



TRANSMITTAL LETTER

DATE FEBRUARY 9, 1987CLIENT ORDER NO. PROJECT NO. 42-1167TO BRIQ TECHNICAL COMMITTEEFROM ALAN GRADETIT CORPORATION

Attached is a draft copy of Chapter 6.0 of IT's Level I Endangerment Assessment data report. The report itself is an internal (IT) document; however, this chapter embodies the results of Phase 02, Task 03 - "Objectives of Remediation". This is our first attempt to establish clean-up criteria for the site as well as general objectives. Please review these data in preparation for our meeting on February 17, 1987 in Houston.

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RSV 0018712

6.0 RISK MANAGEMENT
TECHNICAL APPROACH FOR DEVELOPMENT OF PRELIMINARY CLEAN-UP VALUES
GOALS FOR THE FEASIBILITY STUDY ALTERNATIVES

The Superfund Amendments and Reauthorization Act (SARA) specifies a preference for remedies that use treatment to permanently and significantly reduce the toxicity, mobility or volume of wastes over remedies that do not use such treatment. "The most significant emphasis is on risk reduction through destruction or detoxification of hazardous waste by employing treatment technologies which reduce toxicity, mobility or volume rather than protection achieved through prevention of exposure" (EPA Interim Guidance on Superfund Selection of Remedy, December 24, 1986 letter from Winston Porter to Regional Administrators and Directors).

Justification is required if some form of treatment to reduce the source hazard is not included in the remedial alternatives.

The National Contingency Plan (NCP) and SARA require compliance with applicable, relevant and appropriate requirements (ARARs) if they exist and are appropriate. ARARs may be performance or technology-based standards (e.g., 40 CFR 264, treatment, storage and disposal regulations under RCRA) or contaminant specific health-based standards (e.g., Safe Drinking Water Act MCLs).

Remedial actions for a site must be "protective of human health and the environment. This means that the remedy meets or exceeds ARARs or health-based levels established through a risk assessment when ARARs do not exist" (EPA, Dec. 24, 1986).

The main concept for establishment of clean-up levels (via a risk assessment approach) at Brio/Dixie is that meeting of ARARs is not appropriate for the site because:

- Based on data provided in the Remedial Investigation (RI) Report the conclusion may be drawn that there is no potential for any drinking water supply being contaminated by the Brio/Dixie site. Consequently,

RMCLs, MCLs and MCLGs (for drinking water) are not the appropriate criteria to be used for attainment of ARARs.

The Numerous Sand Channel Zone (NSCZ) is classified as a III A Aquifer, according to the EPA classification scheme, because it is a poor yielding zone with high to intermediate connection with surface water (Mud Gully). The NSCZ is not classified as a potential source of drinking water.

The 50 foot sand could potentially be a drinking water source, however, there is no conclusive evidence in the RI to suggest that it is contaminated at this time.

- With but a few exceptions, acceptable limits of contaminants in soil are not given in environmental regulations but rather are typically determined on a site specific basis.
- For many of the contaminants identified in ground water at the Brio/Dixie site there are no federal drinking water standards or state standards.
- Ambient Air Quality Criteria (AAQC) may have to be met as ARARs. Few AAQCs are currently specified for the indicator chemicals. It is expected that this ARAR (AAQCs) will not have any impact on setting of clean-up levels.

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Ambient Water Quality Criteria (AWQC) for protection of aquatic biota appear to be the most relevant ARAR for the Brio/Dixie site. The AWQC should be attained at the location where a developed aquatic ecological community might be impacted by site runoff or ground water seepage to Mud Gully.

Attainment of ARARs (AWQC) for recreational use of receiving waters may also be necessary. Like AAQC, AWQC are unavailable for all of the chemicals of concern at the Brio/Dixie site.

In the absence of relevant ARARs, the basic premise for remediation becomes protection of the public health with appropriate exposure levels established via a risk assessment approach. The methodology appropriate for developing preliminary clean-up levels for waste in pits, contaminated soils, impoundment sludges, sediments, ground water, surface water and ambient air is described in the following sections.

6.1 CONTAMINATED SOILS, WASTE PITS AND IMPOUNDMENT SLUDGES

There are no ARARs associated with contaminated soils or sediments. Consequently, the rationale for soil and sediment clean-up at Brio/Dixie is based on the concept of prevention of contamination of ground water, surface water and ambient air; and the preclusion of adverse health effects associated with ingestion of soil off-site.

On-site soil ingestion is not assumed to be a plausible or frequent exposure scenario unless future use of the land differs from the current situation (i.e., a secured industrial site).

Chemical uptake by biota and consequent possibility of contamination entering the food chain is also unlikely.

6.1.1 Technical Approach 1

For contaminated soils, wastes in pits and impoundment sludges, a conservative approach is to calculate contaminant concentrations at specific exposure points relative to the observed concentrations of the indicator chemicals. Based on the water solubility of the chemical of concern, the Organic Leachate Model (OLM) is used to predict the concentration of the chemical in the leachate (Federal Register, July 29, 1986). For the first estimate, the Vertical Horizontal Spread (VHS) model will be used (Federal Register, November 27, 1985) to determine attenuation in the ground water. The model allows a dilution factor ranging from 6.3 to 32, the most likely value (using site specific factors) would probably be between 8 and 12. The VHS Model is usually used to predict the contaminant concentration in ground water at a receptor well 500 feet away. For purposes of deriving the preliminary soil decontamination level, the assumption is made that this value is also the assumed concentration that will reach Mud Gully. Mud Gully could become a location where ARARs may be applied. The concentration of contaminant entering Mud Gully could be compared to, for example, ambient water quality criteria.

The application of OLM and VHS models are described in detail in Section 6.1.2.

During Phase II of the Endangerment Assessment, a one dimensional dispersion dispersion ground water model will be used instead of the VHS model to predict ground water contaminant concentrations entering Mud Gully.

Reduction in contaminant concentrations is expected to occur as follows:

- From soil to leachate.
- In ground water based on the dilution ratio between seepage into the aquifer and flow through the aquifer which includes recharge. Seepage rate would be estimated using a water balance method to come up with infiltration rate.
- Attenuation in the surface water body (in which a developed aquatic ecology exists) some distance from the site from mixing and volatilization (based on half-life) of the volatile organic compounds.

The next step is to back-calculate (for each of the indicator chemicals) from a health or environmental goal (e.g., aquatic toxicity). The above developed model is used to derive a concentration in the soils that achieves the health or environmental goal concentration at the receptor location. The goal is a level at which no health consequence or environmental impact would result from an exposure.

6.1.2 Technical Approach 2

An alternative approach is to set soil decontamination levels based on protection of ground water. The target risk level would be the 10^{-4} cancer risk due to absence of drinking water use. This is the highest allowed in the risk range of 10^{-7} to 10^{-4} used by EPA for Superfund sites (Recommendations for Ground Water Remediation at the Millcreek, Pa. site, EPA letter from Winston Porter March 24, 1986). This approach will probably result in much lower clean-up levels than Technical Approach 1 described in Section 6.1.1.

In addition, specifying soil decontamination levels which will expose the closest down-wind off-site receptors to no more than the 10^{-6} cancer risk via inhalation is advised.

The procedure described in Section 6.1.1, Technical Approach 1, will be followed i.e., use of the OLM model and the VHS model. The preliminary target waste clean-up levels to protect ground water to a 10^{-4} cancer risk level have been calculated and are presented in Table 6-1.

Table 6-1 presents a range of waste clean-up levels which will achieve the protection of ground water at a 10^{-4} cancer risk level. The OLM model was used to estimate the amount of contaminant which will leach from the waste. The OLM is an empirical equation which was developed through application of linear regression or statistical techniques rather than modeling to a data base of known waste constituent concentrations and experimentally measured leachate concentrations.

The equation shown below:

$$C_1 = 0.00211 C_w^{0.678} S^{0.373}$$

C_1 = constituent concentration in leachate (ppm)
 C_w = constituent concentration in waste (ppm)
 S = constituent solubility (ppm)

(Federal Register, July 29, 1986, p. 27062).

The OLM is used in concert with the VHS model (Federal Register, November 27, 1985, corrected December 12, 1986) to estimate the potential for ground water contamination from the organic constituents.

According to the VHS model the waste (leachate) dilution factor is dependent upon waste volume. For small volumes of waste ($<475 \text{ yd}^3$) a minimum trench length of 40 foot (12.2 m) is considered. This results in a maximum waste dilution factor of 32. The minimum dilution factor is 6.3 which is applicable to large volumes of waste (approximately $3,600 \text{ yd}^3$).

For purposes of setting preliminary target waste clean-up levels the range of dilution factors in used (i.e. 6.3 to 32) and are presented in Table 6-1.

The VHS model predicts the maximum concentration expected to occur at a specific compliance point (a receptor at a distance at 500 feet). Table 6-1 presents the results of back-calculating from a 1×10^{-4} cancer risk level via lifetime ingestion of ground water to the necessary pit waste clean-up levels required to achieve the 1×10^{-4} cancer risk level. It should be noted that for inorganic constituents the clean-up levels noted on Table 6-1 were not determined by the OLM and VHS model method described. Preliminary clean-up levels for inorganics were determined by multiplying a health based guideline for the specific constituent (usually the RMCL) by a factor of 1000. The factor of 1000 assumes a 100 fold attenuation of the contaminant in the soil and a 10 fold dilution of the contaminant in ground water. This approach is used by the Epidemiological Studies Section of the California Department of Health Services (The California Site Mitigation Decision Tree Manual, May 1986). Cadmium and hexavalent chromium are not considered to be carcinogens via the drinking water route.

The observed values noted on Table 6-1 are ^F the actual contaminant concentrations reported in the RI and are provided as a point of reference to compare to the clean-up range. The ^A comments column on Table 6-1 notes the preliminary conclusions regarding the need for remediation based on the calculated clean-up levels. ^R

6.2 CONTAMINATED SEDIMENTS

^D Since sediments may migrate off-site, a soil (sediment) ingestion scenario will be developed. The exposure is expected to be infrequent (perhaps one time per week or less) at an ingestion rate of 0.1 gram of soil for each day of exposure. Appropriate sediment clean-up levels will be developed based on back calculations from acceptable intakes of contaminants.

The OLM will be used to determine the potential for the off-site sediments to release constituents to surface water. These predicted levels in the surface water will be compared to aquatic toxicity values.

6.3 SURFACE WATER

According to data in the RI, surface water runoff is not contaminated. Consequently runoff to surface water should not result in values that exceed appropriate aquatic toxicity parameters and ambient water quality criteria.

Achieving the limits of the expired NPDES permit is also advised for surface water runoff discharges from the site.

6.4 GROUND WATER

Based on data presented in the RI, contaminated ground water is not a present or potential source of drinking water. It is not plausible to postulate that the 50 foot sand aquifer will become contaminated. Consequently, target clean-up levels for ground water are not based upon drinking water health goals; rather they are based on what has been accepted elsewhere in EPA Records of Decision (RODs) and on potential environmental impacts.

The recommended level of ground water remediation would be based on achieving a 10^{-4} risk level for each carcinogenic constituent detected. The levels have been calculated for each of the contaminants detected in the NSCZ and are presented in Table 6-2. It should be noted that the agency may require that the total carcinogenic risk not exceed the 10^{-4} risk level. This would require adding up the individual carcinogenic risks, thus lowering the individual values.

6.5 AMBIENT AIR (as a limiting factor on soil contamination)

As discussed in the Section 6.1, ambient air values should not exceed the 10^{-6} cancer risk level (via inhalation) at the receptor location or 0.01 of the threshold level (TLV) for non-carcinogens, expected to be present in ambient air.

For purposes of this endangerment assessment and assuming a "no action" scenario, i.e. no soil disturbance, contamination of the air via volatilization of components in the contaminated ground water is not considered a significant concern. Although the contaminants are volatile and will migrate through soil, it is expected that there will be substantial dispersion in ambient air from the point of ground emission to receptors. Volatilization of components in contaminated soils will be examined further in the Level II Assessment.

6.6 FEASIBILITY STUDY OBJECTIVES

Objectives for the construction/remediation phase and for the long term are summarized in Table 6-3. The objectives consider the ground water pathway, soils, sediment and air.

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TABLE 6-1
(PAGE 1 OF 7)
TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

CONSTITUENT	OBSERVED CONCENTRATION(S) (PPM)	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	COMMENTS ³
PIT B			
1,2 DICHLOROETHANE	515; 245,000	7.39 - 81.19	Yes, on the basis of these calculated clean-up levels this pit would require remediation.
1,1,2 TRICHLOROETHANE	918; 166,000	38.6 - 424.4	
BIS(2 CHLOROETHYL)ETHER	3,040	0.160 - 1.76	
CHROMIUM ²	15; 77	120	
BENZO(K)FLUORANTHENE	2.1	15,187 - 166,932	
PIT J			
1,2 DICHLOROETHANE	159; 179,000	7.39 - 81.19	Yes, on the basis of these calculated clean-up levels this pit would require remediation.
1,1,2 TRICHLOROETHANE	126; 89,100	38.6 - 424.4	
VINYL CHLORIDE	22,700	0.118 - 1.30	
BIS(2 CHLOROETHYL)ETHER	1,410	0.160 - 1.76	
PIT Q			
1,2 DICHLOROETHANE	39; 8,140	7.39 - 81.19	Yes, on the basis of these calculated clean-up levels this pit would require remediation.
1,1,2 TRICHLOROETHANE	492; 26,100	38.6 - 424.4	
BIS(2 CHLOROETHYL)ETHER	1,810	0.160 - 1.76	
METHYLENE CHLORIDE	3; 58; 909	188.7 - 2,074	

NOTE: This table presents the necessary waste clean-up levels for constituents in pits to achieve the protection of ground water at a 10⁻⁴ cancer risk level. The organic leachate model (OLM) and the vertical horizontal spread model (VHS) were used to estimate the possible concentrations in the ground water.

¹ Range of values relates to the use of the VHS ground water dilution factors of 6.3 to 32.

² Proposed RMCL (0.12 mg/l) multiplied by 1000.

³ The findings of need/no need of remediation are preliminary and are based on agreement of 10⁻⁴ cancer risk level being appropriate in site-specific circumstances.

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TABLE 6-1
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TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

OBSERVED CONCENTRATION(S) CONSTITUENT	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	(PPM)	COMMENTS ³
<u>PIT A</u>			
1,1,2 TRICHLOROETHANE BENZO(K)FLUORANTHENE	0; 163 <1.0	38.6 - 424.4 15,187 - 166,932 basis of these cal- culated clean-up levels.	No remediation required on the T
<u>PIT C</u>			
BENZO(K)FLUORANTHENE	<1.0	15,187 - 166,932 required on the basis of these cal- culated clean-up levels. A	No remediation
<u>PIT D</u>			
BENZO(K)FLUORANTHENE	<1.0 R	15,187 - 166,932 required on the basis of these cal- culated clean-up levels.	No remediation
<u>PIT G</u>			
BENZO(K)FLUORANTHENE	<1.0 D	15,187 - 166,932 required on the basis of these cal- culated clean-up levels.	No remediation

TABLE 6-1
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TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

OBSERVED CONCENTRATION(S) CONSTITUENT	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	(PPM)	COMMENTS ³
<u>PIT M</u>			
BENZO(K)FLUORANTHENE	<1.0	15,187 - 166,932 required on the basis of these cal- culated clean-up levels.	No remediation
<u>PIT N</u>			
BENZO(K)FLUORANTHENE	<1.0	15,187 - 166,932 required on the basis of these cal- culated clean-up levels.	No remediation
<u>PIT L</u>			
CHROMIUM ²	860	120	Yes, remediation would be required based on chromium
ETHYLBENZENE	8; 68	680	
BENZO(K)FLUORANTHENE	12.4	15,187 - 166,932 concentration - assuming it is leachable and hexavalent.	
<u>PIT O</u>			
CHROMIUM	860	120	Yes, remediation would be required based on chromium
ETHYLBENZENE ²	0, 340	680	
BENZO(K)FLUORANTHENE	<1.0	15,187 - 166,932 concentration - assuming it is leachable and hexavalent.	

TABLE 6-1
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TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

OBSERVED CONCENTRATION(S) CONSTITUENT	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	(PPM)	COMMENTS ³
PIT E			
1,2 DICHLOROETHANE	37; 930	7.39 - 81.19	Yes, remediation would be required based on these calculations.
1,1,2 TRICHLOROETHANE	36; 932	38.6 - 424.4	
ETHYLBENZENE ⁴	13; 192	680	
BENZO(K)FLUORANTHENE	15.0	15,187 - 166,932	
PIT F			
1,2 DICHLOROETHANE	1; 218	7.39 - 81.19	Yes, remediation would be required based on these calculations.
1,1,2 TRICHLOROETHANE	1; 728	38.6 - 424.4	
ETHYLBENZENE	82	680	
BENZO(K)FLUORANTHENE	<1.0	15,187 - 166,932	
NO PIT H			
ETHYLBENZENE	300	680	No remediation would be required.
NO PIT I			
METHYLENE CHLORIDE	2; 256	188.7 - 2,074	No remediation would be required.
ETHYL BENZENE	485	680	
BENZO(K)FLUORANTHENE	4.4	15,187 - 166,932	
PIT K			
1,2 DICHLOROETHANE	250	7.39 - 81.19	Yes, remediation would be required based on these calculations.
1,1,2 TRICHLOROETHANE	1; 33	38.6 - 424.4	
VINYL CHLORIDE	68	0.118 - 1.30	
METHYLENE CHLORIDE	91	188.7 - 2,074	
ETHYLBENZENE	88	680	
BENZO(K)FLUORANTHENE	3.3	15,187 - 166,932	

⁴Proposed RMCL (0.68 mg/l) multiplied by 1000.

TABLE 6-1
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TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

OBSERVED CONCENTRATION(S) CONSTITUENT	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	(PPM)	COMMENTS ³
<u>PITS S,T,U⁵</u>			
			No remediation is recommended, since not carcin- ogenic or toxic constituents were detected in the waste data for these pits.
<u>PIT P</u>			
1,1,2 TRICHLOROETHANE	1; 91	A	38.6 - 424.4
BENZO(K)FLUORANTHENE	8; 68		
			15,187 - 166,932
<u>PIT R</u>			
1,2 DICHLOROETHANE	8; 68	R	7.39 - 81.19
1,1,2 TRICHLOROETHANE	7; 368		
ETHYLBENZENE	21; 558		
BENZO(K)FLUORANTHENE	<1		
			38.6 - 424.4
			680
			15,187 - 166,932

⁵ No carcinogenic or toxic constituents detected.

TABLE 6-1
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TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10⁻⁴
CANCER RISK LEVEL

CONSTITUENT	OBSERVED CONCENTRATION(S) (PPM)	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10 ⁻⁴ CANCER RISK (PPM)	COMMENTS
PIT AA			
CHROMIUM ⁽²⁾	132	120	Yes, remediation would be required based on lead con- centrations.
LEAD ⁽⁵⁾	326	50	
PIT BB			
CHROMIUM ⁽²⁾	123	120	Yes, remediation would be required based on lead con- centrations.
NICKEL ⁽⁶⁾	82	150	
LEAD ⁽⁵⁾	353	50	
PIT CC			
CHROMIUM	226	120	Yes, remediation would be required based on chromium and lead concentra- tions.
NICKEL	179	150	
SELENIUM ⁽⁷⁾	51	45	
LEAD	1,320	50	
PIT DD			
CHROMIUM	100	120	Yes, remediation would be required based on lead con- centration.
LEAD	123	50	

⁵ Lead value is 1000 times the MCL of 0.05 mg/l.

⁶ Nickel value is 1000 times the guidance level of 0.150 mg/l.

⁷ Selenium is 1000 times the proposed RMCL of 0.45 mg/l.

TABLE 6-1
(PAGE 7 OF 7)
TARGET WASTE CLEAN-UP LEVELS TO
PROTECT GROUND WATER AT 10^{-4}
CANCER RISK LEVEL

CONSTITUENT	OBSERVED CONCENTRATION(S) (PPM)	RANGE ¹ OF PIT WASTE CLEAN-UP LEVELS TO PROTECT GROUND WATER AT 10^{-4} CANCER RISK (PPM)	COMMENTS
<u>PIT EE</u>			
CHROMIUM	97	120	Yes, remediation would be required due to hexachloro- benzene concentra- tion.
LEAD	86	50	
HEXACHLOROBENZENE	674	232.9 - 2,560	
BENZO(A) ANTHRACENE	2.66	15,187 - 166,932	
BENZO(A) PYRENE	2.23	15,187 - 166,932	
<u>PIT FF</u>			
CHROMIUM	100	20	No, remediation would be required.
LEAD	48	50	

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TABLE 6-2
10⁻⁴ CANCER RISK LEVELS FOR
CARCINOGENIC OR POTENTIALLY CARCINOGENIC
CONSTITUENTS IN THE NSCZ

CATEGORY	CONSTITUENTS	10 ⁻⁴ CANCER RISK		MAXIMUM CONCENTRATION PPM
		(DRINKING WATER) INGESTION	NO. OF WELLS IN WHICH CON- STITUENT WERE DETECTED	
Volatile	1,1,2 Trichloroethane	.061	9	48,700
Volatile	1,2 Dichloroethane	0.038	10	39,000
Volatile	Vinyl Chloride	0.0015	8	8,400
Volatile	1,1 Dichloroethane	0.006	5	8,820
Volatile	Chloroform	.043	2	3,580
Volatile	1,1 Dichloroethane	-	5	3,380
Base/Neutral	Bis(2-Chloroethyl)Ether	0.0032	3	3,170
Volatile	Trichloroethane	-	2	2,760
Volatile	Tetrachloroethyl	0.323	2	1,580
Volatile	1,1,2,2 Tetrachloroethane	.018	1	777
Base/Neutral	1,3 Dichlorobenzene	-	2	742
Base/Neutral	Bis(2-Ethylhexyl)Pthalate	5.13	1	293
Volatile	Benzene	0.067	2	257
Base/Neutral	1,4 Dichlorobenzene	-	2	235
Base/Neutral	1,2 Dichlorobenzene	-	2	182
Volatile	Carbon Tetrachloride	0.027	1	171
Volatile	1,1,1 Trichloroethane	-	1	166
Volatile	Methylene Chloride	0.47	3	110
Base/Neutral	Hexachlorobutadiene	0.45	1	44
Base/Neutral	Hexachloroethane	2.5	1	27

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TABLE 6-3
FEASIBILITY STUDY OBJECTIVES
(PAGE 1 OF 2)

CONSTRUCTION

PATHWAY Ground Water

OBJECTIVE Prevent additional ground water degradation due to implementation activities.

CRITERIA Maintain ground water quality at no less than present quality or variability.

PATHWAY Soils and Sediments

OBJECTIVE Prevent further degradation of soil contaminant levels during construction and minimize off-site migration of sediments.

CRITERIA Maintain current soil contaminant levels.

LONG TERM

PATHWAY Ground Water

OBJECTIVE Reduction of contaminant levels in the ground water by remedial action.

CRITERIA Ground water quality at levels no greater than the risk assessment derived remediation criteria. Prevent migration of contaminated ground water off-site.

PATHWAY Soil and Sediments

OBJECTIVE Minimize the threat of exposure to significant levels of soil contaminant following remedial action.

CRITERIA Selected toxicity/hazard criteria applicable for human exposure.

CONSTRUCTION

PATHWAY Air

OBJECTIVE Protection of the public through inhalation exposure at or beyond construction.

CRITERIA Utilize current ACGIH TLV (TWA) values adjusted for general population exposures and cancer risk via inhalation.

TABLE 6-3
FEASIBILITY STUDY OBJECTIVES
(PAGE 2 OF 2)

LONG TERM

<u>PATHWAY</u>	Air
<u>OBJECTIVE</u>	Protection of the public through inhalation exposure, on and off-site.
<u>CRITERIA</u>	Utilize current ACGIH TLV (TWA) values adjusted for general population exposures and cancer risk via inhalation.

D R A F T

TABLE
PHYSICAL/CHEMICAL/TOXICOLOGICAL
RANKING OF POTENTIAL INDICATOR CHEMICALS

CHEMICAL	CARCINOGENICITY	PREVALENCE	CONCENTRATION		VAPOR		MOBILITY		KOC	
			RANK	MAX. PPM	PRESSURE	mmHg	RANK	SOLUBILITY	RANK	RANK (ml/g)
								mg/l		
PIT B (POTENTIALLY MIGRATING)										
1,2 DICHLOROETHANE	3	2/2	1	245,000	1	64	2	8,520	2	14
1,1,2 TRICHLOROETHANE	4	2/2	2	166,000	2	30	3	4,500	1	56
BIS(2 CHLOROETHYL)ETHER	1	1/1	3	3,040	3	0.71	1	10,200	3	13.9
CHROMIUM	2 (Airborne dust)	2/2	4	77	-	-	-	-	-	-
PIT J (POTENTIALLY MIGRATING)										
1,2 DICHLOROETHANE	3	2/2	1	179,000	2	64	2	8,520	3	14
1,1,2 TRICHLOROETHANE	4	2/2	2	89,100	3	30	3	4,500	2	56
VINYL CHLORIDE	1	1/2	3	22,700	1	2,660	4	2,670	1	57
BIS(C CHLOROETHYL)ETHER	2	1/1	4	1,410	4	0.71	1	10,200	4	13.9
PIT Q (POTENTIALLY MIGRATING)										
1,2 DICHLOROETHANE	4	2/3	1	26,100	2	64	3	8,520	2	14
1,1,2 TRICHLOROETHANE	2	3/3	2	8,140	3	30	4	4,500	1	56
BIS(2 CHLOROETHYL)ETHER	1	1/1	3	1,810	4	0.71	2	10,200	3	13.9
METHYLENE CHLORIDE	3	3/3	4	909	1	362	1	20,000	4	8.8

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TABLE
PHYSICAL/CHEMICAL/TOXICOLOGICAL
RANKING OF POTENTIAL INDICATOR CHEMICALS
(Continued)

CHEMICAL	CARCINOGENICITY	PREVALENCE		CONCENTRATION		VAPOR		MOBILITY		KOC	
		RANK NO. WELLS		RANK MAX. PPM		PRESSURE		WATER		RANK	
						RANK	mmHg	SOLUBILITY	mg/l	RANK	(ml/g)*
GROUND WATER (NCSZ)											
1,1,2 TRICHLOROETHANE	14	2	9	1	48,700	11	30	6	4,500	12	56
1,2 DICHLOROETHANE	5	1	10	2	39,000	9	64	3	8,520	15	14
VINYL CHLORIDE	3	3	8	3	8,400	1	2,660	8	2,670	11	57
1,1 DICHLOROETHYLENE	4	4	5	4	8,820	2	600	9		10	
CHLOROFORM	6	6	2	5	3,580	5	150	4	8,200	13	31
1,1 DICHLOROETHANE	15	4	5	6	3,380	4	182	5	5,500	14	30
BIS(2-CHLORO ETHYL)ETHER	1	5	3	7	3,170	17	0.710	2	10,200	16	13.9
TRICHLOROETHYLENE	8	6	2	8	2,760	10	57.9	12	1,100	7	12.6
TETRACHLOROETHYLENE	9	6	2	9	1,580	12	17.8	14	150	4	364
1,1,2,2 TETRACHLOROETHANE	12	7	1	10	777	13	5	7	2,900	5	168
1,3 DICHLOROBENZENE	16	6	2	11	742	14	2.28	15	123	3	1,700
BIS(2-ETHYLHEXYL)PHTHALATE	11	7	1	12	293	--	--	18	0.285	--	
BENZENE	2	6	2	13	257	7	95.2	10	1,750	9	83
1,4 DICHLOROBENZENE	16	6	2	14	235	16	1.18	16	79	3	1,700
1,2 DICHLOROBENZENE	16	6	2	15	182	9	64	3	8,520	15	14
CARBON TETRACHLORIDE	7	7	1	16	171	8	90	13	757	8	110
1,1,1 TRICHLOROETHANE	14	7	1	17	166	6	123	11	1,500	6	152
METHYLENE CHLORIDE	10	5	3	18	110	2	362	1	20,000	17	8.8
HEXACHLOROBTADIENE	13	7	1	19	44	15	2	19	0.15	1	29,000
HEXACHLOROETHANE	15	7	1	20	27	18	0.4	17	50	2	20,000

* NOTE: KOC = $\frac{\text{mg absorbed/kg organic carbon}}{\text{mg dissolved/liter solution}}$

KOC indicates the tendency of an organic chemical to be absorbed.
Low KOC values will tend to be leachable from soil and mobile in ground water.

BRO/LEVEL1-TAB

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TABLE
PHYSICAL/CHEMICAL/TOXICOLOGICAL
RANKING OF POTENTIAL INDICATOR CHEMICALS

WASTE DISPOSAL PITS (NON-MIGRATING)

CHEMICAL	CARCINOGENICITY		PREVALENCE PITS	CONCENTRATION		VAPOR PRESSURE		MOBILITY		KOC	
	RANK	LOG POTENCY		RANK	MAX. PPM	RANK	mmHg	WATER SOLUBILITY	mg/l	RANK	(ml/g)
1,2 TRICHLOROETHANE	4	+2	A,E,K,P	3	932	3	30.0	3	4,500	4	56
ETHYLBENZENE	8	Reproductive Tox	E,F,H,I,K,R	8	558	5	7	5	152	2	1,100
IRONIUM	2	A +4	L,O,R,AA,BB,CC,DD,EE,FF	5	860		-		-		-
1,2 DICHLOROETHANE	5	+1	E,F,K,R,A,M	4	930	4	64	2	8,520	4	14
ETHYLENE CHLORIDE	7	-1	I,A	9	256	2	362	1	20,000	5	8.8
ETHYL CHLORIDE	6	A 0	K	11	68	1	2,660	4	2,670	3	57
ICKEL	3	2B +2	BB,CC	10	179		-		-		-
ELENIUM		Toxic	CC	12	51		-		-		-
NTIMONY		Toxic	CC	7	600		-		-		-
EAD		Toxic	CC,DD,EE,FF	2	1,320		-		-		-
EXACHLOROBENZENE	1	2B +3	EE	6	674	6	1.09×10^{-5}	6	0.006	1	3,900
ANGANESE		Toxic	DD,EE,FF	1	1,630		-		-		-

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TABLE
PHYSICAL/CHEMICAL/TOXICOLOGICAL
RANKING OF POTENTIAL INDICATOR CHEMICALS
(Continued)

CHEMICAL	CARCINOGENICITY	PREVALENCE NO. LOCATIONS	CONCENTRATION RANK PPM MAX.	MOBILITY						
				VAPOR PRESSURE RANK mmHg		WATER SOLUBILITY RANK mg/l		KOC RANK (ml/g)		
<u>RUNOFF TO MUD GULLY</u>										
1,1,2 TRICHLOROETHANE	3	2	1 72 ppb	3	30	4	4,500	2	56	
BIS(2-CHLOROETHYL)ETHER	1	1	2 45 ppb	4	0.71	2	10,200	4	13.9	
1,2 DICHLOROETHANE	2	1	3 26 ppb	2	64	3	8,520	3	14	
METHYLENE CHLORIDE	4	2	4 11 ppb	1	362	1	20,000	5	8.8	
DI-N-BUTYL PHTHALATE	-	1	5 10 ppb	5	10 ⁻⁵	5	13	1	170,000	
<u>MUD GULLY SEDIMENT</u>										
CHRYSENE	4	5	1 171	4	6.3X10 ⁻⁹	4	0.0018	7	200,000	
CHROMIUM	2	8	2 39		-		-		-	
BENZO(K)FLUORANTHENE	3	2	3 24	1	5.1X10 ⁻⁷	3	0.0043	5	550,000	
DIBENZO(A,H)ANTHRACENE	3	4	4 11	6	10 ⁻¹⁰	7	0.0005	2	3,300,000	
BENZO(A)ANTHRACENE	3	3	5 8	3	2.2X10 ⁻⁸	2	0.0057	4	1,380,000	
BENZO(B)FLUORANTHENE	3	4	6 6	2	5X10 ⁻⁷	1	0.014	6	550,000	
BENZO(A)PYRENE	1	2	7 3	5	5.6X10 ⁻⁹	5	0.0012	1	5,500,000	
INDENO(1,2,3-CD)PYRENE	5	1	8 3	6	10 ⁻¹⁰	6	0.00053	3	1,600,000	

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TABLE
PHYSICAL/CHEMICAL/TOXICOLOGICAL
RANKING OF POTENTIAL INDICATOR CHEMICALS
SUBSOIL

CHEMICAL	CARCINOGENICITY RANK	PREVALENCE NO. OF PITS	CONCENTRATION RANK MAX. PPM	MOBILITY		WATER SOLUBILITY RANK mg/l	KOC RANK (ml/g)
				VAPOR PRESSURE RANK mmHg			
SUBSOIL							
1,1,2 TRICHLOROETHANE	6	8	1 918	4	30	4 4,500	4 56
1,2 DICHLOROETHANE	1	7	2 515	3	64	2 8,520	6 14
METHYLENE CHLORIDE	5	3	3 58	1	362	1 20,000	7 8.8
*CHLOROBENZENE	7	2	4 3	6	11.7	6 466	2 330
*CHLOROFORM	2	1	5 2	2	150	3 8,200	5 31
1,1,2,2 TETRACHLOROETHANE	4	1	6 1	7	5	5 2,900	3 118
*TETRACHLOROETHYLENE	3	1	6 1	5	17.8	7 150	1 364
WASTEWATER TREATMENT							
		NO. OF CONTAINERS					
CHROMIUM	1	6	1 94		-	-	-
CHRYSENE	4	1	2 85	4	6.3×10^{-9}	4 0.0018	6 200,000
BENZO(A)ANTHRACENE	3	5	3 16	3	2.2×10^{-8}	2 0.0057	4 1,380,000
BENZO(B)FLUORANTHENE	3	5	4 11	2	5×10^{-7}	1 0.014	5 550,000
BENZO(K)FLUORANTHENE	3	8	4 11	1	5.1×10^{-7}	3 0.0043	5 550,000
BENZO(G,H,I)PERYLENE	3	2	5 4	6	1.03×10^{-10}	6 0.0007	3 1,600,000
INDENO(1,2,3-CD)PYRENE	3	5	8 2	7	10^{-10}	7 0.00053	3 1,600,000
DIBENZO(A,H)ANTHRACENE	3	2	6 5	7	10^{-10}	8 0.0005	2 3,300,000
BENZO(A)PYRENE	2	4	7 3	5	5.6×10^{-9}	5 0.0012	1 5,500,000

*Monsanto Data

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