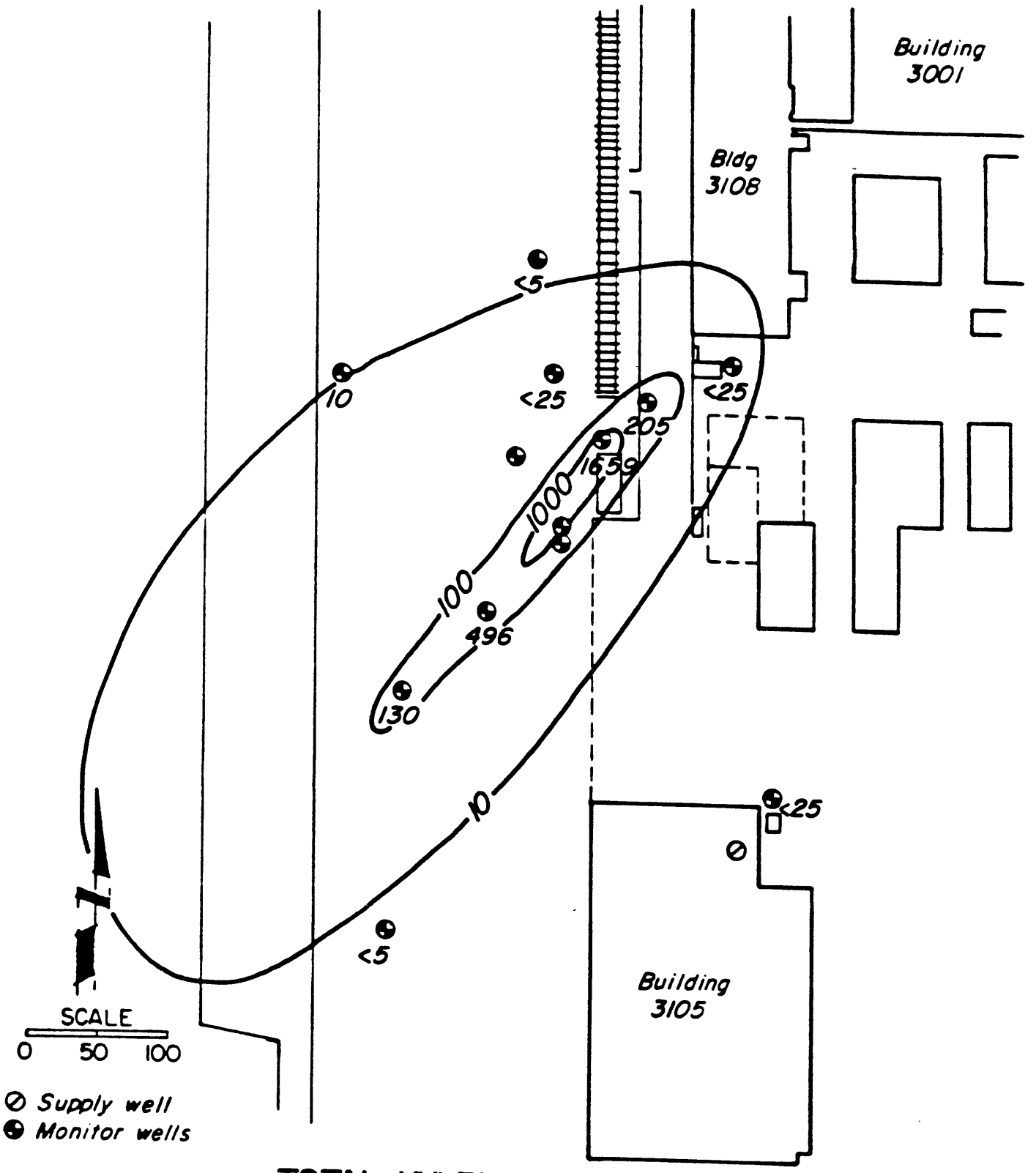
BENZENE CONCENTRATIONS
(ug/l)
SOUTHWEST TANK AREA

FIGURE 8-3



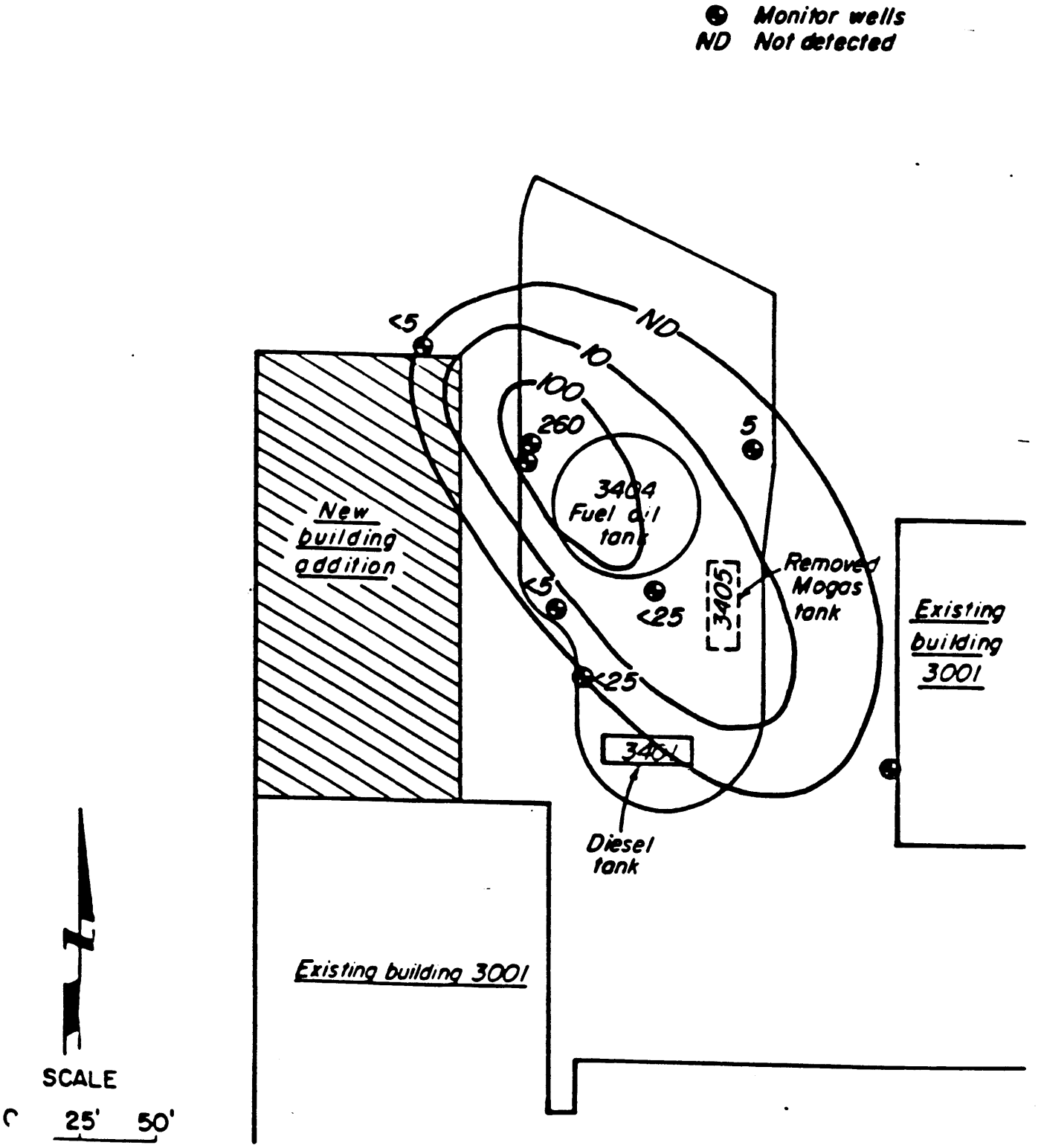
TOLUENE CONCENTRATIONS
(ug/l)
SOUTHWEST TANK AREA

FIGURE B-2



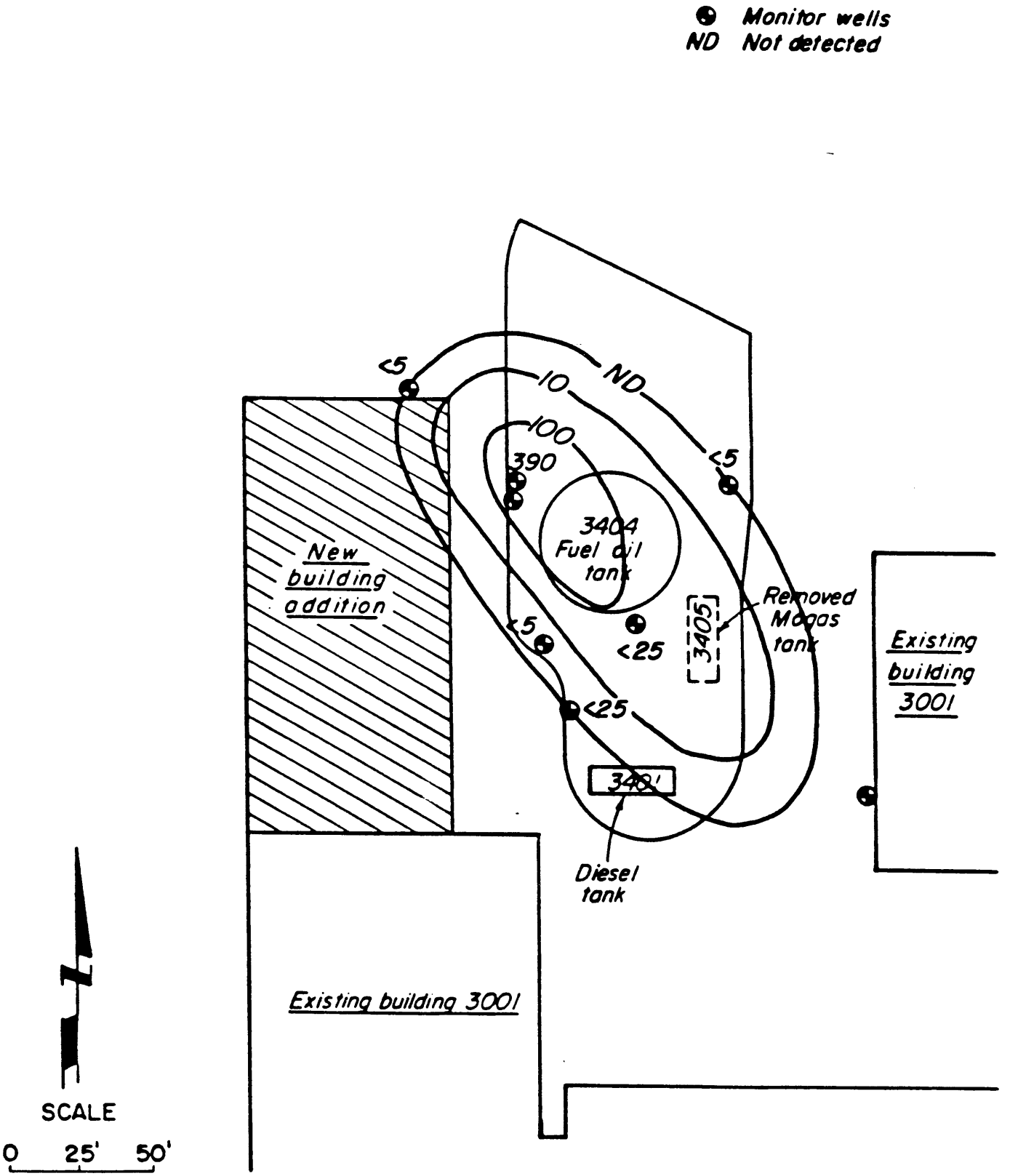
TOTAL XYLENES CONCENTRATIONS
(ug/l)
SOUTHWEST TANK AREA

FIGURE 8-4



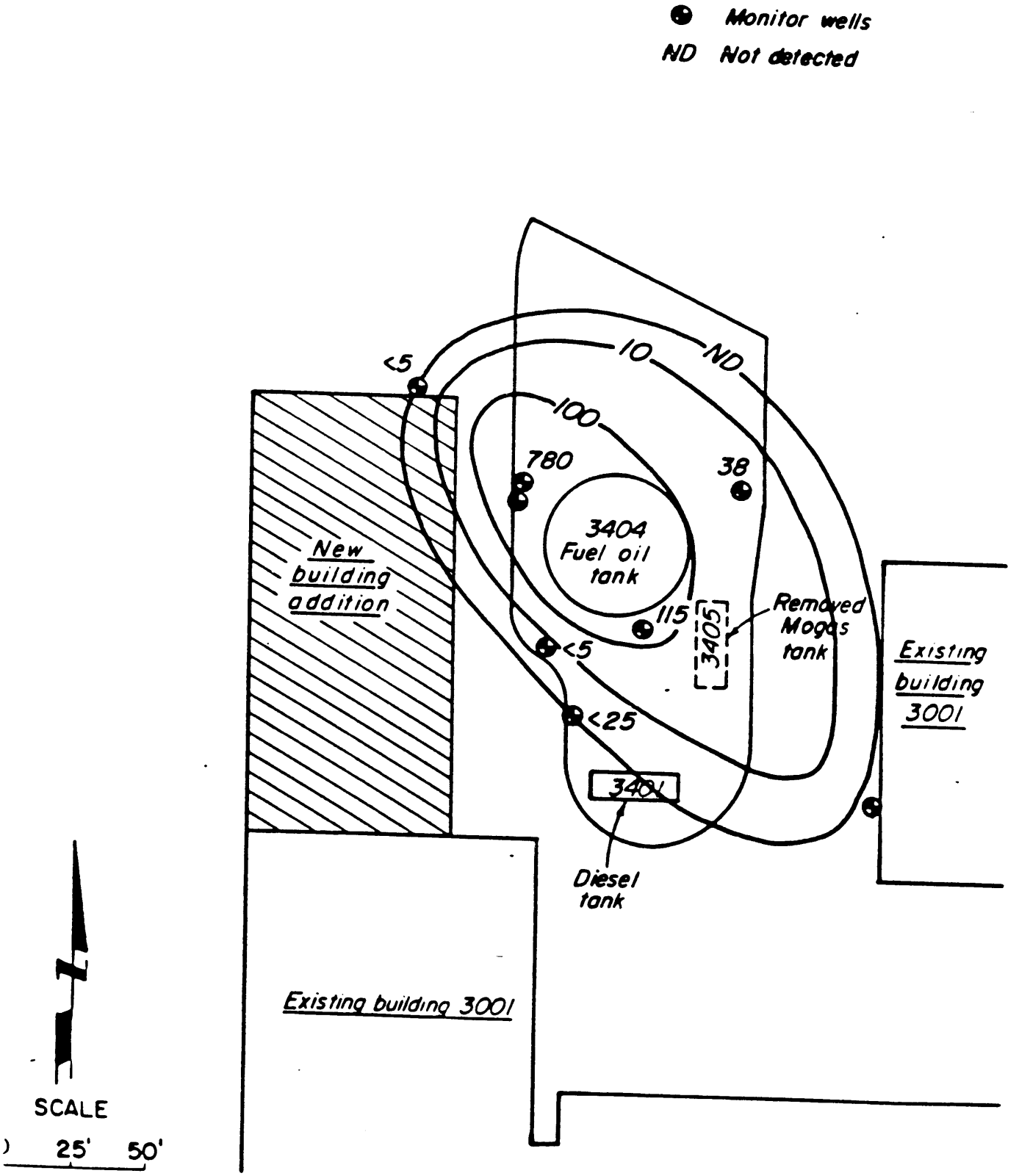
BENZENE CONCENTRATIONS
(ug/l)
NORTH TANK AREA

FIGURE B-6



TOLUENE CONCENTRATIONS
(ug/l)
NORTH TANK AREA

FIGURE 8-7



TOTAL XYLENES CONCENTRATIONS
(ug/l)
NORTH TANK AREA

FIGURE 8-8

Table 8.11
Contaminants Detected in Perched Zone

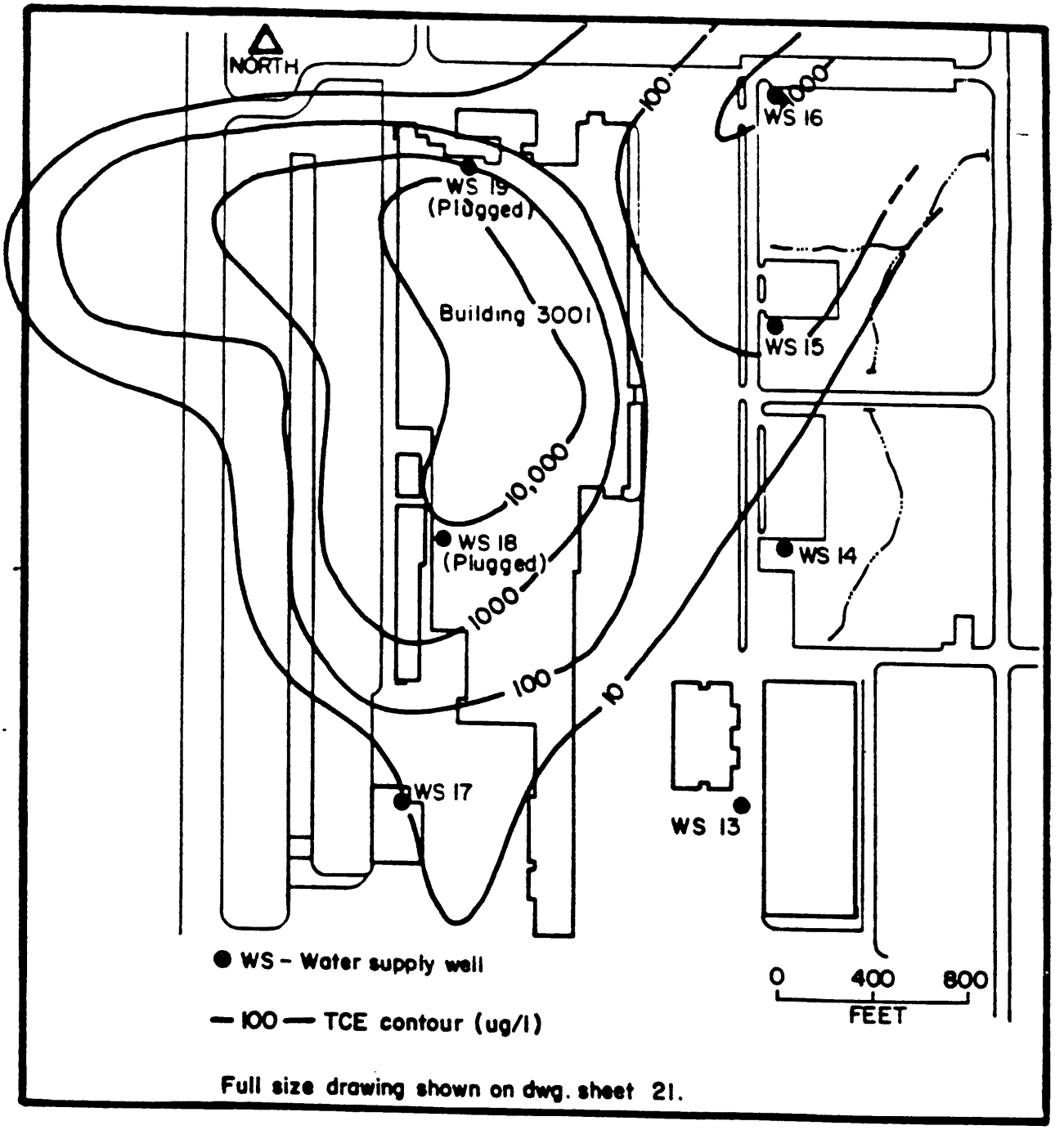
Organic Compounds	Detected[1] Frequency	Concentration Range (ug/l)	Average[2] Conc (ug/l)	Max. Conc. Location
TCE	19/33	<5 - 330,000	12,125	34A
Toluene	10/39	<5 - 47,000	662	M-6
1,2-DCE	10/33	<5 - 4,600	376	1-12B
Acetone	11/33	<5 - 1,600	324	1-18
Benzene	10/39	<5 - 1,535	122	M-6
Xylene	6/39	<5 - 780	98	1-30
PCE	6/33	<5 - 260	102	35A

Total Metals	Detected Frequency	Concentration Range (mg/l)	Average Conc (mg/l)	Max. Conc. Location
Cr	27/33	<0.01 - 80	2.60	34A
Zn	33/33	<0.01 - 1.30	2.10	1-30
Ba	29/33	<0.05 - 28	3.6	1-18
Ni	33/33	.013 - 1.10	0.2	1-30
Pb	33/33	< .01 - .57	0.10	1-30
Cd	9/33	<.005 - .020	0.006	1-30

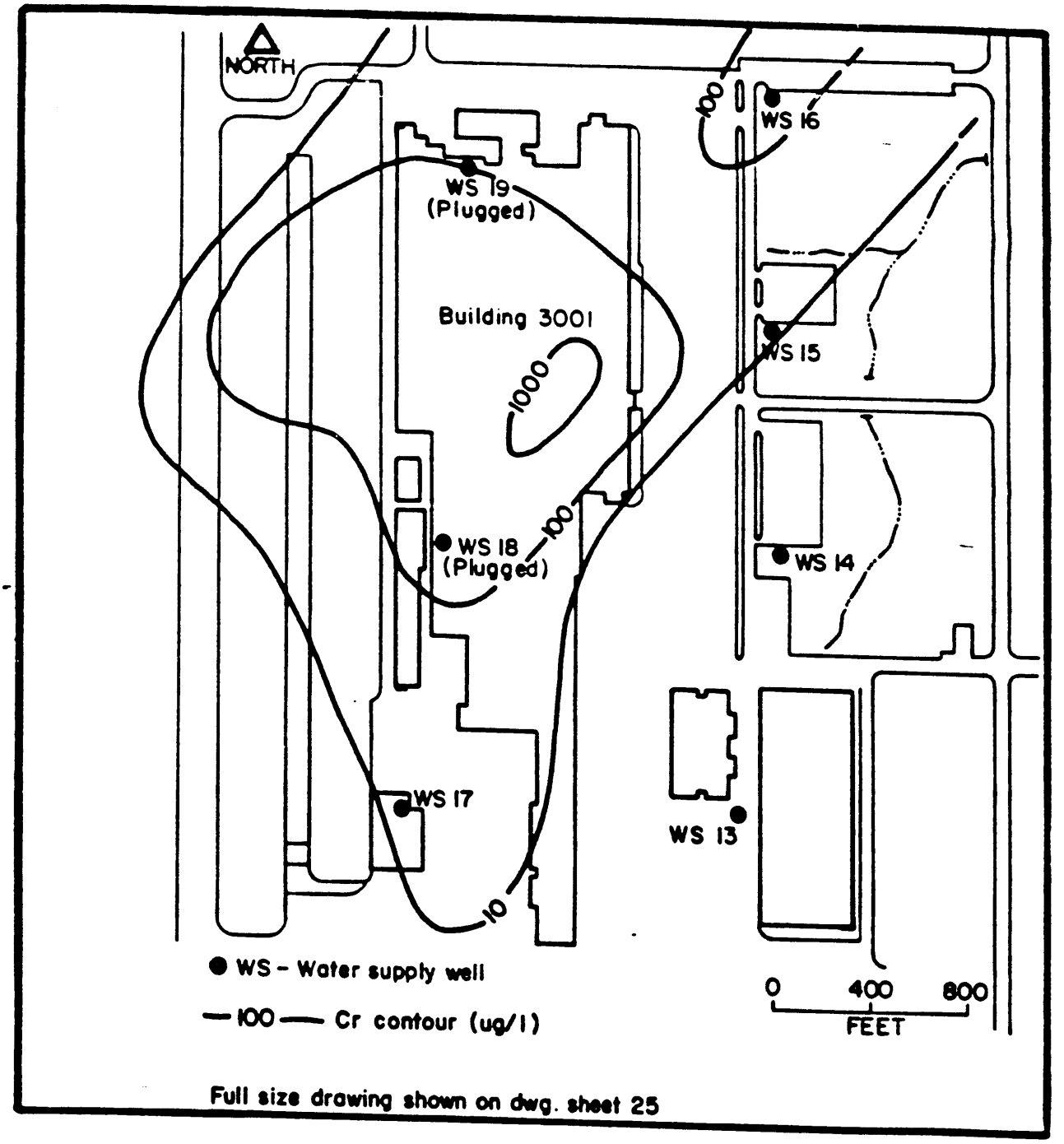
1 Detected Frequency = Number of chemical detections/number of samples analyzed for parameter.

2 Average Values were calculated assuming concentrations below detection limits are equal to half of detection limit.

3 Fuel product was also present in the north tank area (well 1-30).



TCE PLUME IN TOP OF REGIONAL ZONE
FIGURE 1-7



CR PLUME IN TOP OF REGIONAL ZONE

FIGURE I-8

Table 8.14
Compounds and Metals Detected with Maximum Concentrations and Well Locations in Top of Regional Zone

Compound	Detection Frequency	Concentration Range (ug/l)	Average Conc (ug/l)	Max. Conc. Well Locatio
TCE	17/25	<5 - 30,000	2330	34B
1,2-DCE	14/25	<5 - 1,400	123	1-11A
PCE	5/25	<5 - 1,200	94	33B
Toluene	5/25	<5 - 84	6	1-13A
1,2 DCA	5/25	<5 - 300	40	33B
Di-n-butyl phthalate	3/10	<10 - 300	41	19A
Phenol	5/10	<10 - 86	23	21A
Bis(2-Ethylhexyl)phthalate	5/10	<10 - 42	19	23A
1,1 DCE	4/25	<5 - 12	8	34B
Chlorobenzene	3/25	<5 - 940	42	1-11A
Vinyl Chloride	2/25	<10 - 530	29	1-11A
Acetone	13/25	<5 - 1400	86	1-6A

Total Metals	Detection Frequency	Conc. Range (mg/l)	Average Conc (mg/l)	Max. Conc. Well Locati
Cr	27/33	<.01 - 1.7	0.168	34B
Ba	18/23	<.50 - 24	2.6	1-13A
Pb	21/23	<.01 - .41	.09	1-13A
Ni	23/23	.03 - .53	.07	1-13A

Table 8.19
Summary of Organics and Metals Present in
Soil Samples Beneath Building 3001

Organic Compounds	Maximum Concentration (ug/kg)	Location	Depth (ft)
TCE	120,000	E105	5.0-6.0
1,1,1-TCA	5200	W83	5.0-6.0
Methylene Chloride	2.11	E105	5.0-6.0
1,1-DCA	2.1	W83	14.0-15.0
1,2 DCE	.300	A87	9.0-10.0
PCE	4.21	W83	14.0-15.0
1,1,2-TCA	1.92	W83	14.0-15.0
Trichlorofluoromethane	.102	W83	14.0-15.0
chloroform	5.7	W83	14.0-15.0
Methyl ethyl Ketone	7.3	W88	14.0-15.0
Acetone	41	W88	10.0-20.0
Benzene	73,500	E105	10.0-20.0
Chlorobenzene	730	E105	5.0-6.0
Para-dichlorobenzene	6.5	K107	5.0-6.0
Meta-dichlorobenzene	2.4	K107	1.0-5.0
ortho-dichlorobenzene	2.4	K107	1.0-5.0
pi-n-butylphthalate	4.6	K107	1.0-5.0
bis(2-ethylhexyl)pthalate	5.2	K107	7.0-7.5
carbon tetrachloride	1080	E105	7.0-7.5
chloroethylvinyle ether	960	E105	5.0-6.0
1,1,2,2,-PCA	45,400	E105	5.0-6.0
toluene	45,100	E105	5.0-6.0
ethylbenzene	33,600	E105	5.0-6.0

Metals	Maximum Concentration (ug/kg)	Location	Depth (ft)
Ba	1,138	R85	9.0-10.0
Cr	5.0(EP Tox)	R85	9.0-10.0
Hg			
Cd	1,138	R85	9.0-10.0
Cu	29	R85	9.0-10.0
Pb	14	R85	9.0-10.5
Ni	35	R85	9.0-10.0
Zn	66	R85	9.0-10.0

Table 8.20
Volatile Organics Detected in Soil Samples
At Well Location 1-30
(North Tanks Area)

Compound	Maximum Concentration (mg/kg)	Depth (ft)
Methylene chloride	.330	20.3
Acetone	9.96	24.7-25.2
Chlorobenzene	.015	12.0-12.5
Ethylbenzene	10.13	27.7-28.2
Toluene	7.73	24.7-25.2
Xylene (total)	31.0	24.7-25.2
Styrene	27.0	27.7-28.2

APPENDIX H

Selected Tables and Figures from Building 3001
Supplemental Quarterly Remedial Investigation

RESULTS OF CHEMICAL ANALYSES OF SOIL SAMPLES
UNDER BUILDING 3001

TABLE 2.1A

BORE HOLE 1-46

Depth of Sample	Ag mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	TOC mg/kg	pH	TCE ug/g	VA ug/g	MC ug/g	MEK ug/g
2 - 5'	0.6	<1.0	260	<0.5	9.4	12	540	8.06	6.2	<25	< 50	<50
5 - 10'	<0.5	<1.0	120	<0.5	5.7	12	50	8.07	<2.0	<25	< 50	<50
10 - 15'	<0.5	<1.0	80	<0.5	14	9.5	380	8.08	<2.0	<25	< 50	<50
15 - 20'	<0.5	<1.0	20	<0.5	5.0	6.7	1300	8.05	26	<25	< 50	<50
20 - 25'	<0.5	<1.0	20	<0.5	15	<1.0	1000	7.92	15	<25	<120	<50

TABLE 2.1B

BORE HOLE 1-47

Depth of Sample	Ag mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	TOC mg/kg	pH	TCE ug/g	VA ug/g	MC ug/g	MEK ug/g
0.4 - 5.0'	<0.5	<1.0	110	<0.5	5.9	9.8	1,000	8.24	<2.0	<25	< 50	<50
5.0 - 10.0'	0.5	<1.0	23	<0.5	6.1	1.9	2,000	7.91	<2.0	<25	94	<50
10.0 - 15.0'	<0.5	<1.0	63	<0.5	5.2	2.1	2,800	8.09	<2.0	<25	< 50	56
15.0 - 20.0'	0.5	<1.0	15	<0.5	<5.0	2.9	4,300	8.23	3.8	<2.0	135	<50
20.0 - 25.0'	0.5	<1.0	51	<0.5	5.2	3.8	3,300	8.10	6.4	<2.0	56	<50

TABLE 2.1C

BORE HOLE 1-48

Depth of Sample	Ag mg/kg	As mg/kg	Ba mg/kg	Cd mg/kg	Cr mg/kg	Pb mg/kg	TOC mg/kg	pH	TCE ug/g	VA ug/g	MC ug/g	MEK
2.0 - 6.5'	2.1	<1.0	110	4.6	300	50	1,000	12.16	<2.0	<25	< 50	<50
6.5 - 9.5	0.5	1.0	58	<0.5	18	11	460	8.37	<2.0	<25	< 50	<50
9.5 - 15.0'	<0.5	<1.0	63	<0.5	5.0	2.6	6,300	8.96	4.1	<25	< 50	50
15.0 - 20.0'	<0.5	<1.0	25	<0.5	5.7	4.1	8,200	8.49	7.1	51	< 50	<50
20.0 - 25.0'	<0.5	<1.0	25	<0.5	5.5	3.7	8,200	8.38	7.1	44	< 50	<50

< - below detection limit

Ag - Silver
As - Arsenic
Ba - Barium
Cd - Cadmium
Cr - Chromium
Pb - Lead

TOC - Total Organic Carbon
TCE - Trichloroethylene
VA - Vinyl Acetate
MC - Methylene Chloride
MEK - Methylethyl Ketone

TABLE 3.2A
SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 INTERIOR MONITORING WELLS

PERCHED AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
32A	142362	86	Apr 16 1986	210	20	<5	300	95	190
32A	1423665	88	Nov 18 1987	1300	58	7.9	310	<30	60
32A	1423684	88	Feb 23 1988	1088	50	<30	75	22	25
32A	1423698	88	May 24 1988	1300	74	<50	16	<10	<5
32A	14236115	88	Aug 07 1988	1400	<50	<50	42	<10	<5
32A	14236137	89	Nov 29 1988	1200	54	<50	200	55	<5
32A	14873	89	Mar 14 1989	1300	48J	<50	230	<10	<5
32A	OSDH	89	Mar 14 1989	1600	<50	<50	245	<45	<25
32A	14949	89	Jun 13 1989	1800	79	<56	140	<10	<5
32A	OSDH	89	Jun 13 1989	2800	<10	11	105	<45	<25
33A	142362	86	Apr 15 1986	18000	120	170	100	58	100
33A	1423619	87	Dec 21 1986				220	110	530
33A	1423665	88	Nov 17 1987	4000	71	110	180	30	300
33A	1423686	88	Mar 01 1988	74856	<250	<250	23	72	130
33A	14236102	88	Jun 02 1988	70000	<2500	<2500	<5	<10	40
33A	14236117	88	Aug 08 1988	52000	<2500	<2500	28	16	130
33A	14236137	88	Dec 01 1988	72000	<2500	<2500	43	240	130
33A	14873	89	Mar 13 1989	150000	<5000	<5000	18	<10	80
33A	OSDH	89	Mar 13 1989	120000	<500	<500	42	<45	82
33A	14949	89	Jun 13 1989	190000	<6300	<6300	23	10	47
33A	OSDH	89	Jun 13 1989	300000	<500	700	37	<45	50
34A	142363	86	Apr 22 1986	330000	<5000	<5000	80000	130	70
34A	1423619	87	Dec 22 1986				120000	80	110
34A	1423665	88	Nov 23 1987	310000	52	3400	130000	<30	70
34A	1423684	88	Feb 24 1988	198360	<1250	1920	850000	140	70
34A	1423698	88	May 25 1988	220000	<5000	5300	820000	20	22
34A	14236116	88	Aug 08 1988	280000	<5000	8000	900000	<10	40
34A	14236137	89	Nov 03 1988	310000	<8400	<8400	670000	140	<5
34A	148731	89	Mar 15 1989	230000	<6300	3300J	25000	<10	<5
34A	OSDH	89	Mar 15 1989	210000	<50	15000	805200	<180	<100
34A	14949	89	Jun 15 1989	180000	<5000	<5000	1200000	82	30
34A	OSDH	89	Jun 15 1989	350000	<500	21000	881600	<180	<100
35A	142362	86	Apr 17 1986	<50	<50	<50	200	130	220
35A	1423665	88	Nov 24 1989	200	140	4	30	<30	100
35A	1423686	88	Feb 29 1988	835	72	<30	13	82	28
35A	14236101	88	Jun 01 1988	1200	100	<50	<5	<10	5.8
35A	14236117	88	Aug 10 1988	830	80	6J	13	20	<5
35A	14236137	89	Dec 01 1988	940	<31	<31	8	<10	<5
35A	148731	89	Mar 15 1989	1000	86	5J	<5	<10	<5
35A	OSDH	89	Mar 15 1989	11	<5	<5	28	<45	<25
35A	14949	89	Jun 14 1989	1200	88	<31	9	12	<5
35A	OSDH	89	Jun 14 1989	1000	<5	8	<10	<45	<25

NOTE: All concentrations in ug/l

J - indicates estimated value
B - also present in blank

TABLE 3.2A

SIGNIFICANT PARAMETERS RESULTS

BUILDING 3001 INTERIOR MONITORING WELLS

REGIONAL AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
32C	142362	86	Apr 16 1986	540	46	28	150	150	78
32C	1423665	88	Nov 18 1987	390	<2	19	90	<30	100
32C	1423684	88	Feb 23 1988	134	14	6	<10	45	93
32C	1423698	88	May 25 1988	45	10	<5	<5	<5	<10
32C	14236115	88	Aug 07 1988	51	<5	1BJ	6	<10	<5
32C	14236137	89	Nov 29 1988	53	11	<5	<5	<10	<5
32C	14873	89	Mar 14 1989	51	16	<5	<5	<10	<5
32C	OSDM	89	Mar 14 1989	35	<5	<5	17	<45	<25
32C	14949	89	Jun 13 1989	62	18	<5	14	<10	<5
32C	OSM	89	Jun 13 1989	120	<5	3	13	<45	<25
33C	142362	86	Apr 15 1986	540	46	28	150	150	78
33C	1423619	87	Dec 21 1986				120	110	73
33C	1423665	88	Nov 18 1987	80000	16	550	230	<30	<10
33C	1423686	88	Mar 01 1988	474	<250	<250	18	70	58
33C	14236102	88	Jun 02 1988	1800	<50	<50	<5	<10	14
33C	14236117	88	Aug 09 1988	300	<13	3J	16	13	<5
33C	14236137	89	Dec 01 1988	3900	<250	<250	15	<10	26
33C	14873	89	Mar 03 1989	370	<13	<13	<5	<10	25
33C	OSDM	89	Mar 13 1989	340	<5	<5	27	<45	44
33C	14949	89	Jun 06 1989	450	<17	5J	39	18	20
33C	OSDM	89	Jun 19 1989	1100	<5	10	51	<45	56
34C	142363	86	Apr 22 1986	1000	36	25	1200	50	50
34C	1423610	87	Dec 22 1986				540	68	83
34C	1423638	87	May 12 1987	370	58	21			
34C	1423665	88	Nov 19 1987	7200	45	110	130	<30	40
34C	1423684	88	Feb 24 1988	1000	48	<40	10	40	55
34C	14236101	88	May 31 1988	2800	72	<100	<5	<10	29
34C	14236116	88	Aug 1988	180	<50	4J	14	12	24
34C	14236137	89	Nov 03 1988	680	56	25	6	<10	24
34C	148731	89	Mar 15 1989	180	53	11	11	<10	23
34C	OSDM	89	Mar 15 1989	910	<5	20	47	<45	<25
34C	14949	89	Jun 15 1989	1308	53	6	110	10	26
34C	OSDM	89	Jun 15 1989	780	<10	25	28	<45	<25
35C	142362	86	Apr 17 1986	25	12	10	80	130	120
35C	1423665	88	Nov 24 1987	186	130	3	250	<30	200
35C	1423677	88	Feb 25 1988	249	181	<5	20	50	43
35C	14236101	88	Jun 01 1988	280	240	4J	<5	<10	11
35C	14236117	88	Aug 10 1988	250	170	3J	30	15	8.5
35C	14236137	89	Dec 01 1988	300	<13	<13	24	<10	12
35C	14873	89	Mar 14 1989	320	4J	<13	18	<10	8.8
35C	OSDM	89	Mar 14 1989	280	5	<5	30	<45	<25
35C	14949	89	Jun 19 1989	320	180	<13	38	14	11
35C	OSDM	89	Jun 19 1989	490	5	<5	30	<45	<25

TABLE 3.2A
SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 INTERIOR MONITORING WELLS

TOP OF REGIONAL AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
32B	142362	86	Apr 16 1986	6900	930	33	390	80	170
32B	1423665	88	Nov 18 1987	17000	13	27	290	<30	180
32B	1423684	88	Feb 23 1988	17410	586	<385	78	38	40
32B	1423698	88	May 24 1988	30000	1000J	<1250	96	<10	8
32B	14236115	88	Aug 07 1988	33000E	<500	37BJ	110	<10	<5
32B	14236137	89	Nov 29 1988	32000	<1300	<1300	110	<10	11
32B	14873	89	Mar 14 1989	30000	840	<840	70	<10	17
32B	OSDM	89	Mar 14 1989	39000	7	45	118	<45	<25
32B	14949	89	Jun 13 1989	32000	860J	<1300	110	<10	9.2
32B	OSDM	89	Jun 13 1989	46000	<100	50	115	<45	<25
33B	142362	86	Apr 15 1986	14000	240	1200	300	80	300
33B	1423619	87	Dec 21 1986				200	78	320
33B	1423665	88	Nov 17 1987	14000	<2	140	120	<30	200
33B	1423686	88	Mar 01 1988	4512	<250	225	18	65	50
33B	14236102	88	Jun 06 1988	4100	<500	<500	6.5	<10	7.8
33B	14236117	88	Aug 09 1988	7100	<250	510	27	12	7.2
33B	14236137	89	Dec 01 1988	6900	<380	410	16	<10	14
33B	14873	89	Mar 13 1989	9100	150J	570	9	<10	16
33B	OSDM	89	Mar 13 1989	10000	15	500	15	<45	<25
33B	14949	89	Jun 13 1989	12000	200J	670	19	12	28
33B	OSDM	89	Jun 13 1989	16000	<100	740	15	<45	35
34B	142363	86	Apr 22 1986	30000	47	130	1700	250	580
34B	1423638	87	May 05 1987	25000	63	170			
34B	1423665	88	Nov 23 1987	30000	47	200	18000	50	230
34B	1423684	88	Feb 24 1988	22820	<500	<500	79000	55	50
34B	1423698	88	May 25 1988	1300	94	18	2400	<10	25
34B	14236116	88	Aug 08 1988	4300	<1300	100J	8900	<10	20
34B	14236137	89	Nov 03 1988	11000	<500	<500	13000	24	<5
34B	14873	89	Mar 15 1989	10000	<310	84J	18000	<10	24
34B	OSDM	89	Mar 15 1989	39000	<50	440	19820	<180	<100
34B	14949	89	Jun 15 1989	3400	96J	28J	24000	16	20
34B	OSDM	89	Jun 15 1989	3900	<5	28	21520	<45	51
35B	142362	86	Apr 17 1986	1200	61	<5	180	110	63
35B	1423665	88	Nov 24 1987	1200	52	<2	70	<30	150
35B	1423686	88	Feb 29 1988	7350	187	<250	57	60	25
35B	14236101	88	Jun 01 1988	6500	240	<100	49	<10	12
35B	14236117	88	Aug 10 1988	4200	<250	<250	60	16	9.2
35B	14236137	88	Dec 01 1988	2800	<130	<130	56	<10	6
35B	14873	89	Mar 14 1989	9100	220J	<250	44	<10	6
35B	OSDM	89	Mar 14 1989	2000	<5	9	53	<45	<25
35B	14949	89	Jun 14 1989	9500	250J	<250	58	13	20
35B	OSDM	89	Jun 14 1989	3100	<5	<5	78	<45	<25

NOTE: All concentration in ug/l. J-indicates estimated value. B - also present in blank

TABLE 3.2A
SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 INTERIOR MONITORING WELLS

DEEPER REGIONAL AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
34D	1423613	86	Aug 12 1986	<5	<5	7	440	45	25
34D	1423638	87	May 12 1987	7	1	2			
34D	1423665	88	Nov 19 1987	650	<2	25	310	70	350
34D	1423687	88	Mar 16 1988	17	<5	4J	<10	55	43
34D	14236107	88	Jun 29 1988	20	<5	24	<5	<10	<5
34D	14236137	89	Dec 02 1988	16	<1	16	9	<10	<5
34D	148734	89	Mar 29 1989	98	<5	15	<5	<10	<5
34D	OSDH	89	Mar 29 1989	57	<5	11	<10	<45	<25
34D	14949	89	Jun 15 1989	110	<5	8	62	<10	<5
34D	OSDH	89	Jun 15 1989	290	<5	<5	16	<45	<25

NOTE: All concentrations in ug/l. J - indicates estimated value. B - also present in blank

TABLE 3.2B

SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 OUTSIDE SELECT MONITORING WELLS

PERCHED AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
1-10B	142363	86	May 2 1986	<5	<5	<5	<10	30	170
1-10B	1423661	88	Oct 22 1987	10	<2	<2	<10	33	18
1-10B	1423688	88	Mar 14 1988	<5	<5	<5	<10	60	35
1-10B	14236104	88	Jun 07 1988	<5	<5	<5	9.5	<10	<5
1-10B	14236124	88	Sep 19 1988	<5	<5	<5	<5	<10	<5
1-10B	14873	89	Mar 12 1989	<1	<1	<1	<5	<10	<5
1-11B	142363	86	May 05 1986	<5	<5	<5	13	28	140
1-11B	1423660	88	Oct 15 1987	<2	<2	<2	<10	35	20
1-11B	1423688	88	Mar 15 1988	<5	<5	<5	<10	50	38
1-11B	14236104	88	Jun 06 1988	<5	<5	<5	14	10	7.5
1-11B	148733	89	Mar 23 1989	<5	<5	4J	<5	<10	<5
1-13B	1423613	86	Sep 11 1986	<5	<5	<5	13	63	38
1-13B	1423665	88	Dec 01 1987	<2	<2	<2	<10	<30	<10
1-13B	1423680	88	Feb 02 1988	7	6	3	<10	35	15
1-13B	14236103	88	Jun 08 1988	10	10	4J	11	12	<5
1-13B	14236124	88	Sep 21 1988	<5	<5	<5	<12	<10	10
1-13B	148731	89	Mar 19 1989	1J	<5	<5	<5	<10	<5
1-14B	1423615	86	Sep 18 1986	20	<5	<5	240	120	180
1-14B	1423618	87	Oct 29 1986	35	<5	<5	45	63	100
1-14B	1423660	88	Oct 19 1987	15	<2	<2	<10	<25	18
1-14B	1423680	88	Oct 02 1988	47	<5	<5	<10	48	33
1-14B	14236103	88	Jun 08 1988	26	<5	<5	9.8	<10	22
1-14B	14236125	88	Sep 21 1988	16	<5	<5	11	<10	<5
1-14B	148733	89	Mar 20 1989	37	<5	<5	7.5	16	28
25B	142369	86	Jun 13 1986	380	52	<5	110	88	65
25B	1423674	88	Nov 05 1987	480	75	<2	10	<5	<50
25B	1423688	88	Mar 15 1988	873	80	<35	15	102	73
25B	14236107	88	Jun 28 1988	570	<25	<5	7.5	37	11
25B	14236125	88	Sep 21 1988	<5	<5	<5	18	<10	15
25B	14873	89	Mar 02 1989	880	80	<31	9.8	29	10

TABLE 3.2B
SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 OUTSIDE SELECT MONITORING WELLS

TOP OF REGIONAL AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
1-10A	142363	86	May 01 1986	<5	<5	<5	50	45	170
1-10A	1423660	88	Oct 15 1987	<2	<2	<2	<10	48	25
1-10A	1423688	88	Mar 14 1988	<5	<5	<5	<10	60	28
1-10A	14236104	88	Jun 07 1988	<5	<5	<5	10	<10	<5
1-10A	14236124	88	Sep 19 1988	<5	<5	<5	<5	<10	<10
1-10A	148736	89	Apr 09 1989	<5	<5	<5	<5	<10	<5
1-11A	142363	86	May 05 1986	1100	1400	950	160	<25	240
1-11A	1423660	88	Oct 15 1987	300	220	29	70	43	63
1-11A	1423688	88	Mar 15 1988	1008	<30	1068	180	42	190
1-11A	14236104	88	Jun 06 1988	970	720	1300	200	20	150
1-11A	14236124	88	Sep 09 1989	940	570	1100	230	11	190
1-11A	148733	89	Mar 23 1989	1100	790	1300	210	<10	240
1-13A	1423613	86	Sep 11 1986	97	6	<5	370	410	530
1-13A	1423665	88	Dec 12 1987	<2	<2	<2	370	30	670
1-13A	1423680	88	Feb 10 1988	<5	<5	<5	<10	40	15
1-13A	14236103	88	Jun 06 1988	2J	<5	<5	12	13	06
1-13A	14236125	88	Sep 21 1988	<5	<5	<5	10	<10	<5
1-13A	148731	89	Mar 19 1989	5	<5	<5	11	30	72
1-14A	1423613	86	Sep 12 1986	34	11	<5	23	50	28
1-14A	1423618	87	Oct 29 1986	170	19	<5	15	60	45
1-14A	1423660	88	Oct 19 1987	58	5.7	<2	<10	35	23
1-14A	1423680	88	Oct 02 1988	51	<5	<5	<10	43	13
1-14A	14236103	88	Jun 08 1988	250	12	<8	11	<10	<5
1-14A	14236125	88	Sep 21 1988	96	<5	<5	13	<10	<5
1-14A	148731	89	Mar 26 1989	2000e	<72	<50	12	<10	<5
25A	14236	86	Mar 25 1986	<5	<5	<5	10	50	35
25A	1423663	88	Oct 30 1987	<2	<2	<2	10	64	30
25A	1423692	88	Apr 06 1988	<5	<5	<5	<10	14	<5
25A	14236109	88	Jun 27 1988	<5	<5	<5	<5	20	<5
25A	14236129	88	Sep 29 1988	2J	<5	<5	<5	11	<5
25A	14873	89	Mar 12 1989	4	<1	<1	<5	<10	<5

TABLE 3.2B
SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 OUTSIDE SELECT MONITORING WELLS

REGIONAL AQUIFER

Well No.	Report No.	FY	Date Sampled	TCE	DCE	PCE	Cr	Pb	Ni
1-10C	1423617	87	Oct 01 1986	<5	<5	<5	18	150	50
1-10C	1423661	88	Oct 22 1987	<2	<2	<2	<10	20	10
1-10C	1423688	88	Mar 14 1988	<5	<5	<5	<10	70	20
1-10C	14236104	88	Jun 07 1988	<5	<5	<5	9.5	<10	<5
1-10C	14236124	88	Sep 19 1988	<5	<5	<5	14	11	<5
1-10C	148736	89	Apr 09 1989	2J	2J	<5	8.5	10	6.8
1-13C	1423613	86	Sep 11 1986	48	7	<5	<10	53	23
1-13C	1423665	88	Dec 01 1987	<2	<2	<2	<10	<30	<10
1-13C	1423682	88	Jun 08 1988	<50	<50	<50	<10	58	30
1-13C	14236103	88	Jun 08 1988	<5	<5	<5	12	13	7.2
1-13C	14236125	88	Sep 21 1988	<5	<5	<5	11	<10	<5
1-13C	148731	89	Mar 19 1989	7	<5	<5	<5	<10	<5
1-14C	1423613	86	Sep 12 1986	<4	<5	<5	930	400	1100
1-14C	1423618	87	Oct 10 1986	110	7	<5	820	370	1100
1-14C	1423660	88	Oct 15 1987	<2	<2	<2	<10	38	25
1-14C	1423680	88	Feb 02 1988	63	15	<5	<10	43	15
1-14C	14236103	88	Jun 08 1988	64	22	<5	24	18	6.5
1-14C	14236125	88	Sep 21 1988	460	180	<50	17	<10	<5
1-14C	148731	89	Mar 19 1989	140	30	<5	15	<10	10
25C	1423617	87	Oct 01 1986	<250	<250	<250	<10	240	55
25C	1423674	88	Nov 05 1987	9.1	75	<2	10	<5	20
25C	1423688	88	Mar 15 1988	<5	<5	<5	<10	48	30
25C	14236107	88	Jun 28 1988	<5	<5	<5	<5	15	<5
25C	14236125	88	Sep 21 1989	<5	<5	<5	13	<10	<5
25C	14873	89	Mar 12 1989	<13	5J	<13	<5	<10	<5

SIGNIFICANT [illegible]

BUILDING 3001 SITE MONITORING WELLS

Well No.	Report No.	Date Sampled	Aquifer	TCE	DCE	PCE	Cr	Pb	Ni
1-1A	14236-6	23 May 86	T	100	5	<5	60	35	63
1-1A	14236-59	07 Oct 87	T	240	9	5	13	40	30
1-1A	14236-134	03 Nov 88	T	690	6J	28	11	<10	5
1-1B	14236-3	07 May 86	P	<5	<5	<5	58	60	310
1-1B		25 Feb 87	P	<5	<5	<5	50	70	60
1-1B	14236-59	07 Oct 87	P	<5	<5	<5	18	40	45
1-1B	14236-134	03 Nov 88	P	<5	<5	<5	5.2	<10	6
1-2A	14236-6	23 May 86	T	490	21	<5	<10	25	48
1-2A	14236-61	21 Oct 87	T	460	32	<2	<10	60	45
1-2A	14236-134	07 Nov 88	T	1400	35J	<50	7.5	14	5.5
1-2B	14236-3	07 May 86	P	<5	<5	<5	110	43	70
1-2B	14236-61	21 Oct 87	P	4.2	<2	<2	120	70	140
1-2B	14236-134	07 Nov 88	P	<5	<5	<5	3.8	<10	<5
1-3A	14236-6	23 May 86	T	<5	<5	<5	<10	18	35
1-3A	14236-59	08 Oct 87	T	<5	<5	<5	18	33	28
1-3A	14236-134	07 Nov 88	T	<5	<5	<5	5.5	<10	<5
1-3B	14236-3	08 May 86	P	<5	<5	<5	58	63	340
1-3B	14236-59	08 Oct 87	P	<5	<5	<5	25	55	70
1-3B	14236-134	07 Nov 88	P	2J	<5	<5	5.5	<10	8
1-4A	14236-6	23 May 86	T	<5	<5	<5	<10	15	18
1-4A	14236-59	08 Oct 87	T	<5	<5	<5	25	33	53
1-4A	14873-7	11 Apr 89	T	<5	<5	<5	<5	<10	<5
1-4B	14236-3	08 May 86	P	<5	<5	<5	68	35	160
1-4B	14236-59	08 Oct 87	P	<5	<5	<5	60	55	88
1-4B	14236-6	10 Apr 89	P	3J	<5	4J	18	14	61
1-5A	14236-6	21 May 86	T	42	<5	<5	40	120	230
1-5A	14236-17	16 Oct 86	T				25	310	63
1-5A	14236-69	22 Dec 87	T	28	<0.7	0.5J	30	150	62
1-5A	14236-7	13 Apr 89	T	21	<5	<5	24	140	5.5
1-5B	14236-3	08 May 86	P	1600	18	10	210	80	320
1-5B	14236-17	16 Oct 86	P				28	85	100
1-5B	14236-69	22 Dec 87	P	2120	11J	45J	<10	82	30
1-5B	14873-7	13 Apr 89	P	2700	<100	75J	10	20	28
1-6A	14236-6	21 May 86	T	27	<5	<5	45	60	63
1-6A	14873-6	09 Apr 89	T	<5	<5	<5	5	10	<5
1-6B	14236-3	08 May 86	P	35	<5	<5	18	58	490
1-6B	14236-69	22 Dec 87	P	24	<0.7	<1.3	78	75	95
1-6B	14873-6	09 Apr 89	P	36	<5	<5	180	18	37

TABLE 3.2C (Continued)

SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 SITE MONITORING WELLS

Well No.	Report No.	Date Sampled	Aquifer	TCE	DCE	PCE	Cr	Pb	Ni
1-7A	14236-6	21 May 86	T	2400	220	<5	83	38	80
1-7A	14236-63	27 Oct 87	T	3000	170	<2	90	20	50
1-7A	14236-133	02 Nov 88	T	9200E	220	<130	130	<10	7.8
1-7B	14236-6	20 May 86	P	110	<5	<5	140	250	130
1-7B	14236-63	27 Oct 87	P	200	3.3	<2	160	600	160
1-7B	14236-133	02 Nov 88	P	270	<8	<8	12	<10	33
1-8A	14236-6	22 May 86	T	<5	<5	<5	10	25	25
1-8A	14236-59	14 Oct 87	T	95	9	3J	<10	33	20
1-8A	14236-133	02 Nov 88	T	200	17J	<25	17	32	13
1-8B	14236-6	22 May 86	P	45	5	12	<10	23	20
1-8B	14236-59	14 Oct 87	P	290	99	39	<10	35	25
1-8B	14236-133	02 Nov 88	P	320	77	30	<5	27	7
1-9A	14236-6	23 May 86	T	130	7	<5	55	43	90
1-9A	14236-59	14 Oct 87	T	210	99	<5	10	180	33
1-9A	14873-7	12 Apr 89	T	63	39	<5	<5	<10	<5
1-9B	14236-6	23 May 86	P	96	25	<5	90	50	100
1-9B	14236-59	14 Oct 87	P	34	20	<5	50	53	53
1-9B	14873-7	12 Apr 89	P	57	66	5	<5	<10	<5
1-12A	14236-13	10 Sep 86	T	1100	24	<5	<10	68	28
1-12A	14236-18	28 Oct 86	T	660	12	<5	<10	83	45
1-12A	14236-73	05 Nov 87	T	580	13	<2	<10	53	<50
1-12A	14873-7	16 Apr 89	T	1000	59	<42	<5	17	15
1-12B	14236-13	10 Sep 86	P	47000	4600	<500	35	83	75
1-12B	14236-18	12 Oct 86	P	19000	2100	<5	15	73	60
1-12B	14236-65	11 Nov 87	P	32000	2000	99J	<10	<30	110
1-12B	14873-7	16 Apr 89	P	24000	1800	<840	6.8	16	31
1-12C	14236-13	10 Sep 86	R	27	<5	<5	330	345	390
1-12C	14236-18	28 Oct 86	R	95	40	<5	<10	50	20
1-12C	14236-29	10 Apr 87	R				<10	<25	63
1-12C	14236-74	05 Nov 87	R	26	9.3	<2	<10	21	<50
1-12C	14873-7	16 Apr 89	R	84	35	<5	<5	12	7
1-15A	14236-17	08 Oct 86	T	35	16	<5	340	220	580
1-15A	14236-65	11 Nov 87	T	290J	<400	<1000	40	<30	60
1-15A	14236-134	06 Nov 88	T	200	36	<5	7	<10	20
1-15B	14236-17	08 Oct 86	P	440	31	<5	460	230	450
1-15B	14236-65	11 Nov 87	P	720	33	16J	1500	110	200
1-15B	14236-134	06 Nov 88	P	670	41	23J	1400	10	46
1-15C	14236-17	14 Oct 86	R	36	35	<5	950	580	1900
1-15C	14236-65	11 Nov 87	R	<480	<400	<1000	150	<30	40
1-15C	14236-134	06 Nov 88	R	180	21	<5	140	<10	10

TABLE 3.2C (Continued)

SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 SITE MONITORING WELLS

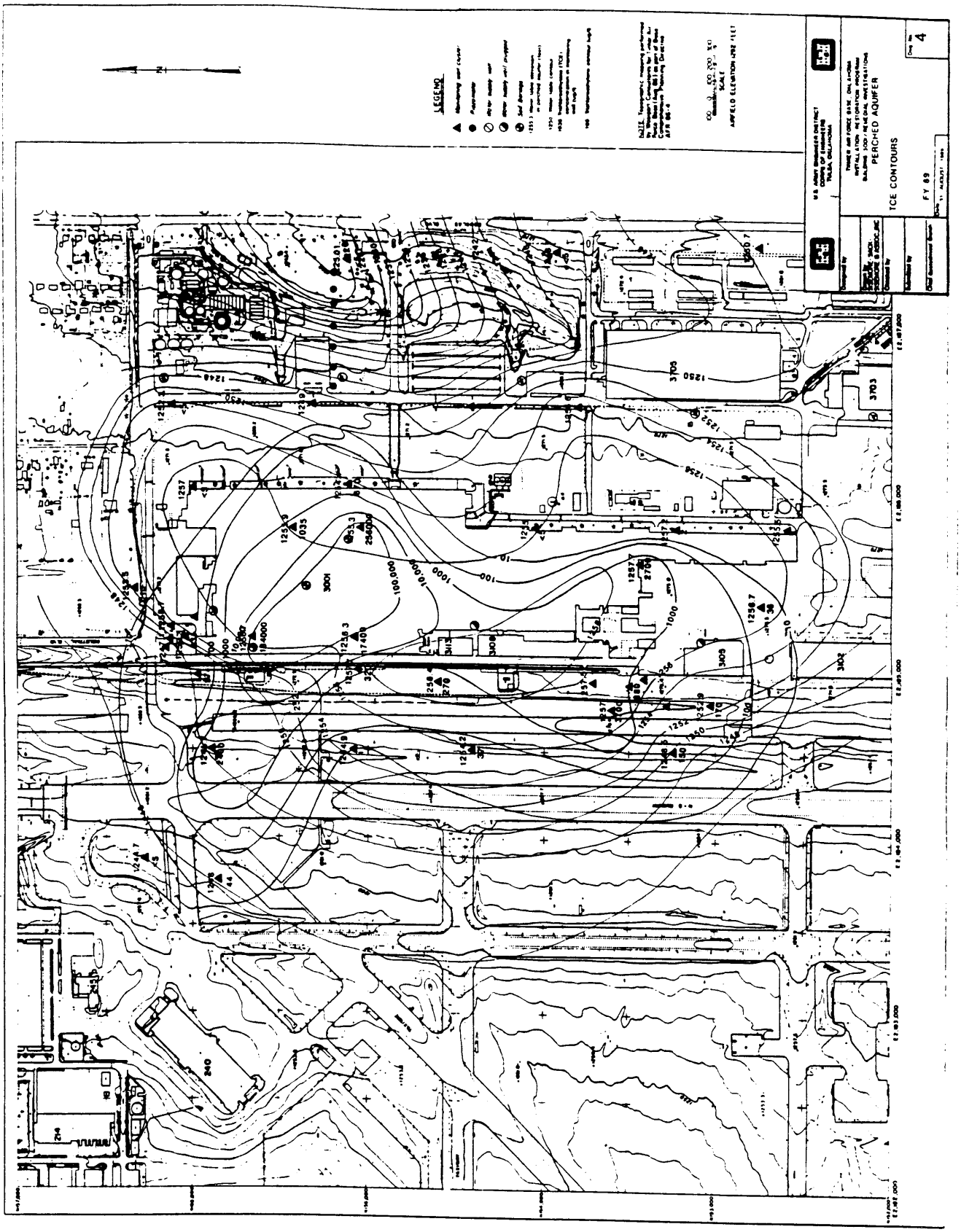
Well No.	Report No.	Date Sampled	Aquifer	TCE	DCE	PCE	Cr	Pb	Ni
1-16	14236-21	03 Dec 86	P	27	<5	<5	13	38	43
1-16	14236-60	20 Oct 87	P	<2	<2	<2	98	110	110
1-16	14873-7	13 Apr 89	P	170	45	<5	<5	14	7.5
1-17	14236-21	03 Dec 86	P	370	<5	<5	210	110	150
1-17	14236-60	20 Oct 87	P	850	58	<2	<10	53	30
1-17	14873-7	13 Apr 89	P	3700	380	<130	6.5	16	9.2
1-18	14236-21	03 Dec 86	P	1200	47	41	870	290	600
1-18	14236-61	22 Oct 87	P	4600	410	92	45	45	55
19A		19 Mar 86	T	490	16	7	35	48	45
19A		07 Oct 86	T				43	70	25
19A	14236-63	27 Oct 87	T	150	6.3	2.2	<10	20	<10
19A	14873-6	10 Apr 89	T	2100	300	690	43	<10	10
19B	14236-3	05 May 86	P	61	<5	14	1200	65	290
19B		07 Oct 86	P				340	58	40
19B	14236-63	27 Oct 87	P	32	<2	2.7	570	100	<10
19B	14873-6	10 Apr 89	P	73	<5	4J	470	<10	5.8
20A		19 Mar 86	T	77	44	<5	<10	35	40
20A	14236-61	21 Oct 87	T	4.9	<2	<2	<10	65	25
20A	14873-6	10 Apr 89	T	130	5	3J	12	20	7.8
21A		19 Mar 86	T	<5	<5	<5	10	58	20
21A	14236-63	27 Oct 87	T	7	2.4	<2	<10	500	<10
21A	14873-6	10 Apr 89	T	56	14	8	13	12	9.5
21B	14236-3	05 May 86	P	<5	<5	<5	68	50	250
21B	14236-63	27 Oct 87	P	7.7	<2	<2	<10	20	<10
22A		19 Mar 86	T	<5	<5	<5	<10	53	40
22A	14236-63	29 Oct 87	T	<2	<2	<2	10	20	10
22A	14873-6	09 Apr 89	T	<5	<5	<5	<5	<10	10
22B	14236-3	07 May 86	P	<5	<5	<5	13	33	170
22B	14236-63	28 Oct 87	P	<2	<2	<2	10	12	10
22B	14873-6	09 Apr 89	P	<5	<5	<5	<5	20	9
23A		24 May 86	R	<5	<5	<5	<10	43	28
23A	14236-63	29 Oct 87	R	<2	<2	<2	20	<5	<10
23A	14873-7	11 Apr 89	P	<5	<5	<5	<5	<10	<5
23B	14236-3	07 May 86	P	<5	<5	<5	<10	<24	130
23B	14236-63	29 Oct 87	P	<2	<2	<2	<10	7	<10
23B	14873-7	11 Apr 89	P	<5	<5	<5	<5	<10	<5
1-26	14236-24	22 Jan 87	P	<5	<5	<5	<10	40	23
1-26	14236-71	04 Jan 88	P	<0.3	17	<1.3	<10	50	15
1-26	14873	18 Apr 89	P	<31	<31	<31	8.5	26	27

TABLE 3.2C (Continued)

SIGNIFICANT PARAMETERS RESULTS
BUILDING 3001 SITE MONITORING WELLS

Well No.	Report No.	Date Sampled	Aquifer	TCE	DCE	PCE	Cr	Pb	Ni
1-27	14236-22	07 Jan 87	P	<5	<5	<5	<10	43	38
1-27	14236-71	04 Jan 88	P	<0.3	<0.7	<1.3	<10	62	30
1-27	14873	18 Apr 89	P	<2500	<1500	<2500	6.5	18	11
1-28A	14236-22	08 Jan 87	T	360	58	<50	<10	<25	30
1-28A	14236-65	03 Dec 87	T	360	62	<2	40	<30	40
1-28A	14873-7	14 Apr 89	T	840	79	<31	14	23	22
1-28B	14236-22	08 Jan 87	P	11	<5	<5	<10	33	<10
1-28B	14236-65	03 Dec 87	P	54	30	4.5	50	<30	50
1-28B	14873-7	14 Apr 89	P	44	19	<5	<5	14	36
1-29	14236-22	08 Jan 87	P	<5	<5	<5	<10	<25	13
1-29	14236-65	03 Dec 87	P	11	<2	7.2	210	130	200
1-29	14873-7	14 Apr 89	P	<5	<5	<5	5.8	31	16
1-30	14236-33	10 Mar 87	P	<5	<5	<5	1100	570	1100
1-30	14873	18 Apr 89	P	<16000000	<16000000	<16000000	<5	2.9	<5
1-45A	14236-65	02 Dec 87	T	49	17	<2	90	<30	60
1-45A	14873-7	16 Apr 89	T	19	<5	<5	9.2	26	18
1-45B	14236-65	02 Dec 87	P	8.1	<2	<2	60	<30	30
1-45B	14873-7	16 Apr 89	P	150	85	<5	5	30	13
1-45C	14236-65	02 Dec 87	R	<2	<2	<2	10	<30	<10
1-45C	14873-7	16 Apr 89	R	35	<5	<5	16	14	6.2
1-58A	14873-7	12 Apr 89	T	7800	<250	<250	<5	10	15
1-58B	14873-7	12 Apr 89	T	700	36	<25	5.5	<10	5.2
1-58C	14873-7	13 Apr 89	R	4800	210	<170	74	14	6.8
M2	14873	18 Apr 89	P	<2500	720J	<2500	14	1300	22
MW-1	14236-24	Jan 87	P				280	110	150
MW-1	14236-65	11 Nov 87	P				130	60	110
MW-1	14236-73	11 Nov 87	P	<95	<80	<210			
MW-1	14873	18 Apr 89	P	<2500	<2500	<2500	14	34	30
MW-2	14236-24	Jan 87	P				50	65	48
MW-2	14236-65	11 Nov 87	P				130	60	90
MW-2	14236-73	11 Nov 87	P	<1.9	<1.6	<4.1			
MW-2	14873	18 Apr 89	P	<130	<130	<130	16	32	18
MW-3	14873	18 Apr 89	P	<8400	<8400	<8400	9.0	9.8	5.4

NOTE: All concentrations in ug/l
J - Indicates estimated value
E - Concentration exceeded instrument calibration range
T - Top of Regional Aquifer
P - Perched Aquifer
R - Regional Aquifer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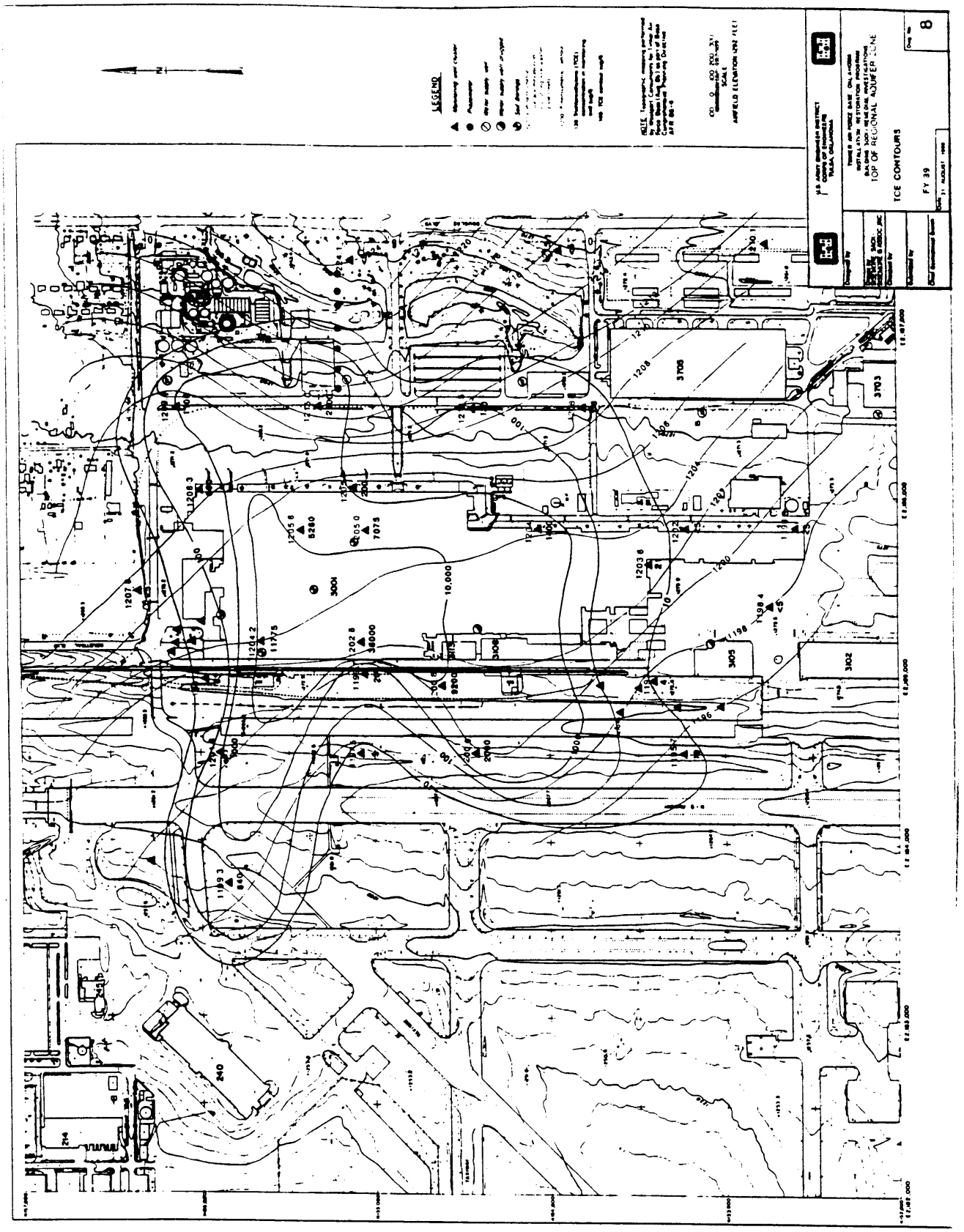
PERCHED AQUIFER
TCE CONTOURS
FY 89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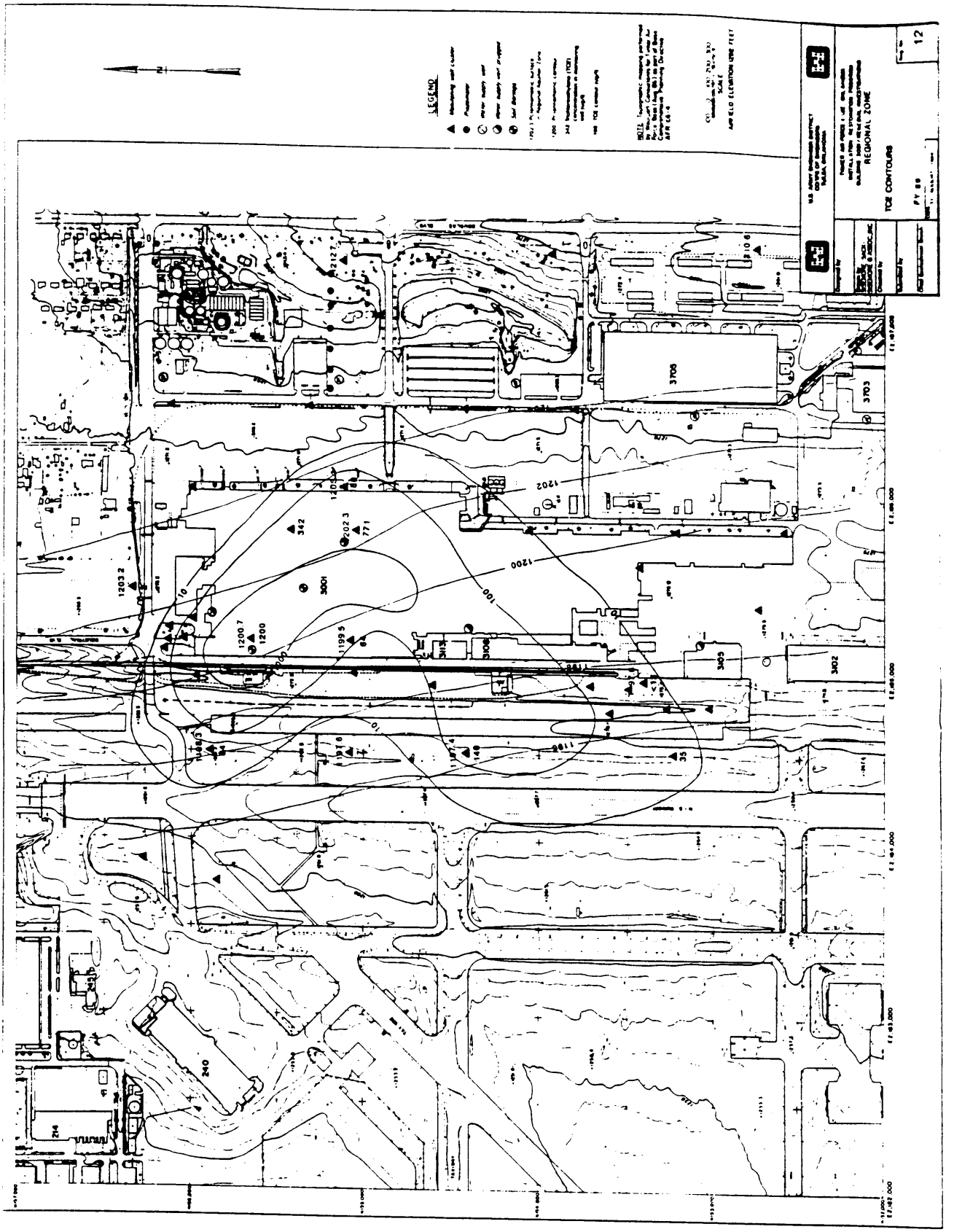
TCE CONTOURS
FY 39
8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REGIONAL ZONE
TOE CONTOURS
12
3705
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1202
1200
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240
214

APPENDIX I

Selected Tables and Figures from POL Facility (Fuel Farm)
Expedited Response Action

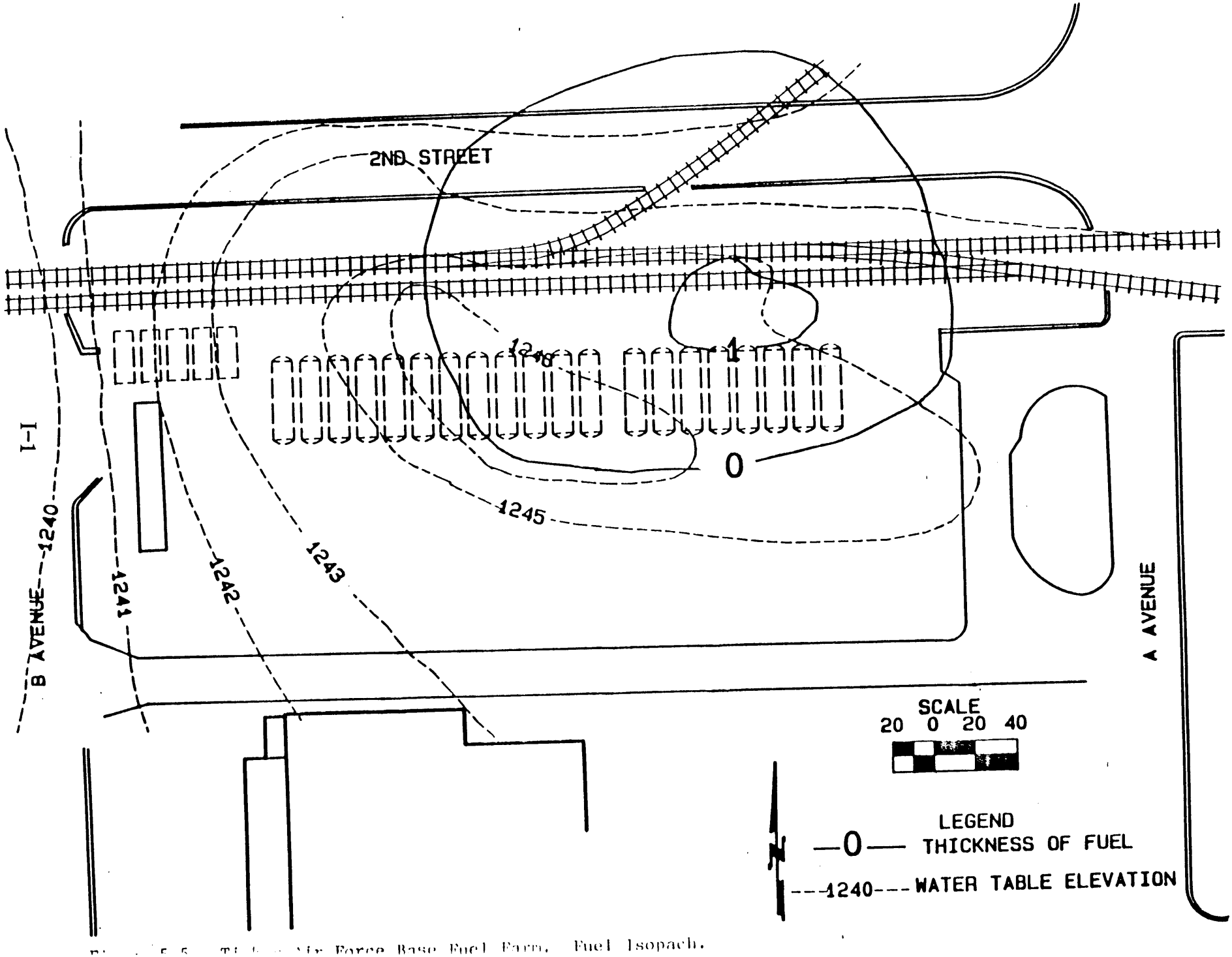


Figure 5.5 Tinker Air Force Base Fuel Farm. Fuel Isopach.

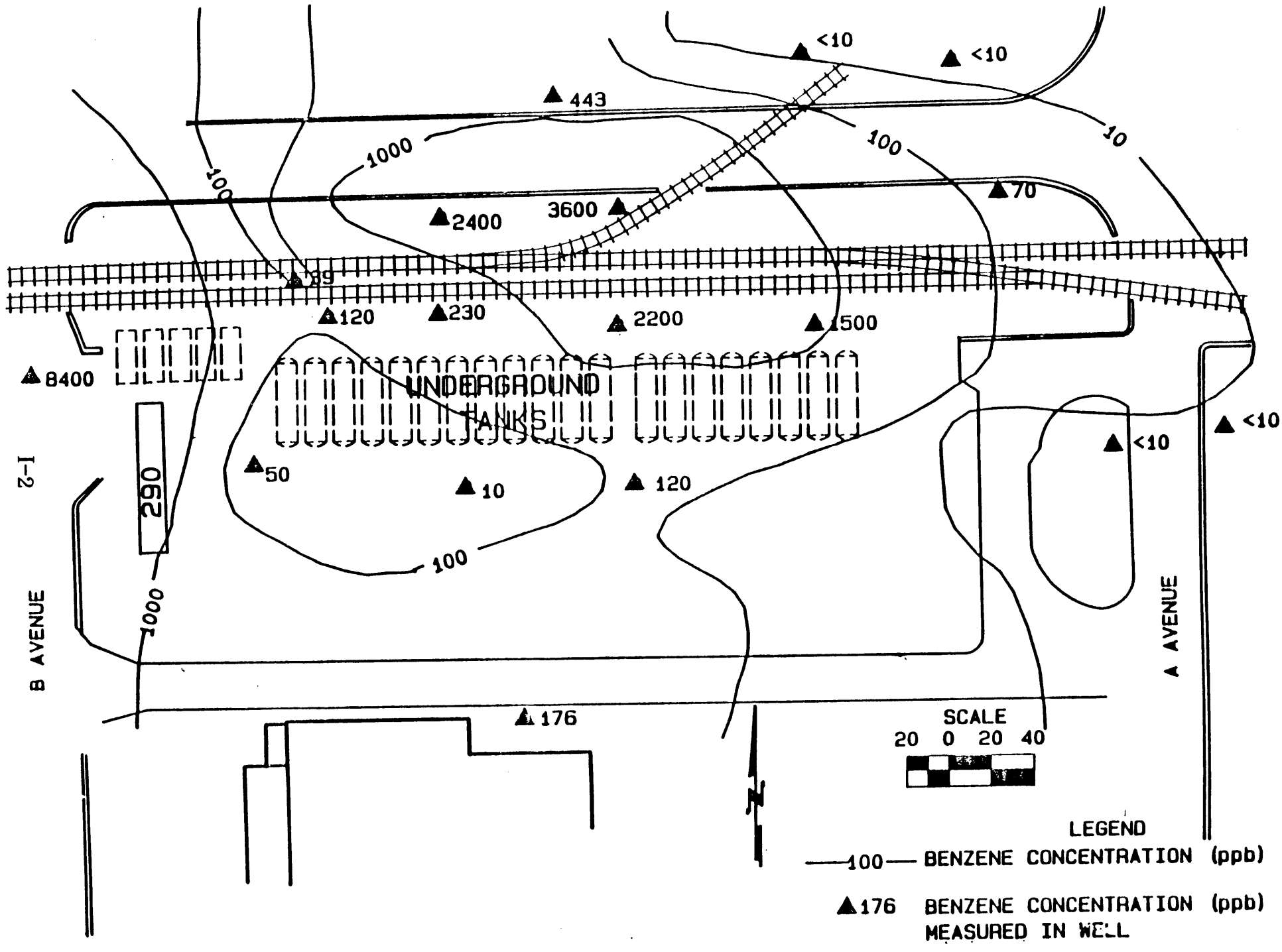


Figure 5-6. Tinker Air Force Base Fuel Farm. Benzene concentrations in the perched aquifer.

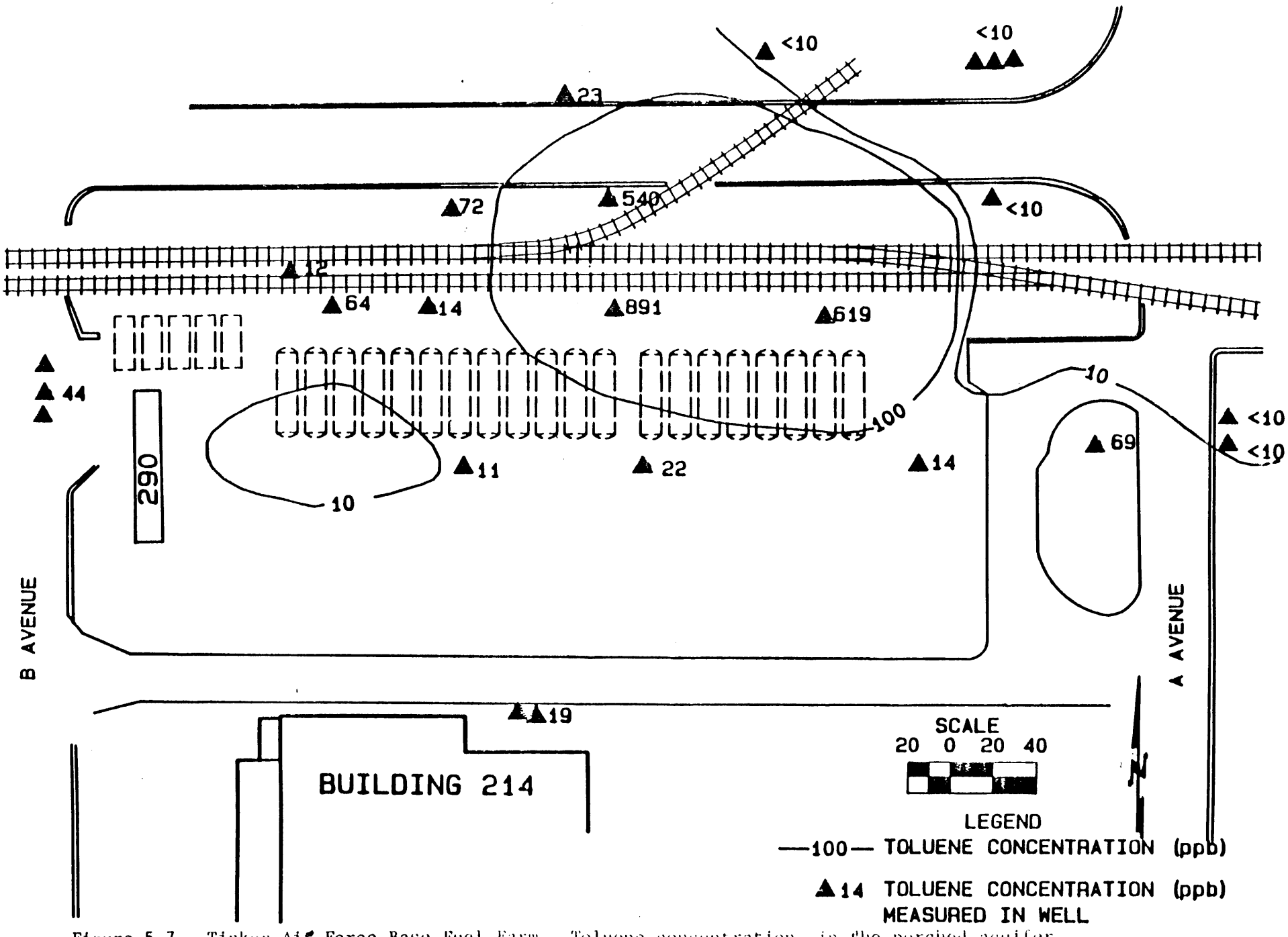


Figure 5-7. Tinker Air Force Base Fuel Farm. Toluene concentration, in the perched aquifer.

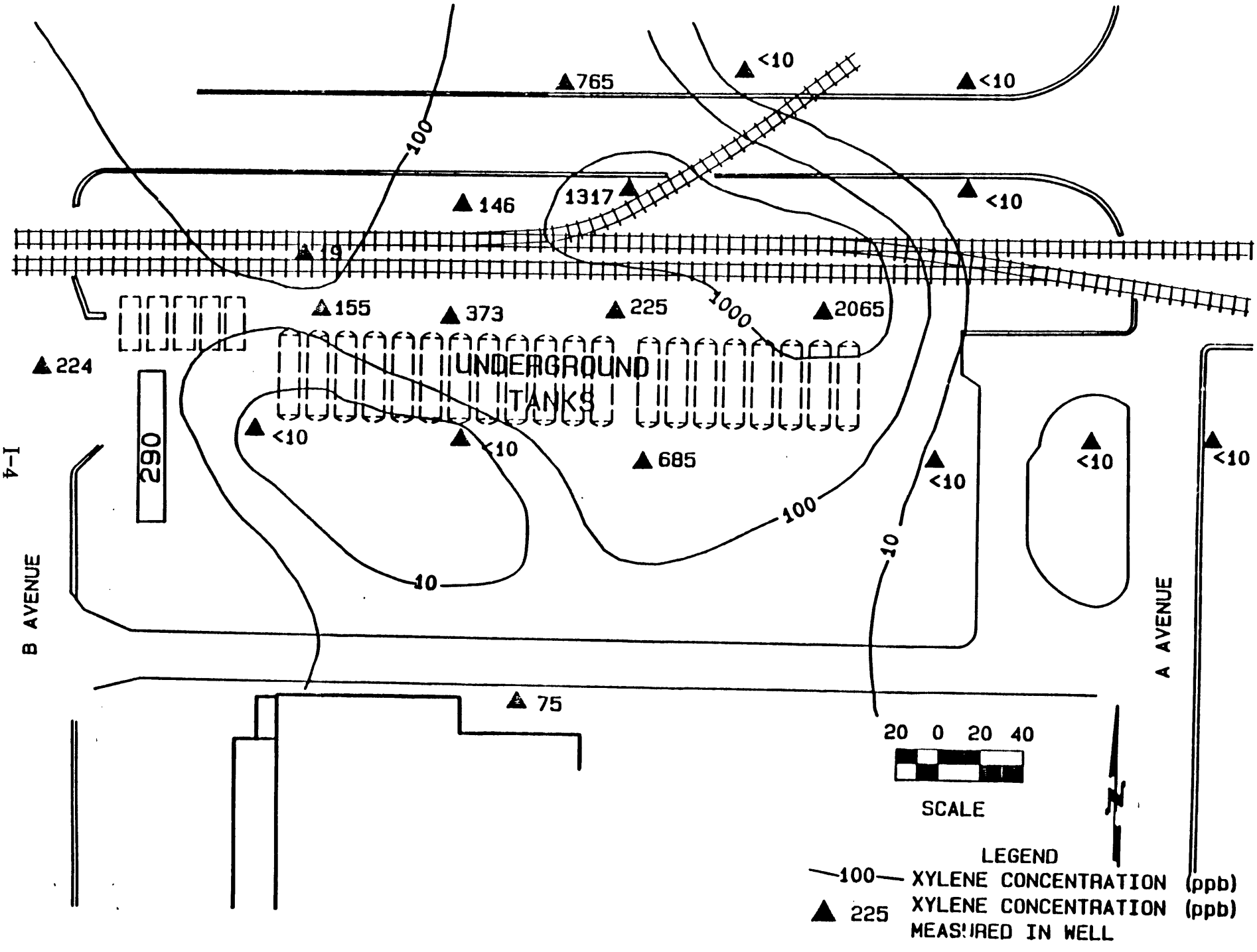


Figure 5-8. Tinker Air Force Base. Xylenes concentrations in the perched aquifer.

TABLE 5-1
Results of Metals Analyses in Perched Aquifer

Well	Barium ppb	Chromium ppb	Lead ppb
MF1B	2000	10	120
MF1C	5400	40	65
MF2	1200	180	140
MF4	6400	55	100
MF6	2900	230	140
MF7	770	150	160
MF8	830	60	130
MF10	620	15	120
MF11	<500	12	40
MF12	2000	60	130
MF13	3700	<10	50
MF14	3800	110	68
MF15C	<500	30	63
MF16B	<500	<10	48
MF17B	4000	35	70
MF18	1100	13	93
MF19	2200	<10	65
MF20	4600	260	270
MF22	1100	110	190
MF23	810	60	55
Drinking Water Standard	1000	50	50
Average*	2138	71	103

*For purpose of averaging, concentrations below detection limits are assumed equal to one half the detection limit.

Table 5-2
Results of Metals Analyses in Regional Aquifer

Well	Barium Concentration, ppb	Chromium Concentration, ppb	Lead Concentration, ppb
MF 1A	<500	33	40
MF15A	3400	58	60
MF16A	<500	<10	35
MF17A	<500	<10	35
Drinking Water Standard	1000	50	50
Average *	1038	26	43

*For purposes of averaging, concentrations below detection limits are assumed equal to one half the detection limit.

APPENDIX J

Selected Table from POL Facility Report of Recovery Operations
June 1987 to December 1988

Fuel Farm Ground Water Chemical Results
June 1987 - December 1988

WELL	DATE	BENZENE (ug/l)	TOLUENE (ug/l)	XYLENE (ug/l)	TOTAL HYDROCARBON (mg/l)	ELEVATION FUEL	ELEVATION WATER
MF-1A	JUN86	113.00	<1.20	<19.00			1197.2
MF-1A	DEC86	582.00	<6.00	<30.00			1197.7
MF-1A	MAY87	<5.00	<5.00	<5.00			1196.9
MF-1A	JAN88	3.20	<0.20	<0.20	<1.00		1196.1
MF-1A	JUN88	1.60	<3.00	<6.00	<1.00		1196.1
MF-1B	03DEC86	8406.50	44.00	224.70			1231.9
MF-1B	03DEC86	10080.00	80.00	820.00			1232.6
MF-1B	14MAY87	16282.00	0.00	437.00			1232.7
MF-1B	28JAN88	8400.00	33.00	<0.20	9.80		1232.8
MF-1B	21JUN88	6100.00	12.00	190.00	4.20		1232.9
MF-1C	18JUN86	4910.00	42.00	<9.00			1240.0
MF-1C	14NOV86	3278.00	48.00	<6.00			1239.7
MF-1C	14MAY87	5934.00	44.00	<15.00			1239.9
MF-1C	06JAN88	5535.00	<25.00	162.00	34.00		1240.1
MF-1C	15JUN88	9000.00	64.00	<30.00	1.70		1240.0
MF-15A	18JUN86	<1.00	<1.40	<9.00			1195.2
MF-15A	03JUN87	<5.00	<5.00	<5.00			1196.0
MF-15A	28JAN88	0.20	<0.20	<0.20	<1.00		1196.7
MF-15A	21JUN88	33.00	<3.00	<6.00	1.00		1197.8
MF-15B	18JUN86	<1.00	<1.40	<9.00			1242.5
MF-15B	21MAY87	<1.20	<2.00	<2.50			1242.8
MF-15B	28JAN88	0.30	<0.20	<0.20	<1.00		1242.6
MF-15B	21JUN88	17.00	<3.00	<6.00	1.00		1242.8
MF-15C	28MAR86	<1.00	1.40	<9.00			
MF-15C	18JUN86	<1.00	1.40	<9.00			1242.6
MF-15C	21MAY87	<1.20	<2.00	<2.50			1242.8
MF-15C	28JAN88	0.50	<0.20	<0.20	<1.00		1242.7
MF-15C	21JUN88	0.00	<3.00	<6.00	1.00		1242.6
MF-16A	25JUN86	<1.00	<1.20	<9.00			1201.7
MF-16A	20MAY87	1.00	U1.10	<3.00			1197.0
MF-16A	09FEB88	0.50	<0.20	<0.20	<1.00		1198.0
MF-16A	14JUN88	<2.00	<3.00	<6.00	<0.00		1197.6
MF-16B	25JUN86	<1.00	<1.20	<9.00			1244.7
MF-16B	20MAY87	2004.00	760.00	3185.00			1245.5
MF-16B	08FEB88	<0.20	<0.20	<0.20	<1.00		1244.6
MF-16B	14JUN88	<2.00	<3.00	<6.00	<0.00		1244.7
MF-17A	09JUL86	<1.00	<1.20	<9.00			1194.4
MF-17A	19MAY87	<5.00	<5.00	<5.00			1195.5
MF-17A	07MAR88	0.90	0.20	0.20	0.70		1196.6
MF-17A	14JUN88	<2.00	<3.00	<6.00	<0.00		1196.4
MF-17B	09JUL86	175.70	18.60	75.50			1243.4
MF-17B	19MAY87	<5.00	<5.00	<5.00			1243.7
MF-17B	09FEB88	540.00	28.00	<0.20	7.62		1243.2
MF-17B	14JUN88	210.00	21.00	107.00	43.00		1243.4
MF-12	26JUN86	1533.70	618.60	2065.10		1243.4	1245.6
MF-12	14MAY87	2004.00	760.00	3185.00		1245.6	1236.4
MF-12	30JUN87	3592.00	2665.00	7676.00		1244.8	1238.7
MF-12	28JUL87	2957.00	4453.00	5315.00		1244.5	1239.3
MF-12	25AUG87	2960.00	2667.00	6593.00		1243.0	1240.5
MF-12	06OCT87	2143.00	350.00	860.00		1242.6	1240.3
MF-12	09NOV87	2500.00	7500.00	10000.00		1241.3	1240.3
MF-12	06JAN88	2460.00	92.00	2330.00	371.00	1244.0	1236.1
MF-12	16MAR88	2900.00	1250.00	3650.00	150.00	1244.0	1236.3
MF-12	05MAY88	2800.00	2400.00	1510.00	2820.00	1245.3	1237.8
MF-12	13JUN88	3400.00	3300.00	6600.00	2040.00	1240.2	1237.1
MF-12	01AUG88	7600.00	3850.00	3240.00		1242.0	1236.3
MF-12	01SEP88	7230.00	3600.00	3880.00		1241.8	1237.2
MF-12	01OCT88	4830.00	2040.00	2790.00	3500.00	1241.8	1236.9
MF-12	01NOV88	6000.00	6000.00	12000.00	160.00	1240.4	1237.2
MF-12	01DEC88	<1.00	<1.00	<1.00	63.50	1241.1	1237.9

Fuel Farm Ground Water Chemical Results
June 1987 - December 1988

WELL	DATE	BENZENE (ug/l)	TOLUENE (ug/l)	XYLENE (ug/l)	TOTAL HYDROCARBON (mg/l)	ELEVATION FUEL	ELEVATION WATER
MF-4	26JUN86	2167.60	891.60	225.00			1246.1
MF-4	20MAY87	2786.00	208.00	429.00			1245.4
MF-4	30JUN87	3177.00	124.50	1707.00			1245.3
MF-4	28JUL87	74.00	<75.00	<150.00			1245.3
MF-4	25AUG87	1868.00	72.00	532.00			1244.7
MF-4	06OCT87	2052.00	22.00	202.00			1243.7
MF-4	09NOV87	2700.00	<20.00	870.00			1243.0
MF-4	08FEB88	136.00	6.00	23.00	23.00		1244.9
MF-4	16MAR88	1400.00	50.00	235.00	6.35		1245.7
MF-4	04MAY88	2400.00	150.00	430.00	207.00		1246.1
MF-4	13JUN88	390.00	270.00	<30.00	94.00		1245.1
MF-4	01AUG88	1850.00	100.00	1520.00			1247.0
MF-4	01OCT88	1630.00	<20.00	394.00	7.00		1245.5
MF-4	01NOV88	<5000.00	<5000.00	<5000:00	<10.00		1245.4
MF-4	01DEC88	820.00	130.00	430.00	7.10		1245.6
MF-14	18JUN86	<1.00	<1.40	<9.00			1241.2
MF-14	21MAY87	181.00	<7.50	<0.00			1242.2
MF-14	30JUN87	<1.00	<1.50	<3.00			1242.4
MF-14	28JUL87	<5.00	<7.50	<15.00			1242.4
MF-14	25AUG87	34.00	29.00	<15.00			1242.4
MF-14	06OCT87	<5.00	0.00	22.00			1241.5
MF-14	09NOV87	<1.00	<1.00	106.00			1241.5
MF-14	06JAN88	<5.00	<5.00	<5.00	<0.10		1241.3
MF-14	16MAR88	28.00	185.00	177.40	5.87		1241.3
MF-14	05MAY88	<2.00	<3.00	<6.00	166.00		1242.0
MF-14	14JUN88	<2.00	53.00	73.00	102.00		1241.8
MF-14	01AUG88	<0.20	<0.20	0.30			1241.9
MF-14	01SEP88	<0.20	0.40	0.47			1241.6
MF-14	01OCT88	0.50	0.60	1.80	<10.00		1241.5
MF-14	01NOV88	<5000.00	<5000.00	<5000.00	<10.00		1241.2
MF-14	01DEC88	1.60	10.00	<1.00	0.90		1241.7
MF-24	20MAY87	1000.00	2100.00	620.00			
MF-24	18JUN87	862.00	3523.00	1005.00		1244.6	1233.9
MF-24	21JUL87	5250.00	13715.00	2218.00		1243.4	1241.6
MF-24	28JUL87	3900.00	10545.00	1139.00		1243.4	1241.6
MF-24	09AUG87	3260.00	3252.00	2114.00			
MF-24	25AUG87	2562.00	6020.00	2519.00			
MF-24	06OCT87	2113.00	4584.00	1570.00		1238.5	1237.5
MF-24	09NOV87	2300.00	5400.00	3130.00		1238.3	1237.1
MF-24	28JAN88	2400.00	2400.00	540.00	58.60	1238.3	1237.0
MF-24	16MAR88	2000.00	4400.00	1610.00	42.20	1240.9	1237.4
MF-24	13JUN88	4600.00	13000.00	2700.00	136.00	1238.2	1238.0
MF-24	01AUG88	3340.00	8430.00	3770.00		1237.6	1237.6
MF-24	01SEP88	2940.00	5830.00	2080.00		1237.8	1237.8
MF-24	01NOV88	<5000.00	<5000.00	<5000.00	<10.00	1243.4	1243.5
MF-24	01DEC88	5.00	30.00	<1.00	2.40		1243.4
MF-26	20MAY87	1710.00	15956.00	5185.00		1243.8	1244.4
MF-26	18JUN87	906.00	3946.00	1020.00		1234.9	
MF-26	21JUL87	9570.00	38295.00	6497.00			
MF-26	28JUL87	5195.00	19303.00	1563.00		1241.1	1242.9
MF-26	09AUG87	5750.00	4810.00	6699.00			
MF-26	25AUG87	2471.00	1870.00	7143.00			
MF-26	06OCT87	3812.00	17856.00	1617.00		1235.1	1236.3
MF-26	09NOV87	3000.00	10000.00	15700.00		1234.8	1235.5
MF-26	28JAN88	1900.00	2900.00	710.00	36.30	1234.8	1236.4
MF-26	16MAR88	2150.00	7300.00	1920.00	50.60	1234.4	1235.7

APPENDIX K

Selected Tables from Industrial Waste Pit No. 2
Remedial Investigations

Table 6-1 Summary of Detected Metals and Organics Perched Water Zone

		Monitoring Well Number & Sample Date					
Analyte	Unit	15 6/1989	15 9/1989	15 1/1990	15 4/1990	16 9/1989	16 1/1990
Metals							
Arsenic	ug/l	7.5	1.6	2.5	2.9	3.2	<1
Barium	ug/l	340	200	160	125	640	230
Cadmium	ug/l	<5	<5	<5	<5	150	150
Chromium	ug/l	7	12	8	<10	740	590
Lead	ug/l	56	48	50	27.5	1020	790
Nickel	ug/l	12	14	10	16.2	1800	2400
Selenium	ug/l	<0.4	0.8	1.1	2.1	<0.4	0.6
Zinc	ug/l	150	97	50	31.2	19200	7700
Manganese	ug/l	960	1200	690	592	1400	730
Magnesium	mg/l	35	28	25	33	36	52
Organics							
Vinyl Chloride	ug/l	NA	<2	<2	<2	1	7
Methylene Chloride	ug/l	NA	<1	<1	1	2	0.6
Chloroform	ug/l	NA	<1	<1	0.1	2	0.8
1,2-Dichloroethane	ug/l	NA	<1	<1	<1	<5	10
1,2-Dichloroethene	ug/l	NA	<1	<1	<1	4	35
Trichloroethene	ug/l	NA	<1	2	0.2	<5	43
Chlorobenzene	ug/l	NA	<1	<1	<1	200	9
1,3-Dichlorobenzene	ug/l	NA	<10	<10	<10	110	21
1,4-Dichlorobenzene	ug/l	NA	<10	<10	<10	370	5
1,2-Dichlorobenzene	ug/l	NA	<10	<10	<10	300	<10
2-Chlorophenol	ug/l	NA	<10	<10	<10	17	<10
2-Methylphenol	ug/l	NA	<10	<10	<10	82	11
4-Methylphenol	ug/l	NA	<10	<10	<10	72	4
2,4-Dimethylphenol	ug/l	NA	<10	<10	<10	72	12
Bis(2-Ethylhexyl) Phthalate	ug/l	NA	3	7	<10	2	<10
Di-N-Octyl Phthalate	ug/l	NA	3	<10	<10	1	<10

NA = NOT ANALYZED

Table 6-3 Summary of Detected Metals and Organics
Top of Regional Zone

		Monitoring Well Number & Sample Date											
		80	80	80	80	81	81	81	81	82	82	82	82
Analyte	Unit	6/1989	9/1989	1/1990	4/1990	6/1989	9/1989	1/1990	4/1990	6/1989	9/1989	1/1990	4/1990
Metals													
Arsenic	ug/l	3.9	<1	<1	2.5	4.9	1.5	3.4	3.8	4.9	1.5	3.1	3.1
Barium	ug/l	300	200	160	242	580	390	210	287	350	320	300	219
Chromium	ug/l	<5	<5	<5	<10	<5	<5	<5	<10	7.5	<5	5	<10
Lead	ug/l	<10	<10	<10	<20	<10	<10	<10	<20	17	<10	<10	<20
Nickel	ug/l	<5	37	10	<15	<5	22	14	<15	6.8	9.8	6.5	<15
Selenium	ug/l	<0.4	<0.4	0.7	<1	<0.4	<0.4	0.6	<1	<0.4	2.7	0.5	<1
Zinc	ug/l	<5	72	14	18.5	10	42	30	<10	67	24	30	<10
Manganese	ug/l	190	64	90	110	240	120	27	69.2	710	340	220	106
Magnesium	mg/l	34	27	27	30	16	25	23	26.4	36	34	35	35.9
Organics													
Methylene Chloride	ug/l	<1	<1	1	2	<1	<1	0.5	<1	0.4	0.7	<1	<1
Acetone	ug/l	<2	<2	10	<2	<2	<2	<2	<2	<2	<1	<2	<2
2-Butanone	ug/l	<2	<2	<2	<2	<2	<2	17	<2	<2	<2	<2	<2
Bis(2-Ethylhexyl) Phthalate	ug/l	<10	9	<10	16	<10	2	<10	17	<10	2	<10	3
Dimethyl Phthalate	ug/l	1	4	3	<10	2	<10	8	<10	3	3	<10	<10
Di-n-octyl Phthalate	ug/l	<10	2	<10	<10	<10	1	<10	<10	<10	0.8	<10	<10
Trichloroethene	ug/l	<1	<1	0.8	<1	<1	<1	0.3	<1	<1	<1	<1	<1
P-Chloro-M-Cresol	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	2	<10
Acenaphthalene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	1	<10
Pyrene	ug/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	2	<10

APPENDIX L

Selected Tables from Landfill 3 Sludge Dump Contaminated Soil
Information for Soil Removal and Decontamination

Table 4.1

Laboratory Results From Soil Samples (mg/Kg)

Hole	Depth (ft)	Material	Petro. Hydro.	TCE
3-2-A	8	sludge/clay		3,000
3-2-B	5	clay/asphalt	3,760	.778
	9.5	sludge/clay	7,450	4,070
3-2-2	8.5	sludge/clay	23,600	6,100
3-2-4	14	red clay	181	140 E*
3-2-6	12.5	red/br clay	851	350 E*
3-2-7	1	clay/asphalt	17,100	2.0
3-2-10	12	red clay	266	29 E*

* Indicates in Excess

Table 4.1 Continued

Laboratory Results From Soil Samples (mg/Kg)

Hole	Depth (ft)	Material	Petro. Hydro.	TCE
3-2-12	8	red/br clay	60.3	.007
3-2-13	7	red/br clay	74.9	.009
3-2-14	10	red clay	175	.011

Table 4.2

Laboratory Results From Soil Samples (mg/Kg)

Hole	Depth (ft)	Material	Total Metals		EP Toxicity
3-2A	8	sludge/clay	Arsenic	1.4	
			Barium	330	
			Cadmium	200	
			Chromium	380	
			Lead	130	
			Zinc	57	
			Mercury	<.1	
			Selenium	<.1	
			Silver	2.4	
3-2B	5	asphalt/clay	Arsenic	-	<.002
			Barium	496	<1.0
			Cadmium	120	<.01
			Chromium	384	<.05
			Lead	5031	0.21
			Zinc	325	-
			Mercury	-	<.002
			Selenium	-	<.002
			Silver	-	<.05
3-2B	9.5	sludge/clay	Arsenic	-	<.002
			Barium	<100	<1.0
			Cadmium	2.4	0.03
			Chromium	8.0	<.05
			Lead	28.0	0.16
			Zinc	13.4	-
			Mercury	-	<.002
			Selenium	-	<.002
			Silver	-	<.05

APPENDIX M

Selected Tables from Landfill 5 Remedial Investigation Report

TABLE 6.1
SOLID WASTE CONTAMINANT
SUMMARY

UG/KG

	ORGANICS				
COMPOUND	L5-1	L5-2	L5-3	L5-4	SEEP
METHYLENE CHLORIDE	<125	<128	124 J	91	38
ACETONE	4500	3400	4300	2100	24000
2-BUTANONE	1100	375	580	410	16000
2-CHLOROETHYLVINYLETHER	<251	<256	<248	<132	220
4-METHYL-2-PENTANONE	230 J	<256	136 J	120 J	7700
2-HEXANONE	85 J	<256	<248	90 J	210
TOLUENE	250	<128	130	100	42
ETHYLBENZENE	180	<128	<124	37 J	ND
XYLENE	890	117 J	310	190	ND
PHENOL	<25000	<26000	62000	1700 J	1500
4-METHYLPHENOL	<25000	15000 J	16000 J	3600	2600

	METALS					
COMPOUND	L5-1	L5-2	L5-3	L5-4	SEEP	BACKGROUND
SILVER	2000	4700	8000	4800	700	560
ARSENIC	5000	2400	1700	1900	2600	1100
BARIUM	230000	450000	200000	460000	420000	220000
CADMIUM	15000	25000	270000	28000	3000	720
CHROMIUM	350000	150000	280000	30000	39000	23000
LEAD	47000	86000	480000	140000	34000	15000
NICKEL	2700000	4100000	6300000	340000	53000	21000
SELENIUM	<100	<100	910	<100	200	100
ZINC	110000	1100000	770000	550000	620000	25000

ND = NOT DETECTED
J = ESTIMATED VALUE

TABLE 6.3

TRENCH WATER CONTAMINANT
SUMMARY
ug/l

COMPOUND	L5-1	L5-3
Cadmium	20	20
Lead	120	50
Acetone	1900	440
2-butanone	610	140
4-methyl-2-pentanone	630	<100
Ethylbenzene	340	<18
Xylene	860	410
2-methylphenol	<50	180
4-methylphenol	<50	120
benzoic acid	260	<250

TABLE 6.4
PERCHED AQUIFER CONTAMINANT
SUMMARY

ug/l

COMPOUND	MW-6 1986	MW-6 1988	MW-6 1989	MW-7 1986	MW-7 1988	MW-7 1989	MW-8 1986	MW-13 1986	MW-13 1988	MW-13 1989	MW-588 1987	MW-588 1988	MW-588 1989
BARIUM	790	840	790	2100	2300	4900	2300	630	640	830	3500	4200	4200
CADMIUM	10	<5	<5	10	<5	5	13	<8	<5	<5	<7.5	11	12
CHROMIUM	<5	<5	<5	<10	<5	<5	250	<10	<5	6	20	5	9.2
LEAD	28	10	<10	23	<10	<10	210	35	<10	<10	53	21	16
ACETONE	870	<10	<10	56	<10	<10	<10	180	<10	<10	<10	88	27
TRANS-1,2-DICHLOROETHENE	720	NA	NA	43	NA	NA	<10	<10	NA	NA	210	NA	NA
1,2-DICHLOROETHENE (TOTAL)	NA	5	87 B	NA	4 J	<5	NA	NA	<5	<5	NA	91	99
TRICHLOROETHENE	<5	<5	<5	12	<5	<5	<5	14	3 J	1 J	31	45	<5
BIS(2-ETHYLHEXYL)PHTHALATE	29	13	10	<10	39	<10	NA	<10	<10	<10	9 J	21	5 J

NA = NOT ANALYZED
J = ESTIMATED VALUE
B = COMPOUND ALSO FOUND IN BLANK

TABLE 6.6
TOP OF REGIONAL CONTAMINANT
SUMMARY

ug/l

COMPOUND	MW-6A 1987	MW-6A 1988	MW-6A 1989	MW-8A 1987	MW-8A 1988	MW-8A 1989	MW-13A 1987	MW-13A 1988	MW-13A 1989	MW-58A 1987	MW-58A 1988	MW-58A 1989
BARIUM	4900	1400	1900	<500	130	410	5600	320	670	<500	420	310
CHROMIUM	10	<5	5.8	<10	<5	5.2	180	5	5.2	15	5	9.2
LEAD	30	29	22	40	<10	<10	80	10	<10	43	12	<10
ACETONE	34	<10	14	<10	<10	<10	3 J	<10	<10	11	<10	<10
TRICHLOROETHENE	<5	<5	<5	<5	<5	<5	<5	6	18	<5	1 J	4 BJ
BIS(2-ETHYHEXYL)PHTHALATE	<10	13	<10	<10	<10	4 J	3 J	18	5 J	17	21	6 J

J = ESTIMATED VALUE

APPENDIX N

Selected Tables and Figures from Landfill 6
Remedial Investigation Report

TABLE 7.2
LANDFILL 6
TRENCH BORINGS

COMPOUND	L6-1	L6-2	L6-3	L6-4	L6-5	L6-6	L6-7	L6-8	L6-10
ORGANICS (ug/kg)									
2-BUTANONE	4200	31	<1760	6300	460	2800	1500	350	53
ETHYLBENZENE	24000	<6	<880	<1095	<6	<905	1500	<7	<6
TOTAL XYLENES	170000	7	<880	2400	500	<905	7100	130	<6
NAPHTHALENE	<12000	31000	<2300	<18000	<4200	<29000	<12000	<8900	<390
BIS(2-ETHYLHEXYL)PHTHALATE	<12000	3500	<2300	75000	6600	<29000	<12000	<8900	<390
4-METHYL-2-PENTANONE	<3080	<12	<1760	2400	2500	<1810	<12	<13	22
TOLUENE	<1540	<6	<880	2600	310	1400	9100	300	<6
METHYLENE CHLORIDE	<1540	<6	<880	<2190	19	<1810	<12	26	7
ACETONE	<3080	<12	<1760	<2190	1400	<1810	36000	420	570
2-HEXANONE	<3080	<12	<1760	<2190	450	<1810	160	24	<12
TRICHLOROETHENE	<1540	<6	<880	<1095	<6	<905	23	<7	<6
TETRACHLOROETHENE	<1540	<6	<880	<1095	9	<905	280	65	<6
CHLOROBENZENE	<1540	<6	<880	<1095	<6	<905	130	<7	<6
METALS (mg/kg)									
SILVER	0.7	0.7	1.1	11	5.5	1.1	0.65	2.4	0.9
ARSENIC	1.4	1.7	5.1	2.2	2.6	4.2	1.6	2.4	1.5
BARIUM	370	170	100	260	290	91	130	830	260
CADMIUM	2.3	2.9	8.3	5.9	32	6.1	6.7	5.1	1.3
CHROMIUM	140	13	13	19	40	25	14	26	67
MERCURY	0.17	<0.1	.46	0.17	.11	<0.1	<0.1	.23	<0.1
NICKEL	28	16	19	46	83	37	19	27	230
LEAD	570	14	11	45	48	50	18	26	35
SELENIUM	0.9	<0.1	<0.1	0.6	.19	0.2	<0.1	0.3	0.4
ZINC	91	63	130	300	200	430	240	720	30

TABLE 7.2 (cont.)
LANDFILL 6
TRENCH BORINGS

COMPOUND	L6-11	L6-12	L6-13	L6-14	L6-15	L6-16	L6-17	L6-18	L6-19	L6-22
ORGANICS (ug/kg)										
2-BUTANONE	<12	320	<15	80	<12	<21	<14	1400	480	1500
ETHYLBENZENE	<6	11	<7	<6	<6	60	27	17	<7	98
TOTAL XYLENES	<6	56	310	31	<6	540	46	<7	41	3000
NAPHTHALENE	<410	<2200	<15000	<4300	<810	<8500	<14000	<2400	<14000	17000
BIS(2-ETHYLHEXYL)PHTHALATE	<410	40000	<15000	<4300	2200	<8500	<14000	<2400	<14000	34
4-METHYL-2-PENTANONE	<12	27	230	2700	<12	<21	<14	<14	<14	2400
TOLUENE	<6	56	2400	44	<6	16	<7	44	180	71
METHYLENE CHLORIDE	<6	<6	<7	<6	<6	24	<7	8	53	2900
ACETONE	<12	820	890	170	<12	<21	<14	2000	520	38
2-HEXANONE	<12	62	35	17	<12	<21	<14	110	<14	160
TRICHLOROETHENE	<6	<6	14	<6	<6	<11	<7	<7	31	4800
TETRACHLOROETHENE	<6	<6	10	<6	<6	<11	<7	<7	83	<7
CHLOROBENZENE	<6	<6	<7	15	<6	57	340	<7	<7	<7
METALS (mg/kg)										
SILVER	1.5	1.8	<0.5	5.7	3.4	4.2	11	1.4	1.4	2.1
ARSENIC	1.8	<1.0	1.1	1	<1.0	1.6	2.2	<1.0	<1.0	<1.0
BARIUM	1000	610	290	140	370	160	150000	220	77	82
CADMIUM	2.2	9.4	0.59	12	3.7	32	34	2.8	5.1	15
CHROMIUM	35	60	22	80	47	230	96	46	20	120
MERCURY	<0.1	<0.1	0.15	.5	<0.1	.89	.42	<0.1	.30	.42
NICKEL	240	41	13	66	140	130	120	34	24	130
LEAD	82	48	10	270	48	290	120	68	24	59
SELENIUM	0.4	<0.1	<0.1	<0.1	<0.1	<.1	<0.1	<0.1	<0.1	<0.1
ZINC	29	120	92	450	39	280	750	240	270	430

TABLE 7.5
LANDFILL 6
TRENCH WATER SAMPLES

ug/l

COMPOUND	L6-3	L6-5	L6-11	L6-13	L6-17
METALS					
arsenic	20	28	3.3	10	9.2
barium	4800	8700	<500	3100	5400
cadmium	10	7.5	7.5	7.5	480
chromium	15	<10	<10	18	610
lead	93	68	75	53	1100
nickel	130	510	220	450	1800
zinc	470	120	75	1000	66000
ORGANICS					
methylene chloride	180	910	6	<100	350
acetone	790	<10	<10	<200	4800
1,1-dichloroethane	37	<5	<5	<100	<250
trans-1,2-dichloroethene	8	<5	<5	<100	165 J
2-butanone	2200	100	<10	<200	6600
1,2-dichloropropene	21	<5	<5	<100	<250
trichloroethene	13	<5	<5	<100	<250
2-hexanone	2600	<10	<10	<200	4400
4-methyl-2-pentanone	83	<10	12	<200	200 J
toluene	43	20	<5	170	2600
total xylenes	24	<5	<5	<35	760
phenol	<100	110	<20	<500	<2000
2-methylphenol	270	<100	<20	<500	<2000
4-methylphenol	<100	340	<20	1700	2400
benzoic acid	<500	<500	<100	<2500	1211 J
n-nitrosodipropylamine	<100	190	<20	<500	<2000

J = estimated value

TABLE 7.8
CONTAMINANT SUMMARY
PERCHED AQUIFER

ug/l

	12			30			31			37		
	1986	1988	1989	1986	1988	1989	1986	1988	1989	1986	1988	1989
METALS												
arsenic	20	42	43	51	72	76	1.4	<1.0	<1.0	17	13	24
barium	3200	11000	5400	4900	12000	10000	990	2900	2900	10000	18000	26000
cadmium	5	9.0	13	20	<5.0	18	7.5	<5.0	<5.0	5	<5.0	8.5
chromium	<10	10	9.8	50	5.5	9	<10	<5.0	<5.0	15	10	19
mercury	<0.1	0.12	<0.10	<0.10	<0.10	<0.10	0.43	0.35	<0.10	<0.1	<0.10	<0.10
lead	73	31	20	88	22	28	20	11	<10	50	18	24
nickel	200	NR	140	660	NR	NR	200	NR	NR	1100	NR	NR
selenium	<0.4	<0.4	<0.4	<0.4	<0.4	0.60	<0.4	<0.4	0.9	0.5	0.8	<0.4
silver	<10	<10	<5.0	13	<10	<5	<10	<10	<5	<10	<5.0	<5.0
zinc	115	24	87	180	120	140	18	14	<5	88	140	100
VOLATILES												
methylene chloride	<10	66	6	5 J	4 J	9	<5	<5	2 J	<10	<25	<5
acetone	1300	25000 E	<10	<10	<10	<10	24	<10	<10	<10	<50	31
1,1-dichloroethane	21	<63	<5	<5	6	<5	<5	15	16	23	28	4 J
trichloroethene	8	<63	<5	<5	<5	<5	<5	1 J	<5	5 J	<25	<5
benzene	7	<63	<5	9	<5	12	5 J	<5	<5	12	<25	<5
toluene	47	130	12	16	6	12	<5	<5	<5	6	1 J	<5
ethylbenzene	5 J	45 J	<5	14	29	29	<5	<5	<5	19	26	9
xylene (total)	30	27 J	9	45	9	88	<5	<5	<5	38	<25	<5
SEMIVOLATILES												
1,4-dichlorobenzene	<100	14	7 J	10 J	20	12	<10	7 J	5 J	<10	50	61
diethylphthalate	100 J	120	99	12	13	30	<10	4 J	<10	15	19	29
bis(2-ethylhexyl)phthalate	230	<10	3 BJ	10 J	<10	<10	10 J	5 J	<10	24000	6 J	<10
di-n-octyl phthalate	<100	8 J	2 BJ	<10	<10	1 J	17	21	2 J	<10	<10	<10

NR = NOT RECORDED J = ESTIMATED VALUE B = COMPOUND ALSO FOUND IN BLANK E = COMPOUND EXCEEDS CALIBRATION RANGE

TABLE 7.8 (CONT.)
ug/l

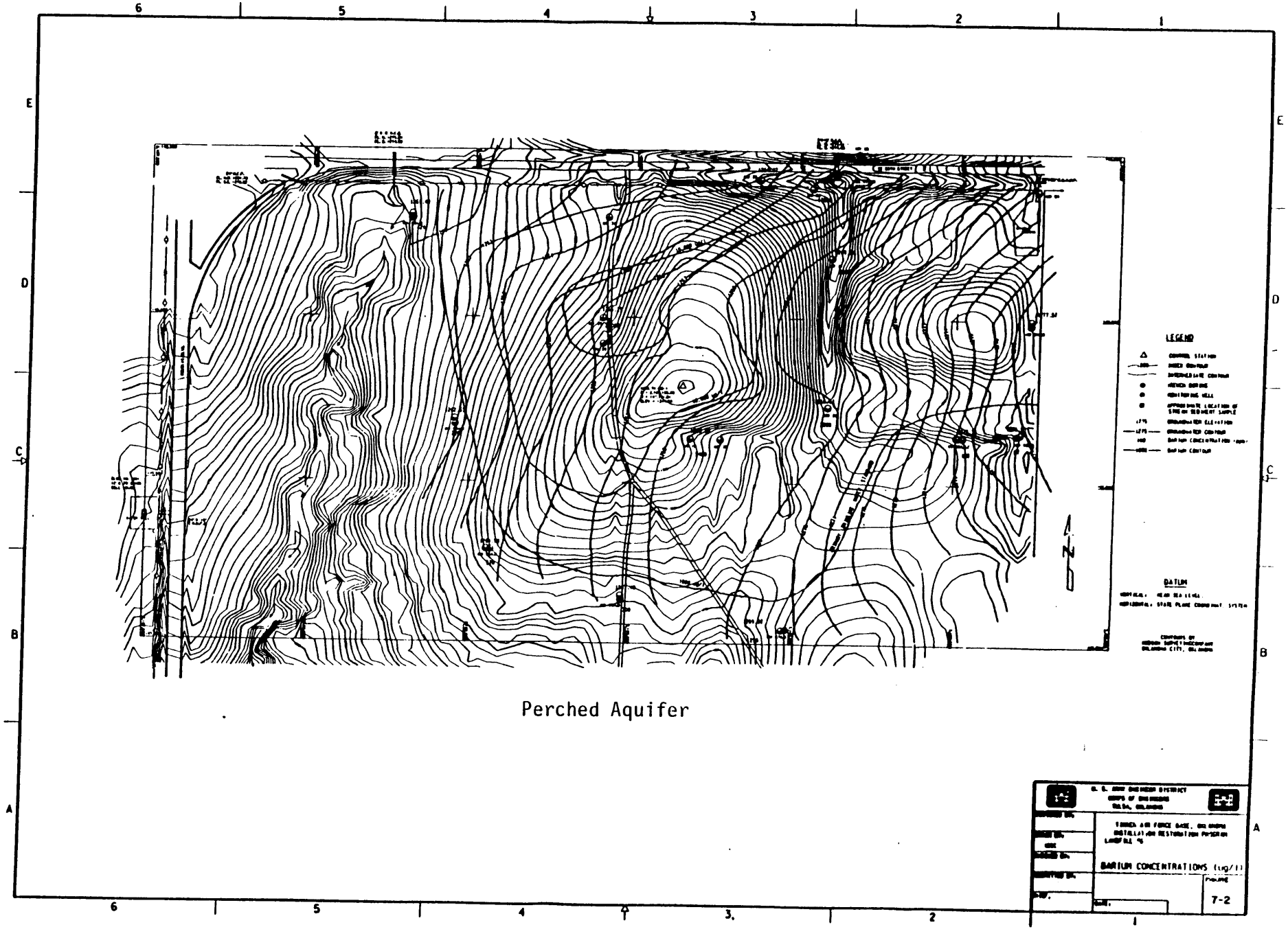
	39			53			55B			56B		
	1986	1988	1989	1986	1988	1989	1987	1988	1989	1987	1988	1989
METALS												
arsenic	9	4.7	3.1	170	140	520	8.1	<1.0	<1.0	1.8	1.9	<1.0
barium	2700	1600	2000	8300	12000	17000	<500	150	100	<500	130	87
cadmium	5	<5.0	<5.0	23	<5.0	51	<7.5	<5.0	<5.0	<7.5	<5.0	<5.0
chromium	<10	<5.0	<5.0	58	<5.0	14	<10	<5.0	33	<10	6.8	<5.0
mercury	<0.1	0.15	<0.10	<0.1	<0.10	<0.10	<0.1	0.19	<0.10	<0.1	0.12	<0.10
lead	35	<10	<10	100	18	120	48	<10	<10	30	<10	10
nickel	68	NR	NR	520	NR	NR	58	NR	NR	30	NR	NR
selenium	<0.4	0.4	<0.40	<0.4	<0.4	<0.4	1.0	3.1	1.4	2.2	1.2	0.16
silver	<10	<5.0	<5.0	<10	<10	<5	<10	<5.0	<5.0	<10	<10	<5
zinc	90	26	26	1200	140	1100	120	NR	<5.0	40	24	<5
VOLATILES												
methylene chloride	11	5	22	<5	<5	9	<5	<5	24	14	<5	19
acetone	160	20	<10	100	<10	<10	25	<10	<10	4 J	<10	15
1,1-dichloroethane	6	14	21	<5	7	6	11	<5	<5	<5	<5	<5
trichloroethene	<5	10	15	<5	<5	<5	5	<5	<5	<5	4 J	7
benzene	<5	<5	<5	<5	<5	7	<5	<5	<5	94	<5	<5
toluene	7	3 J	2 J	<5	10	3 J	10	<5	<5	4 J	<5	<5
ethylbenzene	<5	1 J	<5	<5	23	10	<5	<5	<5	<5	<5	<5
xylene (total)	<5	0.7 J	1 J	<5	8	11	7	<5	<5	<5	<5	<5
SEMIVOLATILES												
1,4-dichlorobenzene	10 J	<11	<10	20 J	18	6 J	<10	<10	<10	<10	<10	<10
diethylphthalate	<10	<11	<10	26	12	<10	4 J	<10	<10	3 J	<10	<10
bis(2-ethylhexyl)phthalate	14	5	<10	20 J	3 J	5 J	5 J	5	<10	3 J	4 J	<10
di-n-octyl phthalate	<10	<11	<10	20 J	2 J	<10	<10	4	<10	<10	8 J	1 J

NR = NOT RECORDED J = ESTIMATED VALUE B = COMPOUND ALSO FOUND IN BLANK E = COMPOUND EXCEEDS CALIBRATION RANGE

TABLE 7.8 (CONT.)
ug/l

	57B			63B		64B		65B		66B		67B	
	1987	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
METALS													
arsenic	5.1	8.1	2.2	1.0	<1.0	1.8	<1.0	1.6	<1.0	<1.0	1.2	1.4	<1.0
barium	3900	1900	3200	610	420	360	220	1400	570	320	300	620	290
cadmium	<7.5	<5.0	16	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chromium	60	11	18	20	31	72	44	9.8	<5.0	<5.0	<5.0	5.2	18
mercury	<0.10	<0.10	<0.10	<.10	<.10	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
lead	90	26	29	<10	<10	<10	<10	19	<10	<10	13	<10	<10
nickel	110	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
selenium	<0.4	<0.4	3.5	1.1	1.4	0.8	<0.4	0.5	<0.4	1.3	<0.4	0.8	<0.4
silver	<10	<5.0	<5.0	<10	<5	<10	<5.0	<10	<5.0	<5.0	<5.0	<5.0	<5.0
zinc	80	150	170	40	<5	66	<5.0	38	<5.0	90	<5.0	47	7
VOLATILES													
methylene chloride	120	7	7	<5	<5	4 J	5 B	10 B	<5	<5	<5	<5	<5
acetone	69	<10	<10	<10	<10	<10	<10	<10	39	<10	60	<10	<10
1,1-dichloroethane	16	27	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
trichloroethene	5	12	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
benzene	3 J	3 J	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
toluene	<5	14	<5	<5	<5	<5	<5	<5	<5	<5	2 J	<5	<5
ethylbenzene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
xylene (total)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	3 J	<5	<5
SEMIVOLATILES													
1,4-dichlorobenzene	<10	<10	<10	<19	<10	<10	<10	<10	<10	<10	<10	<10	<10
diethylphthalate	<10	2 J	<10	<19	<10	<10	<10	<10	<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate	<10	<10	<10	<19	<10	<10	<10	8 J	2 J	<10	3 J	<10	1 BJ
di-n-octyl phthalate	<10	<10	<10	<19	2 J	12	<10	<10	<10	<10	2 J	<10	0.8 J

NR = NOR RECORDED J = ESTIMATED VALUE B = COMPOUND ALSO FOUND IN BLANK E = COMPOUND EXCEEDS CALIBRATION RANGE



Perched Aquifer

TABLE 7.10
GROUNDWATER CONTAMINATION SUMMARY
TOP OF REGIONAL ZONE
ug/l

	Ainsworth	26			28		36			38		
	1986	1986	1988	1989	1986	1989	1986	1988	1989	1986	1988	1989
METALS												
arsenic	<1	8.7	2.5	2.4	5	<1.0	3.8	3.3	4.9	2.0	2.7	1.0
barium	980	19000	1100	1100	<500	<500	960	1100	1500	2300	690	460
cadmium	<7.5	15	<5.0	<5.0	13	<5.0	5	<5.0	<5.0	10	9.0	<5.0
chromium	100	270	19	<5.0	20	<5.0	<10	21	26	70	10	<5.0
mercury	<0.1	<0.10	<0.10	<0.10	<0.4	<0.10	<0.1	<0.10	<0.10	0.12	0.12	<0.10
lead	70	280	17	<10	68	<10	50	<10	12	85	31	<10
nickel	53	180	NR	NR	58	NR	35	NR	NR	50	NR	NR
selenium	1.3	<0.4	0.8	<0.4	<0.4	<0.40	1.4	1.8	<0.40	<0.4	<0.4	0.80
silver	<10	<10	10	<5	<10	<5.0	<10	<10	<5.0	<10	<10	<5.0
zinc	140	220	100	54	53	16	110	59	44	120	24	35
VOLATILES												
methylene chloride	<5	<5	<5	3 BJ	<5	7	<10	<5	13 B	5 J	<5	8
acetone	<10	<10	<10	<10	<10	<10	<10	<10	24	720	<10	<10
trichloroethene	<5	5 J	<5	36	6	<5	<5	<5	<5	41	<5	<5
benzene	<5	<5	<5	<5	12	<5	<5	<5	<5	<5	<5	<5
toluene	<5	<5	<5	<5	<5	<5	<5	<5	<5	17	<5	<5
SEMIVOLATILES												
1,4-dichlorobenzene	<10	<10	<10	<10	<10	<10	45	<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate	28	10 J	<10	<10	<10	<10	10 J	<10	10	46	6 J	4 BJ
di-n-octyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	2 J	10 J	13	3 J

NR = NOT RECORDED
J = ESTIMATED VALUE
B = COMPOUD ALSO FOUND IN BLANK

TABLE 7.10 (CONT.)
ug/l

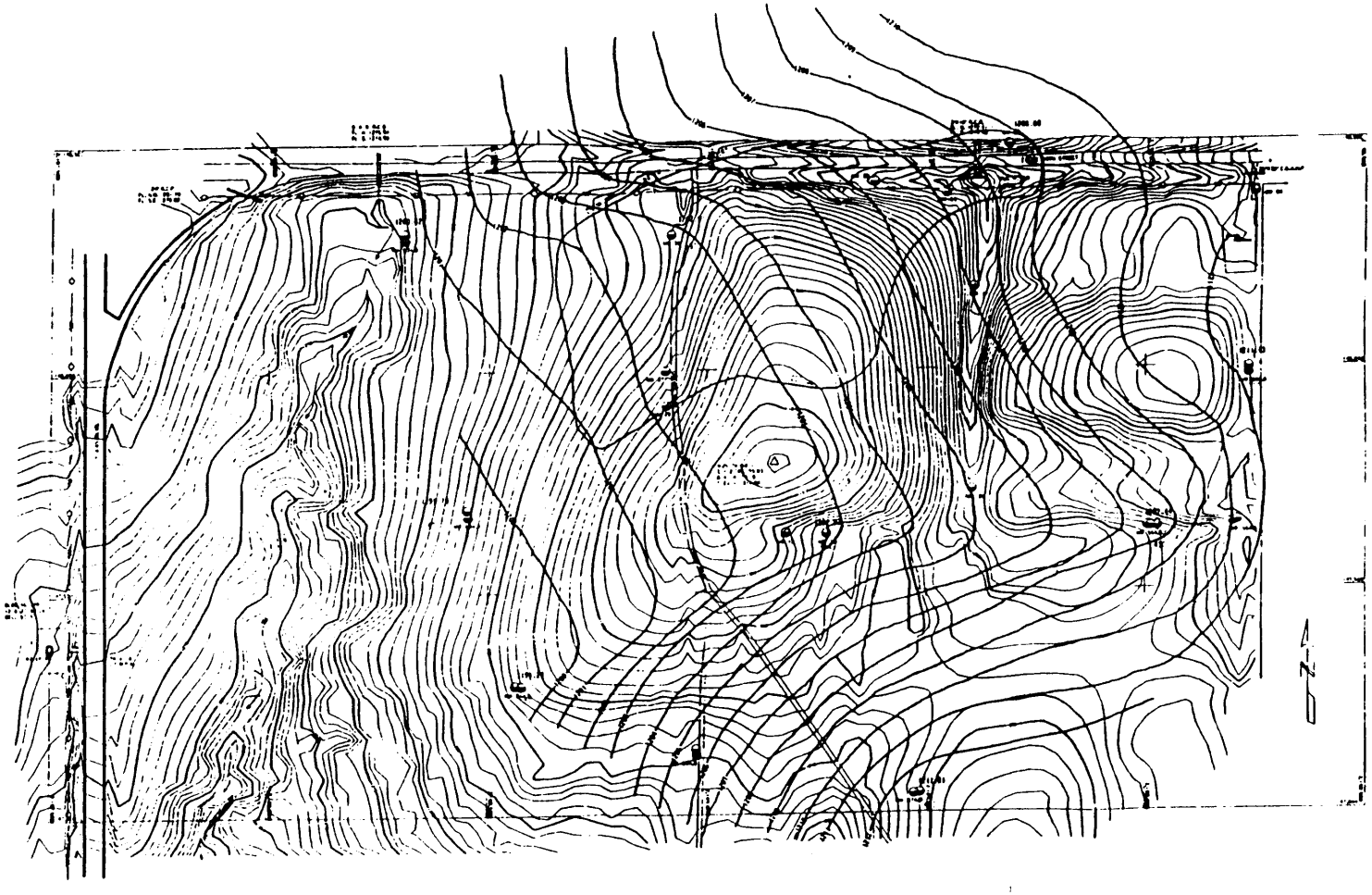
	55A		56A			57A		
	1988	1989	1987	1988	1989	1987	1988	1989
METALS								
arsenic	1.4	<1.0	1.5	4.2	12	6.7	3.3	<1.0
barium	440	430	<500	240	320	530	1100	330
cadmium	<5.0	<5.0	<7.5	<5.0	<5.0	<7.5	<5.0	<5.0
chromium	12	<5.0	<10	7.0	23	20	26	26
mercury	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10
lead	<10	<10	40	18	35	43	18	<10
nickel	NR	NR	25	NR	NR	30	NR	NR
selenium	0.8	<0.40	1.8	1.5	2.0	<0.4	<1.0	<0.4
silver	<5.0	<5.0	<10	<5.0	<5.0	<10	<5.0	<5.0
zinc	NR	25	100	NR	210	75	22	20
VOLATILES								
methylene chloride	<5	<5	<5	<5	5	<5	10	10
acetone	<10	<10	<10	<10	<10	<10	<10	<10
trichloroethene	<5	<5	<5	4 J	2 J	<5	<5	<5
benzene	<5	<5	62	<5	<5	5 J	<5	<5
toluene	<5	<5	<5	1 J	<5	<5	<5	<5
SEMIVOLATILES								
1,4-dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate	<10	18 B	7 J	19	<10	<10	<10	100 B
di-n-octyl phthalate	<10	2 J	<10	<10	<10	1 J	<10	3 J

NR = NOT RECORDED
J = ESTIMATED VALUE
B = COMPOUND ALSO FOUND IN BLANK

TABLE 7.10 (CONT.)
ug/l

	63A		64A		65A		67A	
	1988	1989	1988	1989	1988	1989	1988	1989
METALS								
arsenic	2.0	1.2	2.0	<1.0	3.2	<1.0	4	<1.0
barium	600	340	710	420	840	450	570	410
cadmium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
chromium	18	590	17	5.5	10	<5.0	<5.0	<5.0
mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
lead	<10	<10	<10	<10	25	10	<10	<10
nickel	NR	NR	NR	NR	NR	NR	NR	NR
selenium	1.5	3.4	1.1	<0.4	0.4	<0.4	0.6	<0.4
silver	<10	<5	<10	<10	<10	<5	<5.0	<5.0
zinc	99	27	50	<5.0	160	10	36	11
VOLATILES								
methylene chloride	<5	<5	4J	6 B	6 B	3 BJ	<5	5
acetone	<10	<10	<10	<10	<10	<10	<10	<10
trichloroethene	<5	<5	<5	<5	<5	<5	<5	<5
benzene	<5	<5	<5	<5	<5	<5	<5	<5
toluene	<5	<5	<5	<5	0.6 J	<5	<5	<5
SEMIVOLATILES								
1,4-dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate	<10	<10	<10	<10	<10	<10	<10	87 B
di-n-octyl phthalate	<10	3 BJ	12	<10	<10	<10	<10	0.8 J

NR = NOT RECORDED
J = ESTIMATED VALUE
B= COMPOUND ALSO FOUND IN BLANK



Top of the Regional Aquifer

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA

DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
APP'D:
DATE:

TINKER AIR FORCE BASE, OKLAHOMA
INSTALLATION RESTORATION PROGRAM
LANDFILL #6

BARIUM CONCENTRATIONS (ug/l)

FIGURE
7-3

TABLE 7.11
LANDFILL 6
Stream Sediment Samples
May 1986

COMPOUND	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
METALS (mg/kg)						
arsenic	2.4	2.5	2.6	1.5	1.6	2.7
barium	330	220	260	110	150	280
cadmium	0.50	0.69	<0.5	<0.5	<0.5	<0.5
chromium	10	24	11	8	<5.0	6.6
lead	11	12	13	4.9	6.2	11
nickel	10	12	10	6.8	4.8	5
selenium	6	26	26	30	15	15
zinc	13	13	11	9.6	6.5	9.7
VOLATILE ORGANICS (ug/kg)						
methylene chloride	8	12	8	<7	<5	<5
acetone	28	<13	<13	<13	<14	<12

APPENDIX O

Selected Tables from Supernatant Pond Remedial Investigations

TABLE 5-1 TAFB, SUPERNATANT POND AREA SOIL SAMPLE CHEMICAL ANALYSES

	Average Background Concentration	Maximum Background Concentration	SOIL SAMPLES						
COE Sample No.			SP-2	SP-3	SP-4	SP-5	SP-6	SP-7	SP-9
Lab Sample No.			9-1178	9-1179	9-1180	9-1181	9-1182	9-1183	9-1184
Sample Depth (ft)			5.5-6.5	11.5-12.0	5.0-6.0	5.5-6.5	4.5-5.5	4.5,6.5-7	5.0-6.0
Sample Collection Date			8-24-89	8-24-89	8-25-89	8-25-89	8-25-89	8-25-89	8-28-89
PARAMETER									
Ph			7.3	8.18	7.31	7.68	7.23	7.38	7.86
TRPH mg/kg			<10	<10	68	<10	<10	<10	<10
PCB mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1
Cyanide mg/kg			<0.05	<0.05	0.31	<0.05	<0.05	1.64	<0.05
METALS, (mg/kg)									
Silver	0.56	0.92	<1	<1	33	<1	<1	<1	<1
Arsenic	1.1	2.9	1.3	<1	1.7	<1	1.4	4.8	4.3
Barium	220	2100	290	600	390	180	320	1100	900
Cadmium	0.72	2.1	6.8	6.0	12	7.5	7.4	34	30
Chromium	23	33	18	17	37	25	22	120	130
Mercury	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	21	32	12	16	17	22	18	27	22
Lead	15	30	18	17	82	21	22	210	160
Selenium	<0.10	<0.10	<0.1	<0.1	0.20	<0.1	<0.1	2.0	<0.1
Zinc	25	69	24	23	170	34	25	690	740
VOLATILES (ug/kg)									
Acetone			B14	B39	<13	B190	B30	E1700	80
Chlorobenzene			<6	<6	<6	<6	<6	130	<35
Toluene			6	<6	<6	<6	<6	<40	<35
Total xylene			10	<6	<6	<6	J4	<40	<35
Chloroform			BJ4	J4	J3	J5	J4	BJ21	BJ25
Methylene chloride			B17	B15	B31	B31	B15	B420	B67
SEMIVOLATILES (ug/kg)									
Phenol			<390	<400	<840	<390	<390	J340	550
1,4-Dichlorobenzene			<390	<400	<840	<390	<390	J220	J88
4-Methylphenol			<390	<400	<840	<390	<390	<530	J430
4-Chloroaniline			<390	<400	<840	<390	<390	1900	750
Phenanthrene			<390	<400	<840	<390	<390	J140	J81
Di-n-butylphthalate			<390	<400	<840	<390	<390	<530	J61
Fluoranthene			<390	<400	<840	<390	<390	J230	J140
Pyrene			<390	<400	J280	<390	<390	J330	J200
Chrysene			<390	<400	<840	<390	<390	J170	J150
bis(2-Ethylhexyl)Phthalate			<390	<400	1300	<390	<390	2300	2300

J = estimated concentration
B = analyte found in blank
E = concentration exceeded calibration range of instrument
TIC = tentatively identified compounds

APPENDIX T

Conceptual Hydrogeologic and Environmental Model

CONCEPTUAL HYDROGEOLOGIC AND ENVIRONMENTAL MODEL

This appendix presents the conceptual hydrologic and contaminant model of Tinker Air Force Base (TAFB) as developed by the U.S. Army Corps of Engineers (COE). The discussions that follow are based on all the investigative reports that were reviewed for this Summary of Previous Investigations report. References cited in this appendix are listed at the end of the appendix.

Tinker Air Force Base is located in central Oklahoma, in the southeast portion of the Oklahoma City metropolitan area, in Oklahoma County. The base is bounded by Sooner Road to the west, Douglas Boulevard to the east, Interstate 40 to the north, and Southeast 74th Street to the south. The base encompasses 4,277 acres and contains approximately 500 buildings. TAFB began operations in 1942 and serves as a worldwide repair depot for a variety of aircraft, weapons, and engines. These activities require the use of large quantities of hazardous materials and result in the generation of large quantities of hazardous wastes. These wastes include spent organic solvents, waste oils, waste paint strippers and sludges, electroplating wastewaters and sludges, alkaline cleaners, acids, freon, jet fuels, and radium paints (PRC Environmental Management, Inc., 1989). Wastes are presently managed at two hazardous waste storage areas or treated at the industrial wastewater treatment plant. However, in the past, industrial wastes were discharged into unlined landfills and waste pits, streams, sewers, and ponds. Numerous material spills and leaks from underground tanks and pits have occurred.

GENERAL GEOLOGY AND STRATIGRAPHY

Tinker Air Force Base is located in the Interior Lowlands physiographic province on gently westward-dipping Permian redbeds. Bedrock units encountered beneath the base include the Hennessey Formation and Garber-Wellington Formation. A geologic section for the area is provided in Figure 1. This figure is from a COE report (U.S. Army Corps of Engineers, 1987).

The Hennessey Formation outcrops over the southern half of TAFB. It consists of reddish-brown shale with beds of siltstone and silty sandstone. The formation has a maximum thickness of about 40 feet on the base.

The Hennessey Formation in underlain by the Garber-Wellington Formation, which is also the first bedrock unit encountered in the northern part of the base. The Garber-Wellington Formation is also knows as the Central Oklahoma Aquifer, and outcrops throughout central Oklahoma (U.S. Army Corps of Engineers, 1987). This aquifer is present beneath all of TAFB. The formation consists of the Garber Sandstone and Wellington Formation which are not easily distinguished from each other. The Garber-Wellington Formation is about 900 feet thick in the TAFB area and consists of lenticular and interbedded sandstone, shale, and siltstone. The formation dips westward about 15 feet per mile. The sandstones within the formation are orange-red to reddish brown, fine grained, and poorly cemented. The shales are reddish-brown and silty. The sediments comprising the formation are deltaic in origin. Individual beds vary from a few feet to 40 feet in thickness (U.S. Army Corps of Engineers, 1987). Because of the deltaic origin of the formation, correlation of lithologic units is only possible over short distances.

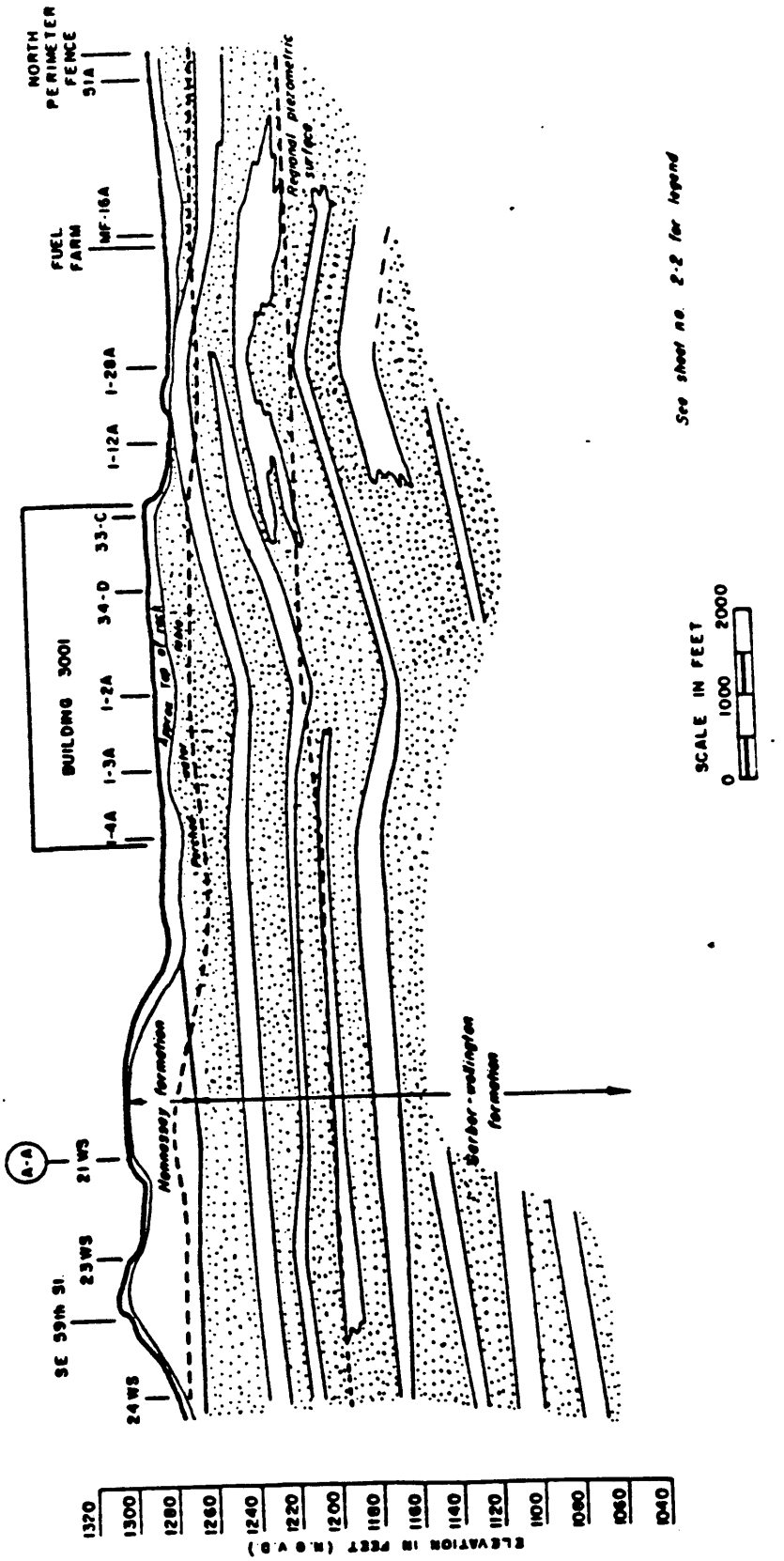


FIGURE 1 Geologic section B-B, a north-south section through the eastern portion of the Base. A more detailed section is located in the back pocket.

From: U.S. Army Corps of Engineers, 1987

Quaternary alluvial deposits consisting of unconsolidated sand, silt, and clay can be found along stream channels at TAFB. The thickness of these deposits has not been determined at TAFB.

GENERAL HYDROGEOLOGY

Although the Hennessey Formation produces minor amounts of water from thin sandstone beds or joints and fractures in the shale, it is not considered a major aquifer in the TAFB area. Typically the Hennessey Formation acts as a confining unit, separating overlying perched ground water from the underlying regional aquifer in the Garber-Wellington Formation (U.S. Army Corps of Engineers, 1987).

The Garber-Wellington Formation is considered to be one hydrologically connected unit. The Garber-Wellington Formation is also known as the Central Oklahoma Aquifer. It supplies much of the drinking water for residents of Oklahoma and Cleveland Counties (U.S. Army Corps of Engineers, 1990a) and is the single most important source of potable ground water in the Oklahoma City area. The recharge area for the formation covers the eastern half of Oklahoma County and includes TAFB (U.S. Army Corps of Engineers, 1990a). Ground water exists in the Garber-Wellington under both water table and confined conditions, depending on the presence or absence of confining shale beds. The direction of regional flow in the aquifer is to the southwest.

TAFB is the greatest user of water from the Garber-Wellington Formation in the area. The formation is the primary source of water for the base. There are 24 active water supply wells located on the base which provide 4 to 6 million gallons per day (mgd) to the base. These wells are screened at depths varying from 250 to 700 feet below ground surface and pump an average of 217 gallons per minute (gpm) (U.S. Army Corps of Engineers, 1990a). The locations of the TAFB supply wells are shown on Figure 2. This figure is from a U.S. Army Corps of Engineers report (U.S. Army Corps of Engineers, 1990b). Also shown on this figure are the locations of three supply wells which have been plugged and are no longer used (Wells 17, 18 and 19).

Because of the presence of shale beds within the Garber-Wellington aquifer, it can be divided into different ground-water zones. These zones are discussed in more detail later in this appendix. The supply wells at the base pump from what has been called the Producing zone. It is the depth from which most water for industrial and commercial use is pumped in the area. Aquifer tests conducted in Producing zone wells located in the towns of Norman and Edmond, to the south and north of TAFB, respectively, have yielded hydraulic conductivities of about 10^{-3} centimeters per second (U.S. Army Corps of Engineers, 1990a). The average depth to water in the Producing zone is about 250 feet.

The alluvial deposits in the TAFB area are also water bearing. They are generally hydrologically connected to perched ground water aquifers which are found over most of the base (U.S. Army Corps of Engineers, 1990a).

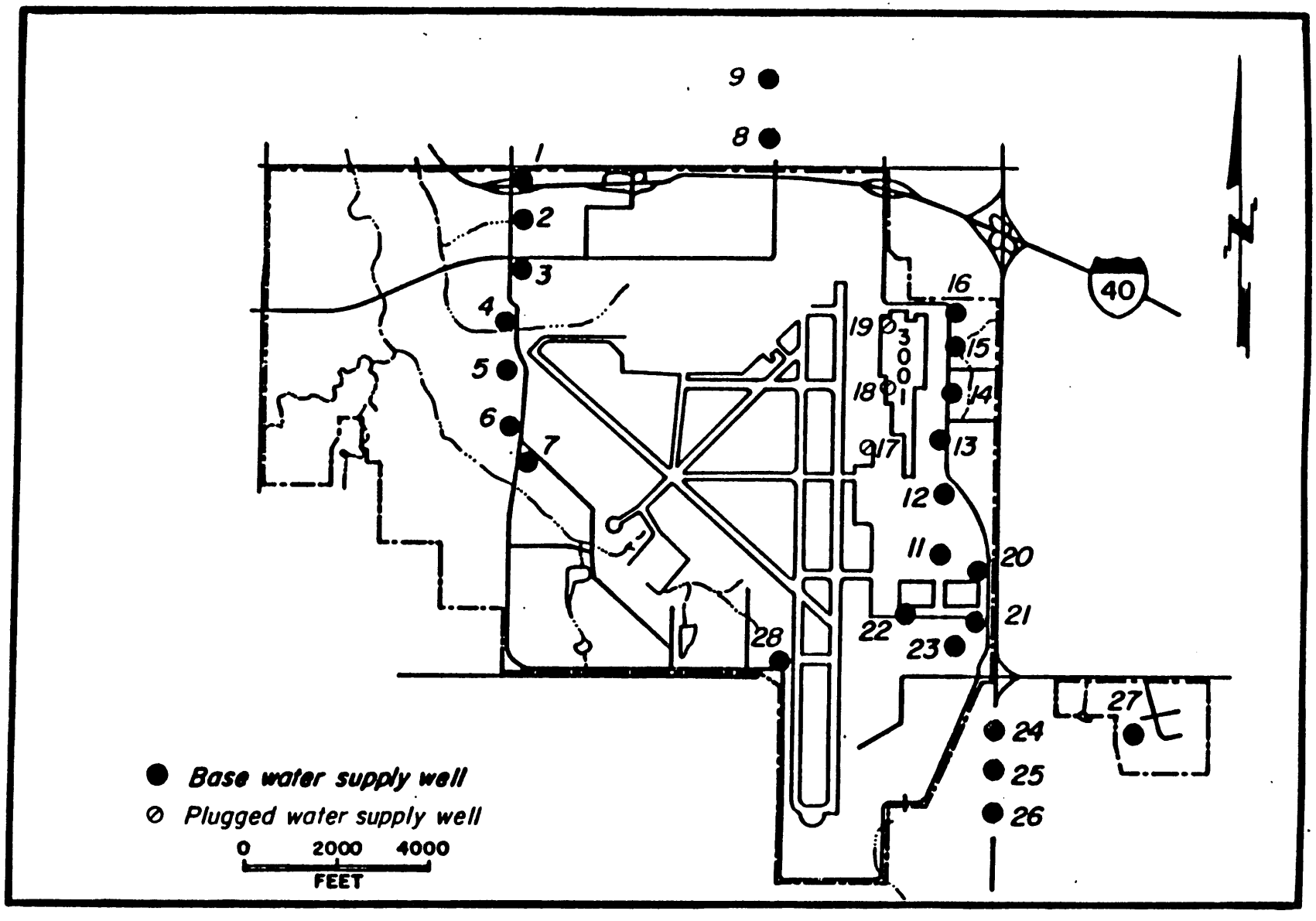


FIGURE 2 **Water supply wells on Tinker Air Force Base.**

From: U.S. Army Corps of Engineers, 1990b

TAFB HYDROGEOLOGY

A conceptual model of TAFB hydrogeology has been developed by the U.S. Army Corps of Engineers based on the results of the numerous subsurface investigations which have been conducted on the base. This model is described below.

A perched ground-water system has been found beneath many areas of the base. This ground water generally occurs above confining shale units in permeable overburden and alluvial deposits (U.S. Army Corps of Engineers, 1987). The average depth to water in the perched ground-water system has been found by the COE to be less than 50 feet. This ground water discharges to streams and low areas, and has been encountered at many of the sites that have been investigated as part of the Installation Restoration Program (IRP). A map showing the configuration of the perched water table at TAFB is presented on Figure 3. This figure is from a 1987 COE report (U.S. Army Corps of Engineers, 1987). The perched ground-water system has not been found to be continuous beneath the base, and may occur in several strata which are separated by lower permeability materials at a particular location. The summaries, presented in Section 2.0 of this Summary of Previous Investigations report provide more detail on specific locations where perched ground water has been encountered.

The first encounter of ground water below perched ground water in the Garber-Wellington Formation is known as the Regional aquifer. This ground water generally occurs within sandstone units of the Garber-Wellington. The average depth to water in the Regional aquifer has been found to be about 50 feet below land surface (U.S. Army Corps of Engineers, 1987). This aquifer is encountered beneath the entire base. It occurs as a confined or unconfined aquifer, depending on the presence of overlying shales. Flow in this aquifer is generally toward the southwest.

As a result of IRP subsurface investigations, the Regional aquifer has been further divided by the COE into the shallow "Top of the Regional" aquifer zone and deeper "Regional" aquifer zone. These zones are typically found to be separate water bearing sandstone units of the Garber-Wellington Formation separated by confining shale beds. As an example, at Building 3001, the Top of the Regional aquifer zone has been identified at a depth of 50 to 80 feet below ground surface, and the Regional aquifer zone at a depth of 110 to 175 feet below ground surface (U.S. Army Corps of Engineers, 1988a). The lower unit is typically a confined aquifer zone, and the upper unit typically an unconfined to semi-confined aquifer zone. The direction of flow in both aquifer zones is typically to the southwest. The potentiometric surface of the Top of the Regional aquifer is illustrated on Figure 4. This figure is from a 1987 COE report (U.S. Army Corps of Engineers, 1987). More detail on specific locations where these two zones have been identified and their respective depths is presented in the report summaries in Section 2.0 of this Summary of Previous Investigations report.

Below these two upper aquifer zones within the regional Garber-Wellington aquifer is found the Producing zone. The Producing zone occurs in deeper sandstone strata of the Garber-Wellington, with an average depth to water of more than 250 feet below land surface (U.S. Army Corps of

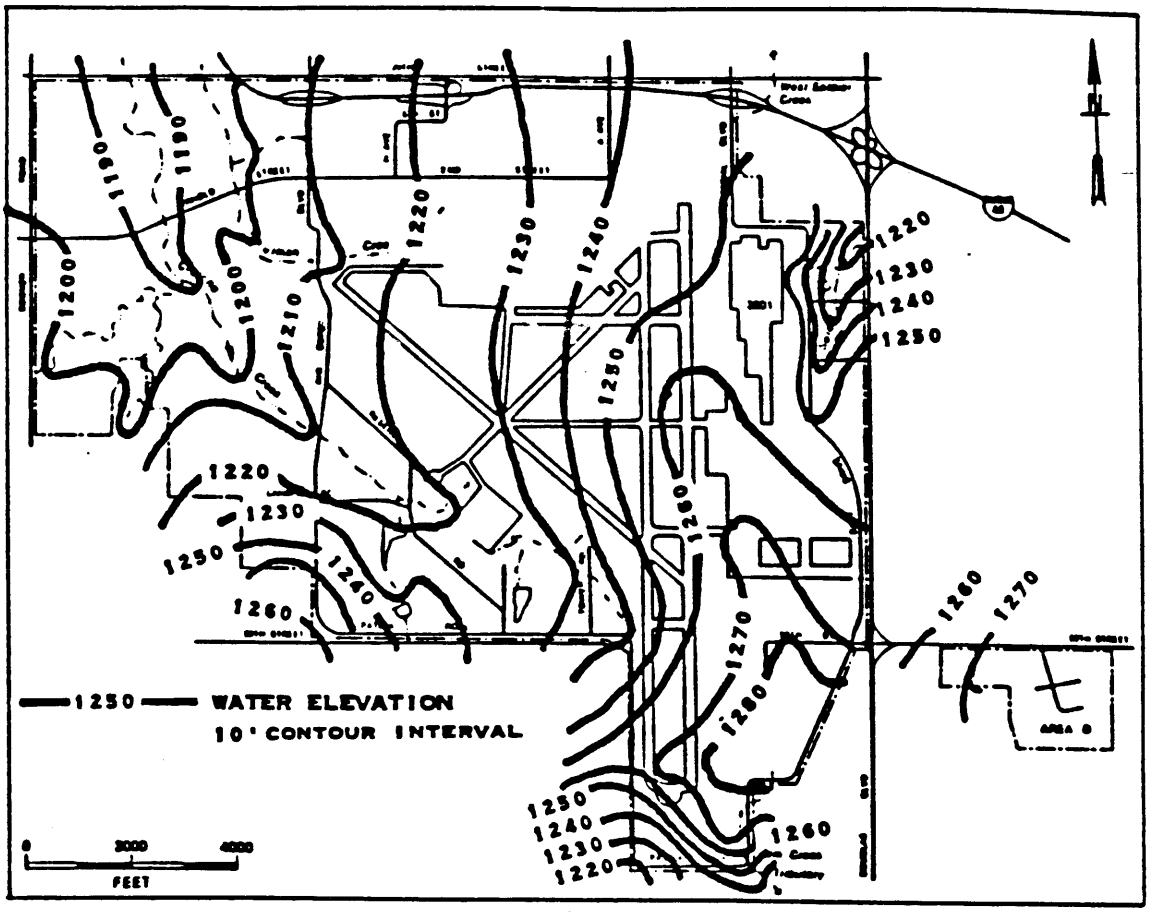


FIGURE 3 Perched water table.

From: U.S. Army Corps of Engineers, 1987

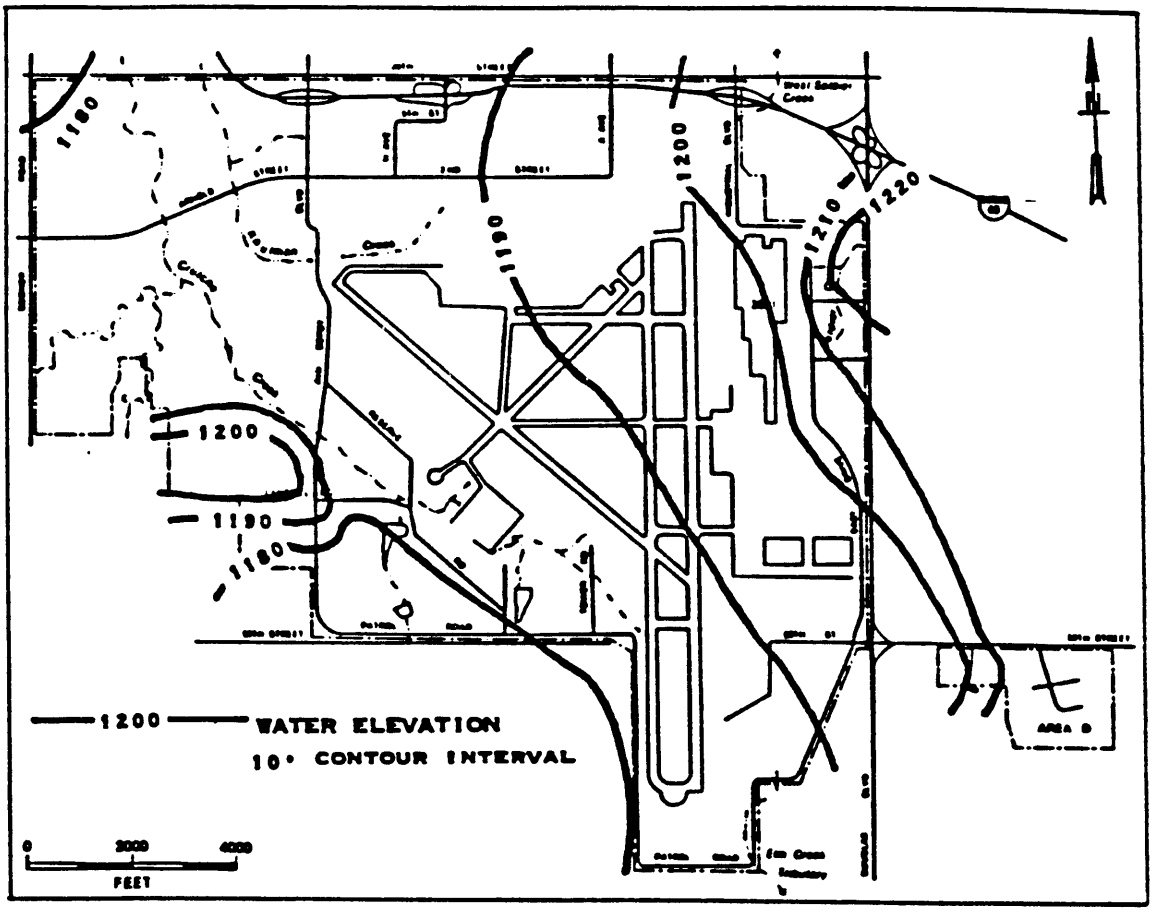


FIGURE 4 **Potentiometric surface of the top of the regional aquifer.**

From: U.S. Army Corps of Engineers, 1987

Engineers, 1987). The Producing zone is always found as a confined aquifer, with flow generally from east to west.

The vertical gradient within the Regional aquifer; i.e., between the Top of the Regional aquifer zone and Regional aquifer zone, and between the perched water table aquifer (where present) and Regional aquifer has been determined by the COE to be downward (U.S. Army Corps of Engineers, 1987). Flow between the various aquifer zones is generally restricted by intervening shale units, but can occur through fractures and discontinuities in the shales.

Plate 1 is a map that illustrates all the ground-water monitoring wells which have been installed on TAFB as part of the on-going IRP. This map was prepared by the U.S. Army Corps of Engineers. This map also shows base supply wells and the primary sites which are being investigated by the IRP. Investigative reports for these sites are summarized in Section 2.0 of this Summary of Previous Investigations report. Many wells are designated with the letters "A, B, or C". Typically, perched aquifer wells have been designated with a "B", Top of the Regional aquifer zone wells have been designated by an "A", and Regional aquifer wells are denoted by "C". However, it should be
pointed out that this well designation is not always consistent, as in some cases, shallow wells are denoted by "A" and deeper wells by "B" and "C". Individual reports for specific sites must be checked for exact well designations. The absence of a letter designation generally denotes a well completed in the perched aquifer.

GROUND-WATER CONTAMINANT PLUMES

Ground-water contamination was first discovered at TAFB in 1983 when trichloroethene (TCE) was detected in water supply wells located in Building 3001. Since that time, numerous remedial investigations have been conducted at the base as part of the U.S. Air Force IRP. During these investigations, over 250 ground-water monitoring wells and piezometers have been installed and sampled. The results of these various investigations are described in the report summaries presented in Section 2.0 of this Summary of Previous Investigations report. In the following discussion, the major plumes of ground-water contamination at TAFB are described. The discussion is based on the IRP reports prepared by the Corps of Engineers that were summarized for this Summary of Previous Investigations report. The sites discussed are located on Plate 1.

BUILDING 3001

The Building 3001 site, located in the northeastern part of the base (see Plate 1), includes the building and two adjacent underground storage tank areas (North and Southwest tank areas). The building is used for aircraft maintenance and repair. Subsurface contamination occurred by leakage from degreasing and paint stripping pits and trenches, leakage from tanks, leakage from storm drains, spills, and discharge of solvents and wastewaters into storm drains leading to Soldier Creek (U.S. Army Corps of Engineers, 1988a).

Ground water beneath the Building 3001 site has been found to be contaminated by solvents (primarily TCE), fuels, and metals (primarily chromium). The remedial investigation (RI) determined that the TCE and chromium plumes cover about 220 acres, and extend to a depth of 175 feet (U.S. Army Corps of Engineers, 1988a). Although TCE has been detected in deeper water supply wells, it is generally believed by the COE that the poor condition of supply wells 18 and 19 (which are now plugged) located in Building 3001 allowed for vertical migration of contaminants from shallow aquifer zones to the Producing zone. (The casing in the wells is known to be highly corroded, and geophysical logs have shown the cement bond in well 18 to be poor. The COE believes that this condition has allowed contaminants to travel downward along the well bores into the Producing zone.) The contamination in the Producing zone is thought to be very localized (U.S. Army Corps of Engineers, 1988a).

The highest concentrations of contaminants have been found in the perched ground-water system beneath the building and in the two tank areas. A fuel product plume exists in the North Tanks area. TCE concentrations are reported to range from 350,000 micrograms per liter (ug/l) beneath the building to 5 ug/l at the plume limits (U.S. Army Corps of Engineers, 1988a). The tank areas are contaminated with benzene, toluene, and xylene.

The Top of the Regional aquifer zone is also contaminated by solvents and metals, but at lower concentrations than in the perched aquifer. The maximum concentration of TCE was found to be 30,000 ug/l beneath the building (U.S. Army Corps of Engineers, 1988a). Chlorobenzene and vinyl chloride have also been detected northeast of the building in the Top of the Regional aquifer zone. Since these contaminants also occur upgradient of the building, they are believed to originate from another source (U.S. Army Corps of Engineers, 1988a).

Solvents and metals were also found in the deeper Regional aquifer zone at even lower concentrations than in the Top of the Regional aquifer zone. The contaminants in the Regional aquifer zone were found primarily beneath the north section of the building (U.S. Army Corps of Engineers, 1988a).

FUEL FARM

The Fuel Farm is a former underground fuel storage facility located northwest of Building 3001 (see Plate 1). It contains 25 buried tanks that until 1986 stored motor and jet fuel. Two major spills of 6,000 and 10,000 gallons occurred in 1979 and 1980, respectively (U.S. Army Corps of Engineers, 1988b).

A major hydrocarbon plume exists on the perched aquifer beneath the Fuel Farm area. It is estimated that 50,000 gallons of fuel (primarily motor fuel, JP-4 jet fuel, and avgas) are floating on top of the perched aquifer water table in this area (U.S. Army Corps of Engineers, 1988b). The perched ground water beneath the Fuel Farm is contaminated by benzene, toluene, and xylene at maximum concentrations of 8400, 890, and 2060 parts per billion (ppb), respectively (U.S. Army Corps of Engineers, 1988b). The metals barium, chromium, and lead, in

concentrations exceeding maximum contaminants limits (MCLs) contaminate the perched ground water as well (U.S. Army Corps of Engineers, 1988b).

Limited contamination by fuels was observed in the Top of the Regional aquifer zone at the Fuel Farm. Benzene was found in a well located west of the Fuel Farm tanks at concentrations ranging from 113 to 582 ppb (U.S. Army Corps of Engineers, 1988b). It is believed by the COE that the ground-water contamination in this area is due to another source, because of its isolated occurrence (U.S. Army Corps of Engineers, 1988b). This will be investigated as part of the investigation of "Four Fuel Sites" by the COE near Buildings 201 and 214.

Contamination below the Top of the Regional aquifer zone in the Fuel Farm area has not been investigated.

LANDFILLS 1-4, SUPERNATANT POND, FIRE TRAINING AREA NO. 1

Landfills 1, 2, 3, and 4 were used to dispose of various industrial and solid wastes generated at TAFB between 1942 and 1968. The four landfills are located in the southwestern portion of the base (see Plate 1) and cover about 50 acres. Landfill 2 contains a former radiological waste disposal area, and another radiological waste disposal area is located just northwest of Landfill 3. Landfill 3 contains a trench area in which sludge from Building 3001 industrial operations and the Fuel Farm was buried.

Investigations conducted at the landfills show that ground water beneath the landfills is contaminated (B&V Waste Science and Technology Corp., 1989). Preliminary investigations have shown that a plume of hydrocarbons is floating on the perched aquifer beneath the Landfill 3 sludge dump area. Ground water beneath Landfill 3 is also reported to be contaminated by solvents and hydrocarbons (U.S. Army Corps of Engineers, 1989a). Investigations are ongoing by the COE to further define the nature and extent of contamination in the area of the landfills.

The Supernatant Pond is located north of the landfills, on the north side of Crutcho Creek (see Plate 1). The pond encompasses about 25,000 square feet and was used to impound sewage effluent between 1954 and 1970, and for the disposal of miscellaneous liquid wastes between 1970 and 1984. The miscellaneous liquid wastes included petroleum hydrocarbon sludges, solvents, and cyanide - contaminated liquids (U.S. Army Corps of Engineers, 1990c). Ground water in the perched ground water zone exhibited concentrations of total organic carbon, radionuclides, and metals exceeding background levels and MCLs (U.S. Army Corps of Engineers, 1990c). Very low concentrations of volatile and semi-volatile organic compounds were also observed in the perched ground water below the pond (U.S. Army Corps of Engineers, 1990c). A monitoring well located in the Top of the Regional aquifer zone upgradient of the pond contained radionuclide and metals concentrations exceeding MCLs (U.S. Army Corps of Engineers, 1990c).

Fire Training Area No. 1 is also located north of the landfills, on the north side of Crutcho Creek, and southwest of the Supernatant Pond (see Plate 1). The area was used between 1950

and 1962 as a fire training/burning area. Volatile organic compounds have been detected in the perched ground water beneath the site. The contaminant most frequently encountered and at the greatest concentrations was 1,2-dichloroethene (1,2-DCE) (reported as high as 540 ug/l in 1987) (U.S. Army Corps of Engineers, 1990d). The location of this contamination is downgradient of both the Fire Training Area and the Supernatant Pond. This compound was also detected in a well completed in the Top of the Regional aquifer zone at a concentration of 9 ug/l (U.S. Army Corps of Engineers, 1990d). This well is located upgradient of the Fire Training Area.

LANDFILL 5

Landfill 5 is a six-acre landfill located on the southeastern part of the base (see Plate 1). The landfill was operated between 1968 and 1970 for disposal of general refuse containing small quantities of industrial waste from Building 3001 operations.

Perched ground water and the Top of the Regional aquifer zone beneath Landfill 5 were found to be contaminated by halogenated solvents. The compounds detected in ground water were different from those detected in the waste materials and trench leachate, which were primarily ketones and fuel-related compounds (U.S. Army Corps of Engineers, 1990e). The organic compounds found in the perched and Top of the Regional aquifer ground-water zones included acetone, 1,2-DCE, TCE, and bis(2-ethyhexyl) phthalate while those in the trench water included acetone, 2-butanone, 4-methyl-2-pentanone, ethylbenzene, xylene, 2-methylphenol, 4-methylphenol, and benzoic acid.

Since the contamination in the perched and Top of the Regional aquifers was not found to be characteristic of contamination found in the trenches, and because contaminants in downgradient monitoring wells were found to be of the same magnitude as those detected in upgradient monitoring wells, it is believed by the COE that the contamination in the perched and Top of the Regional aquifer ground-water zones is due to a different source than the leachate from Landfill 5 (U.S. Army Corps of Engineers, 1990e).

LANDFILL 6

Landfill 6 is a 25-acre landfill located off-base, southeast of TAFB (see Plate 1). The landfill was used for waste disposal between 1970 and 1979. The waste consisted of general refuse, industrial waste, and industrial waste treatment sludges (U.S. Army Corps of Engineers, 1990f).

Perched ground water beneath Landfill 6 was found to be contaminated by metals and organic compounds (U.S. Army Corps of Engineers, 1990f). The majority of contamination in the perched ground water was found in the western portion of the landfill. The primary metals contaminants were arsenic, barium, and cadmium, with barium concentrations reported to range from 2,000 ug/l to 26,00 ug/l in 1989 (U.S. Army Corps of Engineers, 1990f). Organic compounds detected include methylene chloride, acetone, 1,1-dichloroethane (1,1-DCA), TCE, 1,4-dichlorobenzene, fuel-related compounds, and phthalates (U.S. Army Corp of Engineers, 1990f).

The Top of the Regional aquifer zone was found to be contaminated by similar compounds, but at lower concentrations (U.S. Army Corps of Engineers, 1990f). Barium was again the primary metals contaminant.

INDUSTRIAL WASTE PIT NO. 2

Industrial Waste Pit No. 2 is located in the southeast corner of the base (see Plate 1). The pit was used between 1958 and 1965 for disposal of waste oils, cyanides, chromates, phenols, solvents, and waste acids and alkalies from base industrial operations.

This disposal area does not appear to be the source of a major ground-water contaminant plume. Perched ground water immediately beneath the pit was found to be contaminated with metals and organic compounds (U.S. Army Corps of Engineers, 1990g). However, a perched aquifer well located outside the pit boundaries showed only low levels of contaminants which appeared to be the result of laboratory and equipment cross-contamination, and all of which were at concentrations below MCLs (U.S. Army Corps of Engineers, 1990g).

All organic compounds detected in the Top of the Regional aquifer zone were in very low concentrations that appeared to be due to laboratory and equipment cross-contamination (U.S. Army Corps of Engineers, 1990g).

INDUSTRIAL WASTE PIT NO. 1

Industrial Waste Pit No. 1 is located north of Industrial Waste Pit No. 2 (see Plate 1). The pit operated between 1947 and 1958 and reportedly received industrial wastes similar to those placed in Industrial Waste Pit No. 2 (Radian Corporation, 1985).

Some ground-water contamination has been observed at Industrial Waste Pit No. 1 (Radian Corporation, 1985), although the pit does not appear to be a major source of contamination. Contaminant concentrations in a well completed in the pit and in a well completed in the Regional aquifer were below MCLs (Radian Corporation, 1985). The well completed in the waste pit material showed some contamination by total organic carbon, lead, and phenol. Contaminant concentrations in the deeper Regional aquifer well were at very low levels or below detection (Radian Corporation, 1985). However, it should be pointed out that State of Oklahoma data for the same wells showed that TCE may be present in the Regional aquifer well.

OUTLYING AREAS

The COE monitors 25 wells located on the perimeter of TAFB, as well as base water supply wells (see Plate 1 for location of wells). Contamination (solvents and fuel-related compounds) has been observed in supply wells 15 and 16, located near Building 3001, at concentrations ranging from 0.7 to 1.9 ug/l (U.S. Army Corps of Engineers, 1987). This contamination in the Producing zone is believed to be the result of vertical migration of contaminants from the

overlying contaminated zones via deteriorated supply wells 18 and 19, located in Building 3001 (U.S. Army Corps of Engineers, 1987). These two wells have since been plugged.

Ground-water contamination has also been observed in several wells located in the northwestern section of the base. TCE has been consistently detected at 7 to 27 ug/l in well 52B completed in perched ground water, and at 1.6 to 3 ug/l in wells 40A and 40B completed in the Regional aquifer (U.S. Army Corps of Engineers, 1987 and 1989b). The source of the contamination in this area is unknown, but may be the result of a localized spill (U.S. Army Corps of Engineers, 1987). However, due to the isolated nature of the detections and the relatively low concentrations, it does not appear to indicate that there are significant plumes of ground-water contamination in the northwestern portion of the base (U.S. Army Corps of Engineers, 1987). This contamination is to be evaluated in the Khulman Creek remedial investigation.

Finally, ground-water contamination has been observed along the northeastern border of the base. Benzene ranging in concentration from 2.4 to 2.5 ug/l was detected once in perched aquifer wells 22B and 23B located along Soldier Creek in the northeastern part of the base (U.S. Army Corps of Engineers, 1989b). Benzene (110 ug/l) and toluene (22 ug/l) were also detected once in Regional aquifer well 22A, also located along Soldier Creek (U.S. Army Corps of Engineers, 1989b). These two one-time detections occurred during the same sampling round in October 1987. TCE was also detected one time in well 22A at 6 ug/l (U.S. Army Corps of Engineers, 1989b). TCE and toluene were detected one time in Regional aquifer well 24A, located on the eastern boundary of the site (U.S. Army Corps of Engineers, 1989b).

The contamination observed in the northeastern part of the base may represent a one-time sampling problem or contamination migrating onpost from an offpost source (U.S. Army Corps of Engineers, 1989b). This area will be evaluated in the Soldier Creek remedial investigation.

ADDITIONAL PLUMES OF GROUND- WATER CONTAMINATION

Areas currently being investigated at TAFB where plumes of ground-water contamination may be present include:

- Industrial Waste Treatment Plant (IWTP) (may be part of Building 3001 plume)
- Radiological Waste Disposal Sites 1030W and 201S (Site 1030W may be part of Landfill 1-4 plume)
- Soldier Creek (may be part of Building 3001 and IWTP plumes)
- Crutcho and Khulman Creeks (may be part of Landfills 1-4 and 5 plumes)
- Four Fuel-Contaminated Sites (may be part of Fuel Farm plume).

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TABLE 5-3 TAFB, SUPERNATANT POND AREA GROUND WATER SAMPLE CHEMICAL ANALYSES

	Drinking Water Standard or MCL	Background Concentration							
Well/Piezometer No. Sample Collection Date			SP-1 10/89, 11/89	SP-2 11/89	SP-3 10/89,11/89	SP-4 10/89,11/89	SP-5 11/89	SP-6 11/89	SP-7 10/8911/89
PARAMETER		Perched Zone							
Ph		7.10	6.51	6.88	7.70	7.23	7.44	6.98	8.66
Conductivity uMhos/cm		684	680	1010	1630	1280	1050	1090	860
TDS mg/L			570	NA	NA	NA	960	NA	600
PCB ug/L			<0.5	<0.5	<0.5	NA	NA	NA	NA
TOC mg/L		3.9	5.68	12.4	16.8	13.4	4.43	7.08	26.2
TPH mg/L			<0.5	NA	NA	NA	<0.5	NA	6.4
Cyanide mg/L		<0.2	<0.20	NA	NA	NA	<0.20	NA	<0.20
RADIOMETRICS									
Gross Alpha pCi/L	15	55.2	NA	95±37	75±30	NA	NA	NA	NA
Gross Beta Pci/L	50	106.8	NA	215±19	109±15	NA	NA	NA	NA
Radium Pci/L	5		NA	29±3	14±2	NA	NA	NA	NA
METALS (ug/L)									
Arsenic	50	10	NA	9	12	NA	NA	NA	NA
Barium	1000	1110	NA	420	200	NA	NA	NA	NA
Cadmium	10	10	NA	6	<5	NA	NA	NA	NA
Chromium	50	46	NA	5.2	<5	NA	NA	NA	NA
Mercury	2	<0.4	NA	0.12	0.12	NA	NA	NA	NA
Lead	50	57	NA	61	13	NA	NA	NA	NA
Nickel		101	NA	36	19	NA	NA	NA	NA
Selenium	10	2.1	NA	<0.4	<0.4	NA	NA	NA	NA
VOLATILES (ug/L)									
Acetone			<10	<10	<10	<10	<10	<10	49
Chlorobenzene			<5	<5	<5	<5	<5	<5	<5
Carbon disulfide			<5	<5	<5	<5	<5	<5	<5
Trichloroethene	5.0		<5	<5	<5	<5	<5	<5	<5
Methylene chloride			<5	<5	<5	12	<5	<5	<5
SEMIVOLATILES (ug/L)									
Benzoic Acid			4J	NA	NA	<50	NA	<50	NA
Di-n-Octyl Phthalate			<10	NA	NA	<10	NA	2J	NA
bis(2-Ethylhexyl)Phthalate			3BJ	NA	NA	5J	NA	<10	NA
bis(2chloroisopropyl)ether			<10	NA	NA	<10	NA	<10	NA
4-Nitroaniline			<50	NA	NA	<50	NA	<50	NA
Di-n-butylphthalate			<10	NA	NA	<10	NA	<10	NA
1,2,4-Trichlorobenzene			<10	NA	NA	<10	NA	<10	NA

J = estimated concentration
B = analyte found in blank
E = concentration exceeded calibration range of instrument
NA = no analysis

TABLE 5-3 CONTINUED,
TAFB, SUPERNATANT POND AREA GROUND WATER SAMPLE CHEMICAL ANALYSES

	Drinking Water Standard or MCL	Background Concentration							
Well/Piezometer No. Sample Collection Date			SP-8 10/89,11/89	SP-9 11/89	SP-10 11/89	SP-11 11/89	SP-12 11/89	SP-13 11/89	MW-85A 11/21/89
PARAMETER		Perched Zone							
pH		7.10	7.80	7.18	7.10	6.77	6.73	7.22	6.94
Conductivity uMhos/cm		6.84	920	2830	1770	670	960	1840	740
TDS mg/L			NA	1500	NA	710	NA	NA	600
PCB ug/L			NA	NA	<0.5	<0.5	<0.5	<0.5	<1.0
TOC mg/L		3.90	12.3	13.4	17.8	12.6	14.1	19.9	2.85
TPH mg/L			NA	1.1	NA	<0.5	NA	NA	<0.5
Cyanide mg/L		<0.2	NA	<0.20	NA	<0.20	NA	NA	<0.20
RADIOMETRICS									
Gross Alpha pCi/L	15	55.2	NA	NA	13±10	76±34	63±27	NA	14±8
Gross Beta pCi/L	50	106.8	NA	NA	49±13	312±22	104±15	NA	8±8
Radium pCi/L	5		NA	NA	4±2	56±4	23±3	NA	1±0.7
METALS (ug/L)									
Arsenic	50	10	NA	NA	17	17	NA	NA	1.7
Barium	1000	1110	NA	NA	260	1100	NA	NA	460
Cadmium	10	10	NA	NA	<5	18	NA	NA	<5
Chromium	50	46	NA	NA	<5	39	NA	NA	<5
Mercury	2	<0.4	NA	NA	<0.1	<0.1	NA	NA	<0.1
Lead	50	57	NA	NA	<10	100	NA	NA	13
Nickel		101	NA	NA	13	71	NA	NA	10
Selenium	10	2.1	NA	NA	<0.4	<0.4	NA	NA	<0.4
VOLATILES (ug/L)									
Acetone			<10	<10	<10	15	<10	7J	<10
Chlorobenzene			<5	5	24	<5	<5	4J	<5
Carbon disulfide			<5	<5	<5	<5	<5	<5	1J
Trichloroethene	5.0		<5	<5	<5	<5	<5	<5	1J
Methylene chloride			2BJ	<5	<5	<5	<5	3J	<5
SEMIVOLATILES (ug/L)									
Benzoic Acid			<50	<50	NA	<50	NA	<50	<50
Di-n-Octyl Phthalate			2J	<10	NA	<10	NA	<10	2J
bis(2-Ethylhexyl)Phthalate			14	<10	NA	<10	NA	<10	<10
bis(2chloroisopropyl)ether			<10	5J	NA	<10	NA	<10	<10
4-Nitroaniline			<50	3J	NA	<50	NA	<50	<50
Di-n-butylphthalate			<10	<10	NA	<10	NA	<10	0.7J
1,2,4-Trichlorobenzene			<10	<10	NA	<10	NA	<10	<10

J = estimated concentration
B = analyte found in blank
E = concentration exceeded calibration range of instrument
NA = no analysis

TABLE 5-3 CONTINUED, TAFB, SUPERNATANT POND AREA GROUND WATER SAMPLE CHEMICAL ANALYSES

	Drinking Water Standard or MCL	Background Concentration								
Well/Piezometer No. Sample Collection Date Completion Zone		Perched	Top Regional	MW-85B 11/21/89 Top Regional	MW-85AE 11/21/89 Equip. Blank	TB-1 11/21/89 Trav. Blank	MW-85A 05/08/90 Perched	MW-85B 05/08/90 Top Reg.	MW-85 EB 05/08/90 Equip. Blk	MW-85 TB 05/08/90 Trav. Blk.
PARAMETER										
pH		7.10	9.80	7.53	5.60	7.02	6.85	7.41	7.51	8.56
Conductivity uMhos/cm		6.84	7.18	510	0	20	1041	763	1.3	2.7
TDS mg/L				430	200	24	NA	NA	NA	NA
PCB ug/L				<1.0	<1.0	<1.0	NA	NA	NA	NA
TOC mg/L		3.9	5.3	2.43	0.826	0.581	4.02	0.836	<0.5	<0.5
TPH mg/L				<0.5	<0.5	<0.5	NA	NA	NA	NA
Cyanide mg/L		<0.2	<0.2	<0.20	<0.20	<0.20	<0.01	<0.01	<0.01	<0.01
RADIOMETRICS										
Gross Alpha pCi/L	15	55.2	3.7	25±15	0.6±2	0.5±2	NA	NA	NA	NA
Gross Beta pCi/L	50	106.8	9.3	42±19	2 ±4	0 ±4	NA	NA	NA	NA
Radium pCi/L	5			21±3	0.2±1	0.1±0.5	NA	NA	NA	NA
METALS (ug/L)										
Arsenic	50	10	2	5.9	<1	<1	<1.0	2.5	<1.0	<1.0
Barium	1000	1110	663	1200	<5	<5	53.2	112	<10	<10
Cadmium	10	10	<7.5	<5	<5	<5	16.0	17.2	<10	<10
Chromium	50	46	<10	8	<5	<5	<10	<10	<10	<10
Mercury	2	<0.4	<0.4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2
Lead	50	57	48	14	<10	<10	<20	<20	<20	<20
Nickel		101	33	13	<5	<5	<15	<15	17.8	39.5
Selenium	10	2.1	0.5	<0.4	<0.4	<0.4	<1.0	<1.0	<1.0	<1.0
Silver	50	10	10	NA	NA	NA	<10	<10	<10	<10
Zinc	5000	110	120	NA	NA	NA	10.5	<10	23.2	34.8
VOLATILES (ug/L)										
Acetone				<10	<10	<10	<10	<10	<10	<10
Chlorobenzene				<5	<5	<5	<5	<5	<5	<5
Carbon disulfide				<5	<5	<5	<5	<5	<5	<5
Trichloroethene	5.0			<5	<5	<5	<5	<5	<5	<5
Methylene chloride				1J	<5	<5	<5	<5	2BJ	5B
SEMIVOLATILES (ug/L)										
Benzoic Acid				<50	<50	<50	<50	<50	<50	<50
Di-n-Octyl Phthalate				12	1J	<10	<10	<10	<10	<10
bis(2-Ethylhexyl)Phthalate				13	<10	21	5J	24	2J	3J
bis(2chloroisopropyl)ether				<10	<10	<10	<10	<10	<10	<10
4-Nitroaniline				<50	<50	<50	<50	<50	<50	<50
Di-n-butylphthalate				<10	<10	<10	<10	<10	<10	<10
1,2,4-Trichlorobenzene				<10	<10	<10	<10	<10	<10	<10

J = estimated concentration E = concentration exceeded calibration range of instrument
B = analyte found in blank NA = no analysis

APPENDIX P

Selected Tables from Fire Training Area No. 1
Remdial Investigations

Table 5-1 Summary of Frequency of Detection and Concentration of Selected Metals in Soil

Compound	Detected Frequency	Concentrations Range	Mean (mg/kg)	Background Value (mg/kg)
Silver (Ag)	4/10	0.54 - 2.7	0.71	0.56
Arsenic (As)	4/10	1.2 - 1.9	0.9	1.07
Barium (Ba)	10/10	180 - 900	410	218
Cadmium (Cd)	10/10	0.5 - 17	2.4	0.72
Chromium (Cr)	10/10	5.9 - 36	11.25	22.8
Mercury (Hg)	2/10	.14 - .16	0.15	<0.1
Nickel (Ni)	10/10	7.3 - 20	10.4	20.7
Lead (Pb)	10/10	8.1 - 170	34.6	15.0
Selenium (Se)	6/10	0.15 - 0.21	0.12	<0.1
Zinc (Zn)	10/10	7.5 - 160	25.6	25.2

Table 5-2 Summary of the Frequency of Detection and Concentrations of Organic Compounds Identified in Soil

Compound Name	Detection Frequency	Concentration Range (ug/kg)	Location of Maximum Concentration
Acetone	30/55	2-610	F1-6
Methylene Chloride	44/55	5-130	F1-26
Chloroform	11/55	2-5	F1-25
Bis(2-ethylhexyl)phthalate	46/55	120-11000	F1-8
Anthracene	1/55	9	F1-1
Benzo(A)anthracene	1/55	290	F1-6
Benzo(B)fluoranthene	1/55	250	F1-6
Benzo(A)pyrene	1/55	180	F1-6
Benzo(GHI)perylene	1/55	180	F1-6
Chrysene	1/55	170	F1-6
Ethylbenzene	1/55	7	F1-27
Fluoranthene	1/55	390	F1-6
2-Hexanone	1/55	6	F1-6
Ideno(1,2,3-CD)pyrene	1/55	200	F1-6
Phenanthrene	2/55	10-170	F1-6
Pyrene	1/55	330	F1-6
Trans 1,2-dichloroethene	1/55	10	F1-6
Trichloroethene	1/55	3	F1-5
Trichlorofluoro-methane	1/55	10	F1-24
1,1,1-Trichloroethane	1/55	3	F1-5
Toluene	4/55	1-4	F1-24
Xylene	2/55	1-4	F1-24

Table 5-3 Summary of the Frequency of Detection and Concentrations of Organic Compounds in Perched Groundwater

Compound Name	Detection Frequency	Concentration Range (ug/l)	Location of Maximum Concentration
Acetone	2/14	21-140	F1-26
Methylene Chloride	3/14	2-7	MW 62
Bis(2-ethylhexyl)phthalate	3/14	3-24	MW 62
Benzene	2/14	7-9	F1-3
2-Butanone	2/14	18-6450	F1-3
Chloroform	1/14	5	F1-26
Chlorobenzene	1/14	21	F1-3
1,2-dichloroethene (total)	6/14	5-540	MW 61A
Di-n-butyl phthalate	1/14	0.4	F1-3
Di-n-octyl phthalate	5/14	0.7-4	F1-3
Fluoranthene	1/14	6	F1-2
2-Hexanone	1/14	210	F1-3
4-methyl-2-pentanone	1/14	10	F1-3
Pyrene	1/14	10	F1-2
1,2,4-Trichlorobenzene	1/14	4	MW 61A
1,1,2-Trichloroethane	1/14	13	F1-2
1,1,1-Trichloroethane	1/14	5	MW 61A
Trichloroethene	4/14	17-32	MW 61A
Trichlorofluoromethane	3/14	10-690	MW 62
Toluene	1/14	3	F1-3
Xylene	1/14	2	F1-3
Vinyl Chloride	3/14	3-71	MW 61A

Table 5-4 Summary of Detected Metals and Organics (ug/l)
Perched Water Zone
June 1987 Sampling

Metals	F1-1	F1-2	F1-3	MW 61A	MW 62
arsenic	NA	NA	NA	2.3	2.3
barium	NA	NA	NA	3200	1100
chromium	NA	NA	NA	110	58
lead	NA	NA	NA	98	78
nickel	NA	NA	NA	53	73
zinc	NA	NA	NA	<10	88

NA = Not Analyzed

Organic Compound					
vinyl chloride	3	17	<10	71	<10
1,2-dichloroethene (total)	15	<5	<5	540	<5
trans-1,2-dichloroethene	<5	89	<5	<5	<5
2-butanone	<10	18	6450	<10	<10
1,1,1-trichloroethene	<5	<5	<5	3	<5
trichloroethene	<5	17	<5	32	17
1,1,2-trichloroethane	<5	13	<5	<5	<5
tetrachloroethene	<5	<5	<5	<5	4
benzene	<5	7	9	<5	<5
fluoranthene	<10	6	<10	<10	<10
pyrene	<10	10	<10	<10	<10
4-methyl-2-pentanone	<10	<10	10	<10	<10
2-hexanone	<10	<10	210	<10	<10
chlorobenzene	<5	<5	21	<5	<5
TOC (mg/l)	15.6	12.3	12.4	8.9	20

Table 5-5 Summary of Detected Organics (ug/l)
Perched Water Zone
September 1989 Sampling

Compound	F1-1	F1-2	F1-3	MW 61A	MW 62
methylene chloride	<5	16	<5	<5	30
chloroform	<5	<5	<5	<5	37
1,2-dichloroethene (total)	<5	8	<5	150	<50
trichloroethene	<5	<5	<5	20	<50
trichloroflorometh ane	<10	<10	<10	45	690
1,2,4-trichlorobenzene	<10	<10	<10	4	<10
toluene	<5	<5	3	<5	<5
xylenes	<5	<5	2	<5	<5
bis (2-ethylhexyl) phthalate	<10	6	3	4	11
di-n-butyl phthalate	<10	<10	0.4	<10	<10
di-n-octyl phthalate	2	2	4	0.7	3

Table 5-6 Summary of Detected Organics in MW 61B
Top of Regional Zone
September 1989 Sampling

Compound	Concentration (ug/l)
methylene chloride	15
acetone	50
1,2-Dichloroethene (total)	9
Bis(2-ethylhexyl)phthalate	6
Di-n-octyl phthalate	2

APPENDIX Q

Selected Tables from Fire Training Area No. 2.
IRP Response Action

Table 2 - Listed Organic Compounds

Compound Name	Range Of Concentration. (ug/kg)	Number Of Times Detected/Total Samples
	Group I	
methylene chloride	0 - 160	8/11
acetone	0 - 30	3/11
bis(2-ethyl-hexyl)phthalate	0 - 2,200	4/11
	Group II	
tetrahydro furan	0 - 40	11/11

Table 3 - Metals (Group III)

Compound	FTA 2 Max (mg/kg)	FTA 2 Avg (mg/kg)	Background Value (mg/kg)
Ag	0.76	0.38	0.56
As	< 1	< 1	1.07
Ba	400	180	218
Cd	0.80	0.61	0.72
Cr	12.0	8.4	22.8
Hg	0.19	0.07	<0.1
Ni	22.0	11.7	20.7
Pb	15.0	10.7	15.0
Se	0.20	0.15	<0.1
Zn	21.0	11.6	25.2

Table 4 - Non-Listed Organic Compounds (Group IV)

Compound Name	Range of Concentration (ug/Kg)	Samples Detected/ Total Samples
5-methyl-2-hexanone	0 - 3,800	5/11
2,3,4-trimethyl hexane	0 - 1,900	5/11
2,3,6-trimethyl heptane	0 - 3,000	5/11
2,5,6-trimethyl octane	<22	1/11
2,4-dimethyl-2-pentanol	0 - 69,000	3/11
1 methyl ethyl ester acetic acid	5,300	1/11
1-methyl-ethyl-benzene	290	1/11

APPENDIX R

Selected Tables from Sludge Drying Beds
IRP Response Action

Table A-1 - Detected Listed Organic Compounds and Metals

CONTAMINANT CONCENTRATION	BORING NUMBER			
	EF-1	EF-2 *	EF-3	EF-4
	(0 - 3')	(0 - 3')	(0 - 3')	(0 - 3')
	Ag (<0.5)	Ag (<0.5)	Ag (<0.5)	Ag (<0.5)
	As (1.2)	As (<1.0)	As (1.5)	As (1.6)
	Ba (160)	Ba (110)	Ba (250)	Ba (170)
	Cd (0.9)	Cd (0.8)	Cd (<0.5)	Cd (0.4)
	Cr (14)	Cr (22)	Cr (18)	Cr (24)
	Hg (<0.1)	Hg (<0.1)	Hg (<0.1)	Hg (<0.1)
	Pb (10)	Pb (14)	Ni (8.8)	Pb (8.8)
	Se (<0.1)	Se (<0.1)	Pb (8.8)	Se (<0.1)
	methylene chloride (13)	methylene chloride (17)	Se (<0.1)	methylene chloride (36)
	acetone (<12) **	acetone (14)	Zn (13)	(3 - 6')
	1,2-dichloropropane (<6)	N-nitrosodiphenylamine (<400)	methylene chloride (10)	Ag (<0.5)
	tetrahydrofuran (8)	bis(2-ethylhexyl)phthalate (470)	acetone (60)	As (1.0)
	(3 - 6')	tetrahydrofuran (11)	bis(2-ethylhexyl)phthalate (410)	Ba (110)
	Ag (<0.5)	(3 - 6')	(3 - 6')	Cd (<0.7)
	As (1.4)	Ag (<0.5)	Ag (0.5)	Cr (14)
	Ba (210)	As (3.0)	As (1.1)	Hg (<0.1)
	Cd (<0.5)	Ba (490)	Ba (87)	Pb (6.0)
	Cr (13)	Cd (0.7)	Cd (<0.5)	Se (<0.1)
	Hg (<0.1)	Cr (14)	Cr (5.8)	methylene chloride (40)
	Pb (9.4)	Hg (<0.1)	Hg (<0.1)	
	Se (<0.1)	Pb (13)	Ni (5.3)	
	methylene chloride (<6)	Se (<0.1)	Pb (8.3)	
	acetone (<12)	methylene chloride (19)	Se (<0.1)	
	1,2-dichloropropane (<6)	acetone (67)	Zn (6.3)	
	bis(2-ethylhexyl)phthalate (<390)	1,1-dichloroethane (<6)	methylene chloride (11)	
	tetrahydrofuran (6)	bis(2-ethylhexyl)phthalate (450)	bis(2-ethylhexyl)phthalate (<390)	

* depths were reported as 4 - 7' and 7 - 10'
metal concentrations in mg/kg
organic concentrations in ug/kg

** Values listed as <X indicate that the compound was present but below the detection limit X.

Table A-1 - Detected Listed Organic Compounds and Metals Cont'd

CONTAMINANT	CONCENTRATION	BORING NUMBER			
		EF-5	EF-6	EF-7	EF-8
		(0 - 3')	(0 - 3')	(0 - 3')	(0 - 3')
		Ag (<0.5) As (1.4) Ba (100) Cd (<0.5) Cr (14) Hg (<0.1) Pb (5.6) Se (<0.1) methylene chloride (15) trans-1,2-dichloroethene (9) tetrahydrofuran (11) bis(2-ethylhexyl)phthalate (1200)	Ag (17) As (2.5) Ba (330) Cd (14) Cr (1400) Hg (<0.1) Pb (26) Se (<0.1) methylene chloride (7) acetone (17)	Ag (<0.5) As (1.2) Ba (110) Cd (<0.5) Cr (9.3) Hg (<0.1) Ni (8.1) Pb (8.5) Se (<0.1) Zn (7.3) methylene chloride (7) bis(2-ethylhexyl)phthalate (1200)	Ag (0.5) As (1.1) Ba (140) Cd (<0.5) Cr (11) Hg (<0.1) Ni (9.0) Pb (11) Se (<0.1) Zn (6.8) methylene chloride (<6) acetone (<12) bis(2-ethylhexyl)phthalate (<400)
		(3 - 6')	(3 - 6')	(3 - 6')	(3 - 6')
		Ag (<0.5) As (1.6) Ba (150) Cd (<0.5) Cr (18) Hg (<0.1) Pb (9.4) Se (<0.1) methylene chloride (10) acetone (14) benzene (<6) diethyl phthalate (530) bis(2-ethylhexyl)phthalate (<390) tetrahydrofuran (11)	Ag (<0.5) As (1.4) Ba (74) Cd (0.7) Cr (17) Hg (<0.1) Pb (6.4) Se (<0.1) methylene chloride (6)	Ag (<0.5) As (1.4) Ba (66) Cd (<0.5) Cr (11) Hg (<0.1) Ni (12) Pb (10) Se (<0.1) Zn (11) methylene chloride (<6)	Ag (<0.5) As (1.3) Ba (320) Cd (<0.5) Cr (5.2) Hg (<0.1) Ni (13) Pb (9.7) Se (<0.1) Zn (7.6) methylene chloride (<6) acetone (32) bis(2-ethylhexyl)phthalate (410)

Table A-2 - Detected Non-Listed Organic Compounds

CONTAMINANT (ug/kg)	BORING NUMBER: EF-1	BORING NUMBER: EF-2 *
CONCENTRATION	(0 - 3')	(0 - 3')
	3-methyl-pentane (13)	1,1-dimethyl-ethyl-hydroperoxide (34,000)
	diisoctyl 1,2-benzenedicarboxylic acid (840)	5-methyl-2-hexanone (1,700)
	unknowns (2030)	4-propyl-heptane (810)
		unknowns (940)
	(3 - 6')	(3 - 6')
	isocyano-methane (6)	5-methyl-2-hexanone (890)
	unknowns (920)	4-methyl-octane (510)
		4-(1-methyl-ethyl)-heptane (830)
		unknowns (32,780)

Table A-2 - Detected Non-Listed Organic Compounds Cont'd

CONTAMINANT (ug/kg)	BORING NUMBER: EF-3	BORING NUMBER: EF-4
CONCENTRATION	(0 - 3')	(0 - 3')
	acetaldehyde (11)	unknown (10)
	isocyano-methane (8)	
	2,3,6-trimethyl-heptane (670)	(3 - 6')
	5,5-dimethyl-2 (5h) furanone (180)	isocyano-methane (8)
	unknowns (86,640)	
	(3 - 6')	
	acetaldehyde (10)	
	isocyano-methane (11)	
	2,3,4-trimethyl-hexane (160)	
	2,3,6-trimethyl-heptane (400)	
	unknowns (47,170)	

Table A-2 - Detected Non-Listed Organic Compounds Cont'd

CONTAMINANT (ug/kg)	BORING NUMBER	
CONCENTRATION	EF-5	EF-6
	(0 - 3')	(0 - 3')
	1,1-dimethyl-ethyl-hydroperoxide (32,000) 5-methyl-2-hexanone (1,800) 4-(1-methyl-ethyl)-heptane (1,100) unknowns (2,680)	none
	(3 - 6')	(3 - 6')
	4-propyl-heptane (680) unknowns (360)	isocyano-methane (9)

Table A-2 - Detected Non-Listed Organic Compounds Cont'd

CONTAMINANT (ug/kg)	BORING NUMBER	
CONCENTRATION	EF-7	EF-8
	(0 - 3')	(0 - 3')
	isocyano-methane (13) 2,3,4-trimethyl-hexane (320) 2,3,6-trimethyl-heptane (570) unknowns (80,890)	isocyano-methane (5) 2,3,4-trimethyl-hexane (320) 2,3,6-trimethyl-heptane (520) 5,5-dimethyl-2 (5h) furanone (180) mono (2-ethylhexyl)ester hexanedioic acid (1,500) unknowns (98,420)
	(3 - 6')	(3 - 6')
	isocyano-methane (10) 2,3,4-trimethyl-hexane (300) 2,3,6-trimethyl-heptane (660) 5,5-dimethyl-2 (5h) furanone (200) (E)-9-octadecene (570) unknowns (2,470)	isocyano-methane (12) 2,3,6-trimethyl-heptane (780) 2,2'methylene-bis[6-(1,1-dimethyl)]-phenol (190) unknowns (89,317)

Table A-2 - Detected Non-Listed Organic Compounds

CONTAMINANT (ug/kg)	BORING NUMBER: EF-1	BORING NUMBER: EF-2 *
CONCENTRATION	(0 - 3') 3-methyl-pentane (13) diisoctyl 1,2-benzenedicarboxylic acid (840) unknowns (2030) (3 - 6') isocyano-methane (6) unknowns (920)	(0 - 3') 1,1-dimethyl-ethyl-hydroperoxide (34,000) 5-methyl-2-hexanone (1,700) 4-propyl-heptane (810) unknowns (940) (3 - 6') 5-methyl-2-hexanone (890) 4-methyl-octane (510) 4-(1-methyl-ethyl)-heptane (830) unknowns (32,780)

Table A-2 - Detected Non-Listed Organic Compounds Cont'd

CONTAMINANT (ug/kg)	BORING NUMBER: EF-3	BORING NUMBER: EF-4
CONCENTRATION	(0 - 3') acetaldehyde (11) isocyano-methane (8) 2,3,6-trimethyl-heptane (670) 5,5-dimethyl-2 (5h) furanone (180) unknowns (86,640) (3 - 6') acetaldehyde (10) isocyano-methane (11) 2,3,4-trimethyl-hexane (160) 2,3,6-trimethyl-heptane (400) unknowns (47,170)	(0 - 3') unknown (10) (3 - 6') isocyano-methane (8)

APPENDIX S

Selected Table from Industrial Waste Treatment Plant
Abandoned Waste Tanks IRP Response Action

TABLE 3 - DETECTED COMPOUNDS IN IWTP SAMPLES

CONTAMINANT	BORING NUMBER			
	IW - 1	IW - 2	IW - 3	IW - 4
	9 - 10'	9 - 10'	9 - 10'	9 - 10'
	silver (0 mg/kg) arsenic (0 mg/kg) barium (110 mg/kg) cadmium (0.8 mg/kg) chromium (890 mg/kg) mercury (0 mg/kg) lead (4.2 mg/kg) selenium (0 mg/kg) EP Toxicity (chromium 0.1 mg/l) methylene chloride (18 ug/kg) tetrahydro furan (9 ug/kg) Ph (7.16)	silver (0 mg/kg) arsenic (1.0 mg/kg) barium (93 mg/kg) cadmium (0.7 mg/kg) chromium (8.5 mg/kg) mercury (0 mg/kg) lead (7.1 mg/kg) selenium (0 mg/kg) methylene chloride (11 ug/kg) tetrahydro furan (8 ug/kg) Ph (7.94)	silver (0 mg/kg) arsenic (0 mg/kg) barium (140 mg/kg) cadmium (0 mg/kg) chromium (12 mg/kg) mercury (0 mg/kg) lead (10 mg/kg) selenium (0 mg/kg) tetrahydro furan (4 ug/kg) oil and grease (20 mg/kg) Ph (8.43)	silver (0.7 mg/kg) arsenic (0 mg/kg) barium (55 mg/kg) cadmium (0.7 mg/kg) chromium (16 mg/kg) mercury (0 mg/kg) lead (6.4 mg/kg) selenium (0 mg/kg) acetone (21 ug/kg) Ph (8.54)
	11 - 12'	11 - 12'	11 - 12'	11 - 12'
	silver (0 mg/kg) arsenic (1.6 mg/kg) barium (97 mg/kg) cadmium (0.6 mg/kg) chromium (420 mg/kg) mercury (0 mg/kg) lead (2.6 mg/kg) selenium (0 mg/kg) EP Toxicity (chromium 0.25 mg/l) methylene chloride (40 ug/kg) acetone (19 ug/kg) tetrahydro furan (8 ug/kg) Ph (8.07)	silver (0 mg/kg) arsenic (0 mg/kg) barium (150 mg/kg) cadmium (0.5 mg/kg) chromium (7.3 mg/kg) mercury (0 mg/kg) lead (5.5 mg/kg) selenium (0 mg/kg) methylene chloride (12 ug/kg) tetrahydro furan (9 ug/kg) Ph (7.08)	silver (0 mg/kg) arsenic (0 mg/kg) barium (38 mg/kg) cadmium (0 mg/kg) chromium (0 mg/kg) mercury (0 mg/kg) lead (3.9 mg/kg) selenium (0 mg/kg) tetrahydro furan (4 ug/kg) oil and grease (30 mg/kg) Ph (8.51)	silver (2.7 mg/kg) arsenic (0 mg/kg) barium (63 mg/kg) cadmium (2.0 mg/kg) chromium (30 mg/kg) mercury (0 mg/kg) lead (6.4 mg/kg) selenium (0 mg/kg) acetone (33 ug/kg) Ph (9.01)
	14 - 15'	14 - 15'	14 - 15'	14 - 15'
	silver (0 mg/kg) arsenic (1.6 mg/kg) barium (73 mg/kg) cadmium (0.8 mg/kg) chromium (46 mg/kg) mercury (0 mg/kg) lead (4.4 mg/kg) selenium (0 mg/kg) methylene chloride (21 ug/kg) tetrahydro furan (8 ug/kg) oil and grease (20 mg/kg) Ph (8.15)	silver (0 mg/kg) arsenic (0 mg/kg) barium (110 mg/kg) cadmium (0 mg/kg) chromium (8.0 mg/kg) mercury (0 mg/kg) lead (5.9 mg/kg) selenium (0 mg/kg) tetrahydro furan (7 ug/kg) Ph (7.00)	silver (0 mg/kg) arsenic (0 mg/kg) barium (40 mg/kg) cadmium (0 mg/kg) chromium (7.3 mg/kg) mercury (0 mg/kg) lead (4.6 mg/kg) selenium (0 mg/kg) tetrahydro furan (4 ug/kg) oil and grease (30 mg/kg) Ph (7.80)	silver (0 mg/kg) arsenic (0 mg/kg) barium (23 mg/kg) cadmium (0.7 mg/kg) chromium (11 mg/kg) mercury (0 mg/kg) lead (6.7 mg/kg) selenium (0 mg/kg) methylene chloride (10 ug/kg) Ph (8.66)

TABLE 3 - DETECTED COMPOUNDS IN IWTP SAMPLES (CONT'D)

CONTAMINANT	BORING NUMBER: IW - 5	IW6-1	IW6-2	IW6-3
	12 - 13'	12 - 13'	12 - 13'	12 - 13'
	silver (0 mg/kg) arsenic (1.2 mg/kg) barium (460 mg/kg) cadmium (0.5 mg/kg) chromium (11 mg/kg) mercury (0 mg/kg) lead (5.9 mg/kg) selenium (0 mg/kg) methylene chloride (11 ug/kg) oil and grease (80 mg/kg) phenols (2.0 mg/kg) Ph (8.77)	silver (0.7 mg/kg) arsenic (1.0 mg/kg) barium (140 mg/kg) cadmium (0 mg/kg) chromium (26 mg/kg) mercury (0 mg/kg) lead (8.1 mg/kg) selenium (0 mg/kg) trichloroethylene (280 ug/kg) tetrachloroethylene (560 ug/kg) toluene (19 ug/kg) chlorobenzene (9 ug/kg) ethylbenzene (13 ug/kg) total xylenes (50 ug/kg) oil and grease (720 mg/kg) Ph (8.60)	silver (0 mg/kg) arsenic (0 mg/kg) barium (110 mg/kg) cadmium (1.4 mg/kg) chromium (24 mg/kg) mercury (0 mg/kg) lead (3.9 mg/kg) selenium (0 mg/kg) Ph (7.82)	silver (47 mg/kg) arsenic (2.1 mg/kg) barium (340 mg/kg) cadmium (7.0 mg/kg) chromium (1,900 mg/kg) mercury (0 mg/kg) lead (11.0 mg/kg) selenium (0 mg/kg) EP Toxicity (silver 0.00 mg/l) EP Toxicity (chromium 0.12 mg/l) cyanide (3 mg/kg) methylene chloride (12 ug/kg) acetone (42 ug/kg) Ph (6.75)
	14 - 15'	14 - 15'	14 - 15'	14 - 15'
	silver (0 mg/kg) arsenic (0 mg/kg) barium (23 mg/kg) cadmium (0.7 mg/kg) chromium (0 mg/kg) mercury (0 mg/kg) lead (5.2 mg/kg) selenium (0 mg/kg) methylene chloride (9 ug/kg) oil and grease (70 mg/kg) Ph (8.79)	silver (0 mg/kg) arsenic (1.3 mg/kg) barium (50 mg/kg) cadmium (0 mg/kg) chromium (7.1 mg/kg) mercury (0 mg/kg) lead (3.5 mg/kg) selenium (0 mg/kg) trichloroethylene (48 ug/kg) tetrachloroethylene (62 ug/kg) chlorobenzene (7 ug/kg) oil and grease (240 mg/kg) Ph (8.70)	silver (4.1 mg/kg) arsenic (0 mg/kg) barium (47 mg/kg) cadmium (2.2 mg/kg) chromium (130 mg/kg) mercury (0 mg/kg) lead (1.6 mg/kg) selenium (0 mg/kg) tetrahydro furan (4 ug/kg) oil and grease (70 mg/kg) cyanide (8 mg/kg) Ph (8.66)	silver (0 mg/kg) arsenic (1.0 mg/kg) barium (54 mg/kg) cadmium (0 mg/kg) chromium (6.4 mg/kg) mercury (0 mg/kg) lead (6.0 mg/kg) selenium (0 mg/kg) methylene chloride (7 ug/kg) acetone (53 ug/kg) oil and grease (50 mg/kg) Ph (7.06)
	17 - 18'	17 - 18'	17 - 18'	17 - 18'
	silver (0 mg/kg) arsenic (1.3 mg/kg) barium (51 mg/kg) cadmium (0.5 mg/kg) chromium (7.8 mg/kg) mercury (0 mg/kg) lead (6.2 mg/kg) selenium (0 mg/kg) methylene chloride (9 ug/kg) oil and grease (30 mg/kg) Ph (8.77)	silver (0 mg/kg) arsenic (0 mg/kg) barium (27 mg/kg) cadmium (0 mg/kg) chromium (0 mg/kg) mercury (0 mg/kg) lead (2.6 mg/kg) selenium (0 mg/kg) oil and grease (84 mg/kg) Ph (8.85)	silver (1.9 mg/kg) arsenic (1.4 mg/kg) barium (81 mg/kg) cadmium (2.3 mg/kg) chromium (59 mg/kg) mercury (0 mg/kg) lead (3.8 mg/kg) selenium (0 mg/kg) tetrahydro furan (3 ug/kg) oil and grease (20 mg/kg) Ph (8.53)	silver (3.1 mg/kg) arsenic (1.2 mg/kg) barium (150 mg/kg) cadmium (4.1 mg/kg) chromium (120 mg/kg) mercury (0 mg/kg) lead (6.3 mg/kg) selenium (0 mg/kg) methylene chloride (10 ug/kg) acetone (26 ug/kg) oil and grease (90 mg/kg) Ph (9.16)