AP - 2

STAGE 1 & 2 REPORTS

DATE: Oct. 1999

WESTGATE SUBDIVISION
GRIMES BATTERY and TASKER ROAD

STAGE 2 ABATEMENT PLAN REPORT

October 1999

Shell Exploration and Production Company
Houston, Texas

Prepared By:

BBC International, Incorporated
ARCADIS Geraghty & Miller

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

1.0 INTRODUCTION

The subject site is located in west Hobbs, New Mexico. Assessment activities (Stage 1 Abatement activities) were conducted in Westgate Subdivision, consisting of developed and undeveloped property bordered by Tasker Road to the East, the Los Cuatro Land Development property to the West, Sanger Road to the South, and Princess Jean Drive to the North. Assessment activities also included undeveloped property extending approximately 400 feet west of Cobb Drive. Based on the results of the assessment activities, soil remediation activities (Stage 2 Abatement activities) will be performed in four areas. Each of the four areas are shown in Figure 1 and are described in Section 4.1, Tasks 1-5. The identified areas are a small fraction of the Westgate Subdivision area. Groundwater remediation activities (Tasks 6 and 7) are described in Section 4.2

The Grimes lease is an oil production property that has been in operation since the late 1920's. It consists of producing and injection wells, tank batteries, and associated flowlines. Oil and saltwater were produced from the wells on this lease and transported by flowlines to the Grimes battery. Prior to decommissioning of the Grimes battery in 1993, produced oil from the battery was transported south in a pipeline owned by Shell pipeline (currently known as Equilon Pipeline). The pipeline terminates at the former battery location.

2.0 SUMMARY OF STAGE 1 ABATEMENT ACTIVITIES

Stage 1 Abatement activities as approved by New Mexico Oil Conservation Division (NMOCD) were conducted during the period of July 27, 1998 through October 7, 1998 and January 25, 1999 through May 21, 1999.

The work involved soil vapor surveys with mobile laboratory analysis, drilling soil borings, installation of monitor wells, free product removal from monitor wells, near surface soil sampling, and assessment/remediation of soils. All field activities were performed in accordance with the Stage 1 Abatement Plan (Site Assessment Investigation) as modified and approved by NMOCD.

Work conducted during the period of July 27, 1998 through October 7, 1998 involved a soil vapor survey, drilling soil borings, and installation of monitor wells. The soil vapor survey consisted of two hundred and sixty-eight sample locations spaced at approximately 100 foot intervals. A total of twenty-four soil borings were drilled. Thirteen monitor wells were installed and sampled. Soil and groundwater samples were submitted for laboratory analysis. A detailed description of site activities and results for

this period can be found in the report submitted to NMOCD on November 6, 1998 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report)*.

Work conducted during the period of January 25, 1999 through May 17, 1999 consisted of soil vapor surveys (103 sample locations), drilling and sampling of 13 soil borings, installation of three monitor wells, sampling of sixteen monitor wells, free product removal from one monitor well, assessment/remediation of soils and near-surface soil sampling. Soil and groundwater samples were submitted for laboratory analysis. A detailed description of site activities and results for this period, and discussion of data included in both reports can be found in the report submitted to NMOCD on July 1, 1999 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Report (Site Assessment Report)*.

NMOCD approved the Stage 1 site investigation report on August 13, 1999.

3.0 RISK-BASED CORRECTIVE ACTION (RBCA) EVALUATION

Results of the RBCA performed by Shell for this site are included in Appendix I. Based on the results of the RBCA (Appendix I, Worksheet 5.2, pages 4.5 to 4.8), the clean up criteria for total petroleum hydrocarbons (TPH) in residential near-surface soils is 2,600 milligrams per kilogram (mg/kg). RBCA clean up criteria for TPH in non-residential near-surface soils is 26,000 mg/kg. We propose to apply near surface soil TPH criteria within the upper 8 feet of soil, which is also the practical excavation depth. This would be over-protective of current site use, as well as for future use. In exposure estimates, the top 2 centimeters is usually considered surface soils by the USEPA (1996, p.84 section 4.14) while surface soil is considered to be the top 1 meter in ASTM E 1739-95 and ASTM PS 104-98.

No benzene, toluene, ethylbenzene or xylenes (BTEX) was detected in soil samples above the RBCA criteria. RBCA clean up criteria for BTEX (Appendix I, Worksheet 5.2, pages 5.4 to 5.6) in residential near-surface soils is:

- Benzene 3.8 mg/kg
- Toluene 8,100 mg/kg
- Ethylbenzene 5,600 mg/kg
- Xylenes 95,000 mg/kg

For both polycyclic aromatic hydrocarbons (PAHs) and BTEX, (Appendix I, Worksheet 5.2, pages 5.4 to 5.6) in every case where an individual RBCA soil criteria is exceeded, the RBCA 2,600 mg/kg TPH residential soil criteria indicates that the co-located TPH sample is also exceeded. The RBCA TPH criteria would therefore be a conservative indicator for other petroleum-associated chemicals in soils. Based on co-located TPH, PAH, and BTEX analysis, the 2,600 mg/kg TPH criteria would also be protective for surficial soil human-health criteria for PAH and individual BTEX chemicals. Similarly, based on results for co-located samples, the 2,600 mg/kg TPH criteria would also conservatively meet the OCD Guidance value of 50 mg/kg for total BTEX. All metals concentrations detected at the site are below RBCA or USGS background concentrations for western soils. All metals with exception of arsenic and chromium were detected at concentrations below RBCA criteria (Appendix I, Worksheet 5.2, pages 3.4 to 3.6). The arithmetic average values for the site however are within the normal range of soil background concentrations. Further, for chromium the average is met for the USEPA Region 6 screening criteria. The RBCA value uses more conservative (and somewhat less realistic) assumptions for the valance state of the chromium.

4.0 STAGE 2 ABATEMENT PLAN PROPOSAL

After review of various remedial options, Shell proposes the following Stage 2 Abatement Plan. The plan addresses soil and groundwater, and is presented by Task.

4.1 SOIL REMEDIATION

4.1.1 Task 1 - North of Grimes Battery

Task 1A - North Excavation Site

Assessment/remediation activities performed north of the Grimes Battery are described in Tasks 2 and 4 of the report submitted to NMOCD on July 1, 1999 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Report (Site Assessment Report)*. Confirmation samples collected following excavation of soils (Figure 1) did not exhibit concentrations in excess of NMOCD *Guidelines for Remediation of Leaks, Spills, and Release* or Risk Based Standards. BTEX was not detected in the samples. TPH was not detected in samples GBN-5 and GBN-7, and was detected at a concentration of 87.8 mg/kg in sample GBN-6. The excavated area has been remediated to below the NMOCD TPH standard of 1,000 mg/kg and RBCA non-residential TPH standard of 26,000 mg/kg and will be backfilled native soils to surrounding grade and seeded with native vegetation.

Task 1B - Excavation of Remaining Stained Soils

No benzene was detected north of the Grimes Battery at a concentration above the NMOCD standard of 10 mg/kg or RBCA standard. No BTEX was detected above the NMOCD standard of 50 mg/kg or RBCA standards. Only one sample, CSS-6, exceeds the RBCA TPH standard of 2,600 mg/kg for residential soils.

Stage 2 abatement activities to be performed in this Task consist of the excavation of soils where remaining staining and/or PID readings are observed to a depth of approximately 0-1 foot below ground surface. The anticipated extent of excavation based on assessment activities (laboratory analysis, photoionization detector readings and visual observation) is shown in Figure 1. A portion of the back fence at the residence at 1341 Cobb will be removed, and the storage building and concrete slab will be removed and disposed at the municipal landfill. Soils will be excavated to a depth of approximately 1-foot and will be disposed of at an NMOCD approved disposal facility. Soil excavation will continue until no visible staining of soils and/or no PID readings are observed. A five-point composite confirmation sample will be collected from the center of the floor and from the middle of the north, south, east, and west limits of the excavation. The sample will be analyzed for TPH, BTEX and New Mexico Water Quality Control Commission (WQCC) metals using USEPA Methods 418.1, 8260B, and 6010B, respectively. When concentrations are confirmed to be below RBCA standards, the excavations will be backfilled with native soils. Areas currently covered with grass will be re-seeded with comparable grass. The site will be watered and monitored for dust control during site activities.

4.1.2 Task 2 – Grimes Battery

Prior soil assessment activities performed at the former Grimes Battery site are described in the report submitted to NMOCD on November 6, 1998 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report)*. Hydrocarbon impacted soils were excavated at the site by the current lease operator, Altura Energy LTD, to a depth of approximately 15-25 feet bgs. These soils were excavated prior to assessment activities and before the RBCA evaluation was performed. Water, nutrients, and naturally occurring hydrocarbon-degrading microorganisms will be applied to the soils in the excavated pit prior to backfilling the excavations to promote biodegradation of hydrocarbons.

Approximately one foot of the caliche layer inside the fenced area will be scraped into the excavations. Additional clean caliche will be delivered and placed into the pit to a depth of approximately one-foot below ground surface. The site will then be backfilled

with native topsoil to surrounding grade and seeded with native vegetation. The site will be watered and monitored for dust control during site activities.

4.1.3 Task 3 - South of Grimes Battery

Assessment- remediation activities performed south of the Grimes Battery are described in Task 3 of the report submitted to NMOCD on July 1, 1999 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Report (Site Assessment Report)*. Confirmation samples collected following excavation of soils (Figure 1) did not exhibit concentrations in excess of NMOCD *Guidelines for Remediation of Leaks, Spills, and Release* or Risk Based Standards. No benzene or BTEX was detected in any of the samples. TPH was not detected in sample GBS-6. TPH was detected at a concentration below the NMOCD standard of 1,000 mg/kg and the RBCA non-residential standard of 26,000 mg/kg at a concentration of 730 mg/kg in sample GBS-4 and 419 mg/kg in sample GBS-5.

The excavated area has been remediated to below the NMOCD TPH standard of 1,000 mg/kg, and the RBCA standard of 26,000 mg/kg, and will be backfilled with native soils to surrounding grade and seeded with native vegetation. The site will be watered and monitored for dust control during site activities.

4.1.4 Task 4 - West of Tasker Road

Assessment activities performed west of Tasker Road are described in the report submitted to NMOCD on November 6, 1998 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report,* and the report submitted to NMOCD on November 6, 1998 (Task 12) entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report)*.

No benzene was detected at concentrations above NMOCD standard of 10 mg/kg or RBCA standard. BTEX was detected in two samples (TSB-7 and TMW-1) at concentrations above the NMOCD standard of 50 mg/kg. BTEX was not detected above the RBCA standard. TPH was detected above the RBCA residential standard of 2,600 mg/kg in this area.

The selected remedial option at this location will be excavation of soils and biodegradation of any remaining hydrocarbons. Initially, Shell will perform a pilot excavation in a portion of the old pit to identify the uniformity of the hydrocarbon layer and to monitor the site for odors and dust associated with excavation activities. If odors are detected during pilot excavation activities, odor-neutralizing agents will be applied and tested for effectiveness in controlling odors. The pilot excavation will be used to

identify the most efficient excavation, odor and dust control methods, and to determine proper air monitoring protocols and contingency plans. Based on pilot excavation results, Shell will design and submit to the NMOCD, for their approval, an excavation and odor and dust control program.

The unoccupied residence, driveway, sidewalks and foundation at 1331 Tasker will be removed and disposed at the municipal landfill. In order to provide a solid retaining and support wall for the street during excavation activities, a trench will be excavated along the western curb of Tasker Road. A steel rebar frame will be installed in the trench and filled with concrete to a depth approximately 2 feet below ground surface. Excavated soils will be disposed at an NMOCD approved disposal facility. The site will be watered and monitored for dust control.

The anticipated extent of excavation (approximately 140 feet by 75 feet) is based on assessment activities (laboratory analysis, photoionization detector readings and visual observation) and is shown in Figure 1. Soil excavation will continue until no visible staining of soils and/or no PID readings are observed. Soils will be excavated to a maximum depth of eight feet, which is the practical excavation depth. This would be protective of current site use, as well as for future use. A five-point composite confirmation sample will be collected from the center of the floor and from the middle of the north, south, east, and west limits of the excavation. The sample will be analyzed for TPH, BTEX and New Mexico Water Quality Control Commission (WQCC) metals using USEPA Methods 418.1, 8260B, and 6010B, respectively. When concentrations are confirmed to be below residential RBCA standards or the practical excavation (and protective of site use) depth of eight feet, the excavations will be backfilled. The excavation will be backfilled with caliche to a depth two feet below ground surface, and two feet of topsoil will be placed above the caliche. Following placement of the topsoil the area will be seeded with native vegetation.

If TPH and BTEX concentrations at the bottom of the excavation are in excess of the RBCA standards, prior to backfilling of the excavation, the excavation will be treated with water, naturally occurring hydrocarbon degrading microorganisms and nutrients to promote biodegradation. Additionally, if TPH and BTEX concentrations are above RBCA standards, 4-inch sleeved slotted PVC piping will be installed in the excavation. The installation of the piping will be designed for use in vapor monitoring.

Monitor wells TMW–1 and TMW-3 will be replaced if the excavation activities result in removal of these monitor wells.

4.1.5 Task 5 - East of Tasker Road

Assessment activities performed west of Tasker Road are described in the report submitted to NMOCD on November 6, 1998 entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report,* and the report submitted to NMOCD on November 6, 1998 (Tasks 5 and 15) entitled *Westgate Subdivision, Grimes Battery, and Tasker Road Stage I Abatement Plan Interim Report (Site Assessment Report)*.

No benzene or BTEX was detected at concentrations above NMOCD or RBCA standards. TPH was detected above the residential RBCA standard of 2,600 mg/kg. The selected remedial option at this location will be excavation of soils and biodegradation of hydrocarbons.

The selected remedial option at this location will be excavation of soils and biodegradation of hydrocarbons. Initially, Shell will perform a pilot excavation in a portion of the old pit to identify the uniformity of the hydrocarbon layer and to monitor the site for odors and dust associated with excavation activities. If odors are detected during pilot excavation activities, odor-neutralizing agents will be applied and tested for effectiveness in controlling odors. The pilot excavation will be used to identify the most efficient excavation, odor and dust control methods, and to determine proper air monitoring protocols and contingency plans. Based on pilot excavation results, Shell will design and submit to the NMOCD, for their approval, an excavation and odor and dust control program.

The residences, driveways, sidewalks and foundations at 1326, 1328, and 1330 Tasker Road will be removed and disposed at the municipal landfill. In order provide a solid retaining and support wall for the street during excavation activities, a trench will be excavated along the eastern curb of Tasker Road. A steel rebar frame will be installed in the trench and filled with concrete to a depth approximately 2 feet below ground surface. Excavated soils will be disposed at an NMOCD approved disposal facility. The site will be watered and monitored for dust control.

The anticipated extent of excavation (approximately100 feet by 60 feet) is based on assessment activities (laboratory analysis, photoionization detector readings and visual observation) and is shown in Figure 1. Soil excavation will continue until no visible staining of soils and/or no PID readings are observed. Soils will be excavated to a maximum depth of eight feet. This would be protective of current site use, as well as for future use and practical excavation depth. A five-point composite confirmation sample will be collected from the center of the floor and from the middle of the north, south, east, and west limits of the excavation. The sample will be analyzed for TPH, BTEX and New

Mexico Water Quality Control Commission (WQCC) metals using USEPA Methods 418.1, 8260B, and 6010B, respectively. When concentrations are confirmed to be below residential RBCA standards or the practical excavation and (protective of site use) depth of eight feet, the excavations will be backfilled. The excavation will be backfilled with caliche to a depth two feet below ground surface, and two feet of topsoil will be placed above the caliche. Following placement of the topsoil the area will be seeded with native grasses.

If TPH and BTEX concentrations at the bottom of the excavation are in excess of the RBCA standards, prior to backfilling of the excavation, the excavation will be treated with water, naturally occurring microorganisms and nutrients to promote biodegradation.

Additionally, if TPH and BTEX concentrations are above RBCA standards, 4-inch sleeved slotted PVC piping will be installed in the excavation. The installation of the piping will be designed for use in vapor monitoring.

Monitor well TMW–4 will be replaced if the excavation activities result in removal of this monitor well.

Performance of the activities described in Task 5 are based on gaining access to these properties. Shell currently does not have access to these properties.

4.2 GROUNDWATER REMEDIATION

4.2.1 Task 6 - Recovery of Free Product

Downhole passive hydrocarbon skimmers have been installed in monitor wells GMW-1, GMW-3B and GMW-5, and a passive absorbing skimmer was installed in monitor well GMW-9. Free product will be removed weekly or twice weekly from each monitor well. Product level, groundwater level, product thickness, and recovered fluid volumes will be recorded weekly and submitted to NMOCD annually on April 1 (in table form). All recovered fluids will be recycled at an NMOCD approved facility.

4.2.2 Task 7 - Sampling of Monitor Wells

All monitor wells will be sampled quarterly for four quarters. Groundwater samples will be analyzed for BTEX using USEPA Method 8260-B for each of four quarters and PAHs annually using USEPA Method 8270-C. Based on sample results for one year (four quarters), sampling frequency will be reviewed and may be revised.

Sampling will be discontinued when 8 quarters of sample results indicate analytes concentrations are below New Mexico Water Quality Control Commission, Title 20, Chapter 6, part 2 (20 NMAC 6.2 Standards). If no 20 NMAC 6.2 standard is available for a detected analyte, USEPA standards will be used.

Sample results will be submitted to NMOCD annually on April 1. All recovered fluids will be recycled at an NMOCD approved facility.

5.0 STAGE 1 ABATEMENT ACTIVITIES NOT REQUIRING STAGE 2 ABATEMENT

Some Stage 1 assessment activities requested by NMOCD conducted during the period of January 25, 1999 through May 17, 1999 resulted in the confirmation that Stage 2 remediation activities are not required at some locations. Assessment activities are described in the report submitted to NMOCD on July 1, 1999 entitled *Westgate Subdivision, Grimes Battery and Tasker Road Stage 1 Abatement Plan Report (Site Assessment Report)*. The following discussion of the subject areas is referred to by Stage 1 Task number.

5.1 STAGE 1 TASK 6 - SOUTHWEST AREA OF SUBJECT PROPERTY

In Shell's letter dated January 14, 1999 and approved by NMOCD January 22, 1999, Shell proposed drilling and sampling one borehole in the area between soil vapor points SV-24 and SV-239. Based on research that two pipelines (Rice Operating and Equilon) are present in the area, NMOCD agreed that these pipelines are not within the scope of work of the subject Stage 1 Abatement Plan. No further action is required at this site.

5.2 STAGE 1 TASK 7 - SOUTHEAST AREA OF SUBJECT PROPERTY

Soil vapor activities were conducted February 1999 near soil vapor survey sample SV-111 which exhibited a TPH concentration of 9 parts per million (PPM) by the prior (July and August, 1998) soil vapor analysis. TPH was not detected in the additional vapor samples. No further action is required at this site.

5.3 STAGE 1 TASK 8 - COBB DRIVE

Soil vapor activities were conducted February 1999 near soil vapor survey sample SV-164 that exhibited a TPH concentration of 37 PPM by the prior (July and August, 1998) soil vapor analysis. TPH was not detected in the additional soil vapor samples. A soil boring was also drilled at this location (GSB-18), and a soil sample was submitted for

laboratory analysis for TPH and BTEX. TPH and BTEX were not detected in the soil sample. No further action is required at this site.

5.4 STAGE 1 TASK 9 - COBB DRIVE

Soil vapor activities were conducted February 1999 near soil vapor survey sample SV-182 that exhibited a TPH concentration of 30 PPM by the prior (July and August, 1998) soil vapor analysis. TPH was not detected in the additional soil vapor samples. No further action is required at this site.

5.5 STAGE 1 TASK 10 - EAST OF TASKER ROAD

Soil vapor activities were conducted near soil vapor survey sample SV-187 that exhibited a TPH concentration of 7 PPM by the prior (July and August, 1998) soil vapor analysis. TPH was not detected in the additional soil vapor samples. No further action is required at this site.

5.6 ZIA NATURAL GAS LINE LEAK

A TPH concentration of 40 PPM was detected in soil vapor sample SV-158 during soil vapor activities conducted during the period of July and August 1998. This was the site of a Zia Natural Gas utility line leak. Zia Natural gas was contacted and a representative arrived at the site and repaired the leak. NMOCD agreed that no further assessment or remediation activities were required by Shell at this site.

6.0 AIR MONITORING, SAFETY, and HEALTH ACTION PLAN

Procedures:

1.) Air monitoring devices such as a ToxiRAE PGM-30D photo ionization detector (PID) will be on site at all times to monitor for fugitive volatile organic compounds (VOC's).

2.) The volatile organic compounds monitored are listed in the ToxiRAE literature located in Appendix II. The standard permissible exposure limits (PELs) action levels are:

Time-weighted average limit (TWA):	10 ppm
Short-term exposure limit (STEL):	25 ppm
Low:	50 ppm
High:	100 ppm

3.) The air monitors will be on at all times during excavation activities and will be placed in and near excavation site perimeters. Additionally, the site area perimeters will be walked periodically with hand-held monitoring equipment.

4.) The readings will be instantaneous and all readings will be data-logged at an interval of every 60 seconds. All data-logging information will be down loaded to a PC after completion of site activities. Print outs will be generated and kept on file.

5.) All personnel involved in the excavation activities will be wearing personal monitoring devices or badges. All data from analysis of personal devices will be kept on file.

6.) Corrective Action: In the event fugitive emissions exceed limits continuously, all site excavation activities will be suspended, the emission source covered, the NMOCD notified, and any residents potentially affected will be notified. A review of activities will then be conducted and amended accordingly.

7.) Project Manager (s): Cliff P. Brunson/Joe Frank Dean, BBC International, Inc.

8.) Site phone number (s): (505) 390-6102/(505) 390-6103

9.) Emergency Phone Numbers: 397-6388 (24 hrs.) - BBC International, Inc.
911- (Police, Fire, Ambulance)
392-5571 - Dr. Hood (company Doctor)
392-9212 - Columbia Lea Regional Medical Center

10.) Safety Coordinator – Bob Sonnamaker - 393-6169

11.) H_2S monitors will be worn by all personnel while on location at all times.

12.) A minimum of one three (3) gas monitor will be on location at all times for LELs.

13.) A first aid kit will be on location at all times.

14.) All first aid injuries or needs will be reported to the Site Project Manager first, then further action will be taken, if necessary.

15.) All personnel will have personal protection equipment (PPE). As a minimum, hard hats, steel toe safety shoes, gloves, and safety glasses.

16.) Perform daily tailgate safety meeting prior to start of any activities. A safety meeting document will be signed by all attendees with social security numbers and kept on file.

7.0 PUBLIC NOTIFICATION

Written notification of submittal of the Stage 2 plan and site activities will be sent to all surface owners of record within a one-mile radius of the site. NMOCD will be supplied with a list of additional parties. Publication of notice of activities will be published in a state wide circulated newspaper, The Albuquerque Journal and two county newspapers, the Hobbs-Daily News Sun and the Lovington Leader.

8.0 TASK WORK SCHEDULE

Soil remediation activities are expected to be completed in 185 working days (Monday through Friday). A break down of estimated time to complete each task is as follows:

Task 1 North of Grimes Battery	24 days
Task 2 Grimes Battery	14 days
Task 3 South of Grimes Battery	9 days
Task 4 West of Tasker Road	70 days
Task 5 East of Tasker Road	68 days

Groundwater remediation will be ongoing. An estimated completion date for groundwater remediation is not available.

9.0 REFERENCES

Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States; US Geological Survey Professional Paper 1270; 1984

Environmental Inorganic Chemistry Properties, Processes, and Estimation Methods; Edited by Bodek, Lyman, Reehl, Rosenblatt; Pergamon Press

Grimes Battery Soil and Groundwater Assessment Report; Philip Services Corporation; February 1998

Groundwater Handbook; United States Environmental Protection Agency, Office of Research and Development, Center for Environmental Research Information; 1992

Hydrology and Hydrochemistry of the Ogallala Aquifer, Southern High Plains, Texas Panhandle and Eastern New Mexico; Report Number 177; Bureau of Economic Geology; 1988

Hydrogeochemistry and Water Resources of the Lower Dockum Group in the Texas Panhandle and Eastern New Mexico; Report Number 161: Bureau of Economic Geology; 1986

New Mexico Water Quality Control Commission, Title 20 Chapter 6, Part 2, Subpart I

New Mexico State Engineer, Santa Fe, New Mexico; Technical Report 29A, Municipal Water Supplies and Uses, Southeastern New Mexico; 1963

Tasker Road Site Assessment Report; Philip Services Corporation; February 1998
USEPA Soil Screening Guidance, Multimedia Planning and Permitting Division, Region 6 Human Health Medium-Specific Screening Levels; Federal Register, Volume 61, Number 106; May 31, 1996

USEPA Background Document for Chapter V Rationale for Maximum Soil Concentration Levels; USEPA, Toxic Integration Branch, EPA Remedial Response Hazardous Site Evaluation Division; January 1992

USEPA, Region III Risk-Based Concentration (RBC) Table

Westgate Subdivision, Grimes Battery and Tasker Road Stage 1 Abatement Plan (Site Assessment Investigation); Philip Services Corporation; May 1998

Westgate Subdivision, Grimes Battery, and Tasker Road Stage 1 Abatement Plan Interim Report (Site Assessment Investigation); Philip Services Corporation, BBC International, Incorporated; November 1998

Westgate Subdivision, Grimes Battery and Tasker Road Stage 1 Abatement Plan Report (Site Assessment Investigation), BBC International Incorporated, ARCADIS Geraghty and Miller; July 1999

Appendix I

Risk-Based Corrective Action Summary Report

RISK-BASED CORRECTIVE ACTION

SUMMARY REPORT

Tier 1 Assessment Report

Westgate Subdivision, Grimes
Battery & Tasker Road
Site name

Hobbs, New Mexico
Location

George Devaull & Wayne Hamilton
prepared by

October 6, 1999
date issued

reviewed by

Date

RISK BASED CORRECTIVE ACTION

Tier 1 Summary Report
TABLE OF CONTENTS

TIER 1 RBCA EXECUTIVE SUMMARY DISCUSSION 1.1

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	10/6/99	G. E. DeVaull	10/6/99	

EXECUTIVE SUMMARY

1. Site Description and History

Briefly discuss site chronology, operations, features of potential concern, future plans for site use.

The area under investigation is located in west Hobbs, NM. The total area includes the Westgate Subdivision and undeveloped land to the west of the Westgate Subdivision. The identified areas of potential concern fall within this total area but are a small fraction of the total area.

Within the total area, the Westgate Subdivision consists of residential developed property and undeveloped property bordered by Tasker Road to the east, the Los Cuatro Land Development property to the west, Sanger Road to the south, and Princess Jeanne Drive to the north. The site also includes the undeveloped property extending approximately 400 ft west of Cobb Drive. The Grimes site is a former tank battery location that was decommissioned in 1993. The Tasker site consists of two residential properties, one currently unoccupied and one undeveloped.

The Grimes lease is an oil production property that has been in operation since the late 1920's. It consists of producing wells, tank batteries, and associated flowlines. Two oil production wells on the site were drilled in the 1940's and plugged and abandoned in 1953. According to reports on file with NMOCD, the wells were plugged according to NMOCD regulations. Oil and saltwater produced from the Grimes lease was transported by flowlines to the Grimes Battery until it was decommissioned in 1993. While in operation, produced oil was transported from the battery south in a pipeline owned by Shell Pipeline. While in operation, the pipeline terminated at the battery. The number of flowlines from production wells to the battery which were in place during operation of the battery is unknown.

The purpose of this report is to assess the extent, concentration, and exposure risk of chemicals, particularly petroleum and other oilfield-related chemicals, potentially present in the surface soils, subsurface soils, and groundwater within the bounds of the site. Results of this assessment are intended to estimate the extent of remediation which may be needed to meet conservative risk-based criteria. This assessment is not an epidemiological evaluation, a toxicological evaluation, or an evaluation of any actual, current or future exposure at the site, but is an estimate of criteria which would, very conservatively, meet a number of risk-based objectives.

2. Geologic and Hydrogeologic Summary

Briefly describe regional site features, climate, vadose soils, groundwater depth, quality, and use.

The site is located in an area of generally flat topography. The nearest surface water (identified from the topographic USGS quadrangle map for Hobbs West, N. Mex.) is a pond, approximately 0.5 acre in area, 0.4 miles from the site. There is no direct pathway for rainwater runoff from the site to this surface water. The site is in a semi-arid region with annual rainfall in the range of 12 to 15 inches per year.

Unsaturated zone stratigraphy at the site, from below any surface fill to groundwater at 65 ft, consists of intermixed layers of fine-grain silty sand, buff limestone (hard), fine-grain silty sand with chert, and fine-grain sand with sandstone intermixed.

The Ogallala Formation is the principal source of groundwater in the immediate area. Depth to groundwater in Lea County ranges from 12 to 300 feet below ground surface. Within the bounds of the site, depth to groundwater is approximately 65 feet. The Ogallala consists of predominately coarse fluvial conglomerate, sandstone, fine grained eolian sandstone, and clay. Where present in the area, the Ogallala unconformably overlies Triassic red-beds. The regional groundwater gradient at the site is to the east.

3. Potential Exposure Pathways

Discuss completed and potentially completed pathways for soil and groundwater.

The potential sources in the area of concern are based on previous site use. The chemicals of potential interest are those likely originating from historical oil field operations, primarily crude oil and its chemical components, and produced water, including salts. Relevant indicator compounds for crude oil potentially include benzene, ethyl benzene, toluene, xylenes (BTEX), and polycyclic aromatic hydrocarbons (PAHs). Other individual chemicals have also been included in the sample analysis, in accordance with 20 NMAC 6.2 3103 and 1101. The complete chemical analyte list is included in the site report [Westgate Subdivision, Grimes Battery and Tasker Road – Stage 1 Abatement Plan Report (Site Assessment Investigation), July 1999, Shell Exploration and Production Company, Houston, TX; prepared by BBC International, Inc., and ARCADIS Geraghty & Miller].

The site currently includes residential development, with future site use options for undeveloped areas of the site either as residential or restricted use (as a park or paved streets). Relevant exposure pathways for evaluating potential human exposure, as shown in Worksheet 1.3 (page 1.11), for this site include:

1) Potential exposure to surficial soils, including combined soil ingestion, dermal contact, dust inhalation, and inhalation of volatile chemicals, for residential receptors. The top 2 centimeters is usually considered surface soil by USEPA (1996, p.84, section 4.14), while surface soil is taken as the top 1 meter of soil in ASTM E 1739-95 and ASTM PS 104-98.

2) Potential exposure to volatile emissions from subsurface soils, through inhalation, for residential receptors.

3) Potential ingestion of groundwater. A water well survey has been completed, based on information on file in the State Engineer's office for the site vicinity (Sharon Hall, 20 April 1999), that is, Section 28, Township 18 South, Range 38 East, N.M.P.M., Lea County, New Mexico. This was tabulated as wells per quarter section. No downgradient water wells (east of the site) are recorded within one-half mile of the site.Residents in the immediate area are supplied by municipal water. However, use of well water for drinking water use is not known to be precluded (by ordinance or restriction) in the immediate area.

4) Potential mobility of non-aqueous phase liquids (crude oil) in unsaturated soils. As in (3) the potential concern is with groundwater, but in terms of bulk migration of crude oil to ground water.

In addition, agricultural parameters (soil total dissolved solids - TDS and soil pH) are evaluated based on ranges of agricultural parameters. This is intended to determine if potential effects on vegetation (5) may occur.

Each of the above exposure scenarios is evaluated separately; results from each individual exposure pathway scenario are not summed. That is, the resident who may be exposed in (1) to surface soils is a different individual than the receptor who might be exposed in (3) to drinking water. The long-term residential receptor for scenario (2) is a subset of scenario (1) for the case where there is no direct contact with surficial soils. These relevant exposure routes and pathways have been addressed in this assessment using risk assessment methodology consistent with USEPA Risk Assessment Guidance (USEPA, 1996; USEPA, 1991), with ASTM Standards E 1739-95 and PS104-98, and with 20 NMAC 6.2.

The risk-based assessment in this evaluation includes two parts. The first is an evaluation of detected individual indicator chemicals. These are handled with conventional risk assessment methodology, using conservative risk-based screening level (RBSL) concentrations. The second is an evaluation of the crude oil. Crude oil is a mixture of many thousands of petroleum hydrocarbon chemical constituents; evaluating each individual chemical using conventional risk assessment methods is impracticable. In this analysis we have used methodology developed by the Total Petroleum Hydrocarbon Working Group, for risk-based assessment of "Total Petroleum Hydrocarbon", or TPH (Weisman, 1998), to derive representative site-specific RBSL values for crude oil.

Individual indicator chemicals

The equations and parameters used in estimating the potential human health risk in this assessment are consistent with USEPA guidance. Generally, risk or hazard can be estimated as the product of concentration and toxicity:

$$\text{Risk} = \text{Concentration} \cdot \text{Toxicity}$$

For individual constituents, the estimate can be inverted -- a target risk (or hazard) is specified, and an acceptable concentration in the media of interest is estimated:

$$\text{Concentration} = \text{Risk} / \text{Toxicity}$$

We have followed this convention, which is consistent with ASTM Standard E 1739-95, *Risk-Based Corrective Action Applied at Petroleum Release Sites*, in defining concentration levels, or Risk-Based Screening Levels (RBSLs) which meet the desired risk or hazard targets for individual chemical constituents. Site concentrations in soil which are at or below this risk-based screening level concentration will meet the desired target risk.

A tiered assessment process is introduced in ASTM E 1739-95. This tiered approach is used in the present assessment. The first step, or tier, is in development of RBSLs applicable for all project areas using conservative, generic parameters and site assumptions. A refinement of the assessment, in calculating site-specific screening levels using site-specific information, is applied, if needed, only to that portion of the measured concentration data which exceeds the generic RBSLs. This 'tiered' assessment expedites and simplifies the risk assessment process, with no loss in conservatism nor a loss in comprehensiveness.

All screening levels for individual chemicals used in this assessment are defined at the lower limit of the 10^{-4} to 10^{-6} acceptable risk range for carcinogens, or at a generic conservative risk level of 10^{-6}. For non-carcinogens, a hazard quotient of unity (HQ = 1) is specified. The screening level concentrations shown in Worksheets 5.1 to 5.4 (pages 3.1 to 7.4, 9.1 to 10.2) for the relevant exposure pathways and each chemical are the lowest calculated values for either the relevant carcinogenic or non-carcinogenic criteria.

Descriptions and references for selected exposure factors, transport parameters, toxicity, and models, is presented in Attachment 1. This table is complete and up-to-date with respect to the current (15 March 1999) toxicological parameters available from the USEPA IRIS and HEAST databases. The assumptions used in the models are generally conservative. Conservative upper-bound exposure parameters are defined for a Reasonable Maximum Exposure (RME). Transport assumptions used for the applicable exposure pathways are as follows:

1) Potential exposure to surficial soils due to combined soil ingestion, dermal contact, dust inhalation, and inhalation of volatiles, for a residential receptor. For soil ingestion, dermal contact, and dust inhalation, soil concentrations are assumed to remain at their original levels over the entire 25 year exposure period. For volatilization, soil concentrations are assumed to start at their initial concentration level, with a reduction in emissions over time as the volatile chemicals are depleted in the surface soil layer through the volatilization process. For this exposure pathway, the potential exposures due to soil ingestion, dermal contact, dust inhalation, and vapor inhalation are summed to determine an overall acceptable concentration level. The exposure area is presumed to be 0.5 acre, or approximately the size of a residential lot. A relevant screening procedure would be to compare average concentrations over 0.5 acre area blocks to the RBSL values. We conservatively make comparisons of every measurement to the screening value and use averages in only the few instances when point samples exceed the screening level.

2) Potential exposure to volatile emissions from subsurface soils, through inhalation, for a residential receptor. The exposure duration for this scenario is assumed to be 25 years. The chemical is assumed to remain constant at its initial concentration

over the exposure duration (an infinite source), with diffusion to the breathing zone through a one-meter layer of soil. Potential exposure for both indoor and outdoor air are included. This pathway is also used in evaluation of soil gas measurement results.

3) Potential direct ingestion of ground water. Measured groundwater concentrations are directly compared to water ingestion criteria. No additional dilution or attenuation for a spatially separated source area and ground water well have been included in the initial comparison.

Conservative assumptions are used in defining the exposure pathways described above. Discussion of this conservatism is included in this summary, in Section 5, Qualitative Uncertainty Description.

As an additional step we have included comparison to exposure-pathway-specific screening values from USEPA Region 6. While these values are not always identical to the derived RBSL for the same chemical, they are often very close, and their basis for development is very similar.

Petroleum hydrocarbon mixtures

Risk-based assessment of petroleum hydrocarbon mixtures in soil at this site are included in the present evaluation, consistent with methodology discussed by Weisman (1998). In this evaluation, a number of soil samples were analyzed for TPH (total petroleum hydrocarbons) by extracting and separating the oil into an aliphatic fraction and an aromatic fraction, then analyzing each fraction using gas chromatography / flame ionization detection (GC/FID) in a simulated distillation analysis (TX1006 - TraceAnalysis Inc.; Feb 23, 1999). This analysis yields a fractional distribution of the petroleum as a function of boiling point, molecular weight, or carbon number for each of the aliphatic and aromatic fractions. The result, for each TPH analysis, is a total of 6 aliphatic and 7 aromatic petroleum fractions, and a 14th heavy residual fraction. These results are shown in Worksheets 4.4 and 4.5 (pages 2.1 to 2.18). Two additional soil samples were analyzed by detailed gas chromatography / mass spectroscopy (GC/MS) for petroleum constituents (A. D. Little; Feb 17, 1999); these analyses were also included in defining the 14 applicable petroleum fractions. Ten additional soil samples were analyzed in a simulated distillation (Triton Analytics Corp.; Feb 16, 1998); these were not separated into aliphatic and aromatic fractions and have not been used in calculating screening criteria. For each fractionated sample, we have a total TPH concentration, C_T (mg/kg-soil), which is the sum of the 14 fractional concentrations, C_i (mg/kg-soil), or mass fractions, χ_i (mg/mg-total), in the sample.

$$C_T = \sum_{n=1}^{14} C_i = C_T \cdot \sum_{n=1}^{14} \chi_i$$

The toxicity of each of the 14 petroleum fractions is conservatively assigned based on the non-carcinogenic toxicity of similar petroleum hydrocarbon chemicals within the fraction (TPHCWG, 1997, v. 4). Average properties for estimating fate and transport are also assigned to each fraction (TPHCWG, 1997, v. 3). For each of the petroleum fractions, receptor point concentrations, C_i, (in air, water, and soil at the point of exposure) are estimated for each of the sample transport and exposure pathways identified in Worksheet 1.3 (page 1.11), and which were discussed previously.

A hazard quotient (HQ) is calculated for each fraction, here for soil

$$HQ_i = \frac{C_i}{RBSL_i} = C_T \cdot \frac{\chi_i}{RBSL_i}$$

where $RBSL_i$ is an applicable risk-based screening level estimated for each petroleum fraction (in air, water, and soil at the point of exposure). A hazard index, HI, is the sum for the 14 fractions

$$HI = \sum_{n=1}^{14} HQ_i$$

The hazard index, HI, and total concentration, C_T, are directly proportional. As the total concentration in soil increases, the hazard index increases. The TPH screening level in soil is exceeded when the summed HI value is greater than one. By fixing the mixture composition specified by the mass fractions, χ_i, we can calculate a total concentration, C_T for HI = 1. This is the RBSL value for this petroleum sample. TPH concentrations at and below this acceptable level will meet the HI ≤ 1 criteria.

While the hazard index, HI, and total concentration, C_T, are directly proportional for petroleum, they are not always linearly related. Partitioning between petroleum, water, air, and soil is different for each petroleum fraction, and saturation limits for air and water depend on the mixture composition (Mariner, 1997; Mott, 1995; and Johnson, 1990). This means the calculations can sometimes be complicated.

For petroleum hydrocarbons, a range of site-specific risk-based TPH criteria have been derived, based on nine detailed soil analyses of TPH composition, as shown in Worksheets 4.4 and 4.5 (pages 2.1 to 2.18). The values for TPH screening criteria for surficial soil, based on residential exposure (including child exposure factors), ranges from 2400 to 6700 mg/kg. The lower bound is from a (very low) 50 mg/kg total TPH (GSB-9 (2-3') T118812 - TraceAnalysis Inc.; Feb 23, 1999) sample for which detection limits may have affected the measured mass fraction distribution. For a generic site-specific criteria, we choose the second-lowest derived value of:

2600 mg/kg, residential exposure, TPH surface soil screening criteria
(from TSB-7 2-3 ft (A. D. Little; Feb 17, 1999) analysis, based on 57000 mg/kg analyzed in sample)

We use the conservative generic criteria to screen a wider array of 93 detected TPH samples analyzed by method 418.1, and 10 samples analyzed by the GC/FID simulated distillation method. Each of the nine derived sample-specific TPH screening values have been used in screening results for the same respective soil sample.

Further to this analysis, we define restricted site use with all exposure factors, including exposure duration, equal to the residential assumption (Worksheet 4.1, page 1.25), with the exception that an exposure frequency of EF = 35 days/year was used rather than an EF=350 days/year. The EF = 35 days/year is based on USEPA, 1997: Exposure Factors Handbook, Volume III, USEPA, ORD,

Washington, EPA/600/P-95/002Fc; Table 15-8, National averages, outdoor activity for "doer" (an active participant) of 2 hours/day. This is 350 days/year • (2 hrs/day) / (24 hrs/day) = 35 day/year. With this assumption, we find a restricted site use surficial soil screening criteria 10 times greater than the residential criteria, or:

26000 mg/kg, restricted land use [park], TPH surface soil screening criteria
(from TSB-7 2-3 ft (ADL) analysis, 57000 mg/kg in sample)

These screening levels are based on conservative potential human health risk and exposure estimates. They are intended to indicate areas where either further investigation, refinement of the modeling, interim clean-up, or remediation might be needed. In all cases, the screening levels are intended to be conservative (overestimating potential risk and exposure) values. These values are not indicative of any actual, current or future exposure at the site, but are estimates of criteria which would, very conservatively, meet a number of risk-based objectives.

4. Analytical Summary

For the listed pathways (Sec. 3 - above), discuss comparisons of measured concentrations to RBSL values.

Potential exposure to surficial soils

No sorting of samples into surficial and subsurface soil data sets has been attempted in the following comparisons, but we note that the surface soil criteria is relevant only for soils which are exposed at the ground surface (and is otherwise overconservative). The top 2 centimeters is usually considered surface soil by USEPA (1996, p.84, section 4.14), while surface soil is taken as the top 1 meter of soil in ASTM E 1739-95 and ASTM PS 104-98.

For organic indicator chemicals, comparison of all samples to surficial soil criteria is shown in Worksheets 5.1 and 5.2 (pages 4.1 to 6.4). For TPH, 51 of 110 total detected TPH values exceed the residential surficial soil screening criteria (2600 mg/kg) developed in this report. For a more restrictive non-residential land use criteria, we have 14 of 110 samples which exceed the restricted land use surficial soil screening criteria (26000 mg/kg). All TPH values are from the Stage 1 Abatement Plan Report, July 1999; A. D. Little, Feb 17, 1999; and TraceAnalysis Inc.; Feb 23, 1999. The TPH values are shown in Worksheet 5.1 and 5.2 (Soil Data – TPH 4.1 to 4.8)

For individual indicator chemicals (organic), exceedence of either the surficial soil RBSL criteria or EPA Region 6 criteria for organic chemicals are noted as follows:

GMW-8 20-30'	1,1-dichloroethylene 0.37 mg/kg		
TSB-7 2-3 ft	indeno(1,2,3-cd)pyrene	0.95 mg/kg	57000 mg/kg TPH co-located measurement
TSB-7 2-3 ft	benzo(b)fluoranthene 1.1 mg/kg		57000 mg/kg TPH co-located measurement
TMW-3 23-25'	benzo-a-pyrene	8.81 mg/kg	3574 mg/kg TPH co-located measurement
TSB-7 2-3 ft	benzo-a-pyrene	1.1 mg/kg	57000 mg/kg TPH co-located measurement
TSB-8 2-3 ft	benzo-a-pyrene	0.35 mg/kg	32000 mg/kg TPH co-located measurement
TSB-7 2-3 ft	dibenz[1,2;5,6]anthracene	0.34 mg/kg	57000 mg/kg TPH co-located measurement
TSB-8 2-3 ft	dibenz[1,2;5,6]anthracene	0.12 mg/kg	32000 mg/kg TPH co-located measurement

For the PAHs, we note that in every case where and individual surficial soil criteria is exceeded, the 2600 mg/kg TPH residential surficial soil criteria indicates that the co-located TPH sample would also be exceeded. The TPH criteria would therefore be a conservative indicator (at this level) for other petroleum-associated indicator chemicals in surficial soils.

For inorganic chemicals, tabulated values are shown in Worksheets 5.1 and 5.2 (pages 3.1 to 3.6). Exceedences of surficial soil screening levels are noted for arsenic and chromium. The arithmetic average values for the site, however, are within the normal range of soil background concentrations. Further for chromium, the average is met for the Region 6 screening criteria; the RBCA value uses more conservative (and somewhat less realistic) assumptions for the valance state of the chromium. For total activity, the indicated screening level is also exceeded at the maximum measurement, but the arithmetic average value is also within the acceptable range.

Potential exposure to volatile emissions from subsurface soils through inhalation

For exposure to vapors evolved from subsurface soils, both the measured soil concentrations, in Worksheets 5.1 and 5.2 (pages 5.4 to 5.6, 6.3 to 6.4), and soil vapor concentrations, in Worksheets 5.1a and 5.2a, have been compared with screening criteria. Exceedences of the Tier 1 screening criteria are noted for benzene volatilization to indoor air, and for a single TPH analysis, as shown in the tables. We note that the model used in these estimates is known to be very conservative, especially for readily biodegradable chemicals such as benzene (USEPA, 1996). Additional modeling has been completed for the exceeded values, using site-specific information, incorporating a finite mass limit, and including biodegradation in the modeling (see Attachment 2). With this refined modeling, the exceeded values are addressed and no potential indoor air exposure problem can be identified.

Other chemicals

One sample for bromomethane, and one sample for 1,1-dichloroethylene showed exceedences for either or both surficial soil exposure or vapor inhalation exposure. Each of these samples are at depths greater than 28 feet, no vertical migration in the same borehole is noted in sample analyses, and no detection of these chemicals in groundwater is seen. Given the low detection frequency, no observed migration, and little or no potential for exposre, we do not propose further assessment or action for these samples.

Potential ingestion of ground water

The extent and concentration of groundwater impact has been delineated in this investigation. Given the age of the site and any associated releases, we have confined the screening for groundwater to direct comparisons of groundwater measurements to water ingestion screening criteria. Values are shown in Worksheets 5.3 and 5.4 (pages 7.1 to 7.4). No exceedences of criteria for organic chemicals are noted. MCL drinking water criteria for Nickel are exceeded at a single well; Region 6 tap water criteria are exceeded at two wells, for manganese; and 20 NMAC 6.2 drinking water standards are exceeded for fluoride in three samples. All of the inorganic chemicals detected in groundwater are believed to be naturally occurring (Westgate Subdivision, Grimes Battery and Tasker Road – Stage 1 Abatement Plan Report).

Potential mobility of non-aqueous phase liquids (NAPL)

A qualitative evaluation of NAPL mobility is shown in the groundwater investigation. Some NAPL in the vicinity of the Grimes tank battery has migrated downward over time to the water table; lateral migration of the NAPL or of any soluble plume is very limited. The heavily weathered oil in surface soils at this site is not mobile.

Potential effects on vegetation

Measured total dissolved solids (TDS) in soil are well-correlated with soil electrical conductivity and salt levels in soil. High salt levels in soil can disrupt plant growth (changing the osmotic pressure balance across cell walls). Measured values of TDS and pH in soil samples at the site have been compared to agricultural screening criteria [Worksheet 5.5, Soil Data (agricultural screening – pages 8.1 to 8.2)]. Measured values for 12 of 87 TDS measurements show levels of TDS which may lead to plant stress. A number of measured soil pH values are outside the optimum soil pH range for agricultural land use. The measured values of TDS and pH are consistent with the local arid climate and geology. Caliche layers are present in areas of the site and are widespread in the regional area at and just below the soil surface.

5. Qualitative Uncertainty Description

Discuss site conditions relative to the parameters used in deriving the RBSL values, and the conservatism of these parameters.

The risk-based screening levels (RBSLs) used in this evaluation are based on calculations using the upper range residential exposure parameters from USEPA. Most individuals will have exposure levels which are lower than indicated by these parameters, and many will have exposure levels which are significantly less than indicated by these parameters.

Toxicity parameters used in deriving the RBSLs are from USEPA, or for TPH are based on USEPA methodology. The USEPA methods used in deriving the threshold (noncarcinogen) toxicity parameters are based on no observed adverse effects levels, with additional added safety factors of up to 10 000. Similarly, the USEPA development of toxicity parameters for potential carcinogens is extremely conservative.

For groundwater, we have compared RBSLs based on direct ingestion of water to measured concentrations in groundwater. In an actual case (if relevant), the source-zone concentrations in this comparison will (and do) attenuate rapidly with lateral distance from the source.

Inhalation of indoor air evolved from subsurface soils is an indirect exposure route. For benzene, significant biodegradation and diffusive attenuation will occur in the soil layer between the subsurface chemical and the indoor air. The model used in estimating this transport is necessarily very conservative, and neglects this biodegradation. The conservatism of this model for application to benzene and other aromatic hydrocarbons is recognised (USEPA, 1996).

6. Initial Ecological Assessment Summary

Discuss potentially sensitive ecological receptors and habitat in the vicinity of this site.

No sensitive ecological receptors are known to be present on or in the vicinity of the site. Some soil analysis samples, screened against agricultural criteria for total dissolved solids (TDS) indicate that some plant stress is possible in areas of the site. The measured values of TDS and pH are consistent with the local arid climate and geology. Caliche layers are present in areas of the site and are widespread in the regional area at and just below the soil surface.

7. Proposed Corrective Action

Discussed proposed and completed actions at this site relative to site classification and current or proposed future land use.

There is the potential for exposure to chemicals, including TPH in surficial soil, at this site.

Risk requires exposure. Exposure requires contact with the chemical of concern. In the absence of contact with the chemical there can be no exposure. In exposure estimates, the top 2 centimeters is usually considered surface soil by USEPA (1996, p.84, section 4.14), while surface soil is taken as the top 1 meter in ASTM E 1739-95 and ASTM PS 104-98.

We propose to apply a surficial soil TPH criteria only within the upper 8 feet of soil, within residential areas of the site. This would be protective of current site use, as well as for future use and reasonable future excavation depths.

Based on the screening analysis, we propose a site-wide criteria of 2600 mg/kg TPH, for surficial soils in residential areas of the site. Based on co-located TPH and PAH analyses, this 2600 mg/kg TPH criteria would also be protective for surficial soil human-health criteria for other chemicals, including identified individual PAHs.

For areas of the site which are proposed to be restricted from future residential use, streets and a planned city park, a surficial soil screening level of 26 000 mg/kg TPH would be protective of human health. This value is based on an assumption that exposure frequency is 10% of the residential value (350 days per year) for these restricted use areas of the site [based on derivation from USEPA, 1997: Exposure Factors Handbook, Volume III, USEPA, ORD, Washington, EPA/600/P-95/002Fc; Table 15-8, National averages, outdoor activity for "doer" (an active participant) of 2 hours/day. This is 350 days/year • (2 hrs/day) / (24 hrs/day) = 35 day/year]. As with the residential surficial soil criteria, we would propose to apply this criteria to the upper 8 feet of soil.

Applying this surficial soil criteria means excavating some areas of the site to a depth of 8 ft. For soils below this depth, there is no potential for future direct exposure, but there is a limited potential for chemicals to migrate as a NAPL to ground water. We propose no specific concentration criteria for soils at the bottom of a remediation excavation. We do suggest a test for mobile hydrocarbon in soil, such as a paint filter test by SW-846 Method 9095. The paint filter test is used to determine the presence of free liquids in a waste sample. Waste

material is placed in a paint filter. If any of the material passes through and drops from the filter within a 5-minute test period, the material is deemed to contain free liquids.

Aesthetic criteria (e.g. removing visibly stained soil) may also be included in the corrective action.

8. Reference Documents

List the document sources for the data cited in this report and its appendices.

Westgate Subdivision, Grimes Battery and Tasker Road – Stage 1 Abatement Plan Report (Site Assessment Investigation), July 1999, Shell Exploration and Production Company, Houston, TX; prepared by BBC International, Inc., and ARCADIS Geraghty & Miller.

Philip Services, Feb. 1998: Grimes Battery Soil and Water Assessment Report, prepared for Shell Exploration and Production Technology Company, Houston Texas, by Philip Services Corporation, Midland, Texas, Project 18906.

Phillip Services, Feb. 1998: Tasker Road Site Assessment Report, prepared for Shell Exploration and Production Technology Company, Houston Texas, by Philip Services Corporation, Midland, Texas, Project 18906.

USEPA, 1996: Soil Screening Guidance: Technical Background Document (United States Environmental; Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC), EPA/540/R-95/128.

USEPA, 1991: Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim, (United States Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC), NTIS PB92-963333.

ASTM E 1739-95: *Risk-Based Corrective Action Applied at Petroleum Release Sites* (American Society for Testing and Materials, West Conshohocken, PA).

ASTM PS104-98: *Standard Provisional Guide for Risk-Based Corrective Action* (American Society for Testing and Materials, West Conshohocken, PA).

TPHCWG, 1997: Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH), Volume 4, Prepared by Edwards, D. A., M. D. Andriot, M. A. Amoruso, A. C. Tummey, C. J. Bevan, A. Tveit, L. A. Hayes, S. A. Youngren, and D. V. Nakles for Chevron, British Petroleum, and the Total Petroleum Hydrocarbon Criteria Working Group, (Amhurst Scientific Publishers, Amhurst, Massachusetts), ISBN 1-884-940-13-7.

Johnson, P. C., M. B. Hertz, D. L. Byers, 1990: Estimates for hydrocarbon vapor emissions resulting from service station remediations and buried gasoline-contaminated soils, in Petroleum Contaminated Soils, v. 3, P. T. Kostecki and E. J. Calabrese, eds., (Lewis Publishers, Chelsea, Michigan), 295-326.

Mariner, P. E., M. Jin, and R. E. Jackson, 1997: An algorithm for the estimation of NAPL saturation and composition from typical soil chemical analyses, Ground Water Monitoring and Remediation, 17, 1:122-129.

Mott, H. V., 1995: A model for determination of the phase distribution of petroleum hydrocarbons at release sites, Ground Water Monitoring and Remediation, 15, 3:157-167.

Weisman, W. H., 1998: Total Petroleum Hydrocarbon Criteria Working Group: A Risk-Based Approach for the Management of Total Petroleum Hydrocarbons in Soil, *Journal of Soil Contamination*, 7, 1-15.

Triton Analytics Corp. (Feb 16, 1998) Letter from Dan C. Villalanti to Illeana Rhodes, High Temperature Simulated Distillation (HTSD) analysis for 10 soil samples. Phillips Environmental chain of custody record.

A. D. Little, Environmental Monitoring and Analysis Unit. (Feb 17, 1999) Note from Henry Camp to Wayne Hamilton, BTEX - GC/MS, SHC/TPH - GC/FID analysis of two samples. BBC International chain of custody record.

TraceAnalysis Inc. (Feb 23, 1999) Letter from Dr. Blair Leftwich to Cliff P. Brunson, TX1006 Analysis. of soil samples.
Westgate Subdivision, Grimes Battery and Tasker Road, July 1999, SEPC, Houston, TX, report prepared by BBC International, Inc., Hobbs, NM and ARCADIS Geraghty & Miller, Midland/Odessa, Texas.

USEPA, 1997: Exposure Factors Handbook, USEPA, ORD, Washington, EPA/600/P-95/002F.

TIER 1 RBCA EXECUTIVE SUMMARY CHECKLIST 1.2

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
no.	completion / revision:		approval:		Description:
	by:	date:	by:	date:	
	G. E. DeVaull	10/6/99	G. E. DeVaull	10/6/99	

EXECUTIVE SUMMARY

[I would suggest that this tabular summary follow the text. It should not be the first thing that the reader encounters.]
Visual/Historical Assessment:

Site Size (acres):	☐ < 1	☐ < 10	■ > 10 *(total area)*
Current Site Land Use:	■ undeveloped	☐ industrial	■ residential
Site Access:	☐ restricted and monitored	■ fenced *(partial-temporary)*	■ open
Visual Evidence of Environmental Impact:	☐ none	■ limited	☐ extensive

types of chemicals likely to be present:
- ■ petroleum hydrocarbons
- ■ salts
- ☐ inorganic chemicals and metals
- ☐ organic chemicals (specify:_____)
- ☐ other (specify:_____)

contaminant soures:
- ■ tanks / spills *(former tank battery)*
- ☐ pits / ponds
- ☐ flow lines
- ☐ process units (specify:_____)
- ☐ other (specify:_____)

(salts may potentially originate from produced water or alternately may result from the arid climate)

Baseline Receptor Identification:

Boundary to Nearest Off-site Receptor Distance:	☐ > 500 ft	☐ 100 to 500 ft	■ < 100 ft
Depth to First Encountered Groundwater:	☐ > 200 ft	■ 200 to 50 ft	☐ < 50 ft
Travel Time to Nearest Groundwater Receptor:	☐ > 10 years	☐ 2 to 10 years	☐ < 2 years
Indicated Site Classification Evaluation Urgency	☐ > 2 years	☐ 0 to 2 years	☐ immediate

receptor point exposure:
- ■ surface soil
- ☐ groundwater *(residents are on municipal water supply)*
- ☐ surface water *(none present on site or in vicinity)*
- ■ vapors or dust to air

reasonable potential receptors of concern:
- ■ human
- ☐ ecological *(vegetation only)*
- ■ agricultural *(vegetation only)*
- ☐ other (specify:_____)

Notes:
List chemicals, environmental media (soil, groundwater, surface water), and exposure pathways which exceed Tier 1 criteria.
Surface soil criteria include petroleum (TPH) in soils, with some polycyclic aromatic hydrocarbons (PAHs) noted. The petroleum is heavily weathered. Total dissolved solids (TDS) in some surface soil samples indicate that vegetative stress may occur.

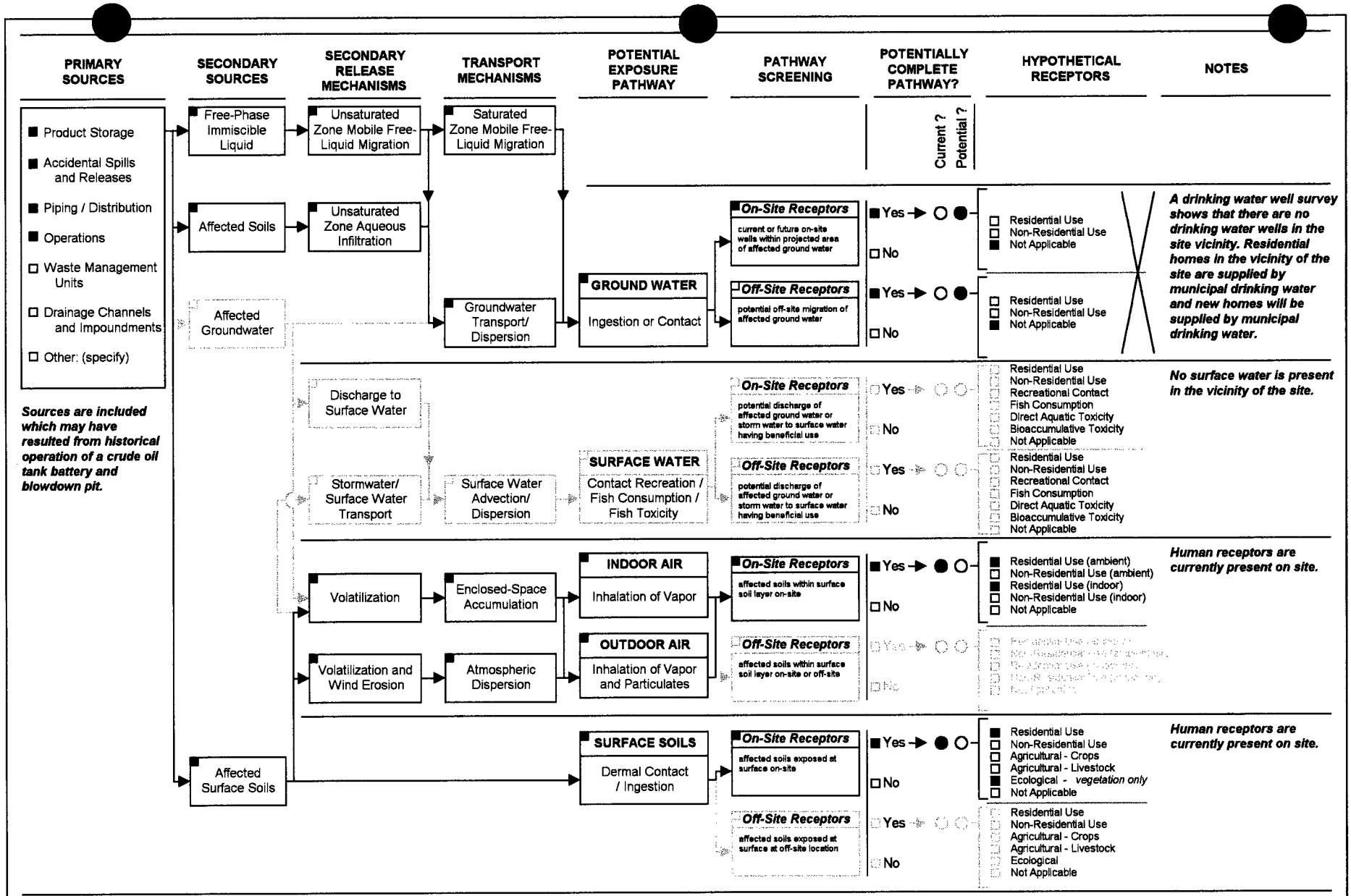
Tier 1 Tasks Completed:

	date:	by:
■ Visual / Historical Assessment	per this report	
■ Initial (screening) Assessment	per this report	
☐ Site Classification		
■ Detailed Site Characterization	per this report	
■ RBSL Comparison	per this report	
■ Initial Ecological Assessment	per this report	
☐ Corrective Action Planned / Implemented		

Suggested Tier 1 Actions:

- ☐ A. Site does not exceed Tier 1 criteria. -- Propose no further action.
- ■ B. Site exceeds some Tier 1 criteria. -- Propose corrective action to meet Tier 1 criteria.
- ☐ C. Site Exceeds some Tier 1 criteria. -- Propose interim actions and re-prioritize site.

Limited additional site-specific modeling for indoor air vapor exposure pathway and some data statistical averaging is applicable.



WORKSHEET 1.3 EXPOSURE SCENARIO EVALUATION FLOWCHART

Based on ASTM E 1739-95, Risk-Based Corrective Action for Petroleum Release Sites.
-- G. E. DeVaull, 12/3/97 conmodl.vsd:Page-7

Information Key

site name: HOBBS WESTGATE SUBDIVISION			site location: Hobbs, New Mexico		
	completion / revision: GED		approval: GED 26 Apl 1999		description:
no.	by:	date:	by:	date:	

SITE DESCRIPTION 2.1

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	W. A. Hamilton	8/1/99	W. A. Hamilton	8/1/99	

location description

Figure 1, Site Regional Topographic Map,
Figure 2, Westgate Site Map,
Figure 3, Site Aerial Photos.

Address, cross-street, city, county, state, zip code, country:
The site is located on the West side of Hobbs, New Mexico. The Westgate subdivision consist of developed and undeveloped property bordered by Tasker Road on the east, Los Cuatro property on the west, Sanger road to the South and Princess Jeanne Drive North.

Lease name, township, range, section:
W.D. Grimes Lease: Township 18 South, Range 38 East, Section 28, SW/4

Legal description of property (lot, block, district, plan):
map of site attached? ☐ no ☐ yes
notes:

Describe access to the site and the area surrounding the site. Describe current site activity.
Oil and gas operations in desert environment of the Permian Basin. Access to site is by paved and dirt roads. The surrounding area is oil and gas operations and Westgate Subdivision.

contact points

list name, address, affiliation, of the person or persons completing these worksheets.

name:	Wayne A. Hamilton	George Devaull
affiliation:	Shell E&P Company	Equilon Enterprises LLC
address:	200 N. Dairy Ashford	3333 Highway Six South
	Houston, TX 77079	Houston, TX 77082

worksheets completed for:

name:	Shell E&P Company
address:	200 N. Dairy Ashford
	Houston TX 77079

There are multiple surface land owners
Current legal owner or owners of site:
name: Shell Western E&P Company

Current legal owner or owners of site:
name: Los Cuatro Land Development Company

Current legal oil and gas lease operator of site:
name: Altura Energy Limited

purpose of assessment

Describe why this assessment is being performed.
This report is required by the Oil Conservation Division to assess and remediate on and off site hydrocarbons. The results of the report will provide the scientific basis for site cleanup levels.

regulatory agencies

List the agencies that have overview responsibility for this site (and for what purpose or program), other interested parties, and current status of the site. Note any previous contacts with the agency(ies) for the site.

agency:	New Mexico Oil Conservation Division	New Mexico Health Department
contact:	Bill Olson or Rodger Anderson	Dr. Evan Nelson or Randy Merker

SITE OWNERSHIP AND ACTIVITY RECORD 2.2

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	W. A. Hamilton	8/1/99	W. A. Hamilton	8/1/99	

Identify (past and present) property owner(s), operator(s), and lease information. Describe past production and materials handling activities, waste handling and disposal practices, and chemicals used. If movement of soil has taken place at this site, note the cause (agricultural use, heavy equipment, mining, natural events, erosion, other). Tabulate in reverse chronological order.

Begin Date	End Date	Description
April 6, 1928	March 3, 1997	**Oil & Gas Lease:** Various names related to Shell Western E&P Company; T18S, R38E, Section 28, SW/4; All interest to OGL 4/445
March 3, 1997	Present	**Oil & Gas Lease:** Altura Energy Ltd.; All interest to OGL 4/445
About 1970's	Present	**Surface Ownership:** Residents along Tasker & Cobb Drives in Westgate units 1, 2 & 3 in SW/4 of Section 28.
May 28, 1976	Present	**Surface Ownership:** Los Cuatro, Inc 100%; Warranty deed dated May 28, 1976 in SW/4 of Section 28.
June 23, 1995	Present	**Surface Ownership:** Grimes Land Co, Ltd, Warranty deed dated June 23, 1995 in SW/4 of Section 28.
1930	1950	**Surface Lease:** Humble Oil/Exxon, 1 acre in the SE corner of SW/4; Surface lease for purpose for construction and maintenance of bldg., storage tanks and etc. Five year lease with right to renew. Document recites that leasee shall not be liable for damages of any nature to the surface.

*Indicate on **Figure 3, SITE PLAN VIEW**, specific areas of site activity and use, facility or unit outlines, fence lines, public roadways.*

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	W. A. Hamilton	8/1/99	W. A. Hamilton	8/1/99	

Describe potential sources and spill events, including location, type and volume of materials stored or released, time and duration of release, and affected media (soil, groundwater, surface water, etc.). Discuss interim measures to contain or remove contaminated media and past remediation efforts as appropriate. Tabulate in reverse chronological order.

Begin Date	End Date	Description
1940's	1960's	**Pit West of Tank Battery:** Dates of operation are estimated from aerial photographs
		Emergency Pit Adjacent to Tank Battery: Battery abandon 1993. Do not have documents concerning pit usage.
		Tank Bottom Spreading: North of Tank Battery and south of Berry Drive. Do not have documentation concerning tank bottom spreading
		Flow Line Release: South of Tank Battery.
		Flow Line Release: Not a SWEPI issue. The probable release source is either Rice Engineering or Equilon.
		Abandoned Well: Grimes: Abandoned well site between two homes on Cobb street. Well was properly abandoned and no hydrocarbons were found in soil gas investigation. (note: see Worksheet 1.2 Section 1, second paragraph)

information key

site name:			site location:		
	completion / revision:		approval:		Description:
no.	by:	Date:	by:	date:	

Typical site activities to be recorded include:
- ☐ *Preliminary Site Assessment/Site Inspection*
- ☐ *Emergency Response*
- ☐ *Review Site Classification System*
- ☐ *Risk/Exposure Assessment*
- ☐ *Remedy Selection*
- ☐ *Interim Corrective Action*
- ☐ *Remedy Implementation*

Types of sampling and testing Include:
☐ *Soil* ☐ *groundwater* ☐ *Surface Water* ☐ *Vapors*

Date Completed	Description of Task	Sampling and Testing Conducted	Goal/Result/ Product/Impact	Project Cost

information key

site name:			site location:		
	completion / revision:		approval:		description:
no.	by:	Date:	by:	date:	

regional hydrogeology

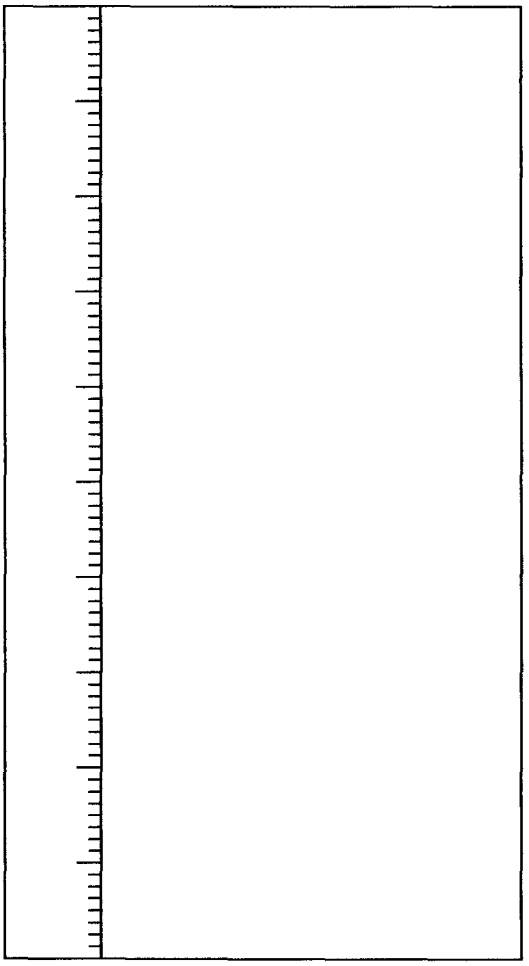
Also see Figure 6, Geological Cross-section(s).

Describe regional geologic framework through depth of principal regional aquifer, and any other potentially impacted lithologic units. Identify principal formations and water-bearing units. Include site vertical stratigraphy.

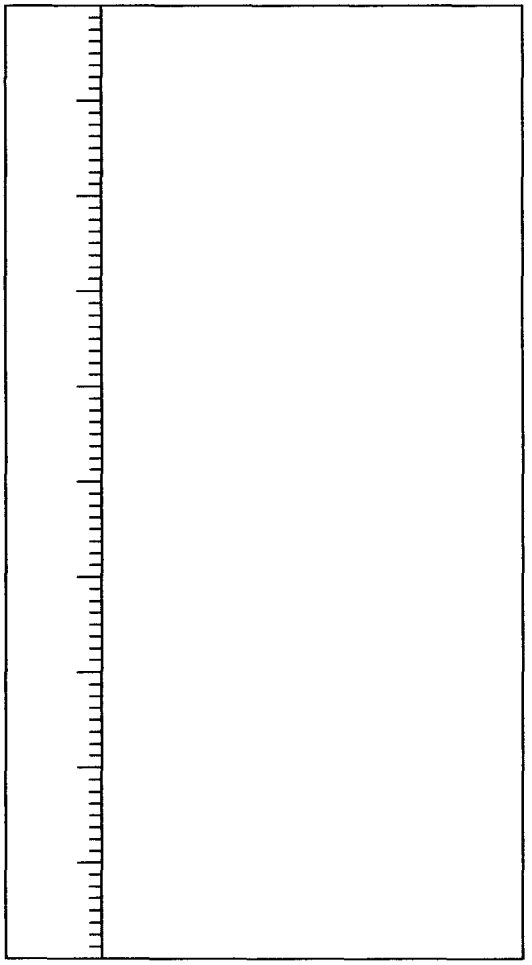
regional stratigraphy
Identify principal oil and gas producing formations, significant confining layers, soil or rock type, depth intervals, etc.

principal aquifers
Identify principle water-bearing zones. Indicate aquifer use designation (if any), inherent water quality (TDS, etc.), and potential yield ("low" < 1500 gpd/well, "medium" - 1500 to 15000 gpm/well, "high" - > 15000 gpd/well

indicate scale:



indicate scale:



information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

Is impact to ground water confirmed or highly suspected? ■ yes / □ no

site hydrogeology

Also see Figure 5, GROUNDWATER ELEVATION MAP, and Figure 6, GEOLOGICAL CROSS-SECTION(S).

water-bearing units:	First Encountered	Primary Drinking Water	
Aquifer Type (perched, confined, unconfined):	unconfined		
Depth to groundwater (ft):	65 ft		
Aquifer Thickness (ft):	unknown		*
Seasonal/Historical water level fluctuations (± ft):			*
Gradient (ft/ft):	1 ft / 180 ft		*
flow direction:	east		
Saturated hydraulic conductivity (ft/day): *(coarse sand)*	50 ft/day (est.)		*
Maximum well yield (gpm/ft):			*
Soil or rock type:			

Discussion:

aquitard/confining layer (if known):	Below First Encountered Water	Above Primary Drinking Water Unit
Depth below grade (ft):		
Thickness (ft):		
Soil or rock type:		

Discussion:

current ground water quality data
Also see Figure 7, SOLUBLE GROUNDWATER PLUME MAPS.

	First Encountered Water	Primary Drinking Water
Total dissolved solids (mg/L):		
Observed groundwater quality impact (Y/N):		
Separate phase (free oil or condensate) present (Y/N)?:	Y	
Off-site sources (Y/N, Identify Below):		

Discussion:
Soluble hydrocarbon plume has been delineated. Weathered free product is present in some wells, but has also been delineated. Given the age of the site and current operations, no further migration of free product is anticipated, and the remaining soluble hydrocarbon plume is attenuating.

Reference Documents for Site:

Date Issued	Author	Title

Ref: See Westgate Subdivision, Grimes Battery, and Tasker Road Stage 1 Abatement Plan Report, July 1999.

** Items not strictly required for Tier 1 analysis.*

SITE SURFACE AND VADOSE (UNSATURATED) ZONE CONDITIONS 3.3

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

topography and surface features

*Site elevation, ground surface slope, and slope direction can be obtained from topographic maps and documents and from a site visit. Topographic information can also be shown on **Figure 1**, **SITE LOCATION MAP** and **Figure 3**, **SITE PLAN VIEW**.*

total site area (acres): _____
Does the site have occupied buildings on it? ■ yes / ☐ no
If yes, how many, covering what area?: multiple homes _____
Is the site paved? ■ yes / ☐ no
If yes, covering what area?: various streets and roads, see map ___
Is the site used for crops or livestock pasture?: ☐ yes / ■ no
If yes, covering what area?: _____

Terrain and surface features ■ Flat ☐ Steep ☐ Variable
site elevation interval (ft-MSL) High Pt._____ Low Pt._____
average ground surface slope Direction _____ Grade (ft/ft)_____

Include building locations and size, notation of paving, and surface gradient on Figure 3, SITE PLAN VIEW, and on worksheet SITE OWNERSHIP AND ACTIVITY RECORD. Note that surface feature information on wildlife habitat is included in worksheet ECOLOGICAL ASSESSMENT SUMMARY.

other comments:

local climate

Average Annual Precipitation (in): 12 to 15 inches, (including 3.3 to 4.8 inches snowfall)
Annual Average Evapotranspiration (in):_____
Annual Pan Evaporation (in): _____
Summer Temperature Range (°F): 112°F max (1961 to 1990) ___
Winter Temperature Range (°F): -11 to 2° F (1961 to 1990) _____

other comments:
Rainfall data from National Oceanic and Atmospheric Administration data (http://www.cdc.noaa.gov), records (Wink, Winkler, TX and Midland, TX) in the vicinity of Hobbs, NM (approximately 32°42'30"N, 103°07'30"N).
Given the relatively low rainfall and dry climate, net infiltration of rainwater in the vicinity of the site, through unsaturated soils to groundwater will be minimal, and in any case, will be a small fraction of the total annual rainfall.

site vadose (unsaturated) zone hydrogeology

Also see Figure 6.

Depth to first encountered water (ft.):	65	
Unsaturated zone permeability (Darcy):		*
Soil or rock type:	note below	
Soil affected by hydrocarbons (Y/N)?	Y	
Separate Phase Present (Y/N)?	Y	

Discussion:
Unsaturated zone stratigraphy at the site, from below any surface fill to groundwater at 65 ft, is expected to consist of intermixed layers of fine-grain silty sand, buff limestone (hard), fine-grain silty sand with chert, and fine-grain sand with sandstone intermixed.

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	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

surface water - non-flowing

Are there non-flowing water bodies on the site? ☐ yes / ■ no
(ponds, lagoons, potholes, lakes, or other)
If yes, name and describe them:

Are there non-flowing water bodies adjacent to the site? ■ yes / ☐ no
(ponds, lagoons, potholes, lakes, oceans, or other)
If yes, name and describe them:

The nearest surface water (identified from the topographic USGS quadrangle map for Hobbs West, N. Mex.) is a pond, approximately 0.5 acre in area, 0.4 miles from the site. There is no direct pathway for rain water runoff from the site to this surface water.

surface water - flowing

Are there flowing water bodies on the site? ☐ yes / ■ no
(ditches, streams, rivers, estuaries, or other)
If yes, name and describe them:

Are there flowing water bodies adjacent to the site? ☐ yes / ■ no
(ditches, streams, rivers, estuaries, or other)
If yes, name and describe them:

*Also see **Figure 1**, SITE LOCATION MAP, and **Figure 3**, SITE PLAN VIEW.*

If no surface waters are identified and impact is unlikely, further evaluation of surface water is unnecessary.

BENEFICIAL LAND USE SUMMARY 3.5

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

The purpose of this worksheet is to identify existing and reasonable beneficial uses for land, groundwater, and surface water. These uses will help establish any existing or potential receptors.

land use

Site Land Use

Figure 2, EXTENDED SITE MAP, should identify the site and the neighborhood land use. Also see ***Figure 1, SITE LOCATION MAP, and Figure 3, SITE PLAN VIEW****. Indicate percent areal use for checked boxes, if possible.*

	Current	Potential	Prior	
Residential	■ _____	■ _____	☐ _____	
Commercial	☐ _____	☐ _____	☐ _____	
Industrial	☐ _____	☐ _____	☐ _____	*(note light / heavy)*
Agricultural - range	■ _____	■ _____	☐ _____	
Agricultural - crop	☐ _____	☐ _____	☐ _____	
Wildlife Habitat	☐ _____	☐ _____	☐ _____	*(see ecological worksheet)*
Recreational	☐ _____	■ *(park)* _____	☐ _____	*(note if park)*
Other:	☐ _____	☐ _____	☐ _____	

Describe:

Review and discuss the options for the listed items (including no anticipated future use).

Prior site use included rangeland and oil and gas operations. Residential development has begun to extend into the region of this former oilfield site. Future site use could include residential development, and restricted development for some former operation areas (tank battery vicinity to city park, for example) .

Local Land Use

Also see Figure 2, ***EXTENDED SITE MAP****. Indicate percent areal use for checked boxes, if possible.*

	Current	Potential	Prior	
Residential	■ _____	■ _____	■ _____	
Commercial	☐ _____	☐ _____	☐ _____	
Industrial	☐ _____	☐ _____	☐ _____	*(note light / heavy)*
Agricultural - range	■ _____	■ _____	■ _____	
Agricultural - crop	☐ _____	☐ _____	☐ _____	
Wildlife Habitat	☐ _____	☐ _____	☐ _____	*(see ecological worksheet)*
Recreational	☐ _____	☐ _____	☐ _____	*(note if park)*
Other:	■ _____	■ _____	■ ***oil and gas production operations***	

Discussion:

Review and discuss the options for the listed items (including no anticipated future use)

surface and ground water use

Surface Water Use

describe the potential use of these surface waters: ***(none present)***

	Current	Potential
Recreational	☐ _____	☐ _____
Domestic/Municipal Supply	☐ _____	☐ _____
Industrial Process Supply	☐ _____	☐ _____
Sensitive Habitat	☐ _____	☐ _____
Commercial/Sport Fishing	☐ _____	☐ _____
Aquacultural Use	☐ _____	☐ _____
Other:	☐ _____	☐ _____

First Encountered Groundwater

Also see worksheets ***REGIONAL HYDROGEOLOGICAL CONDITIONS*** *and* ***SITE HYDROGEOLOGICAL CONDITIONS - GROUNDWATER****, and Figure 6,* ***GEOLOGICAL CROSS-SECTION(S)****.*

	Current	Potential
Domestic Supply	☐	■ *likely connection to municipal supply*
Public/Municipal Supply	☐	☐
Industrial Process Supply	☐	☐
Freshwater Replenishment	☐	☐
Aquacultural Use	☐	☐
Crop Irrigation	☐	☐
Livestock Watering	☐	■
Other:	☐	☐

Primary Drinking Water Aquifer
*Complete if this is a deeper lithologic unit than the first encountered groundwater . Also see worksheets **REGIONAL HYDROGEOLOGICAL CONDITIONS** and **SITE HYDROGEOLOGICAL CONDITIONS - GROUNDWATER**, and Figure 6, **GEOLOGICAL CROSS-SECTION(S)**.*

	Current	Potential
Domestic Supply	☐	☐
Public/Municipal Supply	☐	☐
Industrial Process Supply	☐	☐
Freshwater Replenishment	☐	☐
Other:	☐	☐

Discussion:
Review and discuss the options for the listed items (including no anticipated future use)

For the site vicinity, residences are supplied by municipal water, and any new residences could be connected to municipal water.

potential receptor survey

Comments:
*Discuss type of utility (water, storm sewer, sanitary sewer, electrical, etc.). Discuss type of building construction (slab on grade, crawl space, basement). Listing of receptor is <u>not</u> necessary if it is not near leak or if a deep water table is present. (indicate N/A in table where appropriate) Discuss nearest and other receptors and indicate on **Figure 3, Site Plan View**.*

	Name and Type:	Distance and Direction from Source:
Underground Utility Survey		
Also see Figures 1, 2, and 3		
Nearest Underground Utility		
Nearest Off-Site Underground Utility		
Nearest Downgradient Utility		
Building Survey		
Also see Figures 1, 2, and 3		
Nearest Building		
Nearest Inhabited Building		
Nearest Off-Site Inhabited Building		
Surface Water Hydrology		
Nearest Surface Water		
Nearest Downgradient Surface Water		

Notes:

Water table in this area is relatively deep (65 ft) and the location of residual hydrocarbon has been identified.

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

summary of water wells within 0.5 mile radius of site

See Figure 1, SITE LOCATION MAP, for the well inventory survey within a 0.5 mile radius of the site

			Downgradient Direction		
	Total No.	Active No.	Total No.	Active No.	No. Screened in Potentially Impacted Aquifer
Public/Municipal					
Industrial					
Domestic					
Agricultural					

potential receptor points

for each below, identify:
(1) Closest Downgradient Supply Well
(2) Closest Downgradient Drinking Water Well
(3) Closest Actual Down-gradient Receptor

	(1)	(2)	(3)
Well No. or Designation:			
Distance from Site (ft):			
Total Well Depth (ft):			
Current Use of Water:			
Screened Interval below Ground Surface (ft):			
Seal Interval below Ground Surface (ft):			
Year Constructed:			
Water Use Classification:			

Informational References:

A water well survey has been completed, based on information on file in the State Engineer's office for the site vicinity (Sharon Hall, 20 April 1999), that is, Section 28, Township 18 South, Range 38 East, N.M.P.M., Lea County, New Mexico. This was tabulated as wells per quarter section. No downgradient water wells (east of the site) are recorded within one-half mile of the site.

Notes:

1. ***Any well (drinking water, agricultural, industrial, etc.), which has not been abandoned and is completed through any lithologic unit that could be potentially impacted.***
2. ***Municipal or residential drinking water supply completed in any lithologic unit.***
3. ***Municipal or residential drinking water supply well completed in same lithologic unit in which compounds are migrating.***

ECOLOGICAL ASSESSMENT SUMMARY 3.7

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

qualitative ecological impact assessment

Visual Site Inspection

no.	by:	affiliation:	date:	description

Observed Impacts Associated with Site

On-site vegetation	☐ none	■ limited	☐ extensive
Off-site vegetation	■ none	☐ limited	☐ extensive
On-site mammals, birds, fish, etc.	■ none	☐ suspected	☐ observed
Off-site mammals, birds, fish, etc.	■ none	☐ suspected	☐ observed
Other impacts	☐ none	☐ yes (explain below)	

Discussion:

habitat characterization

Presence of Habitat

Site located within or impacts a sensitive or protected habitat? ■ no ☐ yes (explain below)

Description of Sensitive Habitat

*Include proximate Federal and state parks, national and state monuments, rookeries, wildlife preserves, wildlife management areas, freshwater springs, wetlands, prairie potholes. Include sources of information used to identify these areas. Indicate their location on Figure 1, **SITE LOCATION MAP** and Figure 2, **EXTENDED SITE MAP**.*

Name:
Location:

Habitat Type:	☐ Aquatic	☐ Wetland	☐ Wooded	■ Scrub/Shrub	■ Open Field	☐ Other
Habitat Condition:	☐ Pristine	☐ Highly Altered	☐ Early Recovery	☐ Late Recovery		

Discussion:

*Provide other information relative to habitat characterization including regulatory authority, basis for protection, etc. Include photographs (Figure 4, **SITE PHOTOS**), if available.*

ecological receptors

Presence of Impacted Ecological Receptors

Site conditions have impacted sensitive ecological receptors, either on-site or off-site? ■ no ☐ yes (explain below)

List of Potentially Affected Receptors

Note if threatened or endangered species (plant or animal) are known to inhabit the area of the site.
List economically important or sport species known to inhabit the area of the site.
Note observations, if any, regarding the presence or absence of ecological receptors including insects, fish, birds, mammals, benthic macroinvertebrates, plants, etc., on or in the vicinity of the site.

ecological assessment summary and recommended action

Observed or Potential Impacts	--	Recommended Action
■ None observed or anticipated	--	No action required
☐ Potential for significant impact	--	Further study required (describe below)
☐ Significant impact observed	--	Further study required (describe below)

Recommended Work Program

Attach 1-2 page description of scope of work for more detailed ecological impact assessment, if needed. Address methods to be used, schedule and cost.

SALT–AFFECTED SITE SUMMARY 3.8

Information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM	
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

Qualitative salt impact assessment

Visual Site Inspection

no.	by:	affiliation:	date:	description

Indicate the location of observed effects, reported spills and leaks, past and present operational equipment, and past and present storage locations on Figure 1, SITE LOCATION MAP and Figure 2, EXTENDED SITE MAP. Include surface and aerial photographs (Figure 4, SITE PHOTOS).

Observed Salt Effects Associated with Site
(refer to Worksheet ECOLOGICAL ASSESSMENT SUMMARY for observed effects on vegetation)

On-site erosion	■ none	☐ localized	☐ general
Off-site erosion	■ none	☐ localized	☐ general
On-site soil crust	■ none	☐ white	☐ black
Off-site soil crust	■ none	☐ white	☐ black
Other impacts	■ no	☐ yes (explain below)	

Discussion. ***Note if halophytes (salt-tolerant plants) are present on site:***
Native vegetation in the vicinity includes grassland, short plants and bushes, and rangeland.

Operational characterization

Presence of Salt on Site (refer to SITE OWNERSHIP AND ACTIVITY RECORD)

Salt used on site (drilling mud, production chemical)	☐ no	☐ yes
Salt produced on site (produced water, tank bottom)	☐ no	■ yes
Salt naturally present (salt marsh, coastal waters, playa)	☐ no	■ yes (explain below)

Salt Leaks or Spills

Reported leaks of salt containing material on site	■ no	☐ yes (refer to PAST RELEASES OR SOURCE AREAS)
Potential for leaks from tanks, pipelines, wells ☐ no	■ yes (refer to SITE OWNERSHIP AND ACTIVITY RECORD)	

Water Resources

Potential Surface Water Receptors (refer to HYDROGEOLOGICAL CONDITIONS-SURFACE WATER)

Non-flowing water bodies on site (lakes, ponds, wetland, etc.)	■ no	☐ yes (explain below)
Non-flowing water bodies off-site	■ no	☐ yes (explain below)
Flowing water bodies on site (rivers, estuaries, etc.)	■ no	☐ yes (explain below)
Flowing water bodies off-site	■ no	☐ yes (explain below)

Potential Groundwater Receptors (refer to SITE HYDROGEOLOGIC CONDITIONS-GROUNDWATER)

Depth to groundwater < 6 feet	■ no	☐ yes (explain below)
Impermeable layer < 6 feet	☐ no	☐ yes (explain below)
Off-site seeps or wells	☐ no	☐ yes (explain below).

Note: Consider the potential for deeper groundwater impacts, in the absence of surface evidence.

Salt effects assessment summary and recommended action

Observed or Potential Impacts	Recommended Action
■ None observed or anticipated –	No action required
☐ Potential for significant impact--	Further study required (describe below)
☐ Significant impact observed –	Further study required (describe below)

Recommended Work Program
Attach 1-2 page description of scope of work for more detailed salt impact assessment, if needed. Address methods to be used, schedule and cost. See API (1997). Other useful references are Deuel and Holliday (1994), API (1991), and USDA (1954).

Measured soil total dissoved solids (TDS) levels indicate the potential for limited areas of stressed vegetation.
Caliche layers are present in areas of the site and are widespread in the regional area at and just below the soil surface.

EXPOSURE PARAMETER SUMMARY ASSESSMENT 4.1

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

Indicate if the default exposure parameter value (Tier 1) is conservative for the residential or commercial/industrial scenario (y - ■, n - □). Indicate if a site-specific parameter has been used in deriving SSTL values (Tier 2 analysis). Note that only the selected exposure parameters which may be affected by site-specific conditions (site access, site conditions and use, presence of a receptor, climate, etc.) are checked and tabulated in this Tier 1 worksheet. The specified risk or hazard criteria are set at a level acceptable to the involved parties.

parameter	residential		industrial		definition, units	site-specific values	
specified risk or hazard criteria							
THQ	□	1		...	target hazard quotient for individual chemicals	□	
TR_U	□	10^{-4}		...	target excess individual lifetime cancer risk - upper range value	□	
TR_L	□	10^{-6}		...	target excess individual lifetime cancer risk - lower range value	□	
exposure parameters							
AT_c		70		...	defined carcinogen averaging time (years)		
AT_n		= ED		...	defined averaging time for non-carcinogen (years)		
BW		70		...	body weight (kg) - adult		
BW		15			body weight (kg) - child, 1-6 years		
ED		30		25	exposure duration (years)		
ED		6			exposure duration (years) - child, 1-6 years		
EF	■	350	□	250	exposure frequency (days/year)	□	
IR_{soil}	■	100	□	50	soil ingestion rate (mg/day) - adult	□	
IR_{soil}	■	200			soil ingestion rate (mg/day) - child (1-6 yrs)	□	
IR_{soil}	■	114			soil ingestion rate (mg-yr/kg-day) -- age-adjusted	□	
$IR_{air-indoor}$	■	15	□	20	daily inhalation rate (m^3/day) - indoor	□	
$IR_{air-outdoor}$	■	20	□	20	daily inhalation rate (m^3/day) - outdoor	□	
IR_{water}	■	2	□	1	daily water ingestion rate (L/day)	□	
SA	□	3160	□	...	seasonally-averaged skin surface area (cm^2/day) - adult	□	
SA	□	2023			seasonally-averaged skin surface area (cm^2/day) - child (1-17yrs)	□	
SA	□	1567			seasonally-averaged skin surface area (cm^2-yr/day) -- age-adjusted	□	
M		0.5		...	soil to skin adherence factor (mg/cm^2)		

discussion:
The default residential exposure parameters are always conservative (by definition) for the selected exposure scenarios. This section is to include information (if needed) on revised EF (days/year) estimates, ingestion or inhalation rate estimate changes due to exposure weighting to contaminated media (hours/day, or fractional weighting), and changes in seasonally-averaged exposed dermal area estimates due to climate or fractional exposure weighting.

For estimate of exposure for restricted land use (proposed park), we use the residential exposure criteria with a modified exposure factor of EF = 35 days/year. All other factors are identical to the residential values.

The EF = 35 days/year is based on USEPA, 1997: Exposure Factors Handbook, Volume III, USEPA, ORD, Washington, EPA/600/P-95/002Fc; Table 15-8, National averages, outdoor activity for "doer" (an active participant) of 2 hours/day. This is 350 days/year • (2 hrs/day) / (24 hrs/day) = 35 day/year. With this assumption, we find a restricted site use surficial soil screening criteria 10 times greater than the residential criteria,

SITE PARAMETER SUMMARY ASSESSMENT 4.2

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

This is a comparison of default site parameters (on which Tier 1 RBSL values are based) against site-specific values. The default parameters are intended to be reasonable or conservative relative to actual site conditions.

Notes: * The conservatism of these values are to be evaluated in a Tier 1 analysis if the dependent pathway is potentially complete.
§ These values are suggested for site-specific measurement or estimation if Tier 1 RBSL values are exceeded, if the pathway may result in potential exposure, and if a Tier 2 analysis is warranted.

Indicate if the default parameter values (used in deriving Tier 1 parameters) are conservative or reasonable for the site conditions (y - ■, n - □). Indicate if the site-specific parameter has been used in deriving SSTL values (Tier 2 analysis only).

parameter		residential		industrial	definition, units		site-specific values
soil parameters							
	■	sandy			Soil type	□	silty sand * §
h_{cap}	■	5			Capillary zone thickness (cm)	□	
h_v	■	295			Vadose zone thickness (cm)	□	
θ_{wcap}	■	0.342			Soil water content - capillary fringe region (cm^3-water/cm^3-soil)	□	
θ_{wvad}	■	0.12			Soil water content - vadose zone (cm^3-water/cm^3-soil)	□	§
θ_{wcrk}	■	0.12			Soil water content - soil filled foundation cracks (cm^3-w/cm^3-soil)	□	
θ_{acap}	■	0.038			Soil air content - capillary fringe region (cm^3-air/cm^3-soil)	□	
θ_{avad}	■	0.26			Soil air content - vadose zone (cm^3-air/cm^3-soil)	□	
θ_{acrk}	■	0.26			Soil air content - soil filled foundation cracks (cm^3-air/cm^3-soil)	□	
ρ_s	■	1.7			Soil bulk density - dry soil (g/cm^3)	□	§
f_{oc}	■	0.01			Mass fraction of organic carbon in soil (g-oc/g-soil)	□	§
θ_T	■	0.38			Soil porosity (cm^3-void/cm^3-soil)	□	* §
L_{gw}	■	300			Depth to ground water (cm)	□	65 ft * §
L_s	■	100			Thickness of surficial soils (cm)	□	* §
pH	■	6.8			Soil / water pH (unitless)	□	
groundwater parameters							
δ_{gw}	■	200			groundwater mixing zone height (cm)	□	* §
I	■	30			water infiltration rate (cm/year)	□	* §
U_{gw}	■	6.85			groundwater Darcy velocity (cm/day)	□	* §
$LF_{pw,gw}$	■	4.7			leaching factor, pore water / ground water ratio (cm^3-wat/cm^3-wat)	□	* §
surface parameters							
τ	■	30	□	25	averaging time for surface emission vapor flux (years)	□	
U_{air}	■	225		...	ambient air velocity in mixing zone (cm/s)	□	
δ_{air}	■	200		...	mixing zone height (cm)	□	
A	■	2×10^7		...	source-zone area (cm^2)	□	§
W	■	4500		...	width of source-zone area (cm)	□	§
L_{ss}	■	100		...	thickness of surficial soils (cm)	□	§
P_e	■	6.9×10^{-14}		...	Areal respirable particulate emission flux from source (g/cm^2-s)	□	
DF_{amb}	■	10		...	dispersion factor for ambient air ($g\text{-}cm^2/s$)/(g/cm^3)	□	§
building parameters							
L_b	■	200	□	300	enclosed space volume/infiltration area ratio (cm)	□	
ER	■	12	□	20	enclosed space air exchange rate (1/day)	□	
L_{crack}	■	15		...	enclosed-space foundation or wall thickness (cm)	□	
η	■	0.01		...	foundation crack fraction (cm^2-cracks/cm^2-total area)	□	
dP	■	0		...	indoor/outdoor differential pressure ($g/cm\text{-}s^2$)	□	
k_v	■	10^{-8}		...	soil permeability (cm^2)	□	§
Z_{crack}	■	15		...	depth to bottom of slab (cm)	□	
X_{crack}	■	3400		...	slab perimeter (cm)	□	
A_b	■	700000		...	slab area (cm^2)	□	
Q_s	■	0		...	convective flow through basement slab (cm^3-air/sec)	□	
DF_{esp}	■	0.028		...	dispersion factor for enclosed-space air ($g\text{-}cm^2/s$)/(g/cm^3)	□	

SUMMARY OF MEDIA INVESTIGATION & CHEMICAL ANALYSIS DATA 4.3

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
no.	completion / revision: by:	date:	approval: by:	date:	Description:
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/18/99	

			Media					
			Ground-water	Surface Soil	Subsurf. Soil	Soil Vapor	Ambient Vapor	Surface Water
relevant method?		*Not Applicable*	☐	☐	☐	☐	☐	■
		Samples Taken?	■	■	■	■	☐	☐
Chemical Analysis		Analysis Method	• anal - samples analyzed • det - chemical detected •					
Organic Chemicals			anal/det	anal/det	anal/det	anal/det	anal/det	anal/det
Volatile Organic Compounds	■	EPA 8260B (GC/MS)	■■	■■	■■	☐☐	☐☐	☐☐
	■	EPA 8021B (GC/PID or ELCD)	☐☐	■■	■■	■■	☐☐	☐☐
Nonhalogenated Organics	■	EPA 8015B (GC/FID)	☐☐	☐☐	☐☐	■■	☐☐	☐☐
Total Petroleum Hydrocarbons	■	EPA 8015G / 8015D (modified)	☐☐	☐☐	☐☐	■■	☐☐	☐☐
Total Petroleum Hydrocarbons	■	TX1006 (GC/FID)	☐☐	■■	☐☐	☐☐	☐☐	☐☐
Total Petroleum Hydrocarbons	■	EPA 418.1 (IR)	■■	■■	■■	☐☐	☐☐	☐☐
Total Petroleum Hydrocarbons	■	AD Little (GC/MS)	☐☐	■■	☐☐	☐☐	☐☐	☐☐
Total Petroleum Hydrocarbons	■	GC-HTSD (GC/FID)	☐☐	■■	☐☐	☐☐	☐☐	☐☐
Semivolatile Organic Compounds	■	EPA 8270C (GC/MS)	■■	■■	■■	☐☐	☐☐	☐☐
Polycyclic Aromatic Hydrocarbons	■	EPA 8270C (GC/MS)	■■	■■	■■	☐☐	☐☐	☐☐
	☐	EPA 8310 (HPLC)	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
Halogenated Chemicals			anal/det	anal/det	anal/det	anal/det	anal/det	anal/det
Polychlorinated Biphenyls	■	EPA 8082 (GC/ECD or ELCD)	☐☐	■☐	■☐	☐☐	☐☐	☐☐
Organochlorine pesticides	■	EPA 8080	☐☐	■☐	■☐	☐☐	☐☐	☐☐
Inorganic Chemicals			anal/det	anal/det	anal/det	anal/det	anal/det	anal/det
Metals	■	EPA 6010B (ICP-AES)	■■	■■	■■	☐☐	☐☐	☐☐
	■	EPA 7*xxx* (*various*)	☐☐	■■	■■	☐☐	☐☐	☐☐
Ionizing Organic Chemicals			anal/det	anal/det	anal/det	anal/det	anal/det	anal/det
Gas Treament Amines		modified -- IC method	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
Glycols		EPA 8015 (modified)	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
Others			anal/det	anal/det	anal/det	anal/det	anal/det	anal/det
total activity	■	EPA 901.1M	☐☐	■■	■■	☐☐	☐☐	☐☐
inorganic anions	■	E300.0	■■	■■	■■	☐☐	☐☐	☐☐
ammonia	☐	EPA 350.*x*	☐☐	☐☐	☐☐	☐☐	☐☐	☐☐
total dissolved solids	■	E160.1	■■	■■	■■	☐☐	☐☐	☐☐
pH	■	E150.1	■■	■■	■■	☐☐	☐☐	☐☐

Discussion of Media Investigation and Chemical Analysis (include selection of sampled media, selected analysis methods, planned additional sampling):
Analyses are tabulated from -
Triton Analytics Corp. (Feb 16, 1998).
A. D. Little, Environmental Monitoring and Analysis Unit. (Feb 17, 1999).
TraceAnalysis Inc. (Feb 23, 1999).
Westgate Subdivision, Grimes Battery and Tasker Road – Stage 1 Abatement Plan Report Site Assessment Investigation (July 1999).

information key

site name:		site location:	

	completion / revision:		approval:		description:
no.	by:	date:	by:	date:	

Initial Classification			**Date:**	
	Description	Media	Urgency and Response	Addressed

Revised Classification			**Date:**	
	Description	Media	Urgency and Response	Addressed

Revised Classification			**Date:**	
	Description	Media	Urgency and Response	Addressed

information key

site name:	Westgate Subdivision, Grimes Battery, and Tasker Road		site location:	Hobbs, NM
	completion / revision:		approval:		Description:
no.	by:	date:	by:	date:	
	G. E. DeVaull	8/18/99	G. E. DeVaull	8/25/99	

This table provides a summary of chemical or mixture (petroleum) concentrations which exceed RBSL values on a pathway-specific basis. Corrective action strategies are indicated if relevant for the specific chemicals. The need for additional assessment is also indicated.

residential **(also applicable for restricted site use – proposed city park)**

EXPOSURE PATHWAY	INDICATED CHEMICALS	applicable at site?	removal / treatment	containment measures	institutional controls	additional assessment
surficial soil direct exposure	TPH, several PAHs	■	■		■	
soil to enclosed space vapor	benzene *(refined modeling implemented)*	■				
soil to outdoor vapor		■				
soil leaching to groundwater		■				
soil free-phase mobility		■				
other (specify):						

commercial / industrial **(not applicable)**

EXPOSURE PATHWAY	INDICATED CHEMICALS					
surficial soil direct exposure						
soil to enclosed space vapor						
soil to outdoor vapor						
soil leaching to groundwater						
soil free-phase mobility						
other (specify):						

other (indicate): **evaluation of site vegetation**

EXPOSURE PATHWAY	INDICATED CHEMICALS					
surficial soil direct exposure	total dissolved solids (TDS), soil conductivity	■	■			
soil to enclosed space vapor						
soil to outdoor vapor						
soil leaching to groundwater						
soil free-phase mobility						
other (specify):						

Notes:
discuss the specific corrective action options and additional assessment.

This worksheet is focused on chemicals which may need to be addressed in a remediation plan. Other chemicals are summarized in Worksheet 1.2, section 4.

Attachment 1:

Summary of Exposure Parameters

George DeVaull

October 6, 1999

The following is a summary of the applicable exposure parameters used in calculating risk-based screening levels and risk levels. These equations and parameters are consistent with those used in USEPA risk assessment guidance (USEPA, 1991b, 1989b, 1989a), in the ASTM Standard, *Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM E 1739-95), and in the recently approved ASTM *Standard Guide for Risk Based Corrective Action* (ASTM PS 104-98). Several listed exposure parameters are not relevant in this assessment, but are included here for completeness. Where a site-specific parameter is used, it is noted. The reader is referred to either ASTM E 1739-95 or PS 104-98 for the model equations.

Parameters are defined as follows:

exposure parameters and definitions				
The following parameters are consistent with the Maximally Exposed Individual (MEI) definition for upper range exposure.				
AT_c	defined carcinogen averaging time		70 yrs	Lifetime (EPA, 1991b)
AT_n	defined averaging time for non-carcinogens	residential: commercial:	30 yrs 25 yrs	equal to ED, corresponds to assumed exposure duration
BW	body weight	residential: commercial:	70 kg 70 kg	used directly and in calculating age-adjusted exposure values: residential: 70 kg adult, 15 kg child (1-6 yrs), (EPA, 1991b), 35 kg (1-17 yrs) EPA, 1989b commercial/industrial, EPA (1989b)
ED	exposure duration	residential: commercial:	30 yrs 25 yrs	residential: 24 yr adult (ages 7 to 31 years), 6 yr child (ages 1 to 6 years) = 30 years total, Default value (EPA, 1991b)
EF	exposure frequency	residential: commercial: restricted:	350 dys/yr 250 dys/yr 35 dys/yr	Default value (EPA, 1991b) EPA, 1997 (*see note following)
$IR_{s,\ adj.}$ IR_s	Soil ingestion rate	residential: commercial:	114 mg-yr/ kg-day 50 mg/day	residential: 100 mg/dy adult Default value (EPA, 1991b), 200 mg/dy child Default value (EPA, 1991b) [The calculated age-adjusted value is listed] commercial/industrial: Default value (EPA, 1991b)
AA_s	age adjustment on soil ingestion	residential: commercial:	yes no	residential: for carcinogens, age-adjusted values, 1-6 yrs child, 7-31 yrs adult. For non-carcinogens, child and adult expsoure is evaluated separately. adult receptor only.
IR_a	Daily inhalation rate	residential: commercial:	15 m^3/dy (indoors) 20 m^3/dy (outdoors) 20 m^3/dy	residential: Default value (EPA, 1991b) commercial/industrial: assumed 8 hr per dy exposure of 60 m^3/dy total
IR_w	Daily water ingestion rate	residential: commercial:	2 L/dy 1 L/dy	EPA (1991a)
$SA_{adj.}$	Skin Surface Area	residential:	1567 cm^2-yr/kg	residential: 3176 cm^2 adult - seasonally varying exposure (10-30% of average of mean adult male and female total surface area) (EPA, 1992a); 2023 cm^2 1 to 17 year olds - seasonally varying exposure (10-30% of average of mean male and female total surface area) = 1567 cm^2-yr/kg-dy age-adjusted value.
SA		commercial:	3160 cm^2	commercial/industrial: Based on mean surface area of head, hands, and forearms of adult males (EPA, 1992a)

AA_{SA}	age adjustment on skin surface area	residential:	yes	residential: for carcinogens, age-adjusted values, 1-17 yrs, 18-31 yrs adult. For non-carcinogens, child and adult *factors are evaluated separately*
		commercial:	no	adult receptor only.
M	Soil to Skin Adherence Factor		0.5 $mg/cm^2/dy$	EPA dermal exposure assessment guidance (EPA, 1992a) states values should range between 0.2 to 1.0 $mg/cm^2/dy$

soil parameters and definitions

The listed parameters in this section are consistent with a sandy soil. In this analysis these parameters are applied in estimating vapor emissions from soils. These parameters are conservative (tend to overestimate vapor transport and exposure) compared to actual site soils which are less porous (e. g., silts, silty clays) and which contain a higher fraction of organic carbon. The parameters definitions and values are consistent with ASTM E 1739-95.

θ_w	soil water content - unsaturated (vadose) zone	0.12 cm^3-water/cm^3-soil	
θ_a	soil air content - unsaturated (vadose) zone	0.26 cm^3-air/cm^3-soil	$(= \theta_T - \theta_w)$
ρ_s	Soil bulk density	1.7 g/cm^3	
f_{oc}	mass fraction of organic carbon in soil	0.01g-oc / g-soil	
θ_T	Soil porosity	0.38 cm^3-void/cm^3-soil)	
L_s	Depth to contaminated soil	100 cm	assumed depth to subsurface contaminated soil is 1 m; shallower soil is considered surficial soil.

surface parameters and definitions

The listed parameters are used primarily to estimate dispersion in the atmosphere. The parameters lead to relatively conservative results for a receptor located at the center of an areal source. The parameters definitions and values are consistent with ASTM E 1739-95.

τ	Exposure duration	residential:	30 yr	value is equal to ED for undisturbed soils.
		commercial:	25 yr	
U	Ambient air velocity in mixing zone		225 cm/s	
δ	Mixing zone height		200 cm	
A	Contaminated Area		20250000 cm^2	area in this assessment is assumed to be equal to approximately 21800 ft^2 (0.55 acre)
W	Width of Contaminated Area		4500 cm	$= [A]^{1/2}$
L_{ss}	Thickness of Surficial Soils		100 cm	this is the assumed depth of surficial soils. contamination at greater depth is classified as subsurface contamination. Because of the potential for construction activity at this site, all soil measurements are screened against both surface and subsurface soil criteria.
P_e	Particulate areal emission rate	residential & commercial:	6.86E-14 g/cm^2-s	Cowherd, 1985. Estimated dust emissions from bare, *uncrusted dry soil with unlimited erosion potential*

indoor air parameters and definitions

The listed parameters are used primarily to estimate indoor air infiltration from subsurface soils. The parameters definitions and values in this section are consistent with ASTM E 1739-95, and with Johnson and Ettinger (1991).

L_b	enclosed space volume/infiltration area ratio	residential:	200 cm	For a slab foundation, this is the building height. For a basement, the subsurface walls and floor are included in this ratio.
		commercial:	300 cm	

ER	enclosed space air exchange rate	residential: commercial:	12 /day 20 /day	nominal values for occupied buildings
L_{crack}	enclosed-space foundation or wall thickness		15 cm	
η	foundation crack fraction		0.01 cm^2-cracks/cm^2-total area	
dP	indoor/outdoor differential pressure		0 g/cm-s^2	
k_v	soil permeability		10^{-8} cm^2	
Z_{crack}	depth to bottom of slab		15 cm	
X_{crack}	slab perimeter		3400 cm	
A_b	slab area		700000 cm^2	

chemical parameters			
all of the following are chemical-specific.			
CAS	chemical-specific		Chemical Abstracts Service Reference Number
MW		g/g-mol	molecular weight
D_{air}		cm^2/s	molecular diffusion coefficient in air
D_{water}		cm^2/s	molecular diffusion coefficient in water
K_{oc}		L-water/kg-oc	organic carbon - water partition coefficient
K_d		L-water/kg-soil	soil- water partition coefficient
H'		atm-m^3/g-mol	Henry's law coefficient
H		cm^3-water / cm^3-air	Henry's law coefficient = H' · (1000 cm^3/L) / R T_a
P_{vap}		mm Hg	saturated vapor pressure
S		mg/L	aqueous solubility limit
pK_a		(–)	acid ionization equilibrium constant
pK_b		(–)	base ionization equilibrium constant
RfD_o		mg/kg-dy	chronic oral reference dose
RfD_i		mg/kg-dy	chronic inhalation reference dose
SF_o		(mg/kg-dy) $^{-1}$	chronic oral slope factor
SF_i		(mg/kg-dy) $^{-1}$	chronic inhalation slope factor
RAF_o			relative absorption factor, oral (= 1)
RAF_d			relative absorption factor, dermal

global parameters		
μ	g/cm-s	viscosity of air (= 1.81 · 10^{-4})
ρ_a	g/cm^3	ambient air density (= 0.0012)
T_a	K	average ambient air temperature (= 293)
R	atm-L/g-mol-K	ideal gas constant (= 0.08206)

target risk or hazard quotients	
HQ	specified hazard quotient (= 1.0)
Risk	specified risk level or range (10^{-4} to 10^{-6})

* The restricted site use (proposed park) EF = 35 days/year is based on USEPA, 1997: Exposure Factors Handbook, Volume III, USEPA, ORD, Washington, EPA/600/P-95/002Fc; Table 15-8, National averages, outdoor activity for "doer" (an active participant) of 2 hours/day. This is 350 days/year • (2 hrs/day) / (24 hrs/day) = 35 day/year.

References

ASTM E 1739-95: Risk-Based Corrective Action Applied at Petroleum Release Sites (American Society for Testing and Materials, West Conshohocken, PA).

ASTM PS 104-98: Standard Guide for Risk-Based Corrective Action (American Society for Testing and Materials, West Conshohocken, PA).

Cowherd, C., G. E. Muleski, P. J. Englehart, and D. A. Gillette, 1985: Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites, Midwest Research Institute, PB85-192219.

Johnson, P. C. and R. A. Ettinger, 1991: "Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings", Environmental Science & Technology, 25, 1445-1452.

U. S. EPAb, 1989b: Supplemental Risk Assessment Guidance for the Superfund Program, Draft Final, United States Environmental Protection Agency, Region I, EPA 901/5-89-001, PB89-220974, June.

U. S. EPA, 1992a, Dermal Exposure Assessment: Principles and Applications, Interim Report, EPA/600/8-91/011B.

U. S. EPA, 1991a, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors", (United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC), OSWER Directive 9285.6-03, PB91-921314.

U. S. EPA, 1991b, Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual, Part B: Development of Risk-based Preliminary Remediation Goals. Interim. EPA/540/R-92/003. Publication 9285.7-01B. Office of Emergency and Remedial Response.

Attachment 2. Refined Assessment:
exposure to volatile emissions from subsurface soils through inhalation

16 August 1999

George DeVaull

For exposure to vapors evolved from subsurface soils, both measured soil concentrations, in Worksheets 5.1 and 5.2, and soil vapor concentrations, in Worksheets 5.1a and 5.2a, have been compared with Tier 1 screening criteria. Exceedence of the Tier 1 screening criteria are noted for benzene volatilization to indoor air, and for a single TPH analysis as shown in the tables. Reports are referenced in the Worksheets for each sample.

The indoor air vapor model used in this estimate is directly from ASTM E1739-95, and is based on Johnson and Ettinger (1991). We note that the model used in these estimates known to be is very conservative, especially for readily biodegradable chemicals such as benzene (USEPA, 1996; Fitzpatrick and Fitzgerald, 1996).

To improve the comparison, we discuss and refine the model estimates for benzene, including factors which are initially neglected in the Tier 1 Johnson and Ettinger model.

background concentrations and target risk limits
The risk limit for benzene in air in development of screening-level concentrations is based on a target risk range of TR = 10^{-4} to 10^{-6}. For indoor air exposure factors, this yields screening level concentrations of

RBSL	TRU = 10^{-4}	TRL = 10^{-6}	
(ug/m^3)	3.92E+01	3.92E-01	screening-level concentrations for indoor air

Normal benzene concentrations measured in indoor air (USEPA, 1998) range from 2 to 39 ug/m^3, with a typical value of 5 ug/m^3. The indoor to outdoor ratio of measured values is approximately 2:1. At 5 ug/m^3 the indoor air target risk level for benzene is 1.3 x 10^{-5}. There are many potential sources for this measured benzene in indoor air. Sources of benzene (and other volatile organic chemicals) in indoor air include: building materials, consumer products, tobacco smoke, combustion sources, cooking, and attached garages.

The conservatism of the lower bound target risk level of TRL = 10^{-6} in this screening is very conservative. It is more than an order of magnitude less than normal "background" concentrations of benzene in indoor air.

mass limits
The default assumption in the Tier 1 Johnson and Ettinger model is an infinite mass of chemical in soil. One refinement of screening levels for indoor vapor exposure simply imposes a mass limit on the amount of volatile chemical in soil. This is done by specifying the depth of the impacted layer of soil (2 meters is chosen). This limits the mass of chemical available for volatilization over the exposure duration, and results in higher screening levels. For an imposed impacted layer of soil of 2 meters, screening values are shown in the following table.

subsurface soil volatilization to enclosed space – benzene

RBSLs	TRU = 10^{-4}	TRL = 10^{-4}	
(mg/kg)	7.63E-01	7.63E-03	default assumptions
	3.03E+00	3.03E-02	mass-limit of 2 meters
RBSLs	TRU = 10^{-4}	TRL = 10^{-4}	
(mg/m^3)	2.54E+02	2.54E+00	default assumptions
	1.01E+03	1.01E+01	mass limit of 2 meters

biodegradation
Biodegradation in soil will significantly attenuate transport of petroleum vapor in soil, especially the transport of the BTEX (benzene, toluene, ethylbenzene, and xylenes) fraction. The Johnson and Ettinger (1991) soil vapor to indoor air model has been recently improved to include biodegradation effects (Johnson et al., 1998; 1999). This model requires an estimate of a biodegradation rate factor. DeVaull et al. (1997) present a summary of measured rate factors for aerobic degradation of BTEX suitable for use in this model. This summary includes data from nine authors and approximately 63 experiments, with data from soil microcosm tests, diffusive soil columns, soil columns with airflow, and field data over a broad range of concentration levels and soil types.

The biodegradation rate is a function of site-specific chemical concentration in the soil pore-water, and the rate is slowest for higher concentration levels. For this site, we have maximum near-surface soil and soil vapor concentrations which, with applicable partitioning factors, may be used in estimating a maximum soil pore-water concentration in surface soils.

0.074	(mg/kg-soil)	measured benzene concentration in soil (TMW-3, 3 ft)
0.695	(L-wat/kg-soil)	soil to soil pore-water partitioning factor (calculated from soil properties) = K_{sw}
0.107	(mg/L-water)	soil pore-water concentration using K_{sw} partition (= 0.074 mg/kg / K_{sw})
35.737	(mg/m^3-air)	measured soil gas concentration (TSVX, 3ft)
0.231	(L-wat/L-air)	air to water partition coefficient (= H, dimensionless Henry's law coefficient for benzene)
0.155	(mg/L-water)	soil pore-water concentration using H (= 35.737 / (H • 1000))

The two estimates for maximum soil pore-water concentration are relatively consistent. We use the average value of (0.107 + 0.155) / 2 = 0.131 mg/L-water for soil pore water concentration.

DeVaull (1997) specifies Monod-type kinetic rate parameters for aerobic degradation of BTEX.

0.9	(mg/L-hr)	maximum rate constant
0.2	(mg/L-water)	half-saturation constant

For an estimate of a 1st order rate constant needed in the Johnson et al. (1999) model, we conservatively simplify the Monod-type kinetics in DeVaull (1997), estimating an average rate and a underprediction of the biodegradation rate.

2.72	(1/hr)	calculated average effective 1st order rate constant (= 0.9 mg/L-hr / (0.2 mg/L + 0.131 mg/L))
9.9		95% confidence interval for data distribution in DeVaull (1997)
0.275	(1/hr)	lower limit (underpredicting degradation) rate constant

Using the average and 95% lower limit (underpredicting degradation) for benzene yields refined screening levels for this exposure pathway of:

subsurface soil volatilization to enclosed space

RBSLs	TRU = 10^{-4}	TRL = 10^{-4}	
(mg/kg)	7.63E-01	7.63E-03	default assumptions
	1.71E+01	1.71E-01	underpredicted biodegradation included
	5.38E+01	5.38E-01	average biodegradation rate included

RBSLs	TRU = 10^{-4}	TRL = 10^{-6}	
(mg/m^3)	2.54E+02	2.54E+00	default assumptions
	5.69E+03	5.69E+01	underpredicted biodegradation included
	1.79E+04	1.79E+02	average biodegradation rate included

references

User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings, prepared by Environmental Quality Management, Inc., Durham, NC, for E. H. Pechan and Associates, Inc., Springfield, VA to USEPA, OERR, Washinton, 1997, URL: *http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger.htm*

Fitzpatrick, N. A., and J. J. Fitzgerald, 1996: An Evaluation of Vapor Intrusion into Buildings through and Evaluation of Field Data, Presented at the 11th Annual Conference on Contaminated Soils University of Massachusetts at Amherst, available from Massacusetts Dept of Environmental Protection, Bureau of Waste Site Cleanup, URL: http://www.state.ma.us/dep/bwsc/miscpubs.htm.

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Johnson, P. C., and R. A. Ettinger, 1991: Heuristic model for predicting the intrusion rate of contaminant vapors into buildings. Environmental Science and Technology, 25(8):1445-1452.

Johnson, P. C., M. W. Kemblowski, and R. L. Johnson, 1998: "Assessing the Significance of Subsurface Vapor Contaminant Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates", American Petroleum Institute, Health and Sciences Dept., Publication Number 4674, December 1998.

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ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: TSB-7A field sample ID: T119262
sample description: sampling unit:
sample type: sampling depth: (2-3')
☐ oil sample sample interval:
■ soil sample field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1	TSB-7, 2-3', SAMPLE: 106036, Table 3		20000		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog				
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction				
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		89.3	<10
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		168.2	<10
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		166	<10
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		501.7	<12.3
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		1041	<10
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		0	<10
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		0	<10
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		43.3	<18.9
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		55.3	<10
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		244.2	<15.5
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		2729	<23.1
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		1419	<10
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction				
			aliphatic and aromatic (C35<) sum			TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		6457.9	
			unfractionated analysis			TSB-7A (2-3'), T119262, Trace Analysis, Inc., 2/26/99		9413	<50

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C)	name	formula	homolog	within range:				
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	consistent with summary table, TSB-7, 2-3', S.	0	<0.232
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	TSB-7, 2-3', SAMPLE: 106036, Table 3	1	
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	TSB-7, 2-3', SAMPLE: 106036, Table 3	5.7	
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	TSB-7, 2-3', SAMPLE: 106036, Table 3	15.66	
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270			
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270			
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<5
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270			
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270			
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<5
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<5
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	TSB-7, 2-3', SAMPLE: 106036, Table 3	0	<25
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270			
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270			
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270			

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: TSB-7A
sample description:
sample type:
☐ oil sample
■ soil sample

field sample ID: T119262
sampling unit: TSB-7A
sampling depth: (2-3')
sample interval:
field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0.01382781	89.3	0.01382781	89.3	89.3	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0.026045215	168.2	0.026045215	168.2	168.2	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0.025704552	166	0.025704552	166	166	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0.07768659	501.7	0.07768659	501.7	501.7	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.161195417	1041	0.161195417	1041	1041	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0.000154847	1			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0.006704862	43.3	0.003397337	21.94	43.3	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0.008563023	55.3	0.008563023	55.3	55.3	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.037813565	244.2	0.037813565	244.2	244.2	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.422576649	2729	0.422576649	2729	2729	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.21972747	1419	0.21972747	1419	1419	
14.	TPH-GT35AT1	>C35 total						
		sum	1	6458				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	1	0.000154847	1	1
100-41-4	ethylbenzene	9.	5.7	0.000882626	5.7	5.7
1330-20-7	xylene (mixed isomers)	9.	15.66	0.002424899	15.66	15.66
91-20-3	naphthalene	11.	0	0	0	0
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.	0	0	0	0
85-01-8	phenanthrene	12.	0	0	0	0
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0	0	0	0
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.	0	0	0	0
207-08-9	benzo(k)fluoranthene	13.	0	0	0	0
50-32-8	3,4-benzopyrene	13.	0	0	0	0
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	6458

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Completed By:
Site Location: *Revision Date:*

sample identifier: GBN-4 field sample ID: T119263
sample description: sampling unit:
sample type: sampling depth:
☐ oil sample sample interval: (6"-8")
■ soil sample field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1	MW-9, 8-10', SAMPLE: 106457, Table		11900		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog					
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction					
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<12.3	
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		2623	<10	
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<18.9	
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<10	
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		0	<15.5	
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		4119	<23.1	
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GBN-4 (6"-8"), T119263, Trace Analysis, Inc., 2/26/99		5	<10	
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction					
			aliphatic and aromatic (C35<) sum					6742		
			unfractionated analysis					9901		

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C)	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<0.025	
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<0.025	
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<0.025	
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<0.05	
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270				
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270				
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270				
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270				
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	GMW-9, 8-10', SAMPLE: 106457, Table 3	0	<1.25	
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270				
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270				
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270				

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GBN-4 field sample ID: T119263
sample description: sampling unit: GBN-4
sample type: sampling depth:
☐ oil sample sample interval: (6"-8")
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0	0	0	0	0	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0	0	0	0	0	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0	0	0	0	0	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.388765377	2623	0.388765377	2623	2623	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0	0			0	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0	0			0	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.610493553	4119	0.610493553	4119	4119	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.00074107	5	0.00074107	5	5	
14.	TPH-GT35AT1	>C35 total						
		sum	1	6747				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	0	0	0	0
100-41-4	ethylbenzene	9.	0	0	0	0
1330-20-7	xylene (mixed isomers)	9.	0	0	0	0
91-20-3	naphthalene	11.	0	0	0	0
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.	0	0	0	0
85-01-8	phenanthrene	12.	0	0	0	0
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0	0	0	0
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.	0	0	0	0
207-08-9	benzo(k)fluoranthene	13.	0	0	0	0
50-32-8	3,4-benzopyrene	13.	0	0	0	0
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	6747

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: field sample ID: T117628
sample description: GBN-3 sampling unit:
sample type: sampling depth: (6")
☐ oil sample sample interval:
■ soil sample field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1			0	<10	

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog					
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction					
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			533	<10
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			14043	<10
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			25.1	<10
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			178	<10
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			9406	<10
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GBN-3 (6"), T117628, Trace Analysis, Inc., 2/23/99			0	<10
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction					
			aliphatic and aromatic (C35<) sum						24185.1	
			unfractionated analysis						21841	

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C)	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.025
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.025
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.025
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.05
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270				
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270				
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270				
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270				
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	GMW-2, 13-15', SAMPLE: 103766, Table 3		0	<0.25
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270				
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270				
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270				

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: field sample ID: T117628
sample description: GBN-3 sampling unit:
sample type: sampling depth: (6")
☐ oil sample sample interval:
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0	0	0	0	0	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0	0	0	0	0	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0.022038362	533	0.022038362	533	533	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.580646762	14043	0.580646762	14043	14043	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0.001037829	25.1	0.001037829	25.1	25.1	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.007359903	178	0.007359903	178	178	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.388917143	9406	0.388917143	9406	9406	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0	0			0	
14.	TPH-GT35AT1	>C35 total						
		sum	1	24185.1				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	0	0	0	0
100-41-4	ethylbenzene	9.	0	0	0	0
1330-20-7	xylene (mixed isomers)	9.	0	0	0	0
91-20-3	naphthalene	11.	0	0	0	0
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.	0	0	0	0
85-01-8	phenanthrene	12.	0	0	0	0
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0	0	0	0
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.	0	0	0	0
207-08-9	benzo(k)fluoranthene	13.	0	0	0	0
50-32-8	3,4-benzopyrene	13.	0	0	0	0
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	24185.1

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS

4.4

Site Name: | Completed By:
Site Location: | Revision Date:

sample identifier: GBN-1 | field sample ID: T117626
sample description: | sampling unit:
sample type: | sampling depth: (6")
☐ oil sample | sample interval:
■ soil sample | field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1	GSB-5, 2-3', SAMPLE: 10		0	<10	

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog					
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction					
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			96	<10
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			2571	<10
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			0	<10
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			911	<10
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GBN-1 (6"), T117626, Trace Analysis, Inc., 2/23/99			289	<10
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction					
			aliphatic and aromatic (C35<) sum						3780.6	
			unfractionated analysis						5322	

Indicator Chemical Analysis Results

	CASRN	T_{nbp} (°C)	name	formula	homolog	within range:					
	71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<0.025
	108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<0.025
	100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<0.025
	1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<0.05
	91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270				
	83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270				
	86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270				
	218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270				
	205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	GSB-5, 2-3', SAMPLE: 106262, Table 3		0	<2.5
	193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270				
	53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270				
	191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270				

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GBN-1 field sample ID: T117626
sample description: sampling unit:
sample type: sampling depth: (6")
☐ oil sample sample interval:
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0	0	0	0	0	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0	0	0	0	0	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0.024825446	96	0.024825446	96	96	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.664856478	2571	0.664856478	2571	2571	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0	0			0	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0	0			0	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.235583139	911	0.235583139	911	911	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.074734937	289	0.074734937	289	289	
14.	TPH-GT35AT1	>C35 total						
		sum	1	3867				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	0	0	0	0
100-41-4	ethylbenzene	9.	0	0	0	0
1330-20-7	xylene (mixed isomers)	9.	0	0	0	0
91-20-3	naphthalene	11.	0	0	0	0
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.	0	0	0	0
85-01-8	phenanthrene	12.	0	0	0	0
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0	0	0	0
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.	0	0	0	0
207-08-9	benzo(k)fluoranthene	13.	0	0	0	0
50-32-8	3,4-benzopyrene	13.	0	0	0	0
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	3867

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GBN-2 field sample ID: T117627
sample description: sampling unit:
sample type: sampling depth: (6")
☐ oil sample sample interval:
■ soil sample field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1					

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C	description	formula	homolog						
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction						
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			585	<10	
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			0	<10	
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			372.4	<10	
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GBN-2 (6"), T117627, Trace Analysis, Inc., 2/23/99			15.7	<10	
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction						
			aliphatic and aromatic (C35<) sum						981		
			unfractionated analysis						1217		

Indicator Chemical Analysis Results

	CASRN	T_{nbp} (°C	name	formula	homolog	within range:						
	71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	CSS #1 to 5, 7, 8 (0-1ft) Sample: 103639 to 44, 46			0	ND
	108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	CSS #1 to 5, 7, 8 (0-1ft) Sample: 103639 to 44, 46			0	ND
	100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	CSS #1 to 5, 7, 8 (0-1ft) Sample: 103639 to 44, 46			0	ND
	1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	CSS #1 to 5, 7, 8 (0-1ft) Sample: 103639 to 44, 46			0	ND
	91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270					
	208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270					
	83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270					
	86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270					
	85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270					
	120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270					
	206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270					
	129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270					
	56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270					
	218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270					
	205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270					
	207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270					
	50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270					
	193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270					
	53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270					
	191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270					

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GBN-2 field sample ID: T117627
sample description: sampling unit:
sample type: sampling depth: (6")
☐ oil sample sample interval:
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0	0	0	0	0	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0	0	0	0	0	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0	0	0	0	0	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.601171514	585	0.601171514	585	585	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0	0			0	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0	0			0	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.382694482	372.4	0.382694482	372.4	372.4	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.016134005	15.7	0.016134005	15.7	15.7	
14.	TPH-GT35AT1	>C35 total						
		sum	1	973.1				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	0	0	0	0
100-41-4	ethylbenzene	9.	0	0	0	0
1330-20-7	xylene (mixed isomers)	9.	0	0	0	0
91-20-3	naphthalene	11.				
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.				
85-01-8	phenanthrene	12.				
120-12-7	anthracene	12.				
206-44-0	fluoranthene	13.				
129-00-0	pyrene	13.				
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.				
207-08-9	benzo(k)fluoranthene	13.				
50-32-8	3,4-benzopyrene	13.				
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	973.1

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS

4.4

Site Name:
Site Location:

Completed By:
Revision Date:

sample identifier: GSB-10 (BP)
sample description:
sample type:
☐ oil sample
■ soil sample

field sample ID: T118813
sampling unit:
sampling depth:
sample interval: (2-3')
field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1			1960		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C	description	formula	homolog					
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction					
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			29.6	<10
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			271.3	<10
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			271.2	<10
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			812.7	<10
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			1582.1	<10
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			0	<10
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			0	<10
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			40.2	<10
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			35.2	<10
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			140.6	<10
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			579.7	<10
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GSB-10 (2-3') T118813, 2/23/99, Trace Analysis, Inc.			5	<10
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction					
			aliphatic and aromatic (C35<) sum						3762	
			unfractionated analysis						6257	

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.087
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.087
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.087
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.174
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270				
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270				
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270				
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270				
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	GSB-8,11 (2-3'), Sample: 107016, 107159		0	<0.25
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270				
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270				
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270				

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GSB-10 (BP) field sample ID: T118813
sample description: sampling unit:
sample type: sampling depth:
☐ oil sample sample interval: (2-3')
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0.00785646	29.6	0.00785646	29.6	29.6	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0.072008706	271.3	0.072008706	271.3	271.3	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0.071982164	271.2	0.071982164	271.2	271.2	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0.215707612	812.7	0.215707612	812.7	812.7	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.419922497	1582.1	0.419922497	1582.1	1582.1	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0.010669922	40.2	0.010669922	40.2	40.2	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0.009342818	35.2	0.009342818	35.2	35.2	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.037318187	140.6	0.037318187	140.6	140.6	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.153864529	579.7	0.153864529	579.7	579.7	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.001327105	5	0.001327105	5	5	
14.	TPH-GT35AT1	>C35 total						
		sum	1	3767.6				

CASRN	name	within range				
71-43-2	benzene	7.	0	0	0	0
108-88-3	toluene	8.	0	0	0	0
100-41-4	ethylbenzene	9.	0	0	0	0
1330-20-7	xylene (mixed isomers)	9.	0	0	0	0
91-20-3	naphthalene	11.	0	0	0	0
208-96-8	acenaphthalene	11.				
83-32-9	acenaphthene	11.				
86-73-7	fluorene	12.	0	0	0	0
85-01-8	phenanthrene	12.	0	0	0	0
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0	0	0	0
56-55-3	benzanthracene	13.				
218-01-9	chrysene	13.				
205-99-2	benzo(b)fluoranthene	13.	0	0	0	0
207-08-9	benzo(k)fluoranthene	13.	0	0	0	0
50-32-8	3,4-benzopyrene	13.	0	0	0	0
193-39-5	indeno(1,2,3-cd)pyrene	13.				
53-70-3	dibenz[1,2;5,6]anthracene	13.				
191-24-2	benzo(g,h,i)perylene	13.				
		sum			1	3767.6

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GSB-9 field sample ID: T118812
sample description: sampling unit:
sample type: sampling depth:
☐ oil sample sample interval: (2-3')
■ soil sample field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TRPH	418.1			24		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C	description	formula	homolog						
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction						
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			0	<10	
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			21.4	<10	
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			20.5	<10	
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction	GSB-9 (2-3') T118812, 2/23/99, Trace Analysis, Inc.			5	<10	
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction						
			aliphatic and aromatic (C35<) sum						41.9		
			unfractionated analysis						51		

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270				
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270				
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270				
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270				
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270				
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270	GSB-2 (5-6'), 3, 4 (2-3'), Sample: 105224, 107012, 107002			ND
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270				
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270				
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270				

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Completed By:
Site Location: Revision Date:

sample identifier: GSB-9 field sample ID: T118812
sample description: sampling unit:
sample type: sampling depth:
☐ oil sample sample interval: (2-3')
■ soil sample field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic	0	0	0	0	0	
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0	0	0	0	0	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0	0	0	0	0	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0	0	0	0	0	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	0	0			0	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	0	0			0	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0	0			0	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.456289979	21.4	0.456289979	21.4	21.4	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.437100213	20.5	0.437100213	20.5	20.5	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.106609808	5	0.106609808	5	5	
14.	TPH-GT35AT1	>C35 total						
		sum	1	46.9				

CASRN	name	within range
71-43-2	benzene	7.
108-88-3	toluene	8.
100-41-4	ethylbenzene	9.
1330-20-7	xylene (mixed isomers)	9.
91-20-3	naphthalene	11.
208-96-8	acenaphthalene	11.
83-32-9	acenaphthene	11.
86-73-7	fluorene	12.
85-01-8	phenanthrene	12.
120-12-7	anthracene	12.
206-44-0	fluoranthene	13.
129-00-0	pyrene	13.
56-55-3	benzanthracene	13.
218-01-9	chrysene	13.
205-99-2	benzo(b)fluoranthene	13.
207-08-9	benzo(k)fluoranthene	13.
50-32-8	3,4-benzopyrene	13.
193-39-5	indeno(1,2,3-cd)pyrene	13.
53-70-3	dibenz[1,2;5,6]anthracene	13.
191-24-2	benzo(g,h,i)perylene	13.

sum	1	46.9

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Shell - Hobbs, NM
Site Location: Westgate

Completed By: G. DeVaull
Revision Date:

sample identifier: TSB-7 2-3 ft
sample description: soil sample
sample type:
☐ oil sample
■ soil sample

field sample ID:
sampling unit:
sampling depth:
sample interval:
field sampling date:

Total or Summation Analysis Results

description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TPH				57000		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog						
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction						
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction						
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction				51.7		
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction				0		
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction				0		
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction				1535.78		
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction				0.02		
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction				0.012		
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction				15.3		
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction				0		
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction				352.2		
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction				511.1		
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction				85.22		
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction				10571		
			aliphatic and aromatic (C35<) sum								
			unfractionated analysis						12749		

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C)	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260			0.02		
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260			0.012		J
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260			3.2		L
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260			12.1		L
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270			12		
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270			0		
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270			0		
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270			6.1		
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270			14		
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270			0		
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270			0		
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270			2		
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270			1.2		
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270			3.6		
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270			1.1		
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270			0.22		
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270			1.1		
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270			0.95		
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270			0.34		
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270			1.6		

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name:	Shell - Hobbs, NM	Completed By:	G. DeVaull
Site Location:	Westgate	Revision Date:	

sample identifier:	TSB-7 2-3 ft	field sample ID:	
sample description:	soil sample	sampling unit:	
sample type:		sampling depth:	
☐	oil sample	sample interval:	
■	soil sample	field sampling date:	

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic						
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0.003939848	51.7	0.003939848	51.7	51.7	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0	0	0	0	0	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.1170356	1535.78	0.1170356	1535.78	1535.78	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	1.52412E-06	0.02			0.02	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	9.14472E-07	0.012			0.012	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0.001165951	15.3			15.3	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.026839742	352.2	0.02592527	340.2	352.2	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.03894887	511.1	0.03741713	491	511.1	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.006494273	85.22	0.005571418	73.11	85.22	
14.	TPH-GT35AT1	>C35 total	0.805573278	10571	0.805573278	10571	10571	
		sum	1	13122.332				

CASRN	name	within range				
71-43-2	benzene	7.	0.02	1.52412E-06	0.02	0.02
108-88-3	toluene	8.	0.012	9.14472E-07	0.012	0.012
100-41-4	ethylbenzene	9.	3.2	0.000243859	3.2	3.2
1330-20-7	xylene (mixed isomers)	9.	12.1	0.000922092	12.1	12.1
91-20-3	naphthalene	11.	12	0.000914472	12	12
208-96-8	acenaphthalene	11.	0	0	0	0
83-32-9	acenaphthene	11.	0	0	0	0
86-73-7	fluorene	12.	6.1	0.000464856	6.1	6.1
85-01-8	phenanthrene	12.	14	0.001066884	14	14
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	2	0.000152412	2	2
56-55-3	benzanthracene	13.	1.2	9.14472E-05	1.2	1.2
218-01-9	chrysene	13.	3.6	0.000274341	3.6	3.6
205-99-2	benzo(b)fluoranthene	13.	1.1	8.38266E-05	1.1	1.1
207-08-9	benzo(k)fluoranthene	13.	0.22	1.67653E-05	0.22	0.22
50-32-8	3,4-benzopyrene	13.	1.1	8.38266E-05	1.1	1.1
193-39-5	indeno(1,2,3-cd)pyrene	13.	0.95	7.23957E-05	0.95	0.95
53-70-3	dibenz[1,2;5,6]anthracene	13.	0.34	2.591E-05	0.34	0.34
191-24-2	benzo(g,h,i)perylene	13.	1.6	0.00012193	1.6	1.6
		sum		1	13122.332	

Notes (where applicable):

(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.

(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - PETROLEUM HYDROCARBON ANALYSIS 4.4

Site Name: Shell - Hobbs, NM
Site Location: Westgate
Completed By: G. DeVaull
Revision Date:

sample identifier: TSB-8 2-3 ft
sample description: *soil sample*
sample type:
☐ oil sample
■ soil sample
field sample ID:
sampling unit:
sampling depth:
sample interval:
field sampling date:

Total or Summation Analysis Results description	analytical method number	analysis date	analysis ID code	measured chemical concentration (mg/kg)	detection limit (mg/kg)	QA/QC code
TPH				32000		

Equivalent Carbon Number Range Analysis Results

	indentifier	T_{nbp} (°C)	description	formula	homolog						
1.	TPH-LT6AL1	51	EC 6< aliphatic	C5.5	aliphatic fraction						
2.	TPH-6TO8AL2	96	EC =&>6 to 8 aliphatic	C7	aliphatic fraction						
3.	TPH-8TO10AL3	150	EC >8 to 10 aliphatic	C9	aliphatic fraction				52.76		
4.	TPH-10TO12AL4	200	EC >10 to 12 aliphatic	C11	aliphatic fraction				0		
5.	TPH-12TO16AL5	260	EC >12 to 16 aliphatic	C14	aliphatic fraction				258.6		
6.	TPH-16TO35AL6	320	EC >16 to 35 aliphatic	C19	aliphatic fraction				1059.492		
7.	TPH-6TO7AR1	80	Benzene (EC <6 to 7) arom.	C6.5	aromatic fraction				0.0098		
8.	TPH-7TO8AR2	110	Toluene (EC >7 to 8) arom.	C7.6	aromatic fraction				0.0065		
9.	TPH-8TO10AR3	150	EC > 8 to 10 aromatic	C9	aromatic fraction				59.24		
10.	TPH-10TO12AR4	200	EC > 10 to 12 aromatic	C11	aromatic fraction				0		
11.	TPH-12TO16AR5	260	EC >12 to 16 aromatic	C14	aromatic fraction				244.1		
12.	TPH-16TO21AR6	320	EC >16 to 21 aromatic	C19	aromatic fraction				268.4		
13.	TPH-21TO35AR7	340	EC >21 to 35 aromatic	C28	aromatic fraction				37.508		
14.	TPH-GT35AT1	> 627.98	>C35 total		total fraction				7151.1		
			aliphatic and aromatic (C35<) sum								
			unfractionated analysis						9013.1		

Indicator Chemical Analysis Results

CASRN	T_{nbp} (°C)	name	formula	homolog	within range:					
71-43-2	80.1	benzene	C6H6	alkyl benzenes	7.	EPA 8260			0.0098		J
108-88-3	110.7	toluene	C7H8	alkyl benzenes	8.	EPA 8260			0.0065		J
100-41-4	136.2	ethylbenzene	C8H10	alkyl benzenes	9.	EPA 8260			11		L
1330-20-7	140	xylene (mixed isomers)	C8 H10	alkyl benzenes	9.	EPA 8260			48.24		L
91-20-3	217.9	naphthalene	C10H8	alkyl naphthalenes	11.	EPA 8270			11		
208-96-8	265	acenaphthalene	C12H8	naphtheno-benzenes	11.	EPA 8270			0		
83-32-9	278	acenaphthene	C12H10	naphtheno-benzenes	11.	EPA 8270			0		
86-73-7	295	fluorene	C13H10	naphtheno-benzenes	12.	EPA 8270			3.7		
85-01-8	340	phenanthrene	C14H10	polynuclear aromatics	12.	EPA 8270			8.3		
120-12-7	339.9	anthracene	C14H10	polynuclear aromatics	12.	EPA 8270			0		
206-44-0	384	fluoranthene	C16H10	naphtheno-benzenes	13.	EPA 8270			0		
129-00-0	404	pyrene	C16H10	polynuclear aromatics	13.	EPA 8270			0.81		
56-55-3	433.85	benzanthracene	C18H12	polynuclear aromatics	13.	EPA 8270			0.45		
218-01-9	447.85	chrysene	C18H12	polynuclear aromatics	13.	EPA 8270			1.5		
205-99-2	481	benzo(b)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270			0.38		
207-08-9	480	benzo(k)fluoranthene	C20 H12	naphtheno-benzenes	13.	EPA 8270			0.088		
50-32-8	526.85	3,4-benzopyrene	C20 H12	polynuclear aromatics	13.	EPA 8270			0.35		
193-39-5	536	indeno(1,2,3-cd)pyrene	C21 H24	naphtheno-benzenes	13.	EPA 8270			0.2		
53-70-3	524	dibenz[1,2;5,6]anthracene	C22 H14	polynuclear aromatics	13.	EPA 8270			0.12		
191-24-2	616.85	benzo(g,h,i)perylene	C22 H12	polynuclear aromatics	13.	EPA 8270			0.39		

Notes (where applicable):
All detected petroleum hydrocarbon indicator chemicals and cuts are included in the above list.
Non-detects are omitted from the list.
In this application the indicator chemicals are screened separately from the TPH mixture.

ANALYTICAL RESULTS - PETROLEUM MASS FRACTION DISTRIBUTION 4.5

Site Name: Shell - Hobbs, NM
Site Location: Westgate
Completed By: G. DeVaull
Revision Date:

sample identifier: TSB-8 2-3 ft
sample description: soil sample
sample type:
☐ oil sample
■ soil sample
field sample ID:
sampling unit:
sampling depth:
sample interval:
field sampling date:

Calculated Mass Fraction Distributions

	indentifier	description	equivalent carbon number distribution only (1) mass fraction (g/g)	equivalent carbon number distribution only (1) mass conc. (mg/kg)	equivalent carbon number distribution with indicator chemicals included (2) mass fraction (g/g)	equivalent carbon number distribution with indicator chemicals included (2) mass conc. (mg/kg)	initial measured mass conc. (mg/kg)	
1.	TPH-LT6AL1	EC 6< aliphatic						
2.	TPH-6TO8AL2	EC =&>6 to 8 aliphatic						
3.	TPH-8TO10AL3	EC >8 to 10 aliphatic	0.005777982	52.76	0.005777982	52.76	52.76	
4.	TPH-10TO12AL4	EC >10 to 12 aliphatic	0	0	0	0	0	
5.	TPH-12TO16AL5	EC >12 to 16 aliphatic	0.028320433	258.6	0.028320433	258.6	258.6	
6.	TPH-16TO35AL6	EC >16 to 35 aliphatic	0.116029668	1059.492	0.116029668	1059.492	1059.492	
7.	TPH-6TO7AR1	Benzene (EC <6 to 7) arom.	1.07324E-06	0.0098			0.0098	(1)
8.	TPH-7TO8AR2	Toluene (EC >7 to 8) arom.	7.11844E-07	0.0065			0.0065	(1)
9.	TPH-8TO10AR3	EC > 8 to 10 aromatic	0.006487635	59.24			59.24	
10.	TPH-10TO12AR4	EC > 10 to 12 aromatic	0	0	0	0	0	
11.	TPH-12TO16AR5	EC >12 to 16 aromatic	0.026732474	244.1	0.025527815	233.1	244.1	
12.	TPH-16TO21AR6	EC >16 to 21 aromatic	0.029393675	268.4	0.028079501	256.4	268.4	
13.	TPH-21TO35AR7	EC >21 to 35 aromatic	0.004107667	37.508	0.00363807	33.22	37.508	
14.	TPH-GT35AT1	>C35 total	0.783148681	7151.1	0.783148681	7151.1	7151.1	
		sum	1	9131.2163				

CASRN	name	within range				
71-43-2	benzene	7.	0.0098	1.07324E-06	0.0098	0.0098
108-88-3	toluene	8.	0.0065	7.11844E-07	0.0065	0.0065
100-41-4	ethylbenzene	9.	11	0.001204659	11	11
1330-20-7	xylene (mixed isomers)	9.	48.24	0.005282976	48.24	48.24
91-20-3	naphthalene	11.	11	0.001204659	11	11
208-96-8	acenaphthalene	11.	0	0	0	0
83-32-9	acenaphthene	11.	0	0	0	0
86-73-7	fluorene	12.	3.7	0.000405203	3.7	3.7
85-01-8	phenanthrene	12.	8.3	0.00090897	8.3	8.3
120-12-7	anthracene	12.	0	0	0	0
206-44-0	fluoranthene	13.	0	0	0	0
129-00-0	pyrene	13.	0.81	8.87067E-05	0.81	0.81
56-55-3	benzanthracene	13.	0.45	4.92815E-05	0.45	0.45
218-01-9	chrysene	13.	1.5	0.000164272	1.5	1.5
205-99-2	benzo(b)fluoranthene	13.	0.38	4.16155E-05	0.38	0.38
207-08-9	benzo(k)fluoranthene	13.	0.088	9.63727E-06	0.088	0.088
50-32-8	3,4-benzopyrene	13.	0.35	3.83301E-05	0.35	0.35
193-39-5	indeno(1,2,3-cd)pyrene	13.	0.2	2.19029E-05	0.2	0.2
53-70-3	dibenz[1,2;5,6]anthracene	13.	0.12	1.31417E-05	0.12	0.12
191-24-2	benzo(g,h,i)perylene	13.	0.39	4.27106E-05	0.39	0.39
				sum	1	9131.2163

Notes (where applicable):
(1) EPA 8260 (GC/MS) results, if available, are used for benzene and toluene aromatic cuts.
(2) Indicator concentrations subtracted from applicable cut range and distribution is re-normalized.

ANALYTICAL SUMMARY - SOIL CONCENTRATIONS

5.1

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

All detected chemical analysis results from site soil samples are tabulated. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	1093		soil	TSB-8	8-10'	8	10		107008		E 300.0	16984-48-8	fluoride			17
A	2553	max	soil	GMW-2	13-15'	13	15		103766		Sm 4500 CN,CE	57-12-5	cyanide			0.08
A	695	max	soil	TSB-4	3-5'	3	5		106092		S 6010B	7429-90-5	aluminum			14000
A	832	max	soil	TSB-6	2-3'	2	3		106034		S 6010B	7439-89-6	iron			12000
A	826	max	soil	TSB-6	2-3'	2	3		106034		S 6010B	7439-92-1	lead			92
A	3302	max	soil	GBN-7	6"	0.5			120227		S 6010B	7439-96-5	manganese			257
A	3520	max	soil	BCKG-2	6"	0.5			117633		S 7471	7439-97-6	mercury			3.9
A	3391	max	soil	GBS-3	6"	0.5			117631		S 6010B	7439-98-7	molybdenum			3.8
A	2315	max	soil	GSB-15	19-21'	19	21		T118242		S 6010B	7440-02-0	nickel			38
A	3214	max	soil	GBN-3	6"	0.5			117628		S 6010B	7440-22-4	silver			30
A	2299		soil	GSB-15	19-21'	19	21		T118242		S 6010B	7440-39-3	barium			1020
A	3305		soil	GBN-7	6"	0.5			120227		S 6010B	7440-42-8	boron			60
A	3153		soil	GBN-1	6"	0.5			117626		S 6010B	7440-43-9	cadmium			1.5
A	837		soil	TSB-6	2-3'	2	3		106034		S 6010B	7440-48-4	cobalt			11
A	3216		soil	GBN-3	6"	0.5			117628		S 6010B	7440-50-8	copper			21
A	834		soil	TSB-6	2-3'	2	3		106034		S 6010B	7440-66-6	zinc			350
A	2835		soil	GMW-6	63-65'	63	65		104533		E 300.0	14797-55-8	nitrate			4.2/1.3
A	744		soil	TSB-5	2-3'	2	3		106094		S 6010B	7782-49-2	selenium			3.4
		avg	soil								S 6010B	7440-38-2	arsenic (avg. value, with 1/2 ND (ND=0.5) for 52 samples, 106 total)			1.32
A	738	median	soil								S 6010B	7440-38-2	arsenic (median of 106 samples)			0.54
A	738	max	soil	TSB-5	2-3'	2	3		106094		S 6010B	7440-38-2	arsenic (maximum measured value)			7.3
A	710		soil	TSB-4	18-20'	18	20		106093		S 6010B	7440-38-2	arsenic (2nd highest value)			5.3
		avg.	soil								S 6010B	18540-29-9	chromium (overall avg., neglect 6 ND of 101 values)			7.34
		median	soil								S 6010B	18540-29-9	chromium (median of 101 samples)			4.2

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	825	max	soil	TSB-6	2-3'	2	3		106034		S 6010B	18540-29-9	chromium (maximum measured value)			244
A	3378		soil	GBS-3	6"	0.5			117631		S 6010B	18540-29-9	chromium (2nd highest measured value)			14
		avg	soil								E 901.1M (pCi/gm)	pCi	total activity (overall avg., neglect 3 ND of 86 values)			6.89
		avg	soil								E 901.1M (pCi/gm)	pCi	total activity (median)			4.57
A	2590	max	soil	GMW-2	58-60'	58	60		103765		E 901.1M (pCi/gm)	pCi	total activity (maximum value)			40.61
A	541	2nd highest	soil	TSB-2	3-5'	3	5		105959		E 901.1M (pCi/gm)	pCi	total activity (2nd highest value)			30.66
A	1877	3rd highest	soil	GSB-3	2-3'	2	3		107012		E 901.1M (pCi/gm)	pCi	total activity (3rd highest value)			21.2
A	3556		soil	BCKG-3	6"	0.5			117634		S 6010B	7429-90-5	aluminum			8050
A	3528		soil	BCKG-2	6"	0.5			117633		S 6010B	7429-90-5	aluminum			6630
A	3500		soil	BCKG-1	6"	0.5			117632		S 6010B	7429-90-5	aluminum			7660
A	3544		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-39-3	barium			187
A	3516		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-39-3	barium			218
A	3488		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-39-3	barium			106
A	3557		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-42-8	boron			17
A	3529		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-42-8	boron			15
A	3501		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-42-8	boron			14
A	3545		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-43-9	cadmium			0.88
A	3517		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-43-9	cadmium			0.92
A	3489		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-43-9	cadmium			0.77
A	3546		soil	BCKG-3	6"	0.5			117634		S 6010B	18540-29-9	chromium			9.3
A	3518		soil	BCKG-2	6"	0.5			117633		S 6010B	18540-29-9	chromium			13
A	3490		soil	BCKG-1	6"	0.5			117632		S 6010B	18540-29-9	chromium			8.8
A	3558		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-48-4	cobalt			7.3
A	3530		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-48-4	cobalt			6.9
A	3502		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-48-4	cobalt			6.9
A	3552		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-50-8	copper			8.4
A	3524		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-50-8	copper			11
A	3496		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-50-8	copper			8.3
A	3553		soil	BCKG-3	6"	0.5			117634		S 6010B	7439-89-6	iron			7000
A	3525		soil	BCKG-2	6"	0.5			117633		S 6010B	7439-89-6	iron			6140
A	3497		soil	BCKG-1	6"	0.5			117632		S 6010B	7439-89-6	iron			6460
A	3547		soil	BCKG-3	6"	0.5			117634		S 6010B	7439-92-1	lead			6.8
A	3519		soil	BCKG-2	6"	0.5			117633		S 6010B	7439-92-1	lead			14
A	3491		soil	BCKG-1	6"	0.5			117632		S 6010B	7439-92-1	lead			5.1
A	3554		soil	BCKG-3	6"	0.5			117634		S 6010B	7439-96-5	manganese			169
A	3526		soil	BCKG-2	6"	0.5			117633		S 6010B	7439-96-5	manganese			130
A	3498		soil	BCKG-1	6"	0.5			117632		S 6010B	7439-96-5	manganese			147
A	3548		soil	BCKG-3	6"	0.5			117634		S 7471	7439-97-6	mercury			0.14

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	3520		soil	BCKG-2	6"	0.5			117633		S 7471	7439-97-6	mercury			3.9
A	3492		soil	BCKG-1	6"	0.5			117632		S 7471	7439-97-6	mercury			0.12
A	3559		soil	BCKG-3	6"	0.5			117634		S 6010B	7439-98-7	molybdenum			2.6
A	3531		soil	BCKG-2	6"	0.5			117633		S 6010B	7439-98-7	molybdenum			2.5
A	3503		soil	BCKG-1	6"	0.5			117632		S 6010B	7439-98-7	molybdenum			2.4
A	3560		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-02-0	nickel			26
A	3532		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-02-0	nickel			33
A	3504		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-02-0	nickel			32
A	3550		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-22-4	silver			25
A	3522		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-22-4	silver			24
A	3494		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-22-4	silver			24
A	3555		soil	BCKG-3	6"	0.5			117634		S 6010B	7440-66-6	zinc			27
A	3527		soil	BCKG-2	6"	0.5			117633		S 6010B	7440-66-6	zinc			47
A	3499		soil	BCKG-1	6"	0.5			117632		S 6010B	7440-66-6	zinc			23

Notes (where applicable):

All detected chemicals are included in the above table.
Non-detects are omitted from the list.
A complete analyte list is included in the site analytical data report.
maximum measured value tabulated for fluoride, aluminum, iron, manganese, molybdenum, nickel, silver, barium boron, cadmium, cobalt, copper, zinc, nitrate, and selenium.
sulfate and chloride are not evaluated.
average and statistical values are tabulated for NORM, arsenic, and chromium.
The NORM screening value is cited from the Stage 1 Abatement Plan Report.

ANALYTICAL DATA to RBSL COMPARISONS - SOIL CONCENTRATIONS

5.2

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

This table is a comparison of chemical analysis results to screening level concentrations.
The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):

1) direct soil exposure, ingestion, dermal contact, dust & vapor inhalation - RBCA
2) residential soil - Region VI
3) residential soil w/o dermal exposure - Region VI
4) nominal soil background concentration, arithmetic average - USGS
5) NORM criteria from Stage 1 Abatement Plan Report

						3		24		25		22			
						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).									
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	1) surficial soil, direct exposure (mg/kg)		2) res soil - Region VI (mg/kg)		3) w/o dermal - Region VI (mg/kg)		4) nominal background (mg/kg)		5) NORM (pCi/g)			
1093	max	TSB-8 8-10'	16984-48-8	fluoride	17	□		□	3.6E+3	□	4.7E+3	□		□		□	
2553	max	GMW-2 13-15'	57-12-5	cyanide	0.08	□		□	1.2E+3	□	1.6E+3	□		□		□	
695	max	TSB-4 3-5'	7429-90-5	aluminum	14000	□		□	7.8E+4	□	7.8E+4	□	4.7E+4	□		□	
832	max	TSB-6 2-3'	7439-89-6	iron	12000	□		□	2.3E+4	□	2.3E+4	□	1.8E+4	□		□	
826	max	TSB-6 2-3'	7439-92-1	lead	92	□		□	4.0E+2	□		□		□		□	
3302	max	GBN-7 6"	7439-96-5	manganese	257	□		□	3.2E+3	□	3.2E+3	□		□		□	
3520	max	BCKG-2 6"	7439-97-6	mercury	3.9	□	1.4E+1	□		□		□		□		□	
3391	max	GBS-3 6"	7439-98-7	molybdenum	3.8	□	1.4E+3	□	3.9E+2	□	3.9E+2	□		□		□	
2315	max	GSB-15 19-21'	7440-02-0	nickel	38	□	5.5E+3	□	1.6E+3	□	1.6E+3	■	1.8E+1	□		□	
3214	max	GBN-3 6"	7440-22-4	silver	30	□		□	3.9E+2	□	3.9E+2	□		□		□	
2299		GSB-15 19-21'	7440-39-3	barium	1020	□	1.9E+4	□	5.4E+3	□	5.4E+3	■	5.8E+2	□		□	
3305		GBN-7 6"	7440-42-8	boron	60	□	2.5E+4	□	5.5E+3	□	7.0E+3	□		□		□	
3153		GBN-1 6"	7440-43-9	cadmium	1.5	□	1.4E+2	□	3.9E+1	□	3.9E+1	□		□		□	
837		TSB-6 2-3'	7440-48-4	cobalt	11	□		□	3.4E+3	□	3.4E+3	□		□		□	
3216		GBN-3 6"	7440-50-8	copper	21	□	1.0E+4	□	2.9E+3	□	2.9E+3	□		□		□	
834		TSB-6 2-3'	7440-66-6	zinc	350	□	8.2E+4	□	2.3E+4	□	2.3E+4	□		□		□	
2835		GMW-6 63-65'	14797-55-8	nitrate	4.2/1.3	□		□		□		□		□		□	
744		TSB-5 2-3'	7782-49-2	selenium	3.4	□	1.4E+3	□	3.9E+2	□	3.9E+2	■	3.9E-1	□		□	
	avg		7440-38-2	arsenic (avg. value, with 1/2 ND (ND=0.5) for 52 samp	1.32	■	4.3E-1	■	3.9E-1	■	4.3E-1	□	7.2E+0	□		□	
738	median		7440-38-2	arsenic (median of 106 samples)	0.54	■	4.3E-1	■	3.9E-1	■	4.3E-1	□	7.2E+0	□		□	
738	max	TSB-5 2-3'	7440-38-2	arsenic (maximum measured value)	7.3	■	4.3E-1	■	3.9E-1	■	4.3E-1	■	7.2E+0	□		□	
710		TSB-4 18-20'	7440-38-2	arsenic (2nd highest value)	5.3	■	4.3E-1	■	3.9E-1	■	4.3E-1	□	7.2E+0	□		□	
	avg.		18540-29-9	chromium (overall avg., neglect 6 ND of 101 values)	7.34	■	1.6E-2	□	2.1E+2	□	2.1E+2	□	5.4E+1	□		□	
	median		18540-29-9	chromium (median of 101 samples)	4.2	■	1.6E-2	□	2.1E+2	□	2.1E+2	□	5.4E+1	□		□	

Screening Level comparison against site analytical data.

(continued)

Exceedences are noted by a filled box (■).

line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	1) surficial soil, direct exposure (mg/kg)	2) res soil - Region VI (mg/kg)	3) w/o dermal - Region VI (mg/kg)	4) nominal background (mg/kg)	5) NORM (pCi/g)		
825	max	TSB-6 2-3'	18540-29-9	chromium (maximum measured value)	244	■ 1.6E-2	■ 2.1E+2	■ 2.1E+2	■ 5.4E+1	□	□	□
3378		GBS-3 6"	18540-29-9	chromium (2nd highest measured value)	14	■ 1.6E-2	□ 2.1E+2	□ 2.1E+2	□ 5.4E+1	□	□	□
						□	□	□	□	□	□	□
	avg		pCi	total activity (overall avg., neglect 3 ND of 86 values)	6.89	□	□	□	□	□ 30.00	□	□
	avg		pCi	total activity (median)	4.57	□	□	□	□	□ 30.00	□	□
2590	max	GMW-2 58-60'	pCi	total activity (maximum value)	40.61	□	□	□	□	■ 30.00	□	□
541	2nd highest	TSB-2 3-5'	pCi	total activity (2nd highest value)	30.66	□	□	□	□	■ 30.00	□	□
1877	3rd highest	GSB-3 2-3'	pCi	total activity (3rd highest value)	21.2	□	□	□	□	□ 30.00	□	□
						□	□	□	□	□	□	□
3556		BCKG-3 6"	7429-90-5	aluminum	8050	□	□ 7.8E+4	□ 7.8E+4	□ 4.7E+4	□	□	□
3528		BCKG-2 6"	7429-90-5	aluminum	6630	□	□ 7.8E+4	□ 7.8E+4	□ 4.7E+4	□	□	□
3500		BCKG-1 6"	7429-90-5	aluminum	7660	□	□ 7.8E+4	□ 7.8E+4	□ 4.7E+4	□	□	□
3544		BCKG-3 6"	7440-39-3	barium	187	□ 1.9E+4	□ 5.4E+3	□ 5.4E+3	□ 5.8E+2	□	□	□
3516		BCKG-2 6"	7440-39-3	barium	218	□ 1.9E+4	□ 5.4E+3	□ 5.4E+3	□ 5.8E+2	□	□	□
3488		BCKG-1 6"	7440-39-3	barium	106	□ 1.9E+4	□ 5.4E+3	□ 5.4E+3	□ 5.8E+2	□	□	□
3557		BCKG-3 6"	7440-42-8	boron	17	□ 2.5E+4	□ 5.5E+3	□ 7.0E+3	□	□	□	□
3529		BCKG-2 6"	7440-42-8	boron	15	□ 2.5E+4	□ 5.5E+3	□ 7.0E+3	□	□	□	□
3501		BCKG-1 6"	7440-42-8	boron	14	□ 2.5E+4	□ 5.5E+3	□ 7.0E+3	□	□	□	□
3545		BCKG-3 6"	7440-43-9	cadmium	0.88	□ 1.4E+2	□ 3.9E+1	□ 3.9E+1	□	□	□	□
3517		BCKG-2 6"	7440-43-9	cadmium	0.92	□ 1.4E+2	□ 3.9E+1	□ 3.9E+1	□	□	□	□
3489		BCKG-1 6"	7440-43-9	cadmium	0.77	□ 1.4E+2	□ 3.9E+1	□ 3.9E+1	□	□	□	□
3546		BCKG-3 6"	18540-29-9	chromium	9.3	■ 1.6E-2	□ 2.1E+2	□ 2.1E+2	□ 5.4E+1	□	□	□
3518		BCKG-2 6"	18540-29-9	chromium	13	■ 1.6E-2	□ 2.1E+2	□ 2.1E+2	□ 5.4E+1	□	□	□
3490		BCKG-1 6"	18540-29-9	chromium	8.8	■ 1.6E-2	□ 2.1E+2	□ 2.1E+2	□ 5.4E+1	□	□	□
3558		BCKG-3 6"	7440-48-4	cobalt	7.3	□	□ 3.4E+3	□ 3.4E+3	□	□	□	□
3530		BCKG-2 6"	7440-48-4	cobalt	6.9	□	□ 3.4E+3	□ 3.4E+3	□	□	□	□
3502		BCKG-1 6"	7440-48-4	cobalt	6.9	□	□ 3.4E+3	□ 3.4E+3	□	□	□	□
3552		BCKG-3 6"	7440-50-8	copper	8.4	□ 1.0E+4	□ 2.9E+3	□ 2.9E+3	□	□	□	□
3524		BCKG-2 6"	7440-50-8	copper	11	□ 1.0E+4	□ 2.9E+3	□ 2.9E+3	□	□	□	□
3496		BCKG-1 6"	7440-50-8	copper	8.3	□ 1.0E+4	□ 2.9E+3	□ 2.9E+3	□	□	□	□
3553		BCKG-3 6"	7439-89-6	iron	7000	□	□ 2.3E+4	□ 2.3E+4	□ 1.8E+4	□	□	□
3525		BCKG-2 6"	7439-89-6	iron	6140	□	□ 2.3E+4	□ 2.3E+4	□ 1.8E+4	□	□	□
3497		BCKG-1 6"	7439-89-6	iron	6460	□	□ 2.3E+4	□ 2.3E+4	□ 1.8E+4	□	□	□
3547		BCKG-3 6"	7439-92-1	lead	6.8	□	□ 4.0E+2	□	□	□	□	□
3519		BCKG-2 6"	7439-92-1	lead	14	□	□ 4.0E+2	□	□	□	□	□
3491		BCKG-1 6"	7439-92-1	lead	5.1	□	□ 4.0E+2	□	□	□	□	□
3554		BCKG-3 6"	7439-96-5	manganese	169	□	□ 3.2E+3	□ 3.2E+3	□	□	□	□
3526		BCKG-2 6"	7439-96-5	manganese	130	□	□ 3.2E+3	□ 3.2E+3	□	□	□	□
3498		BCKG-1 6"	7439-96-5	manganese	147	□	□ 3.2E+3	□ 3.2E+3	□	□	□	□
3548		BCKG-3 6"	7439-97-6	mercury	0.14	□ 1.4E+1	□	□	□	□	□	□

Screening Level comparison against site analytical data.

(continued)							Exceedences are noted by a filled box (■).							
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)		surficial soil, direct 1) exposure (mg/kg)		res soil - Region 2) VI (mg/kg)		w/o dermal - Region 3) VI (mg/kg)		nominal back- 4) ground (mg/kg)		5) NORM (pCi/g)		
3520		BCKG-2 6"	7439-97-6	mercury	3.9	□	1.4E+1	□		□		□		□		□	□
3492		BCKG-1 6"	7439-97-6	mercury	0.12	□	1.4E+1	□		□		□		□		□	□
3559		BCKG-3 6"	7439-98-7	molybdenum	2.6	□	1.4E+3	□	3.9E+2	□	3.9E+2	□		□		□	□
3531		BCKG-2 6"	7439-98-7	molybdenum	2.5	□	1.4E+3	□	3.9E+2	□	3.9E+2	□		□		□	□
3503		BCKG-1 6"	7439-98-7	molybdenum	2.4	□	1.4E+3	□	3.9E+2	□	3.9E+2	□		□		□	□
3560		BCKG-3 6"	7440-02-0	nickel	26	□	5.5E+3	□	1.6E+3	□	1.6E+3	■	1.8E+1	□		□	□
3532		BCKG-2 6"	7440-02-0	nickel	33	□	5.5E+3	□	1.6E+3	□	1.6E+3	■	1.8E+1	□		□	□
3504		BCKG-1 6"	7440-02-0	nickel	32	□	5.5E+3	□	1.6E+3	□	1.6E+3	■	1.8E+1	□		□	□
3550		BCKG-3 6"	7440-22-4	silver	25	□		□	3.9E+2	□	3.9E+2	□		□		□	□
3522		BCKG-2 6"	7440-22-4	silver	24	□		□	3.9E+2	□	3.9E+2	□		□		□	□
3494		BCKG-1 6"	7440-22-4	silver	24	□		□	3.9E+2	□	3.9E+2	□		□		□	□
3555		BCKG-3 6"	7440-66-6	zinc	27	□	8.2E+4	□	2.3E+4	□	2.3E+4	□		□		□	□
3527		BCKG-2 6"	7440-66-6	zinc	47	□	8.2E+4	□	2.3E+4	□	2.3E+4	□		□		□	□
3499		BCKG-1 6"	7440-66-6	zinc	23	□	8.2E+4	□	2.3E+4	□	2.3E+4	□		□		□	□
						□		□		□		□		□		□	□
						□		□		□		□		□		□	□

Notes (where applicable):

Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).

Region VI screening values: USEPA Region VI Human Health Medium-Specific Screening Levels, USEPA, Region 6, Multimedia Planning and Permitting Division, Dallas. available at URL: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm

RBCA -based screening levels based on ASTM PS104-98 with default exposure parameters, USEPA toxicity parameters, and representative physical parameters.

ANALYTICAL SUMMARY - SOIL CONCENTRATIONS

5.1

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

All detected chemical analysis results from site soil samples are tabulated except as specifically noted at the end of the table. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	1043		soil	TSB-8 3-5'		3	5		107006		S 418.1	TPH-ss	TRPHC			67000
A	1015		soil	TSB-8 2-3'		2	3		19350		S 418.1	TPH-ss	TRPHC			60300
A	3232		soil	GBN-3 6"		0.5			117628		S 418.1	TPH-ss	TRPHC			52000
A	455		soil	TSB-1 3-5'		3	5		105956		S 418.1	TPH-ss	TRPHC			37100
A	1455		soil	TMW-1 2-3'		2	3		105742		S 418.1	TPH-ss	TRPHC			28500
A	3372		soil	GBS-2 6"		0.5			117630		S 418.1	TPH-ss	TRPHC			25800
A	959		soil	TSB-7 3-5'		3	5		106037		S 418.1	TPH-ss	TRPHC			22900
A	1071		soil	TSB-8D 3-5'		3	5		107007		S 418.1	TPH-ss	TRPHC			21300
A	931		soil	TSB-7 2-3'		2	3		106036		S 418.1	TPH-ss	TRPHC			20000
A	1239		soil	TSB-10 2-3'		2	3		106029		S 418.1	TPH-ss	TRPHC			18500
A	1267		soil	TSB-10 3-5'		3	5		106030		S 418.1	TPH-ss	TRPHC			16000
A	2463		soil	CSS #6					103645		S 418.1	TPH-ss	TRPHC			12900
A	2980		soil	GMW-9 8-10'		8	10		106457		S 418.1	TPH-ss	TRPHC			11900
A	3344		soil	GBS-1 6"		0.5			117629		S 418.1	TPH-ss	TRPHC			11000
A	427		soil	TSB-1 2-3'		2	3		105955		S 418.1	TPH-ss	TRPHC			10200
A	3176		soil	GBN-1 6"		0.5			117626		S 418.1	TPH-ss	TRPHC			8570
A	1707		soil	TMW-4 40-42'		40	42		118283		S 418.1	TPH-ss	TRPHC			8240
A	483		soil	TSB-1 8-10'		8	10		105957		S 418.1	TPH-ss	TRPHC			7790
A	139		soil	GSB-8D 57-59'		57	59		107019		S 418.1	TPH-ss	TRPHC			6380
A	76		soil	GSB-4D 57-59'		57	59		107005		S 418.1	TPH-ss	TRPHC			5720
A	1763		soil	TMW-5 48-50'		48	50		119858		S 418.1	TPH-ss	TRPHC			5610
A	1295		soil	TSB-10 8-10'		8	10		106031		S 418.1	TPH-ss	TRPHC			5580
A	69		soil	GSB-4 57-59'		57	59		107004		S 418.1	TPH-ss	TRPHC			5340
A	875		soil	TSB-6 3-5'		3	5		106035		S 418.1	TPH-ss	TRPHC			4490
A	3400		soil	GBS-3 6"		0.5			117631		S 418.1	TPH-ss	TRPHC			4360
A	3064		soil	GMW-10 3-5'		3	5		106342		S 418.1	TPH-ss	TRPHC			4180

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	132		soil	GSB-8 57-59'		57	59		107018		S 418.1	TPH-ss	TRPHC			4030
A	160		soil	GSB-10 3-5'		3	5		106790		S 418.1	TPH-ss	TRPHC			3960
A	2672		soil	GMW-3 63-65'		63	65		104148		S 418.1	TPH-ss	TRPHC			3820
A	1651		soil	TMW-3 23-25'		23	25		108240		S 418.1	TPH-ss	TRPHC			3574
A	2756		soil	GMW-5 58-60'		58	60		104339		S 418.1	TPH-ss	TRPHC			3170
A	1875		soil	GSB-3 2-3'		2	3		107012		S 418.1	TPH-ss	TRPHC			3130
A	2644		soil	GMW-3 53-55'		53	55		104147		S 418.1	TPH-ss	TRPHC			3000
A	1623		soil	TMW-3 3-5'		3	5		108239		S 418.1	TPH-ss	TRPHC			2986
A	167		soil	GSB-10 50-52'		50	52		106791		S 418.1	TPH-ss	TRPHC			2920
A	62		soil	GSB-4 48-50'		48	50		107003		S 418.1	TPH-ss	TRPHC			2900
A	153		soil	GSB-9 50-52'		50	52		106788		S 418.1	TPH-ss	TRPHC			2310
A	3204		soil	GBN-2 6"		0.5			117627		S 418.1	TPH-ss	TRPHC			2060
A	146		soil	GSB-9 13-15'		13	15		106787		S 418.1	TPH-ss	TRPHC			2050
A	188		soil	GSB-11 48-50'		48	50		107161			TPH-ss	TRPHC			1990
A	2099		soil	GSB-10 2-3'		2	3		106789		S 418.1	TPH-ss	TRPHC			1960
A	2784		soil	GMW-5 63-65'		63	65		104340		S 418.1	TPH-ss	TRPHC			1950
A	55		soil	GSB-3D 48-50'		48	50		107015		S 418.1	TPH-ss	TRPHC			1890
A	6		soil	GSB-1 58-60'		58	60		105072		S 418.1	TPH-ss	TRPHC			1770
A	1595		soil	TMW-3 2-3'		2	3		108238		S 418.1	TPH-ss	TRPHC			1460
A	125		soil	GSB-8 43-45'		43	45		107017		S 418.1	TPH-ss	TRPHC			1350
A	20		soil	GSB-1B 63-65'		63	65		105074		S 418.1	TPH-ss	TRPHC			1340
A	41		soil	GSB-3 38-40'		38	40		107013		S 418.1	TPH-ss	TRPHC			1310
A	181		soil	GSB-11 2-3'		2	3		107160		S 418.1	TPH-ss	TRPHC			1100
A	34		soil	GSB-2 55-57'		55	57		105226		S 418.1	TPH-ss	TRPHC			1020
A	27		soil	GSB-2 45-47'		45	47		105225		S 418.1	TPH-ss	TRPHC			870
A	48		soil	GSB-3 48-50'		48	50		107014		S 418.1	TPH-ss	TRPHC			771
A	3428		soil	GBS-4 6"		0.5			120225		S 418.1	TPH-ss	TRPHC			730
A	174		soil	GSB-11					107162		S 418.1	TPH-ss	TRPHC			704
A	111		soil	GSB-7 33-35'		33	35		106260		S 418.1	TPH-ss	TRPHC			692
A	3036		soil	GMW-9D 63-65'		63	65		106459		S 418.1	TPH-ss	TRPHC			688
A	2351		soil	GSB-16 3-5'		3	5		118543		S 418.1	TPH-ss	TRPHC			665
A	195		soil	CSS #1 0 - 1'		0	1		103639			TPH-ss	TRPHC			460
A	3456		soil	GBS-5 6"		0.5			120226		S 418.1	TPH-ss	TRPHC			419
A	13		soil	GSB-1 63-65'		63	65		105073		S 418.1	TPH-ss	TRPHC			274
A	202		soil	CSS #2 0 - 1'		0	1		103640			TPH-ss	TRPHC			222
A	1987		soil	GSB-7 2-3'		2	3		106259		S 418.1	TPH-ss	TRPHC			217
A	3008		soil	GMW-9 63-65'		63	65		106458		S 418.1	TPH-ss	TRPHC			206
A	987		soil	TSB-7 8-10'		8	10		106038		S 418.1	TPH-ss	TRPHC			139
A	1211		soil	TSB-9 18-20'		18	20		106099		S 418.1	TPH-ss	TRPHC			117
A	819		soil	TSB-5 18-20'		18	20		106096		S 418.1	TPH-ss	TRPHC			102

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	1155		soil	TSB-9 2-3'		2	3		106097		S 418.1	TPH-ss	TRPHC			97.2
A	3288		soil	GBN-6 6"		0.5			120226		S 418.1	TPH-ss	TRPHC			87.8
A	847		soil	TSB-6 2-3'		2	3		106034		S 418.1	TPH-ss	TRPHC			86.8
A	1511		soil	TMW-1A 63-65'		63	65		105744		S 418.1	TPH-ss	TRPHC			63
A	230		soil	CSS #7					103644			TPH-ss	TRPHC			55
A	679		soil	TSB-4 2-3'		2	3		106091		S 418.1	TPH-ss	TRPHC			52.3
A	1567		soil	TMW-2 63-65'		63	65		105615		S 418.1	TPH-ss	TRPHC			50
A	209		soil	CSS #3					103641			TPH-ss	TRPHC			39.8
A	1735		soil	TMW-4 63-65'		63	65		118284		S 418.1	TPH-ss	TRPHC			29
A	2043		soil	GSB-8 2-3'		2	3		107016		S 418.1	TPH-ss	TRPHC			27.5
A	216		soil	CSS #4					103642			TPH-ss	TRPHC			24.7
A	2071		soil	GSB-9 2-3'		2	3		106786		S 418.1	TPH-ss	TRPHC			24.1
A	1539		soil	TMW-2 53-55'		53	55		105614		S 418.1	TPH-ss	TRPHC			21.5
A	223		soil	CSS #5					103643			TPH-ss	TRPHC			19.2
A	1959		soil	GSB-6 2-3'		2	3		106828		S 418.1	TPH-ss	TRPHC			18.7
A	244		soil	TSB-1 43-45'		43	45		105961			TPH-ss	TRPHC			17.4
A	1099		soil	TSB-8 8-10'		8	10		107008		S 418.1	TPH-ss	TRPHC			15.6
A	1127		soil	TSB-8 40-42'		40	42		107009		S 418.1	TPH-ss	TRPHC			15.6
A	2812		soil	GMW-6 3-5'		3	5		104532		S 418.1	TPH-ss	TRPHC			15.6
A	1903		soil	GSB-4 2-3'		2	3		107002		S 418.1	TPH-ss	TRPHC			13.5
A	511		soil	TSB-2 2-3'		2	3		105958		S 418.1	TPH-ss	TRPHC			12.3
A	2127		soil	GSB-11 2-3'		2	3		107159		S 418.1	TPH-ss	TRPHC			12
A	623		soil	TSB-3 3-5'		3	5		106197		S 418.1	TPH-ss	TRPHC			11.7
A	2616		soil	GMW-2 62-64'D		62	64		103764		S 418.1	TPH-ss	TRPHC			10.6
A	1483		soil	TMW-1 63-65'		63	65		105743		S 418.1	TPH-ss	TRPHC			0.11
E	10	SS-1	soil			2	1	35815	89559	02/13/1998	GC-HTSD	TPH-ss	SS-1 (2-3') 89559			182000
E	12	SS-2	soil			2	1	35815	89561	02/13/1998	GC-HTSD	TPH-ss	SS-2 (2-3') 89561			158000
E	14	SS-3	soil			2	1	35815	89563	02/13/1998	GC-HTSD	TPH-ss	SS-3 (2-3') 89563			71000
E	18	SS-5	soil			2		35815	89567	02/13/1998	GC-HTSD	TPH-ss	SS-5 (2') 89567			62000
C	8	TSB-7 ADI	soil								ADL	TSB-7 ADL	TSB-7 2-3 ft (ADL)			57000
E	19	SS-5	soil			5		35815	89568	02/13/1998	GC-HTSD	TPH-ss	SS-5 (5') 89568			39000
C	9	TSB-8 ADI	soil								ADL	TSB-8 ADL	TSB-8 2-3 ft (ADL)			32000
E	13	SS-2	soil			6		35815	89562	02/13/1998	GC-HTSD	TPH-ss	SS-2 (6') 89562			27000
D	3	GBN-3	soil								TX1006	GBN-3	GBN-3 (6") T117628			21841
E	11	SS-1	soil			5		35815	89560	02/13/1998	GC-HTSD	TPH-ss	SS-1 (5') 89560			17000
E	16	SS-4	soil			1		35815	89565	02/13/1998	GC-HTSD	TPH-ss	SS-4 (1') 89565			13000
E	15	SS-3	soil			5.5		35815	89564	02/13/1998	GC-HTSD	TPH-ss	SS-3 (5.5') 89564			11000
D	2	GBN-4	soil								TX1006	GBN-4	GBN-4 (6"-8") T119263			9901
D	1	TSB-7A	soil								TX1006	TSB-7A	TSB-7A (2-3') T119262			9413

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
D	6	GSB-10 (B	soil								TX1006	GSB-10 (BP)	GSB-10 (BP) (2-3') T118813			6257
D	4	GBN-1	soil								TX1006	GBN-1	GBN-1 (6") T117626			5322
E	17	SS-4	soil			5		35815	89566	02/13/1998	GC-HTSD	TPH-ss	SS-4 (5') 89566			4000
D	5	GBN-2	soil								TX1006	GBN-2	GBN-2 (6") T117627			1217
D	7	GSB-9	soil								TX1006	GSB-9	GSB-9 (2-3') T118812			51

Notes (where applicable):

All detected chemicals are included in the above table except as noted.
Non-detects are omitted from the list.
A complete analyte list is included in the site analytical data report.
m- & p-xylenes are screened as part of mixed xylenes (m-, p-, and o- isomers) and are not listed separately above.
Analysis results for phenols using method SM 5530 A,D are not included in the above list; no phenol was detected using GC/MS analysis methods.
maximum measured values only are listed for toluene, ethylbenzene, xylenes (mixed isomers), o-xylene, pyrene, phenanthrene, fluorene, naphthalene, and 1- and 2-methylnapthalene.
A. From Stage 1 Abatement Plan Report, July 1999, Table 2. Soil Analytical Results
B. From Stage 1 Abatement Plan Report, July 1999, Table 4. Confirmation Soil Analytical Results
C. A. D. Little Analysis of Soil Samples by GC/FID, GC/MS, Feb. 17, 1999, Henry Camp.
D. Soil Analyses for TPH by Trace Analysis, Inc. using TX1006 aromatic/aliphatic seperation with boiling-point cut analysis (23 Feb 1999).
E. Soil Analyses for TPH by Triton Analytics using GC - HTSD (Gas Chromatography - High Temperature Simulated Distillation), 16 Feb 1998.

ANALYTICAL DATA to RBSL COMPARISONS - SOIL CONCENTRATIONS

5.2

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

This table is a comparison of chemical analysis results to screening level concentrations.
The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):

1) direct soil exposure, ingestion, dermal contact, dust & vapor inhalation - RBCA
2) volatilization from subsurface soil to ambient (outdoor) air - RBCA
3) volatilization from subsurface soil to indoor air - RBCA
4) Guidelines for Remediation, 8/13/93, NMOCD,, IV.2.a., Ranking Criteria (>19)
5)
7) restricted land use [park] exposure criteria - RBCA
8) tabulation of co-located TPH measurement

						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).						
						3	4	5	24	25		
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	1) surficial soil, direct exposure (mg/kg)	2) soil volatilization indoor (mg/kg)	3) soil volatilization outdoor (mg/kg)	4) NMOCD guidelines (mg/kg)	5) (mg/kg)	6) surficial soil, restricted use (mg/kg)	7) co-located TPH measure (mg/kg)
1043		TSB-8 3-5'	TPH-ss	TRPHC	67000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	67000
1015		TSB-8 2-3'	TPH-ss	TRPHC	60300	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	60300
3232		GBN-3 6"	TPH-ss	TRPHC	52000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	52000
455		TSB-1 3-5'	TPH-ss	TRPHC	37100	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	37100
1455		TMW-1 2-3'	TPH-ss	TRPHC	28500	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	28500
3372		GBS-2 6"	TPH-ss	TRPHC	25800	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	25800
959		TSB-7 3-5'	TPH-ss	TRPHC	22900	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	22900
1071		TSB-8D 3-5'	TPH-ss	TRPHC	21300	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	21300
931		TSB-7 2-3'	TPH-ss	TRPHC	20000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	20000
1239		TSB-10 2-3'	TPH-ss	TRPHC	18500	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	18500
1267		TSB-10 3-5'	TPH-ss	TRPHC	16000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	16000
2463		CSS #6	TPH-ss	TRPHC	12900	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	12900
2980		GMW-9 8-10'	TPH-ss	TRPHC	11900	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	11900
3344		GBS-1 6"	TPH-ss	TRPHC	11000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	11000
427		TSB-1 2-3'	TPH-ss	TRPHC	10200	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	10200
3176		GBN-1 6"	TPH-ss	TRPHC	8570	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	8570
1707		TMW-4 40-42'	TPH-ss	TRPHC	8240	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	8240
483		TSB-1 8-10'	TPH-ss	TRPHC	7790	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	7790
139		GSB-8D 57-59'	TPH-ss	TRPHC	6380	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	6380
76		GSB-4D 57-59'	TPH-ss	TRPHC	5720	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	5720
1763		TMW-5 48-50'	TPH-ss	TRPHC	5610	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	5610
1295		TSB-10 8-10'	TPH-ss	TRPHC	5580	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	5580
69		GSB-4 57-59'	TPH-ss	TRPHC	5340	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	5340
875		TSB-6 3-5'	TPH-ss	TRPHC	4490	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	4490
3400		GBS-3 6"	TPH-ss	TRPHC	4360	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	4360
3064		GMW-10 3-5'	TPH-ss	TRPHC	4180	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	4180

Screening Level comparison against site analytical data.

(continued)

Exceedences are noted by a filled box (■).

line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	1) surficial soil, direct exposure (mg/kg)	2) soil volatilization indoor (mg/kg)	3) soil volatilization outdoor (mg/kg)	4) NMOCD guidelines (mg/kg)	5) (mg/kg)	6) surficial soil, restricted use (mg/kg)	7) co-located TPH measure (mg/kg)
132		GSB-8 57-59'	TPH-ss	TRPHC	4030	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	4030
160		GSB-10 3-5'	TPH-ss	TRPHC	3960	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3960
2672		GMW-3 63-65'	TPH-ss	TRPHC	3820	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3820
1651		TMW-3 23-25'	TPH-ss	TRPHC	3574	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3574
2756		GMW-5 58-60'	TPH-ss	TRPHC	3170	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3170
1875		GSB-3 2-3'	TPH-ss	TRPHC	3130	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3130
2644		GMW-3 53-55'	TPH-ss	TRPHC	3000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	3000
1623		TMW-3 3-5'	TPH-ss	TRPHC	2986	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2986
167		GSB-10 50-52'	TPH-ss	TRPHC	2920	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2920
62		GSB-4 48-50'	TPH-ss	TRPHC	2900	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2900
153		GSB-9 50-52'	TPH-ss	TRPHC	2310	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2310
3204		GBN-2 6"	TPH-ss	TRPHC	2060	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2060
146		GSB-9 13-15'	TPH-ss	TRPHC	2050	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	2050
188		GSB-11 48-50'	TPH-ss	TRPHC	1990	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1990
2099		GSB-10 2-3'	TPH-ss	TRPHC	1960	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1960
2784		GMW-5 63-65'	TPH-ss	TRPHC	1950	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1950
55		GSB-3D 48-50'	TPH-ss	TRPHC	1890	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1890
6		GSB-1 58-60'	TPH-ss	TRPHC	1770	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1770
1595		TMW-3 2-3'	TPH-ss	TRPHC	1460	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1460
125		GSB-8 43-45'	TPH-ss	TRPHC	1350	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1350
20		GSB-1B 63-65'	TPH-ss	TRPHC	1340	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1340
41		GSB-3 38-40'	TPH-ss	TRPHC	1310	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1310
181		GSB-11 2-3'	TPH-ss	TRPHC	1100	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1100
34		GSB-2 55-57'	TPH-ss	TRPHC	1020	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	1020
27		GSB-2 45-47'	TPH-ss	TRPHC	870	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	870
48		GSB-3 48-50'	TPH-ss	TRPHC	771	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	771
3428		GBS-4 6"	TPH-ss	TRPHC	730	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	730
174		GSB-11	TPH-ss	TRPHC	704	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	704
111		GSB-7 33-35'	TPH-ss	TRPHC	692	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	692
3036		GMW-9D 63-65'	TPH-ss	TRPHC	688	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	688
2351		GSB-16 3-5'	TPH-ss	TRPHC	665	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	665
195		CSS #1 0 - 1'	TPH-ss	TRPHC	460	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	460
3456		GBS-5 6"	TPH-ss	TRPHC	419	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	419
13		GSB-1 63-65'	TPH-ss	TRPHC	274	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	274
202		CSS #2 0 - 1'	TPH-ss	TRPHC	222	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	222
1987		GSB-7 2-3'	TPH-ss	TRPHC	217	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	217
3008		GMW-9 63-65'	TPH-ss	TRPHC	206	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	206
987		TSB-7 8-10'	TPH-ss	TRPHC	139	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	139
1211		TSB-9 18-20'	TPH-ss	TRPHC	117	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	117
819		TSB-5 18-20'	TPH-ss	TRPHC	102	□ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	102

Screening Level comparison against site analytical data.

(continued)

Exceedences are noted by a filled box (■).

line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	surficial soil, direct 1) exposure (mg/kg)	soil volatilization indoor 2) (mg/kg)	soil volatilization outdoor 3) (mg/kg)	NMOC D guide 4) lines (mg/kg)	5) (mg/kg)	surficial soil, restricted 6) use (mg/kg)	co-located TPH 7) measure (mg/kg)
1155		TSB-9 2-3'	TPH-ss	TRPHC	97.2	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	97.2
3288		GBN-6 6"	TPH-ss	TRPHC	87.8	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	87.8
847		TSB-6 2-3'	TPH-ss	TRPHC	86.8	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	86.8
1511		TMW-1A 63-65'	TPH-ss	TRPHC	63	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	63
230		CSS #7	TPH-ss	TRPHC	55	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	55
679		TSB-4 2-3'	TPH-ss	TRPHC	52.3	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	52.3
1567		TMW-2 63-65'	TPH-ss	TRPHC	50	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	50
209		CSS #3	TPH-ss	TRPHC	39.8	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	39.8
1735		TMW-4 63-65'	TPH-ss	TRPHC	29	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	29
2043		GSB-8 2-3'	TPH-ss	TRPHC	27.5	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	27.5
216		CSS #4	TPH-ss	TRPHC	24.7	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	24.7
2071		GSB-9 2-3'	TPH-ss	TRPHC	24.1	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	24.1
1539		TMW-2 53-55'	TPH-ss	TRPHC	21.5	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	21.5
223		CSS #5	TPH-ss	TRPHC	19.2	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	19.2
1959		GSB-6 2-3'	TPH-ss	TRPHC	18.7	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	18.7
244		TSB-1 43-45'	TPH-ss	TRPHC	17.4	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	17.4
1099		TSB-8 8-10'	TPH-ss	TRPHC	15.6	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	15.6
1127		TSB-8 40-42'	TPH-ss	TRPHC	15.6	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	15.6
2812		GMW-6 3-5'	TPH-ss	TRPHC	15.6	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	15.6
1903		GSB-4 2-3'	TPH-ss	TRPHC	13.5	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	13.5
511		TSB-2 2-3'	TPH-ss	TRPHC	12.3	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	12.3
2127		GSB-11 2-3'	TPH-ss	TRPHC	12	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	12
623		TSB-3 3-5'	TPH-ss	TRPHC	11.7	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	11.7
2616		GMW-2 62-64'D	TPH-ss	TRPHC	10.6	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	10.6
1483		TMW-1 63-65'	TPH-ss	TRPHC	0.11	□ 2.6E+3	□	□	□ 1.0E+2	□	□ 2.6E+4	0.11
						□	□	□	□	□	□	
10	SS-1		TPH-ss	SS-1 (2-3') 89559	182000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
12	SS-2		TPH-ss	SS-2 (2-3') 89561	158000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
14	SS-3		TPH-ss	SS-3 (2-3') 89563	71000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
18	SS-5		TPH-ss	SS-5 (2') 89567	62000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
8	TSB-7 ADL		TSB-7 ADL	TSB-7 2-3 ft (ADL)	57000	■ 2.7E+3	□ NA	□ NA	■ 1.0E+2	□	■ 2.7E+4	
19	SS-5		TPH-ss	SS-5 (5') 89568	39000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
9	TSB-8 ADL		TSB-8 ADL	TSB-8 2-3 ft (ADL)	32000	■ 2.7E+3	□ NA	□ NA	■ 1.0E+2	□	■ 2.7E+4	
13	SS-2		TPH-ss	SS-2 (6') 89562	27000	■ 2.6E+3	□	□	■ 1.0E+2	□	■ 2.6E+4	
3	GBN-3		GBN-3	GBN-3 (6") T117628	21841	■ 5.2E+3	□ NA	□ NA	■ 1.0E+2	□	□ 5.2E+4	
11	SS-1		TPH-ss	SS-1 (5') 89560	17000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	
16	SS-4		TPH-ss	SS-4 (1') 89565	13000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	
15	SS-3		TPH-ss	SS-3 (5.5') 89564	11000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	
2	GBN-4		GBN-4	GBN-4 (6"-8") T119263	9901	■ 3.5E+3	□ NA	□ NA	■ 1.0E+2	□	□ 3.5E+4	
1	TSB-7A		TSB-7A	TSB-7A (2-3') T119262	9413	■ 3.0E+3	□ NA	□ NA	■ 1.0E+2	□	□ 3.0E+4	

Screening Level comparison against site analytical data.

(continued)						Exceedences are noted by a filled box (■).						
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	surficial soil, direct 1) exposure (mg/kg)	soil volatilization indoor 2) (mg/kg)	soil volatilization outdoor 3) (mg/kg)	NMOC D guidelines 4) (mg/kg)	5) (mg/kg)	surficial soil, restricted 6) use (mg/kg)	co-located TPH 7) measure (mg/kg)
6	GSB-10 (B		GSB-10 (BP)	GSB-10 (BP) (2-3') T118813	6257	□ 6.7E+3	■ 1.4E+3	□ NA	■ 1.0E+2	□	□ 6.7E+4	
4	GBN-1		GBN-1	GBN-1 (6") T117626	5322	□ 6.6E+3	□ NA	□ NA	■ 1.0E+2	□	□ 6.6E+4	
17	SS-4		TPH-ss	SS-4 (5') 89566	4000	■ 2.6E+3	□	□	■ 1.0E+2	□	□ 2.6E+4	
5	GBN-2		GBN-2	GBN-2 (6") T117627	1217	□ 5.3E+3	□ NA	□ NA	■ 1.0E+2	□	□ 5.3E+4	
7	GSB-9		GSB-9	GSB-9 (2-3') T118812	51	□ 2.4E+3	□ NA	□ NA	□ 1.0E+2	□	□ 2.4E+4	
						□	□	□	□	□	□	
						□	□	□	□	□	□	
						□	□	□	□	□	□	
						□	□	□	□	□	□	
						□	□	□	□	□	□	

Notes (where applicable):

Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).

Region VI screening values: USEPA Region VI Human Health Medium-Specific□Screening Levels, USEPA, Region 6, Multimedia Planning and Permitting Division, Dallas. available at URL: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm

RBCA -based screening levels based on ASTM PS104-98 with default exposure parameters, USEPA toxicity parameters, and representative physical parameters.

TPH -based screening levels are based on GRI (1999): Risk-Based Corrective Action Tools for E&P Facilities, review draft.

Screening values for TPH are based on specific sample composition (notes C & D) or on an overall minimum site-specific value otherwise.

ANALYTICAL SUMMARY - SOIL CONCENTRATIONS

5.1

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

All detected chemical analysis results from site soil samples are tabulated except as specifically noted at the end of the table. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	2497		soil	GMW-8 28-30'		28	30		104948		S-8260B	71-43-2	benzene			0.4
A	1358		soil	TMW-3 23-25'		23	25		108240		S-8260B	71-43-2	benzene			0.12
A	1334		soil	TMW-3 2-3'		2	3		108238		S-8260B	71-43-2	benzene			0.074
A	1346		soil	TMW-3 3-5'		3	5		108239		S-8260B	71-43-2	benzene			0.073
A	1370		soil	TMW-3 63-65'		63	65		108241		S-8260B	71-43-2	benzene			0.057
C	3595		soil	TSB-7 2-3 ft		2	3				EPA 8260	71-43-2	benzene			0.02
C	3611		soil	TSB-8 2-3 ft		2	3				EPA 8260	71-43-2	benzene			0.0098
A	73	max	soil	GSB-4D 57-59'		57	59		107005		S 8021B	108-88-3	toluene			10.3
A	294	max	soil	TSB-8 2-3'		2	3		19350		S-8260B	100-41-4	ethylbenzene			17
C	3614	max	soil	TSB-8 2-3 ft		2	3				EPA 8260	1330-20-7	xylene (mixed isomers)			48.24
A	297	max	soil	TSB-8 2-3'		2	3		19350		S-8260B	95-47-6	xylene, o-			5.6
B	3572		soil	TSB-5 2-3'		2	3		118970		8270C	117-81-7	di-2-ethylhexyl phthalate			0.38
A	1312		soil	TMW-1 63-65'		63	65		105743		S-8260B	74-83-9	bromomethane			0.97
A	2498		soil	GMW-8 28-30'		28	30		104948		S-8260B	75-35-4	dichloroethylene, 1,1-			0.37
A	2501		soil	GMW-8 28-30'		28	30		104948		S-8260B	79-01-6	trichloroethylene			0.42
A	334		soil	TSB-11 18-20'		18	20		106102		S-8270C	120-12-7	anthracene			2.97
C	3602	max	soil	TSB-7 2-3 ft		2	3				EPA 8270	129-00-0	pyrene			2
C	3610		soil	TSB-7 2-3 ft		2	3				EPA 8270	191-24-2	benzo(g,h,i)perylene			1.6
C	3626		soil	TSB-8 2-3 ft		2	3				EPA 8270	191-24-2	benzo(g,h,i)perylene			0.39
C	3608		soil	TSB-7 2-3 ft		2	3				EPA 8270	193-39-5	indeno(1,2,3-cd)pyrene			0.95
C	3624		soil	TSB-8 2-3 ft		2	3				EPA 8270	193-39-5	indeno(1,2,3-cd)pyrene			0.2
C	3605		soil	TSB-7 2-3 ft		2	3				EPA 8270	205-99-2	benzo(b)fluoranthene			1.1
C	3621		soil	TSB-8 2-3 ft		2	3				EPA 8270	205-99-2	benzo(b)fluoranthene			0.38
C	3606		soil	TSB-7 2-3 ft		2	3				EPA 8270	207-08-9	benzo(k)fluoranthene			0.22
C	3622		soil	TSB-8 2-3 ft		2	3				EPA 8270	207-08-9	benzo(k)fluoranthene			0.088

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
C	3604		soil	TSB-7 2-3 ft		2	3				EPA 8270	218-01-9	chrysene			3.6
C	3620		soil	TSB-8 2-3 ft		2	3				EPA 8270	218-01-9	chrysene			1.5
A	*1368*		*soil*	*TMW-3 23-25'*		*23*	*25*		*108240*		*S-8270C*	*50-32-8*	*benzo-a-pyrene*			*8.81*
C	3607		soil	TSB-7 2-3 ft		2	3				EPA 8270	50-32-8	benzo-a-pyrene			1.1
C	3623		soil	TSB-8 2-3 ft		2	3				EPA 8270	50-32-8	benzo-a-pyrene			0.35
C	3609		soil	TSB-7 2-3 ft		2	3				EPA 8270	53-70-3	dibenz[1,2;5,6]anthracene			0.34
C	3625		soil	TSB-8 2-3 ft		2	3				EPA 8270	53-70-3	dibenz[1,2;5,6]anthracene			0.12
C	3603		soil	TSB-7 2-3 ft		2	3				EPA 8270	56-55-3	benzanthracene			1.2
C	3619		soil	TSB-8 2-3 ft		2	3				EPA 8270	56-55-3	benzanthracene			0.45
C	3601	max	soil	TSB-7 2-3 ft		2	3				EPA 8270	85-01-8	phenanthrene			14
C	3600	max	soil	TSB-7 2-3 ft		2	3				EPA 8270	86-73-7	fluorene			6.1
B	3578	max	soil	TSB-7 2-3'		2	3		118880		8270C	90-12-0	methylnaphthalene, 1-			43
C	3599	max	soil	TSB-7 2-3 ft		2	3				EPA 8270	91-20-3	naphthalene			12
B	3579	max	soil	TSB-7 2-3'		2	2		118880		8270C	91-57-6	methylnaphthalene, 2-			39
C			soil	TSB-8 2-3 ft		2	3				EPA 8260	BTEX	BTEX (total)			59.2563
A			soil	TMW-1 2-3'		2	3		105742		S-8260B	BTEX	BTEX (total)			54.5
A			soil	TSB-7 3-5'		3	5		106037		S-8260B	BTEX	BTEX (total)			50.9
A			soil	GSB-8D 57-59'		57	59		107019		S 8021B	BTEX	BTEX (total)			41.68
A			soil	GSB-4 48-50'		48	50		107003		S 8021B	BTEX	BTEX (total)			24.91
A			soil	GSB-3D 48-50'		48	50		107015		S 8021B	BTEX	BTEX (total)			23.27
A			soil	TSB-8 2-3'		2	3		19350		S-8260B	BTEX	BTEX (total)			22.6
A			soil	TSB-7 2-3'		2	3		106036		S-8260B	BTEX	BTEX (total)			22.36
A			soil	GSB-4D 57-59'		57	59		107005		S 8021B	BTEX	BTEX (total)			22.03
A			soil	GSB-10 3-5'		3	5		106790		S 8021B	BTEX	BTEX (total)			18.28
A			soil	GSB-10 2-3'		2	3		106789		S-8260B	BTEX	BTEX (total)			18.1
C			soil	TSB-7 2-3 ft		2	3				EPA 8260	BTEX	BTEX (total)			15.332
A			soil	GSB-8 57-59'		57	59		107018		S 8021B	BTEX	BTEX (total)			14.67
A			soil	TMW-3 23-25'		23	25		108240		S-8260B	BTEX	BTEX (total)			14.62
A			soil	TMW-4 40-42'		40	42		118283		S-8260B	BTEX	BTEX (total)			14
A			soil	GSB-4 57-59'		57	59		107004		S 8021B	BTEX	BTEX (total)			13.46
A			soil	TSB-1 3-5'		3	5		105956		S-8260B	BTEX	BTEX (total)			13
A			soil	GMW-3 53-55'		53	55		104147		S-8260B	BTEX	BTEX (total)			12.1
A			soil	GSB-3 48-50'		48	50		107014		S 8021B	BTEX	BTEX (total)			9.1
A			soil	GSB-11 48-50'		48	50		107161			BTEX	BTEX (total)			8.104
A			soil	GSB-9 13-15'		13	15		106787		S 8021B	BTEX	BTEX (total)			7.412
A			soil	GSB-10 50-52'		50	52		106791		S 8021B	BTEX	BTEX (total)			4.887
A			soil	GSB-9 50-52'		50	52		106788		S 8021B	BTEX	BTEX (total)			4.786
A			soil	GSB-8 43-45'		43	45		107017		S 8021B	BTEX	BTEX (total)			4.598
A			soil	GSB-11					107162		S 8021B	BTEX	BTEX (total)			3.559

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A			soil	GSB-11 2-3'		2	3		107160		S 8021B	BTEX	BTEX (total)			3.419
A			soil	GSB-2 55-57'		55	57		105226		S 8021B	BTEX	BTEX (total)			3.397
A			soil	GSB-7 33-35'		33	35		106260		S 8021B	BTEX	BTEX (total)			2.853
A			soil	GSB-3 38-40'		38	40		107013		S 8021B	BTEX	BTEX (total)			2.821
A			soil	GSB-2 45-47'		45	47		105225		S 8021B	BTEX	BTEX (total)			1.476
A			soil	TSB-11 18-20'		18	20		106102		S-8260B	BTEX	BTEX (total)			1.4
A			soil	GMW-5 63-65'		63	65		104340		S-8260B	BTEX	BTEX (total)			1.29
A			soil	GMW-3 63-65'		63	65		104148		S-8260B	BTEX	BTEX (total)			1.14
A			soil	GSB-1 58-60'		58	60		105072		S 8021B	BTEX	BTEX (total)			0.857
A			soil	GMW-8 28-30'		28	30		104948		S-8260B	BTEX	BTEX (total)			0.81
A			soil	GSB-16 38-40'		38	40		118544		S-8260B	BTEX	BTEX (total)			0.583
A			soil	CSS #6					103645			BTEX	BTEX (total)			0.19
A			soil	GSB-6 18-20'		38	40		106829		S 8021B	BTEX	BTEX (total)			0.162
A			soil	GSB-1 63-65'		63	65		105073		S 8021B	BTEX	BTEX (total)			0.075
A			soil	TMW-3 2-3'		2	3		108238		S-8260B	BTEX	BTEX (total)			0.074
A			soil	TMW-3 3-5'		3	5		108239		S-8260B	BTEX	BTEX (total)			0.073
A			soil	TSB-6 18-20'		18	20		106033			BTEX	BTEX (total)			0.072
A			soil	TMW-3 63-65'		63	65		108241		S-8260B	BTEX	BTEX (total)			0.057
A			soil	TSB-42 6-8"		0.5	0.66		125259			BTEX	BTEX (total)			0.027
A			soil	TSB-49 6-8"		0.5	0.66		125260			BTEX	BTEX (total)			0.026

Notes (where applicable):

All detected chemicals are included in the above table except as noted.
Non-detects are omitted from the list.
A complete analyte list is included in the site analytical data report.
m- & p-xylenes are screened as part of mixed xylenes (m-, p-, and o- isomers) and are not listed separately above.
Analysis results for phenols using method SM 5530 A,D are not included in the above list; no phenol was detected using GC/MS analysis methods.
maximum measured values only are listed for toluene, ethylbenzene, xylenes (mixed isomers), o-xylene, pyrene, phenanthrene, fluorene, naphthalene, and 1- and 2-methylnapthalene.
A. From Stage 1 Abatement Plan Report, July 1999, Table 2. Soil Analytical Results
B. From Stage 1 Abatement Plan Report, July 1999, Table 4. Confirmation Soil Analytical Results
C. A. D. Little Analysis of Soil Samples by GC/FID, GC/MS, Feb. 17, 1999, Henry Camp.
D. Soil Analyses for TPH by Trace Analysis, Inc. using TX1006 aromatic/aliphatic seperation with boiling-point cut analysis (23 Feb 1999).
E. Soil Analyses for TPH by Triton Analytics using GC - HTSD (Gas Chromatography - High Temperature Simulated Distillation), 16 Feb 1998.

ANALYTICAL DATA to RBSL COMPARISONS - SOIL CONCENTRATIONS

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

This table is a comparison of chemical analysis results to screening level concentrations.
The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):

1) direct soil exposure, ingestion, dermal contact, dust & vapor inhalation - RBCA
2) volatilization from subsurface soil to ambient (outdoor) air - RBCA
3) volatilization from subsurface soil to indoor air - RBCA
4) residential soil - Region VI
5) residential soil w/o dermal exposure - Region VI
6) Guidelines for Remediation, 8/13/93, NMOCD,, IV.2.a., Ranking Criteria (>19)
7) tabulation of co-located TPH measurement

						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).													
						3		4		5		24		25					
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	1) surficial soil, direct exposure (mg/kg)		2) soil volatilization indoor (mg/kg)		3) soil volatilization outdoor (mg/kg)		4) res soil - Region VI (mg/kg)		5) res soil w/o dermal - Region (mg/kg)		6) NMOCD guide lines (mg/kg)		7) co-located TPH measure (mg/kg)
2497		GMW-8 28-30'	71-43-2	benzene	0.4	☐	3.8E+0	■	7.6E-3	■	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	
1358		TMW-3 23-25'	71-43-2	benzene	0.12	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	3574
1334		TMW-3 2-3'	71-43-2	benzene	0.074	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	1460
1346		TMW-3 3-5'	71-43-2	benzene	0.073	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	2986
1370		TMW-3 63-65'	71-43-2	benzene	0.057	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	
3595		TSB-7 2-3 ft	71-43-2	benzene	0.02	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	57000
3611		TSB-8 2-3 ft	71-43-2	benzene	0.0098	☐	3.8E+0	■	7.6E-3	☐	1.3E-1	☐	6.7E-1	☐	6.8E-1	☐	1.0E+1	32000
73	max	GSB-4D 57-59'	108-88-3	toluene	10.3	☐	8.1E+3	☐	2.6E+1	☐	4.3E+2	☐	5.2E+2	☐	5.2E+2	☐		5720
294	max	TSB-8 2-3'	100-41-4	ethylbenzene	17	☐	5.6E+3	☐	1.2E+2	☐	NA	☐	2.3E+2	☐	2.3E+2	☐		60300
3614	max	TSB-8 2-3 ft	1330-20-7	xylene (mixed isomers)	48.24	☐	9.5E+4	☐	NA	☐	NA	☐		☐		☐		32000
297	max	TSB-8 2-3'	95-47-6	xylene, o-	5.6	☐	9.5E+4	☐	NA	☐	NA	☐	2.8E+2	☐	2.8E+2	☐		60300
3572		TSB-5 2-3'	117-81-7	di-2-ethylhexyl phthalate	0.38	☐	3.4E+1	☐	NA	☐	NA	☐	3.5E+1	☐	4.6E+1	☐		
1312		TMW-1 63-65'	74-83-9	bromomethane	0.97	☐	6.7E+1	■	4.5E-2	■	7.6E-1	☐	3.9E+0	☐	3.9E+0	☐		0.11
2498		GMW-8 28-30'	75-35-4	dichloroethylene, 1,1-	0.37	■	1.5E-1	■	4.6E-5	■	7.7E-4	■	5.3E-2	■	5.4E-2	☐		
2501		GMW-8 28-30'	79-01-6	trichloroethylene	0.42	☐	NA	☐	NA	☐	NA	☐	2.7E+0	☐	2.8E+0	☐		
						☐		☐		☐		☐		☐		☐		
334		TSB-11 18-20'	120-12-7	anthracene	2.97	☐	5.9E+4	☐	NA	☐	NA	☐	1.6E+4	☐	2.2E+4	☐		
3602	max	TSB-7 2-3 ft	129-00-0	pyrene	2	☐	6.1E+3	☐	NA	☐	NA	☐	1.7E+3	☐	2.3E+3	☐		57000
3610		TSB-7 2-3 ft	191-24-2	benzo(g,h,i)perylene	1.6	☐	NA	☐	NA	☐	NA	☐		☐		☐		57000
3626		TSB-8 2-3 ft	191-24-2	benzo(g,h,i)perylene	0.39	☐	NA	☐	NA	☐	NA	☐		☐		☐		32000
3608		TSB-7 2-3 ft	193-39-5	indeno(1,2,3-cd)pyrene	0.95	■	6.5E-1	☐	NA	☐	NA	■	6.2E-1	■	8.8E-1	☐		57000
3624		TSB-8 2-3 ft	193-39-5	indeno(1,2,3-cd)pyrene	0.2	☐	6.5E-1	☐	NA	☐	NA	☐	6.2E-1	☐	8.8E-1	☐		32000
3605		TSB-7 2-3 ft	205-99-2	benzo(b)fluoranthene	1.1	■	6.5E-1	☐	NA	☐	NA	■	6.2E-1	■	8.8E-1	☐		57000
3621		TSB-8 2-3 ft	205-99-2	benzo(b)fluoranthene	0.38	☐	6.5E-1	☐	NA	☐	NA	☐	6.2E-1	☐	8.8E-1	☐		32000
3606		TSB-7 2-3 ft	207-08-9	benzo(k)fluoranthene	0.22	☐	6.5E+0	☐	NA	☐	NA	☐	6.2E+0	☐	8.8E+0	☐		57000
3622		TSB-8 2-3 ft	207-08-9	benzo(k)fluoranthene	0.088	☐	6.5E+0	☐	NA	☐	NA	☐	6.2E+0	☐	8.8E+0	☐		32000

Screening Level comparison against site analytical data.

(continued)

Exceedences are noted by a filled box (■).

line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)	surficial soil, direct 1) exposure (mg/kg)	soil volatilization indoor 2) (mg/kg)	soil volatilization outdoor 3) (mg/kg)	res soil - Region VI 4) (mg/kg)	res soil w/o dermal - Region 5) (mg/kg)	NMOCD guide 6) lines (mg/kg)	co-located TPH 7) measure (mg/kg)
3604		TSB-7 2-3 ft	218-01-9	chrysene	3.6	□ 6.5E+1	□ NA	□ NA	□ 6.2E+1	□ 8.8E+1	□	57000
3620		TSB-8 2-3 ft	218-01-9	chrysene	1.5	□ 6.5E+1	□ NA	□ NA	□ 6.2E+1	□ 8.8E+1	□	32000
1368		TMW-3 23-25'	50-32-8	benzo-a-pyrene	8.81	■ 6.5E-2	□ NA	□ NA	■ 6.2E-2	■ 8.8E-2	□	3574
3607		TSB-7 2-3 ft	50-32-8	benzo-a-pyrene	1.1	■ 6.5E-2	□ NA	□ NA	■ 6.2E-2	■ 8.8E-2	□	57000
3623		TSB-8 2-3 ft	50-32-8	benzo-a-pyrene	0.35	■ 6.5E-2	□ NA	□ NA	■ 6.2E-2	■ 8.8E-2	□	32000
3609		TSB-7 2-3 ft	53-70-3	dibenz[1,2;5,6]anthracene	0.34	■ 6.5E-2	□ NA	□ NA	■ 6.2E-2	■ 8.8E-2	□	57000
3625		TSB-8 2-3 ft	53-70-3	dibenz[1,2;5,6]anthracene	0.12	■ 6.5E-2	□ NA	□ NA	■ 6.2E-2	■ 8.8E-2	□	32000
3603		TSB-7 2-3 ft	56-55-3	benzanthracene	1.2	■ 6.5E-1	□ NA	□ NA	■ 6.2E-1	■ 8.8E-1	□	57000
3619		TSB-8 2-3 ft	56-55-3	benzanthracene	0.45	□ 6.5E-1	□ NA	□ NA	□ 6.2E-1	□ 8.8E-1	□	32000
3601	max	TSB-7 2-3 ft	85-01-8	phenanthrene	14	□ NA	□ NA	□ NA	□	□	□	57000
3600	max	TSB-7 2-3 ft	86-73-7	fluorene	6.1	□ 7.7E+3	□ NA	□ NA	□ 2.0E+3	□ 2.6E+3	□	57000
3578	max	TSB-7 2-3'	90-12-0	methylnaphthalene, 1-	43	□ 3.8E+3	□ NA	□ NA	□	□	□	
3599	max	TSB-7 2-3 ft	91-20-3	naphthalene	12	□ 2.8E+2	□ 4.0E+1	□ NA	□ 5.5E+1	□ 5.6E+1	□	57000
3579	max	TSB-7 2-3'	91-57-6	methylnaphthalene, 2-	39	□ 4.0E+3	□ NA	□ NA	□	□	□	
		TSB-8 2-3 ft	BTEX	BTEX (total)	59.2563	□	□	□	□	□	■ 5.0E+1	32000
		TMW-1 2-3'	BTEX	BTEX (total)	54.5	□	□	□	□	□	■ 5.0E+1	28500
		TSB-7 3-5'	BTEX	BTEX (total)	50.9	□	□	□	□	□	■ 5.0E+1	22900
		GSB-8D 57-59'	BTEX	BTEX (total)	41.68	□	□	□	□	□	□ 5.0E+1	6380
		GSB-4 48-50'	BTEX	BTEX (total)	24.91	□	□	□	□	□	□ 5.0E+1	2900
		GSB-3D 48-50'	BTEX	BTEX (total)	23.27	□	□	□	□	□	□ 5.0E+1	1890
		TSB-8 2-3'	BTEX	BTEX (total)	22.6	□	□	□	□	□	□ 5.0E+1	60300
		TSB-7 2-3'	BTEX	BTEX (total)	22.36	□	□	□	□	□	□ 5.0E+1	20000
		GSB-4D 57-59'	BTEX	BTEX (total)	22.03	□	□	□	□	□	□ 5.0E+1	5720
		GSB-10 3-5'	BTEX	BTEX (total)	18.28	□	□	□	□	□	□ 5.0E+1	3960
		GSB-10 2-3'	BTEX	BTEX (total)	18.1	□	□	□	□	□	□ 5.0E+1	1960
		TSB-7 2-3 ft	BTEX	BTEX (total)	15.332	□	□	□	□	□	□ 5.0E+1	57000
		GSB-8 57-59'	BTEX	BTEX (total)	14.67	□	□	□	□	□	□ 5.0E+1	4030
		TMW-3 23-25'	BTEX	BTEX (total)	14.62	□	□	□	□	□	□ 5.0E+1	3574
		TMW-4 40-42'	BTEX	BTEX (total)	14	□	□	□	□	□	□ 5.0E+1	8240
		GSB-4 57-59'	BTEX	BTEX (total)	13.46	□	□	□	□	□	□ 5.0E+1	5340
		TSB-1 3-5'	BTEX	BTEX (total)	13	□	□	□	□	□	□ 5.0E+1	37100
		GMW-3 53-55'	BTEX	BTEX (total)	12.1	□	□	□	□	□	□ 5.0E+1	3000
		GSB-3 48-50'	BTEX	BTEX (total)	9.1	□	□	□	□	□	□ 5.0E+1	771
		GSB-11 48-50'	BTEX	BTEX (total)	8.104	□	□	□	□	□	□ 5.0E+1	1990
		GSB-9 13-15'	BTEX	BTEX (total)	7.412	□	□	□	□	□	□ 5.0E+1	2050
		GSB-10 50-52'	BTEX	BTEX (total)	4.887	□	□	□	□	□	□ 5.0E+1	2920
		GSB-9 50-52'	BTEX	BTEX (total)	4.786	□	□	□	□	□	□ 5.0E+1	2310
		GSB-8 43-45'	BTEX	BTEX (total)	4.598	□	□	□	□	□	□ 5.0E+1	1350
		GSB-11	BTEX	BTEX (total)	3.559	□	□	□	□	□	□ 5.0E+1	704

Screening Level comparison against site analytical data.

(continued)						Exceedences are noted by a filled box (■).						
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concen-tration (mg/kg)	surficial soil, direct 1) exposure (mg/kg)	soil volatil-ization indoor 2) (mg/kg)	soil volatil-ization outdoor 3) (mg/kg)	res soil - Region VI 4) (mg/kg)	res soil w/o dermal - Region 5) (mg/kg)	NMOCD guide lines 6) (mg/kg)	co-located TPH 7) measure (mg/kg)
		GSB-11 2-3'	BTEX	BTEX (total)	3.419	☐	☐	☐	☐	☐	☐ 5.0E+1	1100
		GSB-2 55-57'	BTEX	BTEX (total)	3.397	☐	☐	☐	☐	☐	☐ 5.0E+1	1020
		GSB-7 33-35'	BTEX	BTEX (total)	2.853	☐	☐	☐	☐	☐	☐ 5.0E+1	692
		GSB-3 38-40'	BTEX	BTEX (total)	2.821	☐	☐	☐	☐	☐	☐ 5.0E+1	1310
		GSB-2 45-47'	BTEX	BTEX (total)	1.476	☐	☐	☐	☐	☐	☐ 5.0E+1	870
		TSB-11 18-20'	BTEX	BTEX (total)	1.4	☐	☐	☐	☐	☐	☐ 5.0E+1	
		GMW-5 63-65'	BTEX	BTEX (total)	1.29	☐	☐	☐	☐	☐	☐ 5.0E+1	1950
		GMW-3 63-65'	BTEX	BTEX (total)	1.14	☐	☐	☐	☐	☐	☐ 5.0E+1	3820
		GSB-1 58-60'	BTEX	BTEX (total)	0.857	☐	☐	☐	☐	☐	☐ 5.0E+1	1770
		GMW-8 28-30'	BTEX	BTEX (total)	0.81	☐	☐	☐	☐	☐	☐ 5.0E+1	
		GSB-16 38-40'	BTEX	BTEX (total)	0.583	☐	☐	☐	☐	☐	☐ 5.0E+1	
		CSS #6	BTEX	BTEX (total)	0.19	☐	☐	☐	☐	☐	☐ 5.0E+1	12900
		GSB-6 18-20'	BTEX	BTEX (total)	0.162	☐	☐	☐	☐	☐	☐ 5.0E+1	
		GSB-1 63-65'	BTEX	BTEX (total)	0.075	☐	☐	☐	☐	☐	☐ 5.0E+1	274
		TMW-3 2-3'	BTEX	BTEX (total)	0.074	☐	☐	☐	☐	☐	☐ 5.0E+1	1460
		TMW-3 3-5'	BTEX	BTEX (total)	0.073	☐	☐	☐	☐	☐	☐ 5.0E+1	2986
		TSB-6 18-20'	BTEX	BTEX (total)	0.072	☐	☐	☐	☐	☐	☐ 5.0E+1	
		TMW-3 63-65'	BTEX	BTEX (total)	0.057	☐	☐	☐	☐	☐	☐ 5.0E+1	
		TSB-42 6-8"	BTEX	BTEX (total)	0.027	☐	☐	☐	☐	☐	☐ 5.0E+1	
		TSB-49 6-8"	BTEX	BTEX (total)	0.026	☐	☐	☐	☐	☐	☐ 5.0E+1	
						☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	

Notes (where applicable):

Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).

Region VI screening values: USEPA Region VI Human Health Medium-Specific□Screening Levels, USEPA, Region 6, Multimedia Planning and Permitting Division, Dallas.
available at URL: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm

RBCA -based screening levels based on ASTM PS104-98 with default exposure parameters, USEPA toxicity parameters, and representative physical parameters.

TPH -based screening levels are based on GRI (1999): Risk-Based Corrective Action Tools for E&P Facilities, review draft.

Screening values for TPH are based on specific sample composition (notes C & D) or on an overall minimum site-specific value otherwise.

Guidelines for Remediation of Leaks, Spills, and Releases (August 13, 1993; New Mexico Oil Conservation Division), IV.2.a., Ranking Criteria, (>19) are shown for benzene and BTEX.

ANALYTICAL SUMMARY - SOIL VAPOR CONCENTRATIONS

5.1a

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

All detected chemical analysis results from site soil samples are tabulated. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/m3)	QA/QC code	measured chemical concentration (mg/m3)
	23			TSVX		3		36027.4	60		8021	71-43-2	benzene			35.7372
	9			TSVI		7		36024.4	60		8021	71-43-2	benzene			19.493
	25			TSVZ		5		36026.7	60		8021	71-43-2	benzene			12.9953
	311			SV-158		5		36017.4	60		8021	71-43-2	benzene			12.9953
	192			SV-39		5		36004.6	60		8021	71-43-2	benzene			3.24884
	396			SV-238		5		36004.7	60		8021	71-43-2	benzene			3.24884
	429			TSVX		3		36027.4	60		8021	108-88-3	toluene			229.934
	598			SV-39		5		36004.6	60		8021	108-88-3	toluene			134.128
	407			TSVA		7		36024.7	60		8021	108-88-3	toluene			126.464
	431			TSVZ		5		36026.7	60		8021	108-88-3	toluene			91.9735
	408			TSVB		5		36024.6	60		8021	108-88-3	toluene			76.6446
	415			TSVI		7		36024.4	60		8021	108-88-3	toluene			76.6446
	802			SV-238		5		36004.7	60		8021	108-88-3	toluene			22.9934
	419			TSVM		5		36024.4	60		8021	108-88-3	toluene			7.66446
	425			TSVS		5		36026.6	60		8021	108-88-3	toluene			3.83223
	430			TSVY		5		36026.7	60		8021	108-88-3	toluene			3.83223
	1219			TSVA		7		36024.7	60		8021	100-41-4	ethylbenzene			242.859
	1220			TSVB		5		36024.6	60		8021	100-41-4	ethylbenzene			132.469
	1227			TSVI		7		36024.4	60		8021	100-41-4	ethylbenzene			61.8187
	1241			TSVX		3		36027.4	60		8021	100-41-4	ethylbenzene			61.8187
	1243			TSVZ		5		36026.7	60		8021	100-41-4	ethylbenzene			44.1562
	1410			SV-39		5		36004.6	60		8021	100-41-4	ethylbenzene			44.1562
	1231			TSVM		5		36024.4	60		8021	100-41-4	ethylbenzene			17.6625
	1237			TSVS		5		36026.6	60		8021	100-41-4	ethylbenzene			8.83125
	1242			TSVY		5		36026.7	60		8021	100-41-4	ethylbenzene			4.41562
	1625			TSVA		7		36024.7	60		8021	1330-20-7	xylenes (mixed)			1324.69

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/m3)	QA/QC code	measured chemical concentration (mg/m3)
	1626			TSVB		5		36024.6	60		8021	1330-20-7	xylenes (mixed)			883.125
	1816			SV-39		5		36004.6	60		8021	1330-20-7	xylenes (mixed)			287.016
	1647			TSVX		3		36027.4	60		8021	1330-20-7	xylenes (mixed)			238.444
	1633			TSVI		7		36024.4	60		8021	1330-20-7	xylenes (mixed)			220.781
	1649			TSVZ		5		36026.7	60		8021	1330-20-7	xylenes (mixed)			167.794
	1637			TSVM		5		36024.4	60		8021	1330-20-7	xylenes (mixed)			66.2344
	1719			SV-286		9.5		36297.7	50		8021	1330-20-7	xylenes (mixed)			35.325
	2020			SV-238		5		36004.7	60		8021	1330-20-7	xylenes (mixed)			30.9094
	1643			TSVS		5		36026.6	60		8021	1330-20-7	xylenes (mixed)			26.4937
	1636			TSVL		5		36024.7	60		8021	1330-20-7	xylenes (mixed)			13.2469
	1648			TSVY		5		36026.7	60		8021	1330-20-7	xylenes (mixed)			13.2469
	1635			TSVK		5		36024.7	60		8021	1330-20-7	xylenes (mixed)			8.83125
	1646			TSVV		5		36026.6	60		8021	1330-20-7	xylenes (mixed)			8.83125
	1756			SV-323		10		36299.5	50		8021	1330-20-7	xylenes (mixed)			8.83125
	1638			TSVN		5		36024.5	60		8021	1330-20-7	xylenes (mixed)			4.41562
	1644			TSVT		5		36026.6	60		8021	1330-20-7	xylenes (mixed)			4.41562
	1645			TSVU		5		36026.6	60		8021	1330-20-7	xylenes (mixed)			4.41562
	1830			SV-53		5		36004.7	60		8021	1330-20-7	xylenes (mixed)			4.41562
	1935			SV-158		5		36017.4	60		8021	1330-20-7	xylenes (mixed)			4.41562
	907			SV-286		9.5		36297.7	50		8021	108-90-7	chlorobenzene			4.68145
	4862			SV-238		5		36004.7	60		8015	110-54-3	hexane			68.0999
	4467			TSVA		7		36024.7	60		8015	110-54-3	hexane			43.0105
	4489			TSVX		3		36027.4	60		8015	110-54-3	hexane			21.5052
	4777			SV-158		5		36017.4	60		8015	110-54-3	hexane			21.5052
	4804			SV-184		5		36013.6	60		8015	110-54-3	hexane			14.3368
	4773			SV-154		5		36012.4	60		8015	110-54-3	hexane			7.16841
	4863			SV-239		5		36026.3	60		8015	110-54-3	hexane			7.16841
	4589			SV-314		3		36299.4	50		8015	110-54-3	hexane			3.58421

Notes (where applicable):

All detected chemicals except as noted are included in the above table.
Non-detects are omitted from the list.
A complete analyte list is included in the site analytical data report.
Samples for TPH, methane, ethane, propane, butane, and pentane are omitted from the above table.

ANALYTICAL DATA to RBSL COMPARISONS - SOIL VAPOR CONCENTRATIONS

5.2a

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

This table is a comparison of chemical analysis results to screening level concentrations.
The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):
1) migration of subsurface soil vapor to indoor air - RBCA
2) migration of subsurface soil vapor to ambient (outdoor) air - RBCA

						21	20	20					
						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).							
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/m3)		1) soil volatilization outdoor (mg/m3)		2) soil volatilization indoor (mg/m3)				
23		TSVX	71-43-2	benzene	35.7372	□	4.3E+1	■	2.5E+0				
9		TSVI	71-43-2	benzene	19.493	□	4.3E+1	■	2.5E+0				
25		TSVZ	71-43-2	benzene	12.9953	□	4.3E+1	■	2.5E+0				
311		SV-158	71-43-2	benzene	12.9953	□	4.3E+1	■	2.5E+0				
192		SV-39	71-43-2	benzene	3.24884	□	4.3E+1	■	2.5E+0				
396		SV-238	71-43-2	benzene	3.24884	□	4.3E+1	■	2.5E+0				
429		TSVX	108-88-3	toluene	229.934	□	6.1E+4	□	3.6E+3				
598		SV-39	108-88-3	toluene	134.128	□	6.1E+4	□	3.6E+3				
407		TSVA	108-88-3	toluene	126.464	□	6.1E+4	□	3.6E+3				
431		TSVZ	108-88-3	toluene	91.9735	□	6.1E+4	□	3.6E+3				
408		TSVB	108-88-3	toluene	76.6446	□	6.1E+4	□	3.6E+3				
415		TSVI	108-88-3	toluene	76.6446	□	6.1E+4	□	3.6E+3				
802		SV-238	108-88-3	toluene	22.9934	□	6.1E+4	□	3.6E+3				
419		TSVM	108-88-3	toluene	7.66446	□	6.1E+4	□	3.6E+3				
425		TSVS	108-88-3	toluene	3.83223	□	6.1E+4	□	3.6E+3				
430		TSVY	108-88-3	toluene	3.83223	□	6.1E+4	□	3.6E+3				
1219		TSVA	100-41-4	ethylbenzene	242.859	□	NA	□	1.1E+4				
1220		TSVB	100-41-4	ethylbenzene	132.469	□	NA	□	1.1E+4				
1227		TSVI	100-41-4	ethylbenzene	61.8187	□	NA	□	1.1E+4				
1241		TSVX	100-41-4	ethylbenzene	61.8187	□	NA	□	1.1E+4				
1243		TSVZ	100-41-4	ethylbenzene	44.1562	□	NA	□	1.1E+4				
1410		SV-39	100-41-4	ethylbenzene	44.1562	□	NA	□	1.1E+4				
1231		TSVM	100-41-4	ethylbenzene	17.6625	□	NA	□	1.1E+4				
1237		TSVS	100-41-4	ethylbenzene	8.83125	□	NA	□	1.1E+4				
1242		TSVY	100-41-4	ethylbenzene	4.41562	□	NA	□	1.1E+4				
1625		TSVA	1330-20-7	xylenes (mixed)	1324.69	□	NA	□	NA				

Screening Level comparison against site analytical data.

(continued)						Exceedences are noted by a filled box (■).						
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/m3)	1) soil volatilization outdoor (mg/m3)		2) soil volatilization indoor (mg/m3)				
1626		TSVB	1330-20-7	xylenes (mixed)	883.125	☐	NA	☐	NA			
1816		SV-39	1330-20-7	xylenes (mixed)	287.016	☐	NA	☐	NA			
1647		TSVX	1330-20-7	xylenes (mixed)	238.444	☐	NA	☐	NA			
1633		TSVI	1330-20-7	xylenes (mixed)	220.781	☐	NA	☐	NA			
1649		TSVZ	1330-20-7	xylenes (mixed)	167.794	☐	NA	☐	NA			
1637		TSVM	1330-20-7	xylenes (mixed)	66.2344	☐	NA	☐	NA			
1719		SV-286	1330-20-7	xylenes (mixed)	35.325	☐	NA	☐	NA			
2020		SV-238	1330-20-7	xylenes (mixed)	30.9094	☐	NA	☐	NA			
1643		TSVS	1330-20-7	xylenes (mixed)	26.4937	☐	NA	☐	NA			
1636		TSVL	1330-20-7	xylenes (mixed)	13.2469	☐	NA	☐	NA			
1648		TSVY	1330-20-7	xylenes (mixed)	13.2469	☐	NA	☐	NA			
1635		TSVK	1330-20-7	xylenes (mixed)	8.83125	☐	NA	☐	NA			
1646		TSVV	1330-20-7	xylenes (mixed)	8.83125	☐	NA	☐	NA			
1756		SV-323	1330-20-7	xylenes (mixed)	8.83125	☐	NA	☐	NA			
1638		TSVN	1330-20-7	xylenes (mixed)	4.41562	☐	NA	☐	NA			
1644		TSVT	1330-20-7	xylenes (mixed)	4.41562	☐	NA	☐	NA			
1645		TSVU	1330-20-7	xylenes (mixed)	4.41562	☐	NA	☐	NA			
1830		SV-53	1330-20-7	xylenes (mixed)	4.41562	☐	NA	☐	NA			
1935		SV-158	1330-20-7	xylenes (mixed)	4.41562	☐	NA	☐	NA			
907		SV-286	108-90-7	chlorobenzene	4.68145	☐	3.7E+3	☐	2.2E+2			
4862		SV-238	110-54-3	hexane	68.0999	☐	1.3E+4	☐	7.9E+2			
4467		TSVA	110-54-3	hexane	43.0105	☐	1.3E+4	☐	7.9E+2			
4489		TSVX	110-54-3	hexane	21.5052	☐	1.3E+4	☐	7.9E+2			
4777		SV-158	110-54-3	hexane	21.5052	☐	1.3E+4	☐	7.9E+2			
4804		SV-184	110-54-3	hexane	14.3368	☐	1.3E+4	☐	7.9E+2			
4773		SV-154	110-54-3	hexane	7.16841	☐	1.3E+4	☐	7.9E+2			
4863		SV-239	110-54-3	hexane	7.16841	☐	1.3E+4	☐	7.9E+2			
4589		SV-314	110-54-3	hexane	3.58421	☐	1.3E+4	☐	7.9E+2			
						☐		☐				

Notes (where applicable):

Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).

ANALYTICAL SUMMARY - GROUNDWATER CONCENTRATIONS

5.3

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

Tabulate all available chemical analysis results from site groundwater (and surface water) samples. Each line corresponds to a specific sample and chemical constituent. Non-detects may be omitted from this list if an analyte list is included (in an appendix) for the cited analysis methods.
Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.
For each detected chemical in groundwater or surface water, include a summary section in this table of the maximum detected chemical concentrations, with "max" indicated in the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	hydro. unit, sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/L)	QA/QC code	measured chemical concentration (mg/L)
	1			GMW-1	LNAPL				119134		S-8260B	100-41-4	Ethylbenzene			0.11
	85			GMW-5	LNAPL				119137		S-8260B	100-41-4	Ethylbenzene			0.07
	43			GMW-3B	LNAPL				119136		S-8260B	100-41-4	Ethylbenzene			0.06
	169			GMW-9	SHEEN				118889		S-8260B	100-41-4	Ethylbenzene			0.012
	316			TMW-5					119967		S-8260B	100-41-4	Ethylbenzene			0.0025
	295			TMW-4					118892		S-8260B	100-41-4	Ethylbenzene			0.0015
	45			GMW-3B	LNAPL				119136		S-8260B	95-47-6	o-xylene			0.106
	3			GMW-1	LNAPL				119134		S-8260B	95-47-6	o-xylene			0.1
	87			GMW-5	LNAPL				119137		S-8260B	95-47-6	o-xylene			0.099
	171			GMW-9	SHEEN				118889		S-8260B	95-47-6	o-xylene			0.011
	87			GMW-5	LNAPL				119137		S-8260B	1330-20-7	xylenes (mixed)			0.599
	46			GMW-3B	LNAPL				119136		S-8260B	1330-20-7	xylenes (mixed)			0.586
	4			GMW-1	LNAPL				119134		S-8260B	1330-20-7	xylenes (mixed)			0.53
	172			GMW-9	SHEEN				118889		S-8260B	1330-20-7	xylenes (mixed)			0.04
	296			TMW-4					118892		S-8260B	1330-20-7	xylenes (mixed)			0.0046
	317			TMW-5					119967		S-8260B	1330-20-7	xylenes (mixed)			0.0023
	149			GMW-8					118939		S-8260B	1330-20-7	xylenes (mixed)			0.0019
	88			GMW-5	LNAPL				119137		8270C	86-73-7	Fluorene			0.011
	90			GMW-5	LNAPL				119137		8270C	91-20-3	Naphthalene			0.071
	6			GMW-1	LNAPL				119134		8270C	91-20-3	Naphthalene			0.024
	174			GMW-9	SHEEN				118889		8270C	91-20-3	Naphthalene			0.002
	89			GMW-5	LNAPL				119137		8270C	85-01-8	Phenanthrene			0.022
	5			GMW-1	LNAPL				119134		8270C	85-01-8	Phenanthrene			0.004

(continued)

note index no.	line index no.	location description	sample type	field sample ID	hydro. unit, sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/L)	QA/QC code	measured chemical concentration (mg/L)
	47			GMW-3B	LNAPL				119136		8270C	85-01-8	Phenanthrene			0.003
	313			TMW-4					118892		418.1	TPH-ss	TRPHC			6.08
	334			TMW-5					119967		418.1	TPH-ss	TRPHC			0.82
	315			TMW-4					118892		901.1M (pCi/L)	pCi	Total Activity			6.57
	336			TMW-5					119967		901.1M (pCi/L)	pCi	Total Activity			1.95
	332			TMW-5					119967		160.1	TDS	TDS			1100
	311			TMW-4					118892		160.1	TDS	TDS			850
	227			GMW-11					118337		160.1	TDS	TDS			530
	309			TMW-4					118892		300	16887-00-6	Chloride			190
	330			TMW-5					119967		300	16887-00-6	Chloride			180
	225			GMW-11					118337		300	16887-00-6	Chloride			120
	307			TMW-4					118892		300	16984-48-8	Fluoride			2.4
	223			GMW-11					118337		300	16984-48-8	Fluoride			2.4
	328			TMW-5					119967		300	16984-48-8	Fluoride			2.1
	224			GMW-11					118337		300	7697-37-2	Nitrate			5.1
	329			TMW-5					119967		300	7697-37-2	Nitrate			4.5
	308			TMW-4					118892		300	7697-37-2	Nitrate			3.7
	331			TMW-5					119967		300	14808-79-8	Sulfate			170
	226			GMW-11					118337		300	14808-79-8	Sulfate			92
	310			TMW-4					118892		300	14808-79-8	Sulfate			85
	228			GMW-11					118337		150.1 (s.u.)	pH	pH			7.5
	312			TMW-4					118892		150.1 (s.u.)	pH	pH			7.3
	333			TMW-5					119967		150.1 (s.u.)	pH	pH			7
	7		max	GMW-1	LNAPL				119134		6010B	7440-39-3	Barium			0.3
	242		max	TMW-1					118936		6010B	7440-42-8	Boron			0.62
	9		max	GMW-1	LNAPL				119134		6010B	7439-89-6	Iron			0.29
	10			GMW-1	LNAPL				119134		6010B	7439-96-5	Manganese			0.34
	325			TMW-5					119967		6010B	7439-96-5	Manganese			0.19
	157			GMW-8					118939		6010B	7439-96-5	Manganese			0.1
	12			GMW-1	LNAPL				119134		6010B	7440-02-0	Nickel			0.25
	281			TMW-3					118888		7471A	7439-97-6	Total Mercury			0.00042

Notes (where applicable):

All detected chemicals are included in the above table.

A complete analyte list is included in the *analytical data report.*

m- an p- xylenes screened point-by-point summed as xylenes (mixed) m-, p-, and o-.

maximum value tabulated for barium, boron, iron.

ANALYTICAL DATA to RBSL COMPARISONS - GROUND WATER CONCENTRATIONS

5.4

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

This table is a comparison of chemical analysis results to screening level concentrations.
The line index no. is identical to that in the first half of this table.

Screening Level Criteria Descriptions:
(residential exposure, minimum of HQ = 1, Risk = 1E-6, or Federal MCL):

1) groundwater ingestion, residential exposure - RBCA
2) Federal Maximum Contaminant Level (MCL) drinking water standards
3) volatilization from groundwater to ambient (outdoor) air, residential exposure - RBCA
4) volatilization from groundwater to indoor air, residential exposure - RBCA
5) tap water - Region VI
6) 20 NMAC 6.2 3-103 drinking water standards

						8		33		10		9		26		29	
						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).											
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/L)	1) water ingestion (mg/L)		2) MCL (mg/L)		3) gw volatilization outdoor (mg/L)		4) gw volatilization indoor (mg/L)		5) tap water (mg/L)		6) 20 NMAC (mg/L)	other (mg/L)
1		GMW-1	100-41-4	Ethylbenzene	0.11	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
85		GMW-5	100-41-4	Ethylbenzene	0.07	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
43		GMW-3B	100-41-4	Ethylbenzene	0.06	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
169		GMW-9	100-41-4	Ethylbenzene	0.012	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
316		TMW-5	100-41-4	Ethylbenzene	0.0025	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
295		TMW-4	100-41-4	Ethylbenzene	0.0015	☐	7.0E-1	☐	NA	☐	NA	☐	7.7E+1	☐	1.1E+3	☐	☐
45		GMW-3B	95-47-6	o-xylene	0.106	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐	7.3E+2	☐	☐
3		GMW-1	95-47-6	o-xylene	0.1	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐	7.3E+2	☐	☐
87		GMW-5	95-47-6	o-xylene	0.099	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐	7.3E+2	☐	☐
171		GMW-9	95-47-6	o-xylene	0.011	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐	7.3E+2	☐	☐
87		GMW-5	1330-20-7	xylenes (mixed)	0.599	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
46		GMW-3B	1330-20-7	xylenes (mixed)	0.586	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
4		GMW-1	1330-20-7	xylenes (mixed)	0.53	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
172		GMW-9	1330-20-7	xylenes (mixed)	0.04	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
296		TMW-4	1330-20-7	xylenes (mixed)	0.0046	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
317		TMW-5	1330-20-7	xylenes (mixed)	0.0023	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
149		GMW-8	1330-20-7	xylenes (mixed)	0.0019	☐	1.0E+1	☐	NA	☐	NA	☐	NA	☐		☐	☐
						☐		☐		☐		☐		☐		☐	☐
88		GMW-5	86-73-7	Fluorene	0.011	☐	1.5E+0	☐	NA	☐	NA	☐	NA	☐	1.5E+2	☐	☐
90		GMW-5	91-20-3	Naphthalene	0.071	☐	7.3E-1	☐	NA	☐	NA	☐	2.6E+0	☐	3.1E+0	☐	☐
6		GMW-1	91-20-3	Naphthalene	0.024	☐	7.3E-1	☐	NA	☐	NA	☐	2.6E+0	☐	3.1E+0	☐	☐
174		GMW-9	91-20-3	Naphthalene	0.002	☐	7.3E-1	☐	NA	☐	NA	☐	2.6E+0	☐	3.1E+0	☐	☐
89		GMW-5	85-01-8	Phenanthrene	0.022	☐	NA	☐	NA	☐	NA	☐	NA	☐		☐	☐
5		GMW-1	85-01-8	Phenanthrene	0.004	☐	NA	☐	NA	☐	NA	☐	NA	☐		☐	☐

Screening Level comparison against site analytical data.

(continued)						Exceedences are noted by a filled box (■).															
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/L)		1) water ingestion (mg/L)		2) MCL (mg/L)		3) gw volatilization outdoor (mg/L)		4) gw volatilization indoor (mg/L)		5) tap water (mg/L)		6) 20 NMAC (mg/L)		other (mg/L)	
47		GMW-3B	85-01-8	Phenanthrene	0.003	☐	NA	☐	NA	☐	NA	☐	NA	☐		☐		☐	
						☐		☐		☐		☐		☐		☐		☐	
313		TMW-4	TPH-ss	TRPHC	6.08	☐		☐		☐		☐		☐		☐		☐	
334		TMW-5	TPH-ss	TRPHC	0.82	☐		☐		☐		☐		☐		☐		☐	
315		TMW-4	pCi	Total Activity	6.57	☐		☐		☐		☐		☐		☐	3.0E+1	☐	
336		TMW-5	pCi	Total Activity	1.95	☐		☐		☐		☐		☐		☐	3.0E+1	☐	
332		TMW-5	TDS	TDS	1100	☐		☐		☐		☐		☐		■	1.0E+3	☐	
311		TMW-4	TDS	TDS	850	☐		☐		☐		☐		☐		☐	1.0E+3	☐	
227		GMW-11	TDS	TDS	530	☐		☐		☐		☐		☐		☐	1.0E+3	☐	
309		TMW-4	16887-00-6	Chloride	190	☐		☐		☐		☐		☐		☐	2.5E+2	☐	
330		TMW-5	16887-00-6	Chloride	180	☐		☐		☐		☐		☐		☐	2.5E+2	☐	
225		GMW-11	16887-00-6	Chloride	120	☐		☐		☐		☐		☐		☐	2.5E+2	☐	
307		TMW-4	16984-48-8	Fluoride	2.4	☐		☐		☐		☐		☐		■	1.6E+0	☐	
223		GMW-11	16984-48-8	Fluoride	2.4	☐		☐		☐		☐		☐		■	1.6E+0	☐	
328		TMW-5	16984-48-8	Fluoride	2.1	☐		☐		☐		☐		☐		■	1.6E+0	☐	
224		GMW-11	7697-37-2	Nitrate	5.1	☐		☐		☐		☐		☐		☐	1.0E+1	☐	
329		TMW-5	7697-37-2	Nitrate	4.5	☐		☐		☐		☐		☐		☐	1.0E+1	☐	
308		TMW-4	7697-37-2	Nitrate	3.7	☐		☐		☐		☐		☐		☐	1.0E+1	☐	
331		TMW-5	14808-79-8	Sulfate	170	☐		☐		☐		☐		☐		☐	6.0E+2	☐	
226		GMW-11	14808-79-8	Sulfate	92	☐		☐		☐		☐		☐		☐	6.0E+2	☐	
310		TMW-4	14808-79-8	Sulfate	85	☐		☐		☐		☐		☐		☐	6.0E+2	☐	
228		GMW-11	pH	pH	7.5	☐		☐		☐		☐		☐		☐		☐	
312		TMW-4	pH	pH	7.3	☐		☐		☐		☐		☐		☐		☐	
333		TMW-5	pH	pH	7	☐		☐		☐		☐		☐		☐		☐	
7		GMW-1	7440-39-3	Barium	0.3	☐	2.0E+0	☐	NA	☐	NA	☐	NA	☐	5.2E-1	☐	1.0E+0	☐	
242		TMW-1	7440-42-8	Boron	0.62	☐	3.3E+0	☐	NA	☐	NA	☐	NA	☐	2.1E+1	☐	7.5E-1	☐	
9		GMW-1	7439-89-6	Iron	0.29	☐		☐		☐		☐		☐		☐	1.0E+0	☐	
10		GMW-1	7439-96-5	Manganese	0.34	☐		☐		☐		☐		■	5.1E-2	■	2.0E-1	☐	
325		TMW-5	7439-96-5	Manganese	0.19	☐		☐		☐		☐		■	5.1E-2	☐	2.0E-1	☐	
157		GMW-8	7439-96-5	Manganese	0.1	☐		☐		☐		☐		■	5.1E-2	☐	2.0E-1	☐	
12		GMW-1	7440-02-0	Nickel	0.25	■	1.0E-1	☐	NA	☐	NA	☐	NA	☐		■	2.0E-1	☐	
281		TMW-3	7439-97-6	Total Mercury	0.00042	☐	2.0E-3	☐	NA	☐	5.9E+0	☐	3.7E-2	☐	3.1E-1	☐	2.0E-3	☐	

Notes (where applicable):
Indicators in the screening level comparison table include NA (not applicable) because of: insufficient vapor pressure to be of concern for this exposure pathway; insufficient solubility to be of concern for this exposure pathway; or no concern with chemical present at concentrations above residual level for this exposure pathway.

ANALYTICAL SUMMARY - SOIL CONCENTRATIONS 5.5

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

Detected chemical analysis results from site soil samples are tabulated. Each line corresponds to a specific sample and co-located TDS and pH measurement.
Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

Measured values are compared to nominal soil pH (6 < pH < 8) and electrical conductivity (EC < 4 mmhos/cm) ranges from API (1997). Electrical conductivity is based on a correllation with TDS from Deuel and Holliday (1994).

											Out of range values are noted by a filled box (■).	
note index no.	line index no.	location description	sample type	field sample ID	sampling depth (ft)	sample interval (ft)	analysis ID code	measured pH (s.u.)	measured TDS concentration (mg/kg)	derived electrical conductivity (mmhos/cm)	1) EC > 4	2) pH < 8 pH > 6
A	1041		soil	TSB-8 3-5'	3	5	107006	9.4	10000	16.3	■ high EC	■ high pH
A	1069		soil	TSB-8D 3-5'	3	5	107007	7.8	9600	15.7	■ high EC	□
A	425		soil	TSB-1 2-3'	2	3	105955	8.1	6900	11.3	■ high EC	■ high pH
A	3230		soil	GBN-3 6"	0.5		117628	5.6	6200	10.1	■ high EC	■ low pH
A	1013		soil	TSB-8 2-3'	2	3	19350	9.5	4000	6.5	■ high EC	■ high pH
A	2810		soil	GMW-6 3-5'	3	5	104532	8.7	3900	6.4	■ high EC	■ high pH
A	1097		soil	TSB-8 8-10'	8	10	107008	8.6	3200	5.2	■ high EC	■ high pH
A	1265		soil	TSB-10 3-5'	3	5	106030	9.4	3000	4.9	■ high EC	■ high pH
A	1453		soil	TMW-1 2-3'	2	3	105742	10	2700	4.4	■ high EC	■ high pH
A	1901		soil	GSB-4 2-3'	2	3	107002	8	2700	4.4	■ high EC	□
A	1293		soil	TSB-10 8-10'	8	10	106031	9	2500	4.1	■ high EC	■ high pH
A	2558		soil	GMW-2 13-15'	13	15	103766	8.3	2500	4.1	■ high EC	■ high pH
A	957		soil	TSB-7 3-5'	3	5	106037	9.1	2100	3.4	□	■ high pH
A	1237		soil	TSB-10 2-3'	2	3	106029	8.8	2100	3.4	□	■ high pH
A	985		soil	TSB-7 8-10'	8	10	106038	8.9	1800	2.9	□	■ high pH
A	2097		soil	GSB-10 2-3'	2	3	106789	8.2	1600	2.6	□	■ high pH
A	537		soil	TSB-2 3-5'	3	5	105959	8.2	1500	2.4	□	■ high pH
A	509		soil	TSB-2 2-3'	2	3	105958	8.2	1400	2.3	□	■ high pH
A	761		soil	TSB-5 2-3'	2	3	106094	8.1	1400	2.3	□	■ high pH
A	3174		soil	GBN-1 6"	0.5		117626	7.6	1300	2.1	□	□
A	3202		soil	GBN-2 6"	0.5		117627	7.8	1300	2.1	□	□
A	1985		soil	GSB-7 2-3'	2	3	106259	8	1200	2.0	□	□
A	789		soil	TSB-5 3-5'	3	5	106095	8.2	1100	1.8	□	■ high pH
A	1873		soil	GSB-3 2-3'	2	3	107012	8.3	1100	1.8	□	■ high pH
A	929		soil	TSB-7 2-3'	2	3	106036	9.3	1000	1.6	□	■ high pH
A	1125		soil	TSB-8 40-42'	40	42	107009	8.4	1000	1.6	□	■ high pH
A	3062		soil	GMW-10 3-5'	3	5	106342	7.9	900	1.5	□	□
A	1845		soil	GSB-2 5-6'	5	6	105224	8.6	880	1.4	□	■ high pH
A	2978		soil	GMW-9 8-10'	8	10	106457	8.1	880	1.4	□	■ high pH
A	2041		soil	GSB-8 2-3'	2	3	107016	8.5	870	1.4	□	■ high pH
A	1209		soil	TSB-9 18-20'	18	20	106099	8.4	850	1.4	□	■ high pH
A	2461		soil	CSS #6			103645	7.9	850	1.4	□	□
A	481		soil	TSB-1 8-10'	8	10	105957	8.6	830	1.4	□	■ high pH
A	2433		soil	GSB-17 38-40'	38	40	118542	8.9	760	1.2	□	■ high pH
A	817		soil	TSB-5 18-20'	18	20	106096	8.5	710	1.2	□	■ high pH
A	593		soil	TSB-3 2-3'	2	3	106196	7.7	630	1.0	□	□
A	677		soil	TSB-4 2-3'	2	3	106091	8.2	620	1.0	□	■ high pH
A	705		soil	TSB-4 3-5'	3	5	106092	8.3	570	0.9	□	■ high pH
A	2614		soil	GMW-2 62-64'D	62	64	103764	8.7	570	0.9	□	■ high pH
A	3118		soil	GMW-11 19-21'	19	21	118337	8.7	560	0.9	□	■ high pH
A	649		soil	TSB-3 18-20'	18	20	106198	8.7	540	0.9	□	■ high pH
A	2349		soil	GSB-16 3-5'	3	5	118543	8.3	540	0.9	□	■ high pH
A	2922		soil	GMW-8 28-30'	28	30	104948	8.7	530	0.9	□	■ high pH
A	873		soil	TSB-6 3-5'	3	5	106035	8.4	510	0.8	□	■ high pH
A	1509		soil	TMW-1A 63-65'	63	65	105744	8.7	510	0.8	□	■ high pH
A	1957		soil	GSB-6 2-3'	2	3	106828	8.7	510	0.8	□	■ high pH
A	733		soil	TSB-4 18-20'	18	20	106093	8.5	500	0.8	□	■ high pH
A	2013		soil	GSB-7 33-35'	33	35	106344	9	480	0.8	□	■ high pH
A	1621		soil	TMW-3 3-5'	3	5	108239	8.4	470	0.8	□	■ high pH
A	3090		soil	GMW-10 63-65'	63	65	106343	8.7	470	0.8	□	■ high pH

(continued)

note index no.	line index no.	location description	sample type	field sample ID	sampling depth (ft)	sample interval (ft)	analysis ID code	measured pH (s.u.)	measured TDS concentration (mg/kg)	derived electrical conductivity (mmhos/cm)	Out of range values are noted by a filled box (■). 1) EC > 4	2) pH < 8 pH > 6
A	1593		soil	TMW-3 2-3'	2	3	108238	8.2	460	0.8	□	■ high pH
A	1181		soil	TSB-9 3-5'	3	5	106098	8.5	440	0.7	□	■ high pH
A	845		soil	TSB-6 2-3'	2	3	106034	8.4	420	0.7	□	■ high pH
A	621		soil	TSB-3 3-5'	3	5	106197	8.3	400	0.7	□	■ high pH
A	1153		soil	TSB-9 2-3'	2	3	106097	8.4	400	0.7	□	■ high pH
A	2069		soil	GSB-9 2-3'	2	3	106786	8.4	400	0.7	□	■ high pH
A	2586		soil	GMW-2 58-60'	58	60	103765	8.6	400	0.7	□	■ high pH
A	2125		soil	GSB-11 2-3'	2	3	107159	8.2	380	0.6	□	■ high pH
A	2405		soil	GSB-17 3-5'	3	5	118541	8.6	360	0.6	□	■ high pH
A	901		soil	TSB-6 18-20'	18	20	106033	8.5	350	0.6	□	■ high pH
A	2642		soil	GMW-3 53-55'	53	55	104147	9.6	330	0.5	□	■ high pH
A	1761		soil	TMW-5 48-50'	48	50	119858	8.8	310	0.5	□	■ high pH
A	2670		soil	GMW-3 63-65'	63	65	104148	9	310	0.5	□	■ high pH
A	565		soil	TSB-2 18-20'	18	20	105960	8.6	300	0.5	□	■ high pH
A	1817		soil	GSB-1 2-3'	2	3	105071	8.5	300	0.5	□	■ high pH
A	1789		soil	TMW-5 63-65'	63	65	119859	8.8	290	0.5	□	■ high pH
A	1929		soil	GSB-5 2-3'	2	3	106262	8.5	290	0.5	□	■ high pH
A	453		soil	TSB-1 3-5'	3	5	105956	8.4	280	0.5	□	■ high pH
A	2754		soil	GMW-5 58-60'	58	60	104339	10.3	280	0.5	□	■ high pH
A	2894		soil	GMW-7 63-65'	63	65	104634	8.9	280	0.5	□	■ high pH
A	2782		soil	GMW-5 63-65'	63	65	104340	8.9	260	0.4	□	■ high pH
A	3034		soil	GMW-9D 63-65'	63	65	106459	8.7	252	0.4	□	■ high pH
A	2726		soil	GMW-4 63-65'	63	65	104100	8.8	240	0.4	□	■ high pH
A	2838		soil	GMW-6 63-6	63	65	104533	8.5	220	0.4	□	■ high pH
A	3146		soil	GMW-11 63-65'	63	65	118338	8.9	210	0.3	□	■ high pH
A	1649		soil	TMW-3 23-25'	23	25	108240	8.6	200	0.3	□	■ high pH
A	2866		soil	GMW-7 48-50'	48	50	104633	8.8	200	0.3	□	■ high pH
A	2377		soil	GSB-16 38-40'	38	40	118544	9.2	190	0.3	□	■ high pH
A	1481		soil	TMW-1 63-65'	63	65	105743	8.7	170	0.3	□	■ high pH
A	1677		soil	TMW-3 63-65'	63	65	108241	9.2	170	0.3	□	■ high pH
A	2950		soil	GMW-8 63-65'	63	65	104949	9.1	170	0.3	□	■ high pH
A	2698		soil	GMW-4 18-20'	18	20	104099	8.7	160	0.3	□	■ high pH
A	3006		soil	GMW-9 63-65'	63	65	106458	8.9	150	0.2	□	■ high pH
A	1537		soil	TMW-2 53-55'	53	55	105614	9	140	0.2	□	■ high pH
A	1565		soil	TMW-2 63-65'	63	65	105615	8.4	130	0.2	□	■ high pH
A	1705		soil	TMW-4 40-42'	40	42	118283	9	120	0.2	□	■ high pH
A	1733		soil	TMW-4 63-65'	63	65	118284	8.6	120	0.2	□	■ high pH
											□	□
											□	□

Notes (where applicable):
pH measured using method E 150.1 (s.u.); Total dissolved solids (TDS) with method E 160.1

API, 1997, Environmental Guidance Document: Waste Management in Exploration and Production Operations, API E5, Second Edition, American Petroleum Institute, Exploration and Production Department, February.
Deuel, L. E., and G. H. Holliday, 1994: Soil Remediation for the Petroleum Extraction Industry, PennWell Books, Tulsa, OK.

ANALYTICAL SUMMARY - SOIL CONCENTRATIONS

5.1

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

refined analysis

All detected chemical analysis results from site soil samples are tabulated except as specifically noted at the end of the table. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/kg)	QA/QC code	measured chemical concentration (mg/kg)
A	2497		soil	GMW-8 28-30'		28	30		104948		S-8260B	71-43-2	benzene			0.4
A	1358		soil	TMW-3 23-25'		23	25		108240		S-8260B	71-43-2	benzene			0.12
A	1334		soil	TMW-3 2-3'		2	3		108238		S-8260B	71-43-2	benzene			0.074
A	1346		soil	TMW-3 3-5'		3	5		108239		S-8260B	71-43-2	benzene			0.073
A	1370		soil	TMW-3 63-65'		63	65		108241		S-8260B	71-43-2	benzene			0.057
C	3595		soil	TSB-7 2-3 ft		2	3				EPA 8260	71-43-2	benzene			0.02
C	3611		soil	TSB-8 2-3 ft		2	3				EPA 8260	71-43-2	benzene			0.0098
D	6	GSB-10 (BP)	soil								TX1006	GSB-10 (BP)	GSB-10 (BP) (2-3') T118813			6257

Notes (where applicable):

This table is limited to chemicals and samples showing exceedence of screening-level values for potential indoor air exposure.
Non-detects are omitted from the list.
A complete analyte list is included in the site analytical data report.
m- & p-xylenes are screened as part of mixed xylenes (m-, p-, and o- isomers) and are not listed separately above.
Analysis results for phenols using method SM 5530 A,D are not included in the above list; no phenol was detected using GC/MS analysis methods.
maximum measured values only are listed for toluene, ethylbenzene, xylenes (mixed isomers), o-xylene, pyrene, phenanthrene, fluorene, naphthalene, and 1- and 2-methylnapthalene.
A. From Stage 1 Abatement Plan Report, July 1999, Table 2. Soil Analytical Results
C. A. D. Little Analysis of Soil Samples by GC/FID, GC/MS, Feb. 17, 1999, Henry Camp.
D. Soil Analyses for TPH by Trace Analysis, Inc. using TX1006 aromatic/aliphatic seperation with boiling-point cut analysis (23 Feb 1999).

ANALYTICAL DATA to RBSL COMPARISONS - SOIL CONCENTRATIONS

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

refined analysis

This table is a comparison of chemical analysis results to screening level concentrations.
The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):

1) direct soil exposure, ingestion, dermal contact, dust & vapor inhalation - RBCA
2) volatilization from subsurface soil to ambient (outdoor) air - RBCA - with mass limit
3) volatilization from subsurface soil to indoor air - RBCA - with mass limit
4) subsurface soil vapor to indoor air - with lower limit (underprediction) of biodegradation
5) subsurface soil vapor to indoor air - with average rate of biodegradation

6) tabulation of co-located TPH measurement

						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).											
							3		5		4						
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/kg)		surficial soil, direct 1) exposure (mg/kg)		soil volatilization 2) outdoor (mg/kg)		soil volatilization 3) indoor (mg/kg)		soil volatilization 4) indoor		soil volatilization 5) indoor		co-located TPH 6) measure (mg/kg)
2497		GMW-8 28-30'	71-43-2	benzene	0.4	☐	3.8E+0	☐	8.2E+0	■	3.0E-2	■	1.7E-1	☐	5.4E-1	☐	
1358		TMW-3 23-25'	71-43-2	benzene	0.12	☐	3.8E+0	☐	8.2E+0	■	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	3574
1334		TMW-3 2-3'	71-43-2	benzene	0.074	☐	3.8E+0	☐	8.2E+0	■	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	1460
1346		TMW-3 3-5'	71-43-2	benzene	0.073	☐	3.8E+0	☐	8.2E+0	■	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	2986
1370		TMW-3 63-65'	71-43-2	benzene	0.057	☐	3.8E+0	☐	8.2E+0	■	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	
3595		TSB-7 2-3 ft	71-43-2	benzene	0.02	☐	3.8E+0	☐	8.2E+0	☐	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	57000
3611		TSB-8 2-3 ft	71-43-2	benzene	0.0098	☐	3.8E+0	☐	8.2E+0	☐	3.0E-2	☐	1.7E-1	☐	5.4E-1	☐	32000
						☐		☐		☐		☐		☐		☐	
6	GSB-10 (BP)		GSB-10 (BP)	GSB-10 (BP) (2-3') T118813	6257	☐	6.7E+3	☐	NA	☐	NA	☐		☐		☐	
						☐		☐		☐		☐		☐		☐	
						☐		☐		☐		☐		☐		☐	

Notes (where applicable):

Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).
RBCA -based screening levels based on ASTM PS104-98 with default exposure parameters, USEPA toxicity parameters, and representative physical parameters.
TPH -based screening levels are based on GRI (1999): Risk-Based Corrective Action Tools for E&P Facilities, review draft.
The refined screening level values (2 and 3) are based on a specified layer of impacted soil of 2 meters. This imposes a mass-limit on the amount of chemical in soil.
The refined screening level values (4 and 5) include aerobic biodegradation in the estimate.

ANALYTICAL SUMMARY - SOIL VAPOR CONCENTRATIONS

5.1a

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed by: G. E. DeVaull
Revision Date: 16 Aug 1999

refined analysis

All detected chemical analysis results from site soil samples are tabulated. Each line corresponds to a specific sample and chemical constituent.

Notes, if needed, are added at the end of this table and are indexed to samples using the "note index no." column.

note index no.	line index no.	location description	sample type	field sample ID	sampling unit	sampling depth (ft)	sample interval (ft)	field sampling date	analysis ID code	analysis date	analytical method number	Chemical Abstracts Service No. (CASRN)	chemical name	detection limit (mg/m3)	QA/QC code	measured chemical concentration (mg/m3)
	23			TSVX		3		36027.4	60		8021	71-43-2	benzene			35.7372
	9			TSVI		7		36024.4	60		8021	71-43-2	benzene			19.493
	25			TSVZ		5		36026.7	60		8021	71-43-2	benzene			12.9953
	311			SV-158		5		36017.4	60		8021	71-43-2	benzene			12.9953
	192			SV-39		5		36004.6	60		8021	71-43-2	benzene			3.24884
	396			SV-238		5		36004.7	60		8021	71-43-2	benzene			3.24884

Notes (where applicable):

This table is limited to chemicals and samples showing exceedence of screening-level values for potential indoor air exposure.

ANALYTICAL DATA to RBSL COMPARISONS - SOIL VAPOR CONCENTRATIONS

5.2a

Site Name: Westgate Subdivision
Site Location: Hobbs, NM

Completed By: G. E. DeVaull
Revision Date: 16 Aug 1999

refined analysis

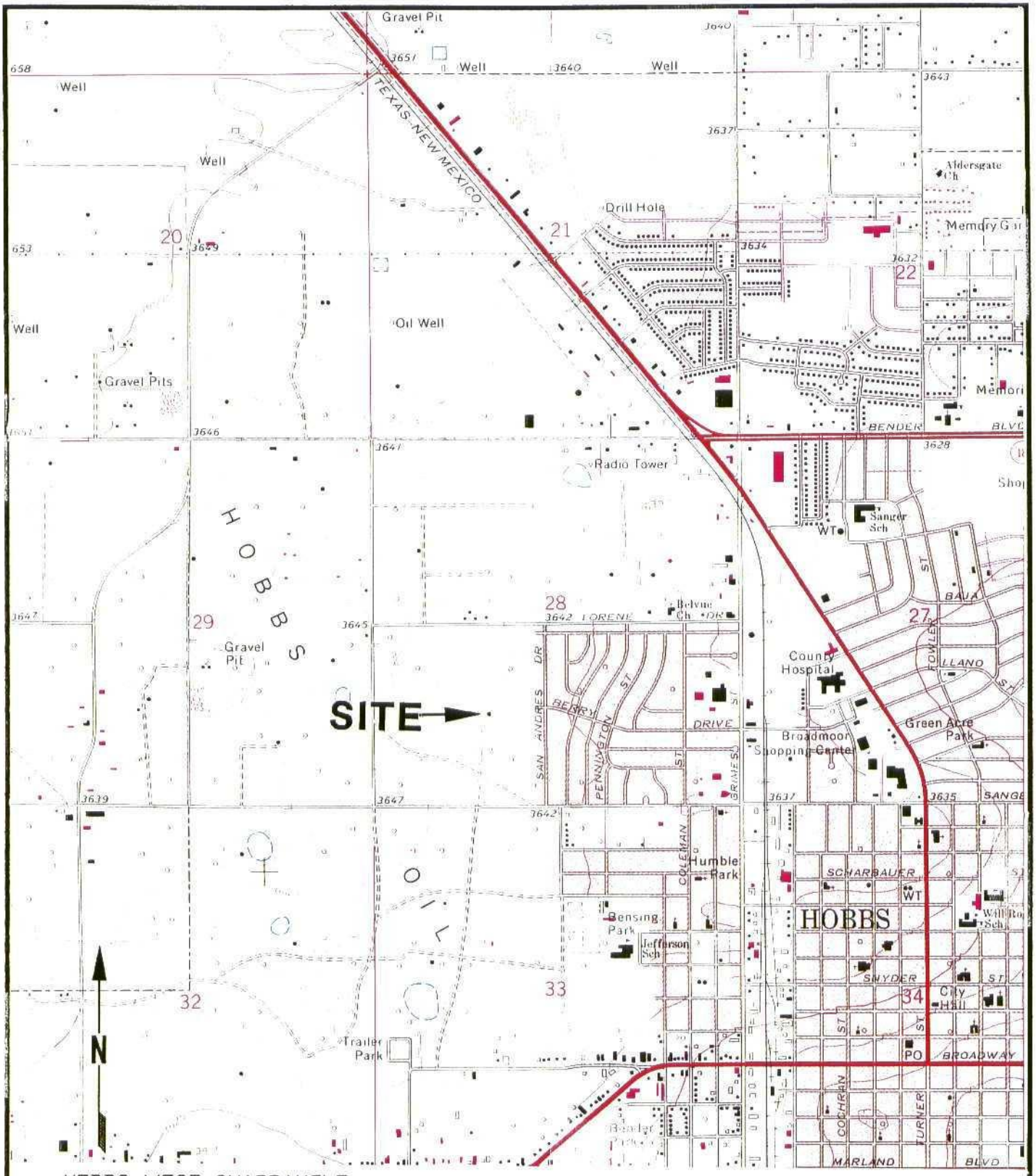
This table is a comparison of chemical analysis results to screening level concentrations. The line index number is identical to that in the first half of this table.

Screening Level Criteria Descriptions
(residential exposure, minimum of HQ = 1 or Risk = 1E-6):

1) migration of subsurface soil vapor to ambient (outdoor) air - RBCA - with mass limit
2) migration of subsurface soil vapor to indoor air - RBCA - with mass limit
3) migration of subsurface soil vapor to indoor air - RBCA - with lower limit (underprediction) of biodegradation
4) migration of subsurface soil vapor to indoor air - RBCA - with average estimate of biodegradation

						21		20									
						Screening Level comparison against site analytical data. Exceedences are noted by a filled box (■).											
line index no.	location description	field sample ID	Chemical Abstracts Service No. (CASRN)	chemical name	measured chemical concentration (mg/m3)	1) soil volatilization outdoor (mg/m3)		2) soil volatilization indoor (mg/m3)		3) soil volatilization indoor (mg/m3)		4) soil volatilization indoor (mg/m3)					
23		TSVX	71-43-2	benzene	35.7372	☐	2.7E+3	■	1.0E+1	☐	5.7E+1	☐	1.8E+2				
9		TSVI	71-43-2	benzene	19.493	☐	2.7E+3	■	1.0E+1	☐	5.7E+1	☐	1.8E+2				
25		TSVZ	71-43-2	benzene	12.9953	☐	2.7E+3	■	1.0E+1	☐	5.7E+1	☐	1.8E+2				
311		SV-158	71-43-2	benzene	12.9953	☐	2.7E+3	■	1.0E+1	☐	5.7E+1	☐	1.8E+2				
192		SV-39	71-43-2	benzene	3.24884	☐	2.7E+3	☐	1.0E+1	☐	5.7E+1	☐	1.8E+2				
396		SV-238	71-43-2	benzene	3.24884	☐	2.7E+3	☐	1.0E+1	☐	5.7E+1	☐	1.8E+2				
						☐		☐		☐		☐					

Notes (where applicable):
Indicators in the screening level comparison table include NA (not applicable), [blank] (not calculated).
The refined screening level values (1 and 2) are based on a specified layer of impacted soil of 2 meters. This imposes a mass-limit on the amount of chemical in soil.
The refined screening level values (3 and 4) include aerobic biodegradation in the estimate.



HOBBS WEST QUADRANGLE
NEW MEXICO - LEA Co
7.5 Minute Series (Topographic)
1969
Photo Revised 1979

PHILIP SERVICES CORP

TITLE:
SHELL EXPLORATION & TECHNOLOGY COMPANY
GRIMES BATTERY
SITE LOCATION MAP

DWN:	DES.:
CHKD: seh	APPD: seh
DATE: FEB. 1998	REV.: 1

PROJECT NO.: 18906
GRIMES ASSESSMENT
Hobbs, New Mexico

FIGURE 1

C:\PROJECTS\18906\18906-7.DWG
ko

Appendix II

ToxiRAE Pocket PID Literature

ToxiRAE pocket photo ionization detector

personal toxic gas monitor

actual size

the

world's

smallest

PID

RAE SYSTEMS

PARTIAL LIST OF AIR CONTAMINANTS DETECTED BY PID

HAZARD
Paint solvents
Volatile organic compounds
Solvents in adhesives e.g. methylene chloride
Hazardous chemicals
Doping gases
Hazardous waste
Residual accelerants, spill response
Hexane residues, ammonia from cold storage
Ethylene oxide
Waste from multiple sources
Degreasing agents & solvents
Chlorinated solvents e.g. carbon tetrachloride
Residual solvents, monomers e.g. toluene
Fugitive emissions, hydrocarbons, BTEX
Solvents e.g. butyl acetate, diethyl ether
Chlorinated solvents
Monomers & solvents
Chlorinated organics, sulfur compounds
Volatile organic compounds e.g. butadiene
Degreasing agents & solvents, inorganic gases
Hazardous material response to leaks & spills
Re[illegible]pounds, fume extraction

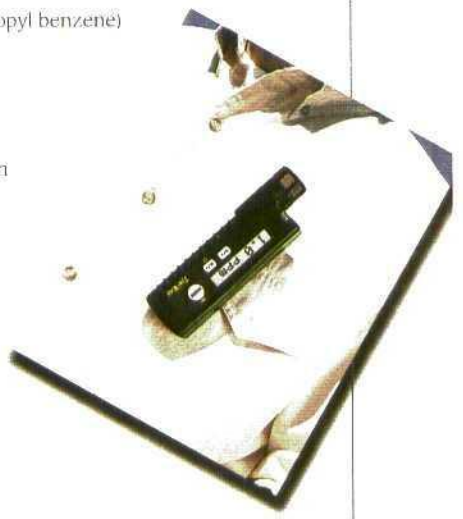
VOLATILES CONTAINING CHLORINE
Benzyl chloride
Carbon tetrachloride
Chloracetaldehyde
Chlorobenzene
Chloroform (Trichloromethane)
o-Dichlorobenzene
1,2 Dichloroethylene
Epichlorohydrin
Methylene chloride
Perchloroethylene
Trichloroethylene
Vinyl chloride

VOLATILES
Acetaldehyde
Acrolein
Acrylonitrile
1,3-Butadiene
Butanol (n-Butyl alcohol)
Carbon disulfide
Cyclohexanone
Dimethylamine
Ethyl acetate
Ethyl ether
Methyl ethyl ketone (2-Butanone)
Methyl methacrylate
Styrene

SOLVENTS
Acetone
Aniline
Benzonitrile
Cumene (Isopropyl benzene)
Cyclohexene
Furfural
Hexane
Pyridine
Tetrahydrofuran

BTEX
Benzene
Ethyl benzene
Toluene
Xylene

EXPLOSIVE/ PROPELLANTS
Ammonia
Hydrazine
Nitrotoluene



Digital instantaneous display of actual reading in ppm

Display backlight

12 hours of continuous monitoring using rechargeable batteries

Choice of alkaline or rechargeable Ni-Cd batteries

Infrared port for PC interface

Sturdy pocket and belt clip for hands free monitoring

- *Small, lightweight, pocket PID*
- *Rugged, high impact exterior*
- *Datalogging capability*

OPERATOR SECURITY PROVIDES TWO MODES:

Display mode - display readings only. These include instantaneous reading, STEL, TWA and peak as well as battery voltage and elapsed time. Downloading data to PC. Fresh air zero during power on.

Program mode - need 4 digit password to calibrate or change calibration gas, set alarm threshold for peak, STEL and TWA, set clock, clear data, change instrument setup and response factor.

FEATURES OF TOXIRAE DATALOGGING VERSION

Download data to PC and upload unit setup from PC through IR link to serial port

Programmable datalogging modes:
- automatic start/stop
- manual start/stop
- periodic start/stop
- scheduled start/stop

4000 data points with date and time stamp

Header information includes user and site ID and unit serial number

Correction factor list in PC software 3 stored in ToxiRAE

Calibration and calibration check data storage - date, time and value of span calibration

Programmable alarm modes - automatic reset or latching

Hazardous and Toxic Material Monitoring

Employee rights to a hazard-free workplace requires the management of employee exposure. OSHA's Hazard Communication Standard Title 29 Code of Federal Regulations Part 1910.1200 and many international regulations require industrial hygienists, plant and health and safety managers to monitor:

Personnel - to determine proper personal protective equipment (PPE) during hazardous spill cleanup and on hazardous waste sites

Work place and ambient air - for real time assessment of peak, STEL & TWA

Perimeter - for permit compliance at construction and hazardous waste sites

In addition, OSHA's 29 CFR 1910.146 Appendix E (May 19, 1994) regulation requires broad band, atmospheric monitoring of confined spaces for toxic gases.

Why use a Photo Ionization Detector (PID)?

RAE Systems has developed a pocket size PID for personal monitoring. A PID continuously monitors hazardous and toxic gases or vapors in low parts per million (ppm) concentrations. Examples of these volatile organic compounds (VOCs) include benzene, butadiene, methylene chloride and vinyl chloride. Current and proposed permissible exposure limits (PELs) of these air contaminants require low ppm levels, often with resolution down to 0.1 ppm. A PID provides fast response and real time readings compared against programmable alarms, in addition to datalogging for compliance.

SELECTED LIST OF PID USERS AND TOXIC MATERIAL

INDUSTRY

Automotive industry
Chemical manufacturing
Construction industry
Consultants
Electronic industries
Environmental contractors
Fire & arson
Food processing and refrigeration
Hospitals
Industrial land fills
Machine Shops
Munitions/explosive manufacturing
Packaging, paint/ink formulation
Petroleum refining and reuse
Pharmaceutical process control
Photographic products
Plastics manufacturing
Pulp and paper industry
Rubber manufacturing
Semiconductor manufacturing
Transportation
Universities & colleges

TOXIRAE FEATURES

TOXIRAE SPECIFICATIONS

Size:	6.0"L x 1.75"W x 1.0"H (15.2 cm x 4.4 cm x 2.5 cm)
Weight:	6.4 oz with battery (180g)
Detector:	Electrodeless lamp with Teflon™/ stainless steel chamber
Battery:	Rechargeable 2.4 V, 900 mAh, Ni-Cd battery pack and alkaline battery adapter
Operating Hours:	12 hours continuous
Attachment:	Pocket/belt clip
Display:	8 digit LCD with LED back light
Range:	0 to 99.9 ppm, 0.1 ppm resolution; 100 to 2999 ppm, 1 ppm resolution
Accuracy:	10% of reading or ±2 ppm when calibrated to 100 ppm isobutylene
Key-Pads:	1 operation key and 2 programming keys
Response Time:	< 20 second to 90% when exposed to 100 ppm isobutylene
Sampling Period:	1 - 3600 seconds
Direct Readout:	Instantaneous value, STEL ,TWA, battery voltage and elapsed time
Intrinsic Safety:	UL & cUL Class I, Division I, Group A,B,C,D (US & Canada), EEx ia IIC T4 (Europe)
Alarm Setting:	Separate alarm limit for TWA, STEL, and Peak
Alarm:	90 dB buzzer and flashing red LED to indicate exceeded preset limits, low battery, or lamp failure
Calibration:	Two point field calibration for zero and standard reference gas
Operation Mode:	Display and Program modes of operation
Temperature:	14° F to 104° F (-10° C to 40° C)
Humidity:	0% to 95% relative humidity (non-condensing)

POCKET TOXIRAE ORDERING INFORMATION

TOXIRAE UNIT: PGM-30

- Pocket PID unit with 10.6 eV lamp
- Rechargeable 2.4 V, 900 mAh battery (installed inside)
- Single unit charging station
- Battery charger 110 VAC to 6 VDC, 0.3 A
- Alkaline battery adapter
- Calibration adapter with tubing
- Operation and maintenance manual

TOXIRAE DATALOGGING UNIT: PGM-30D

- As previously stated plus
- Single unit charging station with additional computer interface
- ProRAE 30 software package for Windows™ 3.1

TOXIRAE: PGM-30 OR PGM-30D FIVE PACK

ACCESSORIES:

- Electrodeless discharge lamp 11.7 eV
- Calibration kit : 100 ppm isobutylene and zero air gas bottles, and calibration gas regulator with flow controller
- Vibration alarm
- Remote sampling hand pump
- Carry case

RAE SYSTEMS

680 West Maude Avenue #1, Sunnyvale, California 94086
phone (408) 481•4999 fax (408) 481•4998
http://www.raesystems.com

DISTRIBUTED BY:

CH004 Rev A, 6/97

Figure 1

TASK #1
N. GRIMES BATTERY EXCAVATION–BACKFILL & EXCAVATION AT 1341 COBB

TASK #2
GRIMES BATTERY FENCE AREA
SCRAPING & BACKFILLING

TASK #3
S. GRIMES BATTERY (FLOWLINE LEAK)
BACKFILLING

TASK #4–WEST OF TASKER
HOUSE REMOVAL, EXCAVATION, BACKFILLING

TASK #5–EAST OF TASKER
HOUSE REMOVALS, EXCAVATION, BACKFILLING

TASK #6
RECOVERY OF FREE PRODUCT

TASK #7
QUARTERLY SAMPLING OF MONITOR WELLS

EXCAVATION SITE

FORMER GRIMES TANK BATTERY EXCAVATION SITE

EXCAVATION SITE

ALLEY

COBB DRIVE

BERRY DRIVE

TASKER DRIVE

SAN ANDRES

PIPELINE EASEMENT

SKIMMER

NOTE:
THE INFORMATION AND INTERPRETATION CONTAINED ON THIS MAP ARE PRELIMINARY AND MAY CHANGE BASED UPON COMMENTS FROM NMOCD.

LEGEND

- DENOTES EXCAVATED AREA
- DENOTES PROPOSED PARK CARVE–OUT
- DENOTES PROPOSED EXCAVATION AREA
- DENOTES DIRT LEASE ROAD

- TSB – DENOTES TASKER SOIL BORING
  GSB – DENOTES GRIMES SOIL BORING
- TMW – DENOTES TASKER MONITOR WELL
  GMW – DENOTES GRIMES MONITOR WELL
- GBS– DENOTES SURFACE SAMPLES PRIOR TO EXCAVATION
  GBN– DENOTES SURFACE SAMPLES PRIOR TO EXCAVATION
- GBS– DENOTES SURFACE SAMPLES AFTER EXCAVATION
  GBN– DENOTES SURFACE SAMPLES AFTER EXCAVATION

40 0 40 80 FEET
Scale: 1"=40'

JOHN WEST SURVEYING COMPANY
HOBBS, NEW MEXICO

BBC INTERNATIONAL, INC. / ARCADIS GERAGHTY & MILLER

GRIMES BATTERY & TASKER ROAD

STAGE 2 ABATEMENT PLAN REMEDIATION TASKS
MONITOR WELL, SOIL BORING & SURFACE SOIL SAMPLE LOCATIONS IN SECTION 28
TOWNSHIP 18 SOUTH,
RANGE 38 EAST, N.M.P.M.,
LEA COUNTY, NEW MEXICO.

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DATE END: 9/1/98	CHECKED BY:	SHEET 1 OF 1	FIGURE 1
PROJECT #: 98110738	DISK #: BBC	Scale: 1"=40'	