AP - 2

STAGE 1 & 2 REPORTS

DATE:

Sept. 2003

Addendum

George DeVaull, Equilon Enterprises LLC, Houston

7 January 2000

This is an addendum to the 17 Sept 1999 RBCA Tier 1 Summary Assessment Report for the Westgate Subdivision, Grimes Battery, and Tasker Road; Hobbs, New Mexico. This addendum illustrates the calculations that have been used in deriving the site-specific TPH screening criteria.

The assumptions used identically match the 17 Sept report. Since the completion of the 17 Sept report, additional information has become available which might be used to change some of the prior assumptions. This includes:

- The Texas Natural Resource Conservation Commission (TNRCC) Risk Reduction Program Rule (30 TAC 350) assigns a hazard index target for chemical mixtures, including petroleum, of HI = 10. We have used HI = 1 as an assumption in this analysis.
- The USEPA, Region 9 Preliminary Remediation Goals (PRGs) [1 Oct 1999], use recent guidance for dermal relative exposure factors for VOCs of zero, and SVOCs of 0.1. Using this updated guidance would set the dermal exposure for the volatile petroleum fraction to zero. [http://www.epa.gov/region09/waste/sfund/prg/]
- The child dermal exposure factors for surface area and body weight used in the 17 Sept 1999 report could be modified. For the oil composition at this site the dermal exposure is small (1.2% of the total exposure for the TSB-7 2-3ft (ADL) sample). Changes to the dermal exposure factors would not significantly change the recommended screening level.

If these new assumptions were applied individually (compared to the values in the 17 Sept 1999 report), the derived TPH screening levels would either rise significantly (item 1); rise by up to several percent (item 2); or (item 3) decrease by up to several percent.

Detail of Calculations – Surficial Soil

The values for TPH screening for surficial soil in this report were derived for each of nine soil analyses. The following detailed calculations are shown for sample TSB-7 2-3ft (ADL) which is the value used in the site-specific screening. The derived surficial soil screening criteria was calculated as 2600 mg/kg (or 2650 mg/kg without roundoff).

For surficial soil, the controlling assumptions are for child receptor. The calculations correspond to a hazard index of one, HI = 1. Estimated exposure is due to summed:

- direct ingestion of soil
- dermal contact with soils
- inhalation of dust from soils
- inhalation of vapors from surface soils

The calculations in the Sept 17 report were done with the aid of an Excel spreadsheet which included extensive macro calculations. The following numbers were taken from the spreadsheet with the calculations repeated individually for sample TSB-7 2-3ft (ADL).

The measured mass of TPH in soil for sample TSB-7 2-3ft (ADL) was 12749 mg/kg. We have used the relative composition of this sample in these calculations, not the total value. The calculations are iterated for a range of soil concentrations to find the level for which HI = 1. The concentration distribution of cuts for sample TSB-7 2-3ft (ADL) at this level (2650 mg/kg) is given by:

	chemical name	mass fraction		soil concentration		mass concentration of cut in soil
		(g/g-oil)		(mg-oil/kg-soil)		(mg/kg-soil)
1.	EC >8 to 10 aliphatic	3.94E-03	x	2650.1	=	10.4
2.	EC >16 to 35 aliphatic	1.17E-01	x	2650.1	=	310.2
3.	Benzene (EC <6 to 7) aromatic	1.52E-06	x	2650.1	=	4.0E-3
4.	Toluene (EC >7 to 8) aromatic	9.14E-07	x	2650.1	=	2.4E-3
5.	EC > 8 to 10 aromatic	1.17E-03	x	2650.1	=	3.1
6.	EC >12 to 16 aromatic	2.68E-02	x	2650.1	=	71.1
7.	EC >16 to 21 aromatic	3.89E-02	x	2650.1	=	103.2
8.	EC >21 to 35 aromatic	6.49E-03	x	2650.1	=	17.2
9.	EC > 35	8.06E-01	x	2650.1	=	2134.9
	sum total:	1				2650.1

direct ingestion of soil

For a child receptor, the average daily uptake rate of soil due to ingestion is given by:

(exposure frequency) · (ingestion rate of soil) · (relative oral absorption factor) /
[(body weight) · (365 dy/yr)] =

(350 dy/yr) (200 mg/dy) (1.0) / [(15 kg) (365 dy/yr)] · (1.0E-6 kg/mg) = 1.28E-05 kg/(kg-dy)

The calculation of hazard quotient is:

	chemical name	mass concentration of cut in soil (mg/kg-soil)		oral reference dose RfDo (mg/kg-day)		average daily uptake rate - child (kg/kg-day)		hazard quotient
1.	EC >8 to 10 aliphatic	10.4	/	0.1	x	1.2785E-05	=	1.33E-03
2.	EC >16 to 35 aliphatic	310.2	/	2	x	1.2785E-05	=	1.98E-03
3.	Benzene (EC <6 to 7) aromatic	4.0E-3	/	0.2	x	1.2785E-05	=	2.58E-07
4.	Toluene (EC >7 to 8) aromatic	2.4E-3	/	0.2	x	1.2785E-05	=	1.55E-07
5.	EC > 8 to 10 aromatic	3.1	/	0.04	x	1.2785E-05	=	9.88E-04
6.	EC >12 to 16 aromatic	71.1	/	0.04	x	1.2785E-05	=	2.27E-02
7.	EC >16 to 21 aromatic	103.2	/	0.03	x	1.2785E-05	=	4.40E-02
8.	EC >21 to 35 aromatic	17.2	/	0.03	x	1.2785E-05	=	7.33E-03
9.	EC > 35	2134.9	/	0.03	x	1.2785E-05	=	9.10E-01
	sum total:	2650.1				(ingestion) hazard index	=	**9.88E-01**

This shows that the direct ingestion exposure for surficial soil comprises 98.8% (HI=0.988) of the total exposure for this oil composition, at 2650 mg/kg soil concentration, with a target hazard index, HI = 1. The other surficial soil exposure routes (dermal contact, inhalation of dust, and inhalation of vapors from surface soils) comprise 1.2% of the exposure.

dermal soil uptake

For a child receptor, the average daily uptake rate of soil due to dermal contact in the 17 Sept 1999 RBCA Tier 1 Summary Assessment Report is taken as

(exposure frequency) · (surface area) · (soil to skin adherence factor) · (dermal relative absorption factor) /
[(body weight) · (365 dy/yr)] =

or

(350 dy/yr) (1567 cm^2/dy) (0.5 mg/cm^2) (dermal relative absorption factor) / [(70 kg) (365 dy/yr)]

The dermal relative absorption factor and thus the daily uptake rate depends on the cut of oil. These values effectively are:

		dermal relative absorption factor	average daily uptake rate - child - dermal contact
1.	EC >8 to 10 aliphatic	0.1	1.0733E-06
2.	EC >16 to 35 aliphatic	0.1	1.0733E-06
3.	Benzene (EC <6 to 7) aromatic	0.1	1.0733E-06
4.	Toluene (EC >7 to 8) aromatic	0.1	1.0733E-06
5.	EC > 8 to 10 aromatic	0.1	1.0733E-06
6.	EC >12 to 16 aromatic	0.1	1.0733E-06
7.	EC >16 to 21 aromatic	0.1	1.0733E-06
8.	EC >21 to 35 aromatic	0.1	1.0733E-06
9.	EC > 35	0.00375	4.0248E-08

The dermal relative absorption factor, RAFd, for cut no. 9 (EC > 35) is due to the lower dermal toxicity (RfDd = 0.8 mg/kg-day) than oral toxicity (RfDo = 0.03 mg/kg-day) for this cut. The effective tabulated value is RAFd (effective) = RAFd · RfDo/RfDd = 0.1 · (0.03 / 0.8). The calculation of hazard quotient for the dermal exposure route is:

	chemical name	mass concentration of cut in soil (mg/kg-soil)		oral reference dose RfDo (mg/kg-day)		average daily uptake rate – child (mg/kg-day)		hazard quotient
1.	EC >8 to 10 aliphatic	10.4	/	0.1	x	1.0733E-06	=	1.12E-04
2.	EC >16 to 35 aliphatic	310.2	/	2	x	1.0733E-06	=	1.66E-04
3.	Benzene (EC <6 to 7) aromatic	4.0E-3	/	0.2	x	1.0733E-06	=	2.17E-08
4.	Toluene (EC >7 to 8) aromatic	2.4E-3	/	0.2	x	1.0733E-06	=	1.30E-08
5.	EC > 8 to 10 aromatic	3.1	/	0.04	x	1.0733E-06	=	8.29E-05
6.	EC >12 to 16 aromatic	71.1	/	0.04	x	1.0733E-06	=	1.91E-03
7.	EC >16 to 21 aromatic	103.2	/	0.03	x	1.0733E-06	=	3.69E-03
8.	EC >21 to 35 aromatic	17.2	/	0.03	x	1.0733E-06	=	6.16E-04
9.	EC > 35	2134.9	/	0.03	x	4.0248E-08	=	2.86E-03
	sum total:	2650.1				(dermal) hazard index	=	**9.44E-03**

With these calculations, the dermal fraction of the surficial soil exposure is 0.94% (HI = 0.0094) of the total.

dust inhalation from soils

For the inhalation exposure route, the ratio of inhalation rate to body weight is relatively independent of age, therefore adult inhalation rate and body weight are used in the calculation (consistent with the development of the inhalation reference concentration).

The concentration of chemical in soil dust is directly proportional to the concentration in soil. A factor, VF_p, relating soil concentration to dust concentration is given by:

VF_p = (particulate emission rate) · (surface area) / [(air velocity) · (source width) · (mixing height)]

(6.9E-14 g/cm^2-sec) (20250000 cm^2) / [(225 cm/s) (4500 cm) (200 cm)] = 6.9E-15 g-soil/cm^3-air

Dust concentration is related to soil concentration

$C_{air,dust} = VF_p \cdot C_{soil} \cdot (10^3 \text{ cm}^3 - \text{kg} / \text{m}^3\text{-g})$

For each of the petroleum cuts (note the unit conversion):

	chemical name	mass concentration of cut in soil (mg/kg-soil)		particulate emission factor (g-soil/cm^3-air)		mass concentration of cut in air - dust (mg/m^3)
1.	EC >8 to 10 aliphatic	10.4	x	6.9E-15	=	7.20E-11
2.	EC >16 to 35 aliphatic	310.2	x	6.9E-15	=	2.14E-09
3.	Benzene (EC <6 to 7) aromatic	4.0E-3	x	6.9E-15	=	2.79E-14
4.	Toluene (EC >7 to 8) aromatic	2.4E-3	x	6.9E-15	=	1.67E-14
5.	EC > 8 to 10 aromatic	3.1	x	6.9E-15	=	2.13E-11
6.	EC >12 to 16 aromatic	71.1	x	6.9E-15	=	4.91E-10
7.	EC >16 to 21 aromatic	103.2	x	6.9E-15	=	7.12E-10
8.	EC >21 to 35 aromatic	17.2	x	6.9E-15	=	1.19E-10
9.	EC > 35	2134.9	x	6.9E-15	=	1.47E-08
	sum total:	2650.1				1.83E-08

For non-carcinogenic inhalation exposure, a reference concentration is used. A hazard index is calculated as the ratio of the actual (or estimated) air concentration to the reference concentration, with an adjustment for exposure frequency of:

EF / 365 = (exposure frequency) / (365 dy/yr) = (350 dy/yr / 365 dy/yr)

For each of the petroleum cuts:

	chemical name	mass concentration of cut in air - dust (mg/m^3)		reference concentration (mg/m^3)		exposure frequency fraction (EF/365)		hazard quotient
1.	EC >8 to 10 aliphatic	7.20E-11	/	1.05	x	0.9589	=	6.58E-11
2.	EC >16 to 35 aliphatic	2.14E-09	/	7	x	0.9589	=	2.93E-10
3.	Benzene (EC <6 to 7) aromatic	2.79E-14	/	0.35	x	0.9589	=	7.64E-14
4.	Toluene (EC >7 to 8) aromatic	1.67E-14	/	0.35	x	0.9589	=	4.58E-14
5.	EC > 8 to 10 aromatic	2.13E-11	/	0.175	x	0.9589	=	1.17E-10
6.	EC >12 to 16 aromatic	4.91E-10	/	0.175	x	0.9589	=	2.69E-09
7.	EC >16 to 21 aromatic	7.12E-10	/	0.105	x	0.9589	=	6.50E-09
8.	EC >21 to 35 aromatic	1.19E-10	/	0.105	x	0.9589	=	1.08E-09
9.	EC > 35	1.47E-08	/	0.105	x	0.9589	=	1.35E-07
	sum total:					(dust inhalation) hazard index	=	**1.45E-07**

vapor inhalation from soils

The concentration of chemical vapor adjacent to soils containing crude oil can be described by a mixing factor relating soil concentrations to vapor concentrations in the breathing zone above the soil. This is a function of:

- the volatility, or vapor pressure, of the cut.
- the mixture composition.
- the mass of crude oil in the surface soil layer.

For each of the petroleum cuts (note the unit conversion):

	chemical name	mass concentration of cut in soil (mg/kg-soil)		vapor emission factor ($g\text{-}soil/cm^3\text{-}air$)		mass concentration of cut in air - vapor (mg/m^3)
1.	EC >8 to 10 aliphatic	10.4	x	1.80E-08	=	1.88E-04
2.	EC >16 to 35 aliphatic	310.2	x	4.82E-10	=	1.50E-04
3.	Benzene (EC <6 to 7) aromatic	4.0E-3	x	1.80E-08	=	7.26E-08
4.	Toluene (EC >7 to 8) aromatic	2.4E-3	x	1.80E-08	=	4.35E-08
5.	EC > 8 to 10 aromatic	3.1	x	1.80E-08	=	5.55E-05
6.	EC >12 to 16 aromatic	71.1	x	3.62E-09	=	2.58E-04
7.	EC >16 to 21 aromatic	103.2	x	4.83E-10	=	4.99E-05
8.	EC >21 to 35 aromatic	17.2	x	1.19E-11	=	2.05E-07
9.	EC > 35	2134.9	x	4.35E-14	=	9.29E-08
	sum total:	2650.1				7.01E-04

For each of the petroleum cuts:

	chemical name	mass concentration of cut in air - vapor (mg/m^3)		reference concentration (mg/m^3)		exposure frequency fraction (EF/365)		hazard quotient
1.	EC >8 to 10 aliphatic	1.88E-04	/	1.05	x	0.9589	=	1.71E-04
2.	EC >16 to 35 aliphatic	1.50E-04	/	7	x	0.9589	=	2.05E-05
3.	Benzene (EC <6 to 7) aromatic	7.26E-08	/	0.35	x	0.9589	=	1.99E-07
4.	Toluene (EC >7 to 8) aromatic	4.35E-08	/	0.35	x	0.9589	=	1.19E-07
5.	EC > 8 to 10 aromatic	5.55E-05	/	0.175	x	0.9589	=	3.04E-04
6.	EC >12 to 16 aromatic	2.58E-04	/	0.175	x	0.9589	=	1.41E-03
7.	EC >16 to 21 aromatic	4.99E-05	/	0.105	x	0.9589	=	4.56E-04
8.	EC >21 to 35 aromatic	2.05E-07	/	0.105	x	0.9589	=	1.87E-06
9.	EC > 35	9.29E-08	/	0.105	x	0.9589	=	8.49E-07

(vapor inhalation) hazard index = **2.37E-03**

summary

For sample TSB-7 2-3ft (ADL), and repeating from the distribution of hazard indices calculated above, we have a summary table, at a specified concentration level of 2650 mg/kg, of:

	ingestion fraction:	dermal fraction:	particulate inhalation fraction:	vapor inhalation fraction:	total:
total:	9.88E-01	9.44E-03	2.35E-03	1.45E-07	1.00

cut:	fraction of total:	fraction of total:	fraction of total:	fraction of total:	fraction of above:
1	1.33E-03	1.12E-04	1.71E-04	6.58E-11	1.62E-03
2	1.98E-03	1.66E-04	2.04E-05	2.93E-10	2.17E-03
3	2.58E-07	2.17E-08	1.99E-07	7.64E-14	4.79E-07
4	1.55E-07	1.30E-08	1.19E-07	4.58E-14	2.87E-07
5	9.88E-04	8.29E-05	3.04E-04	1.17E-10	1.37E-03
6	2.27E-02	1.91E-03	1.40E-03	2.69E-09	2.60E-02
7	4.40E-02	3.69E-03	4.53E-04	6.50E-09	4.81E-02
8	7.33E-03	6.16E-04	1.86E-06	1.08E-09	7.95E-03
9	9.10E-01	2.86E-03	8.44E-07	1.35E-07	9.13E-01

The illustrated TPH calculation was for the residential child, surficial soil exposure pathway. A composite table of TPH analysis values and derived screening levels follows. This shows the mass distribution for the analyzed soil samples, soil mass concentrations, and the derived Risk-Based Screening levels for the residential exposure scenario.

sample location:	TSB-7A	GBN-4	GBN-3	GBN-1	GBN-2	GSB-10 (BP)	GSB-9	TSB-7	TSB-8
field sample ID:	T119262	T119263	T117628	T117626	T117627	T118813	T118812	(ADL)	(ADL)
sample interval:	(2-3')	(6"-8")	(6")	(6")	(6")	(2-3')	(2-3')	2-3 ft	2-3 ft
mass fraction analysis:	TX1006	TX1006	TX1006	TX1006	TX1006	TX1006	TX1006	ADLittle	ADLittle
mass fraction distribution results:									
	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)	(g/g-oil)
EC =&>6 to 8 aliphatic	0.013828	0	0	0	0	0.007856	0		
EC >8 to 10 aliphatic	0.026045	0	0	0	0	0.072009	0	0.00394	0.005778
EC >10 to 12 aliphatic	0.025705	0	0	0	0	0.071982	0	0	0
EC >12 to 16 aliphatic	0.077687	0	0.022038	0.024825	0	0.215708	0	0	0.02832
EC >16 to 35 aliphatic	0.161195	0.388765	0.580647	0.664856	0.601172	0.419922	0	0.117036	0.11603
Benzene (EC <6 to 7) arom.	0	0	0	0	0	0	0	1.52E-06	1.07E-06
Toluene (EC >7 to 8) arom.	0.000155	0	0	0	0	0	0	9.14E-07	7.12E-07
EC > 8 to 10 aromatic	0.006705	0	0.001038	0	0	0.01067	0	0.001166	0.006488
EC > 10 to 12 aromatic	0.008563	0	0	0	0	0.009343	0	0	0
EC >12 to 16 aromatic	0.037814	0	0.00736	0	0	0.037318	0.45629	0.02684	0.026732
EC >16 to 21 aromatic	0.422577	0.610494	0.388917	0.235583	0.382694	0.153865	0.4371	0.038949	0.029394
EC >21 to 35 aromatic	0.219727	0.000741	0	0.074735	0.016134	0.001327	0.10661	0.006494	0.004108
>C35 total								0.805573	0.783149
sum	1	1	1	1	1	1	1	1	1

all values in (mg/kg-soil):

closest available sample location for 418.1 TPH, otherwise same sample	TSB-7, 2-3', SAMPLE: 106036, Table 3	GMW-9, 8-10', SAMPLE: 106457, Table 3		GSB-5, 2-3', SAMPLE: 106262, Table 3					
TPH (418.1)	20000	11900		<10		1960	24	57000	32000
aliphatic and arom (C35<) sum	6457.9	6742	24185.1	3780.6	981	3762	41.9		
unfractionated analysis	9413	9901	21841	5322	1217	6257	51	12749	9013.1
surficial soil exposure (HI = 1):									
residential - child	2955	3483	5236	6576	5278	6736	2388	**2650**	2711
residential - adult	11414	13584	20429	25730	20620	25881	9175	21060	21323
soil leaching to groundwater ingestion (HI = 1):									
residential	NA	NA	NA	NA	NA	NA	NA	NA	NA
subsurface soil volatilization (HI = 1):									
to enclosed space - residential	NA	NA	NA	NA	NA	1425 (a)	NA	NA	NA
to ambient air - residential	NA	NA	NA	NA	NA	NA	NA	NA	NA

(a) addressed in refined analysis for soil vapor exposure pathway.

WESTGATE SUBDIVISION

Addendum Report
to
Stage 2 Abatement Plan (AP-2)
Grimes Battery & Tasker Road
Hobbs, New Mexico

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SFP 17 2003
Environmental Bureau
Oil Conservation Division

September 2003

Shell Exploration and Production Company
Houston, Texas

Prepared by:

BBC International, Inc.
Hobbs, New Mexico

Addendum to Stage 2 Abatement Plan
Soil Remediation Activities Report -May 2003
Trace Analysis Confirmation Sampling and Analytical Data
August 15, 2003

		GBN-27 3'	GBN-28 3'
Analyte	Method	Sample: 15535	Sample: 15536
		µg/Kg	µg/Kg
Benzene	S 8260B	ND	ND
Toluene	S 8260B	ND	ND
Ethylbenzene	S 8260B	ND	ND
m, p-Xylene	S 8260B	ND	ND
o-Xylene	S 8260B	ND	ND
Total Aluminum	S 6010B	14200	ND
Total Arsenic	S 6010B	ND	ND
Total Barium	S 6010B	132	250
Total Boron	S 6010B	18.2	13.9
Total Cadmium	S 6010B	2.52	2.33
Total Chromium	S 6010B	11.6	7.99
Total Cobalt	S 6010B	ND	ND
Total Copper	S 6010B	8.38	5.19
Total Iron	S 6010B	ND	ND
Total Mercury	S 6010B	ND	ND
Total Lead	S 6010B	12.7	13
Total Manganese	S 6010B	170	59
Total Molybdenum	S 6010B	ND	ND
Total Nickel	S 6010B	11.7	10.8
Total Selenium	S 6010B	ND	13.6
Total Silica	S 6010B	ND	430
Total Silver	S 6010B	ND	ND
Total Zinc	S 6010B	25.7	ND
TPH	E 418.1	ND	ND
Total Calcium	S 6010B	46900	92300
Total Magnesium	S 6010B	3070	8530
Total Potassium	S 6010B	3140	1670
Total Sodium	S 6010B	207	167

Summary Report

Cliff Brunson
BBC International
1324 W. Marland
Hobbs, NM 88240

Report Date: August 21, 2003

Work Order: 3081901

Project Location: Hobbs,NM
Project Name: Shell Westgate

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
15535	GBN-27-3'	soil	2003-08-15	09:06	2003-08-18
15536	GBN-28-3'	soil	2003-08-15	09:32	2003-08-18

Sample: 15535 - GBN-27-3'

Param	Flag	Result	Units	RL
Total Calcium		46900	mg/Kg	50.0
Total Magnesium		3070	mg/Kg	50.0
Total Potassium		3140	mg/Kg	50.0
Total Sodium		207	mg/Kg	50.0

Sample: 15536 - GBN-28-3'

Param	Flag	Result	Units	RL
Total Calcium		92300	mg/Kg	50.0
Total Magnesium		8530	mg/Kg	50.0
Total Potassium		1670	mg/Kg	50.0
Total Sodium		167	mg/Kg	50.0

TRACEANALYSIS, INC.

6701 Aberdeen Avenue, Suite 9 Lubbock, Texas 79424 800•378•1296 806•794•1296 FAX 806•794•1298
155 McCutcheon, Suite H El Paso, Texas 79932 888•588•3443 915•585•3443 FAX 915•585•4944
E-Mail: lab@traceanalysis.com

Analytical and Quality Control Report

Cliff Brunson
BBC International
1324 W. Marland
Hobbs, NM 88240

Report Date: August 21, 2003

Work Order: 3081901

Project Location: Hobbs,NM
Project Name: Shell Westgate
Project Number: Shell Westgate

Enclosed are the Analytical Report and Quality Control Report for the following sample(s) submitted to TraceAnalysis, Inc.

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
15535	GBN-27-3'	soil	2003-08-15	09:06	2003-08-18
15536	GBN-28-3'	soil	2003-08-15	09:32	2003-08-18

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 4 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Dr. Blair Leftwich, Director

Analytical Report

Sample: 15535 - GBN-27-3'

Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B
QC Batch:	4052	Date Analyzed:	2003-08-26	Analyzed By:	BC
Prep Batch:	3535	Date Prepared:	2003-08-22	Prepared By:	TP

Parameter	Flag	RL Result	Units	Dilution	RL
Total Calcium		46900	mg/Kg	1	50.0
Total Magnesium		3070	mg/Kg	1	50.0
Total Potassium		3140	mg/Kg	1	50.0
Total Sodium		207	mg/Kg	1	50.0

Sample: 15536 - GBN-28-3'

Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B
QC Batch:	4052	Date Analyzed:	2003-08-26	Analyzed By:	BC
Prep Batch:	3535	Date Prepared:	2003-08-22	Prepared By:	TP

Parameter	Flag	RL Result	Units	Dilution	RL
Total Calcium		92300	mg/Kg	1	50.0
Total Magnesium		8530	mg/Kg	1	50.0
Total Potassium		1670	mg/Kg	1	50.0
Total Sodium		167	mg/Kg	1	50.0

Method Blank (1) QC Batch: 4052

Parameter	Flag	Result	Units	RL
Total Calcium		123	mg/Kg	50
Total Magnesium		<50.0	mg/Kg	50
Total Potassium		53.4	mg/Kg	50
Total Sodium		<50.0	mg/Kg	50

Laboratory Control Spike (LCS-1) QC Batch: 4052

Param		LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Calcium	[1,2]	9060	9060	mg/Kg	1	10000	<28.0	91	0	85 - 115	20
Total Magnesium	[3,4]	9070	8860	mg/Kg	1	10000	<15.6	91	2	80 - 120	20

continued ...

[1]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[2]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[3]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[4]Changed spike amount from 100 to 10000 due to concentration in spiking solution

control spikes continued ...

Param		LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Potassium	[5,6]	8900	8920	mg/Kg	1	10000	<25.8	89	0	85 - 115	20
Total Sodium	[7,8]	9390	9660	mg/Kg	1	10000	<21.1	94	3	85 - 115	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1) QC Batch: 4052

Param		MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Calcium	[9,10]	10900	11000	mg/Kg	1	10000	1250	96	1	75 - 125	20
Total Magnesium	[11,12]	11000	10900	mg/Kg	1	10000	1630	94	1	75 - 125	20
Total Potassium	[13,14]	13100	12800	mg/Kg	1	10000	2150	110	2	75 - 125	20
Total Sodium	[15,16]	11000	10800	mg/Kg	1	10000	133	109	2	75 - 125	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Standard (ICV-1) QC Batch: 4052

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Calcium		mg/Kg	25.0	25.1	100	90 - 110	2003-08-26
Total Magnesium		mg/Kg	25.0	24.4	98	90 - 110	2003-08-26
Total Potassium		mg/Kg	25.0	23.2	93	90 - 110	2003-08-26
Total Sodium		mg/Kg	25.0	24.5	98	90 - 110	2003-08-26

Standard (CCV-1) QC Batch: 4052

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Calcium		mg/Kg	25.0	23.8	95	90 - 110	2003-08-26
Total Magnesium		mg/Kg	25.0	23.9	96	90 - 110	2003-08-26
Total Potassium		mg/Kg	25.0	24.7	99	90 - 110	2003-08-26
Total Sodium		mg/Kg	25.0	25.2	101	90 - 110	2003-08-26

[5]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[6]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[7]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[8]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[9]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[10]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[11]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[12]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[13]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[14]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[15]Changed spike amount from 100 to 10000 due to concentration in spiking solution
[16]Changed spike amount from 100 to 10000 due to concentration in spiking solution

Summary Report

Cliff Brunson
BBC International
1324 W. Marland
Hobbs, NM 88240

Report Date: August 21, 2003

Work Order: 3081901

Project Location: Hobbs,NM
Project Name: Shell Westgate

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
15535	GBN-27-3'	soil	2003-08-15	09:06	2003-08-18
15536	GBN-28-3'	soil	2003-08-15	09:32	2003-08-18

Sample - Field Code	TPH 418.1 TRPHC (mg/Kg)
15535 - GBN-27-3'	<10.0
15536 - GBN-28-3'	<10.0

Sample: 15535 - GBN-27-3'

Param	Flag	Result	Units	RL
Total Aluminum		14200	mg/Kg	10.0
Total Arsenic		<2.00	mg/Kg	2.00
Total Barium		132	mg/Kg	10.0
Total Boron		18.2	mg/Kg	10.0
Total Cadmium		2.52	mg/Kg	0.100
Total Chromium		11.6	mg/Kg	2.50
Total Cobalt		<10.0	mg/Kg	10.0
Total Copper		8.38	mg/Kg	1.25
Total Iron		<10000	mg/Kg	10.0
Total Mercury		<0.150	mg/Kg	0.150
Total Lead		12.7	mg/Kg	1.00
Total Manganese		170	mg/Kg	10.0
Total Molybdenum		<10.0	mg/Kg	10.0
Total Nickel		11.7	mg/Kg	10.0
Total Selenium		<1.00	mg/Kg	1.00
Total Silica		<10000	mg/Kg	10.0
Total Silver		<0.200	mg/Kg	0.200
Total Zinc		25.7	mg/Kg	10.0
Benzene		<20.0	µg/Kg	1.00
Toluene		<20.0	µg/Kg	1.00
Ethylbenzene		<20.0	µg/Kg	1.00
m,p-Xylene		<20.0	µg/Kg	1.00
o-Xylene		<20.0	µg/Kg	1.00

Sample: 15536 - GBN-28-3'

Param	Flag	Result	Units	RL
Total Aluminum		<10000	mg/Kg	10.0
Total Arsenic		<2.00	mg/Kg	2.00
Total Barium		250	mg/Kg	10.0
Total Boron		13.9	mg/Kg	10.0
Total Cadmium		2.33	mg/Kg	0.100
Total Chromium		7.99	mg/Kg	2.50
Total Cobalt		<10.0	mg/Kg	10.0
Total Copper		5.19	mg/Kg	1.25
Total Iron		<10000	mg/Kg	10.0
Total Mercury		<0.150	mg/Kg	0.150
Total Lead		13.0	mg/Kg	1.00
Total Manganese		59.0	mg/Kg	10.0
Total Molybdenum		<10.0	mg/Kg	10.0
Total Nickel		10.8	mg/Kg	10.0
Total Selenium		13.6	mg/Kg	1.00
Total Silica		430	mg/Kg	10.0
Total Silver		<0.200	mg/Kg	0.200
Total Zinc		<10.0	mg/Kg	10.0
Benzene		<20.0	µg/Kg	1.00
Toluene		<20.0	µg/Kg	1.00
Ethylbenzene		<20.0	µg/Kg	1.00
m,p-Xylene		<20.0	µg/Kg	1.00
o-Xylene		<20.0	µg/Kg	1.00

TRACEANALYSIS, INC.

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Analytical and Quality Control Report

Cliff Brunson
BBC International
1324 W. Marland
Hobbs, NM 88240

Report Date: August 21, 2003

Work Order: 3081901

Project Location: Hobbs,NM
Project Name: Shell Westgate
Project Number: Shell Westgate

Enclosed are the Analytical Report and Quality Control Report for the following sample(s) submitted to TraceAnalysis, Inc.

Sample	Description	Matrix	Date Taken	Time Taken	Date Received
15535	GBN-27-3'	soil	2003-08-15	09:06	2003-08-18
15536	GBN-28-3'	soil	2003-08-15	09:32	2003-08-18

These results represent only the samples received in the laboratory. The Quality Control Report is generated on a batch basis. All information contained in this report is for the analytical batch(es) in which your sample(s) were analyzed.

This report consists of a total of 11 pages and shall not be reproduced except in its entirety, without written approval of TraceAnalysis, Inc.

Dr. Blair Leftwich, Director

Analytical Report

Sample: 15535 - GBN-27-3'

Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3010A
QC Batch:	3880	Date Analyzed:	2003-08-20	Analyzed By:	RR
Prep Batch:	3467	Date Prepared:	2003-08-19	Prepared By:	TP
Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B

Parameter	Flag	Result	RL	Units	Dilution	RL
Total Aluminum		14200		mg/Kg	1000	10.0
Total Arsenic		<2.00		mg/Kg	1	2.00
Total Barium		132		mg/Kg	1	10.0
Total Boron		18.2		mg/Kg	1	10.0
Total Cadmium		2.52		mg/Kg	1	0.100
Total Chromium		11.6		mg/Kg	1	2.50
Total Cobalt		<10.0		mg/Kg	1	10.0
Total Copper		8.38		mg/Kg	1	1.25
Total Iron		<10000		mg/Kg	1000	10.0
Total Mercury		<0.150		mg/Kg	1	0.150
Total Lead		12.7		mg/Kg	1	1.00
Total Manganese		170		mg/Kg	1	10.0
Total Molybdenum		<10.0		mg/Kg	1	10.0
Total Nickel		11.7		mg/Kg	1	10.0
Total Selenium		<1.00		mg/Kg	1	1.00
Total Silica		<10000		mg/Kg	1000	10.0
Total Silver		<0.200		mg/Kg	1	0.200
Total Zinc		25.7		mg/Kg	1	10.0

Sample: 15535 - GBN-27-3'

Analysis:	TPH 418.1	Analytical Method:	E 418.1	Prep Method:	N/A
QC Batch:	3885	Date Analyzed:	2003-08-21	Analyzed By:	DS
Prep Batch:	3493	Date Prepared:	2003-08-21	Prepared By:	DS

Parameter	Flag	Result	RL	Units	Dilution	RL
TRPHC		<10.0		mg/Kg	1	10.0

Sample: 15535 - GBN-27-3'

Analysis:	Volatiles	Analytical Method:	S 8260B	Prep Method:	S 5030B
QC Batch:	3897	Date Analyzed:	2003-08-20	Analyzed By:	JG
Prep Batch:	3498	Date Prepared:	2003-08-20	Prepared By:	JG

Parameter	Flag	Result	RL	Units	Dilution	RL
Benzene		<20.0		µg/Kg	20	1.00
Toluene		<20.0		µg/Kg	20	1.00
Ethylbenzene		<20.0		µg/Kg	20	1.00
m,p-Xylene		<20.0		µg/Kg	20	1.00

continued ...

sample 15535 continued ...

Parameter	Flag	RL Result	Units	Dilution	RL
o-Xylene		<20.0	µg/Kg	20	1.00

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
Dibromofluoromethane		39.2	µg/Kg	1	50.0	78	42 - 129
Toluene-d8		47.7	µg/Kg	1	50.0	95	93 - 107
4-Bromofluorobenzene (4-BFB)		48.0	µg/Kg	1	50.0	96	78 - 120

Sample: 15536 - GBN-28-3'

Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3010A
QC Batch:	3880	Date Analyzed:	2003-08-20	Analyzed By:	RR
Prep Batch:	3467	Date Prepared:	2003-08-19	Prepared By:	TP
Analysis:	OCD Metals	Analytical Method:	S 6010B	Prep Method:	S 3050B

Parameter	Flag	RL Result	Units	Dilution	RL
Total Aluminum		<10000	mg/Kg	1000	10.0
Total Arsenic		<2.00	mg/Kg	1	2.00
Total Barium		250	mg/Kg	1	10.0
Total Boron		13.9	mg/Kg	1	10.0
Total Cadmium		2.33	mg/Kg	1	0.100
Total Chromium		7.99	mg/Kg	1	2.50
Total Cobalt		<10.0	mg/Kg	1	10.0
Total Copper		5.19	mg/Kg	1	1.25
Total Iron		<10000	mg/Kg	1000	10.0
Total Mercury		<0.150	mg/Kg	1	0.150
Total Lead		13.0	mg/Kg	1	1.00
Total Manganese		59.0	mg/Kg	1	10.0
Total Molybdenum		<10.0	mg/Kg	1	10.0
Total Nickel		10.8	mg/Kg	1	10.0
Total Selenium		13.6	mg/Kg	1	1.00
Total Silica		430	mg/Kg	1	10.0
Total Silver		<0.200	mg/Kg	1	0.200
Total Zinc		<10.0	mg/Kg	1	10.0

Sample: 15536 - GBN-28-3'

Analysis:	TPH 418.1	Analytical Method:	E 418.1	Prep Method:	N/A
QC Batch:	3885	Date Analyzed:	2003-08-21	Analyzed By:	DS
Prep Batch:	3493	Date Prepared:	2003-08-21	Prepared By:	DS

Parameter	Flag	RL Result	Units	Dilution	RL
TRPHC		<10.0	mg/Kg	1	10.0

Sample: 15536 - GBN-28-3'

Analysis:	Volatiles	Analytical Method:	S 8260B	Prep Method:	S 5030B
QC Batch:	3897	Date Analyzed:	2003-08-20	Analyzed By:	JG
Prep Batch:	3498	Date Prepared:	2003-08-20	Prepared By:	JG

Parameter	Flag	RL Result	Units	Dilution	RL
Benzene		<20.0	µg/Kg	20	1.00
Toluene		<20.0	µg/Kg	20	1.00
Ethylbenzene		<20.0	µg/Kg	20	1.00
m,p-Xylene		<20.0	µg/Kg	20	1.00
o-Xylene		<20.0	µg/Kg	20	1.00

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
Dibromofluoromethane		39.3	µg/Kg	1	50.0	79	42 - 129
Toluene-d8		47.5	µg/Kg	1	50.0	95	93 - 107
4-Bromofluorobenzene (4-BFB)		48.7	µg/Kg	1	50.0	97	78 - 120

Method Blank (1) QC Batch: 3880

Parameter	Flag	Result	Units	RL
Total Aluminum		<10.0	mg/Kg	10
Total Arsenic		<2.00	mg/Kg	2
Total Barium		<10.0	mg/Kg	10
Total Boron		<10.0	mg/Kg	10
Total Cadmium		<0.100	mg/Kg	0.1
Total Chromium		<2.50	mg/Kg	2.5
Total Cobalt		<10.0	mg/Kg	10
Total Copper		<1.25	mg/Kg	1.25
Total Iron		<10.0	mg/Kg	10
Total Lead		<1.00	mg/Kg	1
Total Manganese		<10.0	mg/Kg	10
Total Molybdenum		<10.0	mg/Kg	10
Total Nickel		<10.0	mg/Kg	10
Total Selenium		<1.00	mg/Kg	1
Total Silica		<10.0	mg/Kg	10
Total Silver		<0.200	mg/Kg	0.2
Total Zinc		<10.0	mg/Kg	10

Method Blank (1) QC Batch: 3885

Parameter	Flag	Result	Units	RL
TRPHC		<10.0	mg/Kg	10

Method Blank (1) QC Batch: 3897

Parameter	Flag	Result	Units	RL
Bromochloromethane		<10.0	µg/Kg	1
Dichlorodifluoromethane		<10.0	µg/Kg	1
Chloromethane (methyl chloride)		<10.0	µg/Kg	1
Vinyl Chloride		<10.0	µg/Kg	1
Bromomethane (methyl bromide)		<50.0	µg/Kg	5
Chloroethane		<10.0	µg/Kg	1
Trichlorofluoromethane		<10.0	µg/Kg	1
Acetone		<100	µg/Kg	10
Iodomethane (methyl iodide)		<50.0	µg/Kg	5
Carbon Disulfide		<10.0	µg/Kg	1
Acrylonitrile		<10.0	µg/Kg	1
2-Butanone (MEK)		<50.0	µg/Kg	5
4-Methyl-2-pentanone (MIBK)		<50.0	µg/Kg	5
2-Hexanone		<50.0	µg/Kg	5
trans 1,4-Dichloro-2-butene		<100	µg/Kg	10
1,1-Dichloroethene		<10.0	µg/Kg	1
Methylene chloride		<50.0	µg/Kg	5
MTBE		<10.0	µg/Kg	1
trans-1,2-Dichloroethene		<10.0	µg/Kg	1
1,1-Dichloroethane		<10.0	µg/Kg	1
cis-1,2-Dichloroethene		<10.0	µg/Kg	1
2,2-Dichloropropane		<10.0	µg/Kg	1
1,2-Dichloroethane (EDC)		<10.0	µg/Kg	1
Chloroform		<10.0	µg/Kg	1
1,1,1-Trichloroethane		<10.0	µg/Kg	1
1,1-Dichloropropene		<10.0	µg/Kg	1
Benzene		<10.0	µg/Kg	1
Carbon Tetrachloride		<10.0	µg/Kg	1
1,2-Dichloropropane		<10.0	µg/Kg	1
Trichloroethene (TCE)		<10.0	µg/Kg	1
Dibromomethane (methylene bromide)		<10.0	µg/Kg	1
Bromodichloromethane		<10.0	µg/Kg	1
2-Chloroethyl vinyl ether		<50.0	µg/Kg	5
cis-1,3-Dichloropropene		<10.0	µg/Kg	1
trans-1,3-Dichloropropene		<10.0	µg/Kg	1
Toluene		<10.0	µg/Kg	1
1,1,2-Trichloroethane		<10.0	µg/Kg	1
1,3-Dichloropropane		<10.0	µg/Kg	1
Dibromochloromethane		<10.0	µg/Kg	1
1,2-Dibromoethane (EDB)		<10.0	µg/Kg	1
Tetrachloroethene (PCE)		<10.0	µg/Kg	1
Chlorobenzene		<10.0	µg/Kg	1
1,1,1,2-Tetrachloroethane		<10.0	µg/Kg	1
Ethylbenzene		<10.0	µg/Kg	1
m,p-Xylene		<10.0	µg/Kg	1
Bromoform		<10.0	µg/Kg	1
Styrene		<10.0	µg/Kg	1
o-Xylene		<10.0	µg/Kg	1
1,1,2,2-Tetrachloroethane		<10.0	µg/Kg	1
2-Chlorotoluene		<10.0	µg/Kg	1
1,2,3-Trichloropropane		<10.0	µg/Kg	1
Isopropylbenzene		<10.0	µg/Kg	1

continued ...

method blank continued ...

Parameter	Flag	Result	Units	RL
Bromobenzene		<10.0	µg/Kg	1
n-Propylbenzene		<10.0	µg/Kg	1
1,3,5-Trimethylbenzene		<10.0	µg/Kg	1
tert-Butylbenzene		<10.0	µg/Kg	1
1,2,4-Trimethylbenzene		<10.0	µg/Kg	1
1,4-Dichlorobenzene (para)		<10.0	µg/Kg	1
sec-Butylbenzene		<10.0	µg/Kg	1
1,3-Dichlorobenzene (meta)		<10.0	µg/Kg	1
p-Isopropyltoluene		<10.0	µg/Kg	1
4-Chlorotoluene		<10.0	µg/Kg	1
1,2-Dichlorobenzene (ortho)		<10.0	µg/Kg	1
n-Butylbenzene		<10.0	µg/Kg	1
1,2-Dibromo-3-chloropropane		<50.0	µg/Kg	5
1,2,3-Trichlorobenzene		<50.0	µg/Kg	5
1,2,4-Trichlorobenzene		<50.0	µg/Kg	5
Naphthalene		<50.0	µg/Kg	5
Hexachlorobutadiene		<50.0	µg/Kg	5

Surrogate	Flag	Result	Units	Dilution	Spike Amount	Percent Recovery	Recovery Limits
Dibromofluoromethane		46.5	µg/Kg	1	50.0	93	42 - 129
Toluene-d8		48.8	µg/Kg	1	50.0	98	93 - 107
4-Bromofluorobenzene (4-BFB)		46.2	µg/Kg	1	50.0	92	78 - 120

Method Blank (1) QC Batch: 3900

Parameter	Flag	Result	Units	RL
Total Mercury		<0.150	mg/Kg	0.15

Laboratory Control Spike (LCS-1) QC Batch: 3880

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Aluminum	108	110	mg/Kg	1	100	<0.0400	108	2	85 - 115	20
Total Arsenic	43.9	43.0	mg/Kg	1	50.0	<0.228	88	2	75 - 125	20
Total Barium	95.5	92.7	mg/Kg	1	100	<0.0601	96	3	75 - 125	20
Total Boron	4.60	4.83	mg/Kg	1	5.00	<0.0206	92	5	85 - 115	20
Total Cadmium	24.7	23.1	mg/Kg	1	25.0	<0.00794	99	7	75 - 125	20
Total Chromium	9.30	10.0	mg/Kg	1	10.0	<0.0125	93	7	75 - 125	20
Total Cobalt	23.6	22.0	mg/Kg	1	25.0	<0.0164	94	7	85 - 115	20
Total Copper	12.6	11.0	mg/Kg	1	12.5	<0.0268	101	14	75 - 125	20
Total Iron	48.5	46.2	mg/Kg	1	50.0	<0.0208	97	5	85 - 115	20
Total Lead	49.9	51.8	mg/Kg	1	50.0	<0.367	100	4	75 - 125	20
Total Manganese	23.7	25.2	mg/Kg	1	25.0	<0.172	95	6	85 - 115	20
Total Molybdenum	45.5	46.6	mg/Kg	1	50.0	<0.0241	91	2	85 - 115	20
Total Nickel	24.1	23.2	mg/Kg	1	25.0	<0.0222	96	4	85 - 115	20

continued ...

control spikes continued ...

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Selenium	43.0	45.2	mg/Kg	1	50.0	<0.0767	86	5	75 - 125	20
Total Silica	48.6	48.4	mg/Kg	1	50.0	0	97	0	85 - 115	20
Total Silver	11.5	11.4	mg/Kg	1	12.5	<0.00444	92	1	80 - 120	20
Total Zinc	23.2	22.5	mg/Kg	1	25.0	<0.124	93	3	85 - 115	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Laboratory Control Spike (LCS-1) QC Batch: 3885

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
TRPHC	275	273	mg/Kg	1	250	<4.32	110	1	80 - 120	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Laboratory Control Spike (LCS-1) QC Batch: 3897

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
1,1-Dichloroethene	874	858	µg/Kg	10	100	<2.44	87	2	64 - 129	20
Benzene	937	927	µg/Kg	10	100	<1.84	94	1	69 - 121	20
Trichloroethene (TCE)	1100	998	µg/Kg	10	100	<7.08	110	10	65 - 115	20
Toluene	953	940	µg/Kg	10	100	2.8	95	1	70 - 119	20
Chlorobenzene	989	978	µg/Kg	10	100	2.1	99	1	74 - 119	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Surrogate	LCS Result	LCSD Result	Units	Dil.	Spike Amount	LCS Rec.	LCSD Rec.	Rec. Limit
Dibromofluoromethane	44.1	43.5	µg/Kg	1	50.0	88	87	42 - 129
Toluene-d8	48.8	48.8	µg/Kg	1	50.0	98	98	93 - 107
4-Bromofluorobenzene (4-BFB)	45.2	45.0	µg/Kg	1	50.0	90	90	78 - 120

Laboratory Control Spike (LCS-1) QC Batch: 3900

Param	LCS Result	LCSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Mercury	2.49	2.45	mg/Kg	1	2.50	<0.0420	100	2	80 - 120	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1) QC Batch: 3880

Param		MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Aluminum	[1,2]	13800	14000	mg/Kg	1	100	14200	-400	1	75 - 125	20
Total Arsenic		40.2	40.6	mg/Kg	1	50.0	<0.228	80	1	75 - 125	20

continued ...

[1]Matrix spike recovery invalid due to required dilution. LCS demonstrates process under control.
[2]Matrix spike recovery invalid due to required dilution. LCS demonstrates process under control.

matrix spikes continued ...

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Barium	241	238	mg/Kg	1	100	132	109	1	75 - 125	20
Total Boron	22.6	22.9	mg/Kg	1	5.00	18.2	88	1	75 - 125	20
Total Cadmium	26.8	27.1	mg/Kg	1	25.0	2.52	97	1	75 - 125	20
Total Chromium	21.3	21.0	mg/Kg	1	10.0	11.6	97	1	75 - 125	20
Total Cobalt	28.2	28.5	mg/Kg	1	25.0	4.76	94	1	75 - 125	20
Total Copper	19.6	19.8	mg/Kg	1	12.5	8.38	90	1	75 - 125	20
Total Iron [34]	9810	9750	mg/Kg	1	50.0	9890	-160	1	75 - 125	20
Total Lead	58.3	57.9	mg/Kg	1	50.0	12.7	91	1	75 - 125	20
Total Manganese	196	189	mg/Kg	1	25.0	170	104	4	75 - 125	20
Total Molybdenum	40.2	40.8	mg/Kg	1	50.0	<0.0241	80	1	75 - 125	20
Total Nickel	34.8	35.3	mg/Kg	1	25.0	11.7	92	1	75 - 125	20
Total Selenium	42.0	41.7	mg/Kg	1	50.0	<0.0767	84	1	75 - 125	20
Total Silica	487	476	mg/Kg	1	50.0	430	114	2	75 - 125	20
Total Silver	11.6	11.8	mg/Kg	1	12.5	<0.00444	93	2	75 - 125	20
Total Zinc	51.3	50.6	mg/Kg	1	25.0	25.7	102	1	75 - 125	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1) QC Batch: 3885

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
TRPHC	273	274	mg/Kg	1	250	<4.32	109	0	80 - 120	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Matrix Spike (MS-1) QC Batch: 3900

Param	MS Result	MSD Result	Units	Dil.	Spike Amount	Matrix Result	Rec.	RPD	Rec. Limit	RPD Limit
Total Mercury [56]	<0.0420	0.00	mg/Kg	1	2.50	<0.0420	0	0	80 - 120	20

Percent recovery is based on the spike result. RPD is based on the spike and spike duplicate result.

Standard (ICV-1) QC Batch: 3880

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Aluminum		mg/Kg	1.00	1.00	100	90 - 110	2003-08-20
Total Arsenic		mg/Kg	1.00	1.05	105	95 - 105	2003-08-20
Total Barium		mg/Kg	1.00	1.04	104	95 - 105	2003-08-20
Total Boron		mg/Kg	1.00	1.05	105	90 - 110	2003-08-20
Total Cadmium		mg/Kg	1.00	1.05	105	95 - 105	2003-08-20
Total Chromium		mg/Kg	1.00	1.04	104	90 - 110	2003-08-20
Total Cobalt		mg/Kg	1.00	1.04	104	90 - 110	2003-08-20
Total Copper		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20

continued ...

[3]Matrix spike recovery invalid due to required dilution. LCS demonstrates process under control.
[4]Matrix spike recovery invalid due to required dilution. LCS demonstrates process under control.
[5]ms recovery invalid due to spiking error, use lcs/lcsd
[6]ms recovery invalid due to spiking error, use lcs/lcsd

standard continued ...

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Iron		mg/Kg	1.00	1.06	106	90 - 110	2003-08-20
Total Lead		mg/Kg	1.00	1.05	105	95 - 105	2003-08-20
Total Manganese		mg/Kg	1.00	1.04	104	90 - 110	2003-08-20
Total Molybdenum		mg/Kg	1.00	1.08	108	90 - 110	2003-08-20
Total Nickel		mg/Kg	1.00	1.03	103	90 - 110	2003-08-20
Total Selenium		mg/Kg	1.00	1.05	105	95 - 105	2003-08-20
Total Silica		mg/Kg	5.00	5.12	102	90 - 110	2003-08-20
Total Silver		mg/Kg	0.125	0.130	104	90 - 110	2003-08-20
Total Zinc		mg/Kg	1.00	1.06	106	90 - 110	2003-08-20

Standard (CCV-1) QC Batch: 3880

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Aluminum		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20
Total Arsenic		mg/Kg	1.00	0.934	93	90 - 110	2003-08-20
Total Barium		mg/Kg	1.00	1.02	102	90 - 110	2003-08-20
Total Boron		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20
Total Cadmium		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20
Total Chromium		mg/Kg	1.00	1.02	102	90 - 110	2003-08-20
Total Cobalt		mg/Kg	1.00	0.972	97	90 - 110	2003-08-20
Total Copper		mg/Kg	1.00	0.963	96	90 - 110	2003-08-20
Total Iron		mg/Kg	1.00	1.04	104	90 - 110	2003-08-20
Total Lead		mg/Kg	1.00	1.02	102	90 - 110	2003-08-20
Total Manganese		mg/Kg	1.00	1.00	100	90 - 110	2003-08-20
Total Molybdenum		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20
Total Nickel		mg/Kg	1.00	0.984	98	90 - 110	2003-08-20
Total Selenium		mg/Kg	1.00	0.944	94	90 - 110	2003-08-20
Total Silica		mg/Kg	5.00	4.86	97	90 - 110	2003-08-20
Total Silver		mg/Kg	0.125	0.125	100	90 - 110	2003-08-20
Total Zinc		mg/Kg	1.00	1.01	101	90 - 110	2003-08-20

Standard (ICV-1) QC Batch: 3885

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
TRPHC		mg/Kg	100	105	105	80 - 120	2003-08-21

Standard (CCV-1) QC Batch: 3885

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
TRPHC		mg/Kg	100	103	103	80 - 120	2003-08-21

Standard (CCV-1) QC Batch: 3897

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Vinyl Chloride		µg/Kg	50.0	45.5	91	80 - 120	2003-08-20
1,1-Dichloroethene		µg/Kg	50.0	44.1	88	80 - 120	2003-08-20
Chloroform		µg/Kg	50.0	44.4	89	80 - 120	2003-08-20
1,2-Dichloropropane		µg/Kg	50.0	49.3	99	80 - 120	2003-08-20
Toluene		µg/Kg	50.0	49.2	98	80 - 120	2003-08-20
Chlorobenzene		µg/Kg	50.0	48.9	98	80 - 120	2003-08-20
Ethylbenzene		µg/Kg	50.0	49.3	99	80 - 120	2003-08-20

Standard (ICV-1) QC Batch: 3900

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Mercury		mg/L	0.00500	0.00510	102	90 - 110	2003-08-21

Standard (CCV-1) QC Batch: 3900

Param	Flag	Units	CCVs True Conc.	CCVs Found Conc.	CCVs Percent Recovery	Percent Recovery Limits	Date Analyzed
Total Mercury		mg/L	0.00500	0.00465	93	80 - 120	2003-08-21

TraceAnalysis, Inc.

6701 Aberdeen Avenue, Ste. 9 Lubbock, Texas 79424
Tel (806) 794 1296 Fax (806) 794 1298
1 (800) 378 1296

CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST

LAB Order ID # 3081901

Company Name: BBC International, Inc. Phone #: 505-397-6388
Address: 1324 W. Marland Hobbs Fax #: 505-397-0397
Contact Person: Cliff Brunson
Invoice to: (If different from above) Shell E&P Co ATTN: Wayne Hamilton
Project #: Project Name: Shell Westgate
Project Location: Hobbs NM Sampler Signature:

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume/Amount	MATRIX: WATER	SOIL	AIR	SLUDGE	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	Mech	SAMPLING: DATE	TIME
15535	GBN-27-3'	1	VOA		✓							✓	8-15-03	9:06
	GBN-27-3'	1	4oz		✓					✓			8-15-03	9:06
36	GBN-28-3'	1	VOA		✓							✓	8-15-03	9:32
	GBN-28-3'	1	4oz		✓					✓			8-15-03	9:32

ANALYSIS REQUEST (Circle or Specify Method No.)

MTBE 8020/602	BTEX 8260	TPH 418.1	PAH 8270	Total Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Metals Ag As Ba Cd Cr Pb Hg Se	TCLP Volatiles	TCLP Semi Volatiles	RCI	GC.MS Vol 8240/8260/624	GC/MS Semi Vol 8270/625	PCB's 8080/608	Pest. 8080/608	BOD, TSS, PH	WQCC CCD Metals			Turn Around Time if different from standard	Hold
	✓	✓												✓				
	✓	✓												✓				
	✓	✓												✓				
	✓	✓												✓				

Relinquished by: Date: 8-15-03 Time: 10:05 Received by: Date: Time:
Relinquished by: Date: Time: Received by: Date: Time:
Relinquished by: Date: Time: Received at Laboratory by: Date: Time: 8-15-03 2:00pm

LAB USE ONLY
Intact (Y) N
Headspace Y / N
Temp 4c °
Log-in Review

REMARKS:

Carrier # Key Xpress 25813

Submittal of samples constitutes agreement to Terms and Conditions listed on reverse side of C.O.C.

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BBC INTERNATIONAL, INC.

GRIMES BATTERY & TASKER ROAD

STAGE 2 ABATEMENT PLAN REMEDIATION - SEPTEMBER 2001
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.

SURVEYED BY: LAWLESS	DRAWN BY: D.COLLINS	REV. DATE: 9/10/03	F-366
DATE BEGIN: 9/11/98	DATE: 9/15/98	FILE: REMEDIATION.DGN	REMEDIATION SITE OUTLINE
DATE END: 9/1/98	CHECKED BY:	SHEET 1 OF 1	
PROJECT #: 98110738	DISK #: BBC	Scale: 1"=40'	

BBC INTERNATIONAL INCORPORATED

JOHN WEST SURVEYING COMPANY
HOBBS, NEW MEXICO