

Appendix M-1
Supplemental Soil Screening Evaluation - Protection of Groundwater

Henning Management, L.L.C. v. Chevron U.S.A. Inc., et al.
Hayes Oil and Gas Field
Calcasieu and Jefferson Davis Parishes, Louisiana

Constituent (a)	RECAP Soil _{SSGW} (b)	Maximum Concentration in Soil (c)				
		Area 2	Area 4	Area 5	Area 6	Area 8
Metals (mg/kg)						
Arsenic	100	6.68	11	12.2	6.9	7.65
Barium (e)	2000 / SPLP	2740	7000	6390	7410	7290
Cadmium	20	0.568	0.73	0.983	0.538	<0.493
Chromium	100	27.2	20.5	28.8	63.4	18.5
Lead	100	32.4	54.5	34	54.2	13.4
Mercury	4	<0.134	0.157	<0.145	0.32	0.164
Selenium	20	<2.5	<4	<2.61	<4	-
Silver	100	<0.312	<0.29	<0.325	-	-
Strontium (d)	44000	110	558	124	278	39.2
Zinc	2800	121	103	81.7	67.4	43.7
SPLP Metals (mg/L) (e)						
SPLP Barium	40	0.206	1.83	12.4	11	2.41
TPH Fractions (mg/kg) (f)						
Aliphatic C6-C8	10000	-	49.5	44.4	-	-
Aliphatic >C8-C10	5300	-	151	90.9	-	-
Aliphatic >C10-C12	10000	-	42.1	12.8	-	-
Aliphatic >C12-C16	10000	-	206	68.9	-	-
Aliphatic >C16-C35	10000	-	223	52	-	-
Aromatic >C8-C10	65	-	39.9	<36.2	-	-
Aromatic >C10-C12	100	-	<7.47	<7.52	-	-
Aromatic >C12-C16	200	-	23.3	11.8	-	-
Aromatic >C16-C21	2100	-	11.8	<7.52	-	-
Aromatic >C21-C35	10000	-	30.7	<7.52	-	-
PAHs (mg/kg)						
2-Methylnaphthalene	1.7	-	0.116	-	-	-
Acenaphthene	220	-	0.0969	-	-	-
Acenaphthylene	88	-	<0.0835	-	-	-
Anthracene	120	-	<0.0835	-	-	-
Benzo(a)anthracene	330	-	<0.0835	-	-	-
Benzo(a)pyrene	23	-	<0.0835	-	-	-
Benzo(b)fluoranthene	220	-	<0.0835	-	-	-
Benzo(k)fluoranthene	120	-	<0.0835	-	-	-
Chrysene	76	-	<0.0835	-	-	-
Dibenz(ah)anthracene	540	-	<0.0835	-	-	-
Fluoranthene	1200	-	<0.0835	-	-	-
Fluorene	230	-	<0.0835	-	-	-
Indeno(123-cd)pyrene	9.2	-	<0.0835	-	-	-
Naphthalene	1.5	-	<0.0835	-	-	-
Phenanthrene	660	-	<0.0835	-	-	-
Pyrene	1100	-	<0.0835	-	-	-

Notes provided on the following page.

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Notes:

Concentrations (except leachate) are provided in mg/kg dry weight

< - Not detected at the detection limit shown

SPLP - Synthetic Precipitation Leaching Procedure (SPLP) SW-846 Method 1312

TPH - Total Petroleum Hydrocarbons

PAHs - Polycyclic Aromatic Hydrocarbons

A **bold value** indicates that the maximum reported concentration exceeds the Soilssgw for the respective constituent and groundwater protection was further evaluated using site-specific leachate analysis. Based on leachate analysis, further assessment under a higher management option is not required.

- (a) Constituents analyzed in soil samples collected from the site by ERM and ICON.
- (b) Soilssgw = RECAP Screening Option Standard from Table 1 of RECAP (2003) for soil protective of ground water, unless otherwise noted.
- (c) The maximum reported concentration in soil samples collected from the site, including ERM and ICON splits.
- (d) Value not provided in RECAP; the risk-based value was calculated in accordance with Appendix H of RECAP (2003).
- (e) Samples were collected for leachate (SPLP) analysis in each area at locations where barium was reported at the high end of the concentration range, and above the default RECAP Screening Standard for the protection of ground water (Soilssgw). Where split sample material was not available for leachate testing, ERM replicated the locations to the extent possible for SPLP testing. Leachate analysis provides a site-specific evaluation and demonstrates concentrations are below the leachate standard.
- (f) TPH analysis was performed using two analytical methods: (1) ICON samples were analyzed using the hydrocarbon mixture method (e.g., TPH-DRO, TPH-ORO), and (2) ERM samples were analyzed using the more informative hydrocarbon fractioning method (i.e., aliphatic and aromatic fractions). TPH fraction data are available for all sample locations with TPH mixture data, and the TPH fraction data are used in the risk assessment in accordance with RECAP

Table M-2
Toxicity Values and Bioconcentration Factors for Constituents Not in RECAP

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Constituent	CAS#	RfDo mg/kg-d	REF	BCF L/kg	REF	RECAP Standards (a)					
						GWSS mg/L	GW1 / GW2 mg/L	GW3NDW mg/L	Soil _{SSni} mg/kg	Soil _{ni} mg/kg	Soil _{SSGW} (b) mg/kg
Barium	7440-39-3	0.2	IRIS	-	-	-	-	-	-	1.6E+04	-
Strontium	7440-24-6	0.6	IRIS	60	RAIS	2.2E+00	2.2E+01	3.3E+01	4.7E+03	-	4.4E+04

Notes:

- Not applicable for this site

mg/kg-d = milligrams per kilogram per day

L/kg = Liters per Kilogram

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

CAS# = Chemical Abstract Number

RfDo = Oral Reference Dose

IRIS = Integrated Risk Information System (USEPA)

S = Surrogate (pyrene)

BCF - bioconcentration factor

RAIS = Risk Assessment Information System

GWSS = RECAP Groundwater Screening Standard

GW1 = RECAP Standard for Class 1 groundwater

GW2 = RECAP Standard for Class 2 groundwater

GW3NDW = Groundwater Class 3 non-drinking water RECAP Standard

Soil_{SSni} = Screening Standard for soil protective of human health for non-industrial land use.

Soil_{ni} = RECAP Standard for soil protective of human health for non-industrial land use.

Soil_{SSGW} = Screening Standard for soil protective of groundwater.

(a) RECAP Standards calculated in accordance with Appendix H of RECAP (2003).

(b) For inorganic constituents for which a TCLP regulatory level is not available, the Soil_{SSGW} is estimated by multiplying the GW1 by a dilution factor of 100 and then by a factor of 20. This calculation approach is provided in RECAP Appendix H to duplicate the assumptions and methods used for those inorganic constituents with TCLP criteria. For a COC that is not listed in Table 3 such as strontium, the GW1 is calculated in accordance with Section H2.2.2.