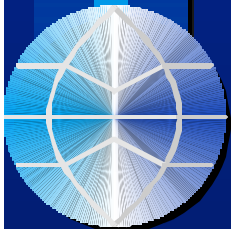


# ***CASE STUDY 2 - PIPELINE BREAK***

***Miles J. Tindal and James H. Sevigny***

***Komex International Ltd.***



**Komex International Ltd.**

*Environmental and Engineering Consultants*

# ***CASE STUDY OVERVIEW***

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## ■ ***Case Study 1 - Flare Pit***

- ◆ **Illustrate Tier 1 Guideline Use**
- ◆ **Subsoil Guidelines**
- ◆ **PAH Analysis**

## ■ ***Case Study 2 - Pipeline Break***

- ◆ **Reinforce Tier 1 Soil Guideline Use**
- ◆ **Illustrate Tier 1 Groundwater Guideline Use**
- ◆ **Illustrate Tier 2A Guideline Development**

# **CASE STUDY 2**

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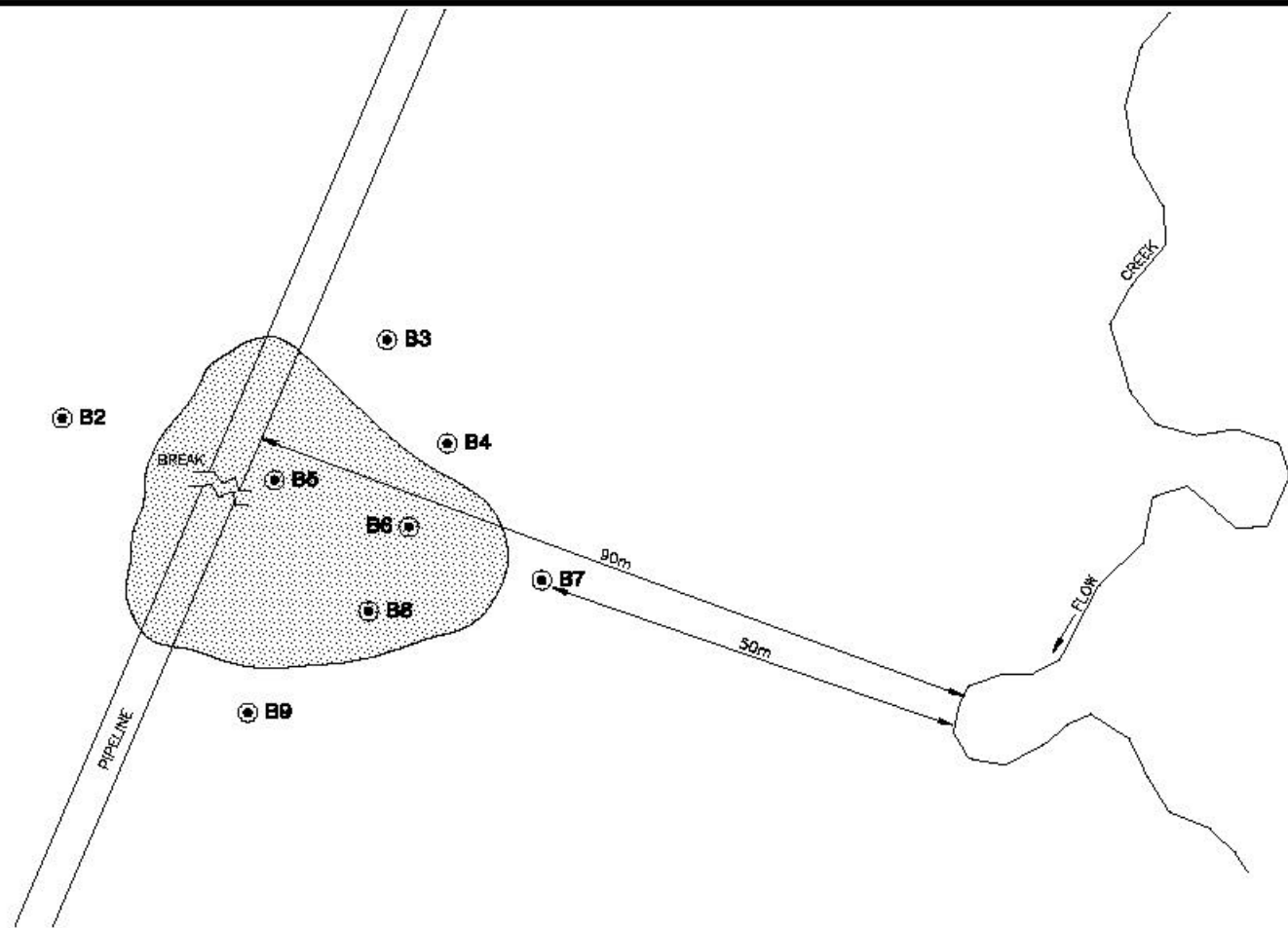
- ***Scenario - Managing a Pipeline Spill***
  - ◆ **Tier 1 Soil Guidelines**
  - ◆ **Tier 1 Groundwater Guidelines**
  - ◆ **Tier 2A Soil Guidelines**

# **TIER 1 SOIL GUIDELINE PROCESS**


---

- ***Site Information***
- ***Determine if Tier 1 Applicable***
- ***Determine if Subsoil Guidelines to be Used***
- ***Determine if PAH Analysis Required***
- ***Identify Soil Type and Land Use***
- ***Exclude Inapplicable Pathways***
- ***Select Tier 1 Soil Guidelines***

⊙ B1  
(Background)



**LEGEND**

- ⊙ B1 SOIL SAMPLE LOCATION
-  AREA OF INITIAL EXCAVATION

NO SCALE

**XYZ ENERGY INC.**

**ABC ENVIRONMENTAL LTD.**

**CASE STUDY 2 - PIPELINE BREAK**

DRAWN BY: C.D.	EDITED BY: -	DATE: JUN 11/01
APPROVED:		FIGURE: <b>2</b>

# PHYSICAL SETTING

- ***Agricultural Land in Central Alberta***
- ***Land Slopes Gently to Creek, 90 m from Break***
- ***Stratigraphy:***
  - ◆ ***Silty Clay Till (Fine), With***
  - ◆ ***Lenses of Silty Sand (Coarse)***
  - ◆ ***Shale Bedrock***

# **CONTAMINANT SITUATION**

---

- ***Light Crude Hydrocarbon***
- ***Hydrocarbon Data From 9 Boreholes (1 Background)***
- ***Samples from Most Contaminated Intervals***
- ***Sample Depths 0.15 - 2.6 m***
- ***BTEX and F1 to F4 Data Collected***

# ***PAH ANALYSIS?***

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- ***Not required, based on Hydrocarbon Composition***



# SITE SOIL DATA

<b>Borehole</b>	<b>Sample Depth (m)</b>	<b>B (mg/kg)</b>	<b>T (mg/kg)</b>	<b>E (mg/kg)</b>	<b>X (mg/kg)</b>	<b>F1 (mg/kg)</b>	<b>F2 (mg/kg)</b>	<b>F3 (mg/kg)</b>	<b>F4 (mg/kg)</b>
<b>B1</b>	<b>1.0</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>0</b>	<b>&lt;10</b>	<b>&lt;10</b>	<b>&lt;10</b>
<b>B2</b>	<b>0.3</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>3</b>	<b>&lt;10</b>	<b>&lt;10</b>	<b>&lt;10</b>
<b>B3</b>	<b>0.3</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>4</b>	<b>&lt;10</b>	<b>&lt;10</b>	<b>&lt;10</b>
<b>B4</b>	<b>0.2</b>	<b>&lt;0.05</b>	<b>0.31</b>	<b>0.091</b>	<b>0.637</b>	<b>24</b>	<b>120</b>	<b>150</b>	<b>&lt;10</b>
<b>B5</b>	<b>2.6</b>	<b>0.70</b>	<b>4.6</b>	<b>1.3</b>	<b>9.3</b>	<b>930</b>	<b>2,500</b>	<b>1,430</b>	<b>210</b>
<b>B6</b>	<b>2.1</b>	<b>0.33</b>	<b>2.2</b>	<b>0.63</b>	<b>4.4</b>	<b>460</b>	<b>1,200</b>	<b>720</b>	<b>&lt;10</b>
<b>B7</b>	<b>0.5</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>0.064</b>	<b>13</b>	<b>50</b>	<b>&lt;10</b>	<b>&lt;10</b>
<b>B8</b>	<b>1.8</b>	<b>&lt;0.05</b>	<b>0.29</b>	<b>0.084</b>	<b>0.59</b>	<b>15</b>	<b>80</b>	<b>160</b>	<b>&lt;10</b>
<b>B9</b>	<b>0.9</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>&lt;0.05</b>	<b>2</b>	<b>&lt;10</b>	<b>&lt;10</b>	<b>&lt;10</b>

# TIER 1 DECISION TREE

1. Determine if Subsoil Applicable



2. Identify Soil Type



3. Select Land Use



4. Exclude Inapplicable Pathways



5. Select Smallest Remaining Guideline for Each Chemical

# **SUBSOIL GUIDELINES APPLICABLE?**

---

- ***No - Site Not Within 30 m of Wellhead***

# ***IDENTIFY SOIL TYPE AND LAND USE***

---

- ***Soil Type - Coarse***

- ◆ Use Guidelines in User Guide Table 4

- ***Land Use - Agricultural***

- ◆ Use Second “Block” in User Guide Table 4

# SURFACE SOIL - APPLICABLE "BLOCK"

## COARSE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	B(a)P	F1	F2	F3	F4
<b>Human</b>									
Ingestion	1,200	22,000	10,000	RES	4.9	15,000	8,000	18,000	25,000
Dermal	2,700	RES	RES	RES	4.3	RES	RES	RES	RES
Inhalation	0.048	120	54	14	NA	30	150	NA	NA
Groundwater	0.13	1.6	0.36	49	NA	3,700	5,100	NA	NA
<b>Ecological</b>									
Soil Contact	8.3	24	91	90	F3	130	450	400	2,800
Soil Ingestion	33	1,800	1,200	4,900	F3	4,000	3,700	6,000	4,000
Aquatic	1.6	0.16	79	59	F3	360	230	NA	NA
Livestock	2.2	2,200	16,000	25,000	F3	11,000	8,600	NA	NA

**NA = not applicable; RES = residual hydrocarbon formation; NC = not calculated; and, F3 = ecological endpoints for B(a)P included in F3 guideline.**

# ***EXCLUDE INAPPLICABLE PATHWAYS***

---

- ***None***

# TIER 1 SOIL GUIDELINES

## COARSE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	F1	F2	F3	F4
<b>Human</b>								
<i>Ingestion</i>	1,200	22,000	10,000	RES	15,000	8,000	18,000	25,000
<i>Dermal</i>	2,700	RES	RES	RES	RES	RES	RES	RES
<i>Inhalation</i>	0.048	120	54	14	30	150	NA	NA
<i>Groundwater</i>	0.13	1.6	0.36	49	3,700	5,100	NA	NA
<b>Ecological</b>								
<i>Soil Contact</i>	8.3	24	91	90	130	450	400	2,800
<i>Soil Ingestion</i>	33	1,800	1,200	4,900	4,000	3,700	6,000	4,000
<i>Aquatic</i>	1.6	0.16	79	59	360	230	NA	NA
<i>Livestock</i>	2.2	2,200	16,000	25,000	11,000	8,600	NA	NA

**NA = not applicable; RES = residual hydrocarbon formation; NC = not calculated; and, F3 = ecological endpoints for B(a)P included in F3 guideline.**

# TIER 1 SOIL GUIDELINES

## COARSE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	F1	F2	F3	F4
<b>Human</b>								
<b>Ingestion</b>	1,200	22,000	10,000	RES	15,000	8,000	18,000	25,000
<b>Dermal</b>	2,700	RES	RES	RES	RES	RES	RES	RES
<b>Inhalation</b>	<b>0.048</b>	120	54	<b>14</b>	<b>30</b>	<b>150</b>	NA	NA
<b>Groundwater</b>	0.13	1.6	<b>0.36</b>	49	3,700	5,100	NA	NA
<b>Ecological</b>								
<b>Soil Contact</b>	8.3	24	91	90	130	450	<b>400</b>	<b>2,800</b>
<b>Soil Ingestion</b>	33	1,800	1,200	4,900	4,000	3,700	6,000	4,000
<b>Aquatic</b>	1.6	<b>0.16</b>	79	59	360	230	NA	NA
<b>Livestock</b>	2.2	2,200	16,000	25,000	11,000	8,600	NA	NA

**Tier 1 Guidelines Shaded and Boxed; NA = not applicable; RES = residual hydrocarbon formation; NC = not calculated; and, F3 = ecological endpoints for B(a)P included in F3 guideline.**

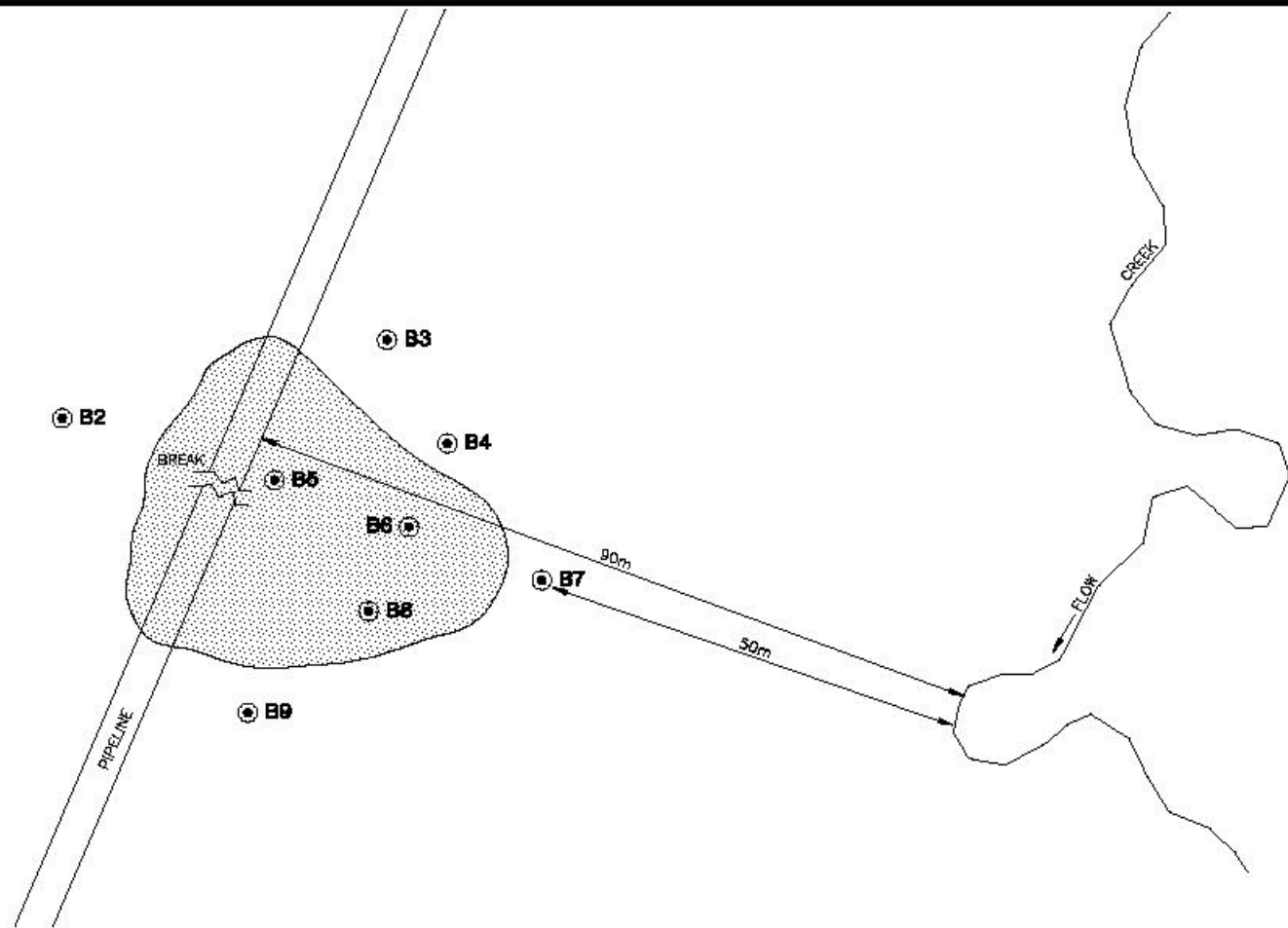


# SITE SOIL DATA vs. TIER 1 GUIDELINES


Borehole	Sample Depth (m)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
<b>Guideline</b>		<b>0.048</b>	<b>0.16</b>	<b>0.36</b>	<b>14</b>	<b>30</b>	<b>150</b>	<b>400</b>	<b>2,800</b>
B1	1.0	<0.05	<0.05	<0.05	<0.05	0	<10	<10	<10
B2	0.3	<0.05	<0.05	<0.05	<0.05	3	<10	<10	<10
B3	0.3	<0.05	<0.05	<0.05	<0.05	4	<10	<10	<10
B4	0.2	<0.05	0.31	0.091	0.637	24	120	150	<10
B5	2.6	0.70	4.6	1.3	9.3	930	2,500	1,430	210
B6	2.1	0.33	2.2	0.63	4.4	460	1,200	720	<10
B7	0.5	<0.05	<0.05	<0.05	0.064	13	50	<10	<10
B8	1.8	<0.05	0.29	0.084	0.59	15	80	160	<10
B9	0.9	<0.05	<0.05	<0.05	<0.05	2	<10	<10	<10

**Values Exceeding Tier 1 Guidelines are Shaded and Boxed**

⊙ B1  
(Background)



**LEGEND**

- ⊙ B1 SOIL SAMPLE LOCATION
-  AREA OF INITIAL EXCAVATION

NO SCALE

**XYZ ENERGY INC.**

**ABC ENVIRONMENTAL LTD.**

**CASE STUDY 2 - PIPELINE BREAK**

DRAWN BY: C.D.	EDITED BY: -	DATE: JUN 11/01
APPROVED:		FIGURE: <b>2</b>

# **CASE STUDY 2**

---

- ***Tier 1 Soil Guidelines***
- ***Tier 1 Groundwater Guidelines***
- ***Tier 2A Soil Guidelines***

# **TIER 1 GROUNDWATER GUIDELINE PROCESS**

---

- ***Determine if Groundwater Guidelines Required***
- ***Exclude Inapplicable Water Uses***
- ***Select Tier 1 Groundwater Guidelines***

# ***DETERMINE IF GROUNDWATER GUIDELINES REQUIRED***

---

- ***Groundwater Present at Site***
- ***Groundwater in Hydraulic Contact With Source***
- ***Groundwater Guidelines and Assessment Required***

# SITE GROUNDWATER DATA

<i>Piezometer</i>	<i>B</i> (mg/L)	<i>T</i> (mg/L)	<i>E</i> (mg/L)	<i>X</i> (mg/L)	<i>F1</i> (mg/L)	<i>F2</i> (mg/L)
<i>B2</i>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<i>B4</i>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<i>B5</i>	5.2	8.3	0.87	11	0.7	<0.5
<i>B6</i>	0.23	0.18	0.010	0.10	<0.05	<0.5
<i>B7</i>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<i>B8</i>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5

# TIER 1 GROUNDWATER GUIDELINES (ALL USES)

## GROUNDWATER GUIDELINES (mg/L)

<i>Pathway</i>	<i>B</i>	<i>T</i>	<i>E</i>	<i>X</i>	<i>B(a)P</i>	<i>F1</i>	<i>F2</i>
<i>Human Drinking Water</i>	0.005	0.024	0.0024	0.3	0.00001	4.6	2.1
<i>Livestock Watering</i>	0.51	29	19	76	NA	62	57
<i>All Soils – Piezometers &lt;10 m From Surface Water Body</i>							
<i>Freshwater Aquatic Life</i>	0.370	0.002	0.090	0.180	NA	TBD	TBD
<i>Wildlife Watering</i>	1.2	69	45	180	NA	150	140
<i>Coarse Soils – Piezometers &gt;10 m From Surface Water Body</i>							
<i>Freshwater Aquatic Life</i>	0.53	0.021	4.8	3.3	NA	NG	NG
<i>Wildlife Watering</i>	1.8	NG	NG	NG	NA	NG	NG
<i>Fine Soils – Piezometers &gt;10 m From Surface Water Body</i>							
<i>Freshwater Aquatic Life</i>	NG	NG	NG	NG	NG	NG	NG
<i>Wildlife Watering</i>	NG	NG	NG	NG	NG	NG	NG

**NA = not applicable; NG = no guideline calculated; and, TBD = to be determined.**

# ***EXCLUDE INAPPLICABLE WATER USES***

---

- ***Human Drinking Water - Applicable***
- ***Livestock Watering - Applicable***
- ***Freshwater Aquatic Life - Applicable***
- ***Wildlife Watering - Applicable***



# ***DETERMINE SOIL TYPE AND DISTANCE TO SURFACE WATER***

---

- ***Soil Type is Coarse***
- ***Groundwater Plume is >10 m From Surface Water***

# TIER 1 GROUNDWATER GUIDELINES

## GROUNDWATER GUIDELINES (mg/L)

<i>Pathway</i>	<i>B</i>	<i>T</i>	<i>E</i>	<i>X</i>	<i>F1</i>	<i>F2</i>
<i>Human Drinking Water</i>	0.005	0.024	0.0024	0.3	4.6	2.1
<i>Livestock Watering</i>	0.51	29	19	76	62	57
<i>Freshwater Aquatic Life</i>	0.53	0.021	4.8	3.3	NG	NG
<i>Wildlife Watering</i>	1.8	NG	NG	NG	NG	NG

**NA = not applicable; NG = no guideline calculated**

# TIER 1 GROUNDWATER GUIDELINES

## GROUNDWATER GUIDELINES (mg/L)

<i>Pathway</i>	<i>B</i>	<i>T</i>	<i>E</i>	<i>X</i>	<i>F1</i>	<i>F2</i>
<i>Human Drinking Water</i>	0.005	0.024	0.0024	0.3	4.6	2.1
<i>Livestock Watering</i>	0.51	29	19	76	62	57
<i>Freshwater Aquatic Life</i>	0.53	0.021	4.8	3.3	NG	NG
<i>Wildlife Watering</i>	1.8	NG	NG	NG	NG	NG

**Tier 1 Guidelines are Shaded and Boxed; NA = not applicable; and, NG = no guideline calculated**

# GROUNDWATER DATA VS. GUIDELINES

Piezometer	B (mg/L)	T (mg/L)	E (mg/L)	X (mg/L)	F1 (mg/L)	F2 (mg/L)
<b>Guideline</b>	<b>0.005</b>	<b>0.021</b>	<b>0.0024</b>	<b>0.3</b>	<b>4.6</b>	<b>2.1</b>
<b>B2</b>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<b>B4</b>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<b>B5</b>	5.2	8.3	0.87	11	0.7	<0.5
<b>B6</b>	0.23	0.18	0.010	0.10	<0.05	<0.5
<b>B7</b>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5
<b>B8</b>	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.5

**Tier 1 Guidelines in Blue; Values Exceeding Guidelines are Shaded and Boxed**

# **CASE STUDY 2**

---

- ***Tier 1 Soil Guidelines***
- ***Tier 1 Groundwater Guidelines***
- ***Tier 2A Soil Guidelines***

# ***ROLE OF TIER 2A GUIDELINES***

---

- ***“Customize” Tier 1 Guidelines***

# **TIER 2A GUIDELINE PROCESS**

---

- ***Identify Limiting Pathway at Tier 1***
- ***Determine If Guideline Can be Modified***
- ***Calculate Tier 2A Guideline***

# TIER 1 SOIL GUIDELINES

## COARSE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	F1	F2	F3	F4
<b>Human</b>								
<i>Ingestion</i>	1,200	22,000	10,000	RES	15,000	8,000	18,000	25,000
<i>Dermal</i>	2,700	RES	RES	RES	RES	RES	RES	RES
<i>Inhalation</i>	<b>0.048</b>	120	54	<b>14</b>	<b>30</b>	<b>150</b>	NA	NA
<i>Groundwater</i>	0.13	1.6	<b>0.36</b>	49	3,700	5,100	NA	NA
<b>Ecological</b>								
<i>Soil Contact</i>	8.3	24	91	90	130	450	<b>400</b>	<b>2,800</b>
<i>Soil Ingestion</i>	33	1,800	1,200	4,900	4,000	3,700	6,000	4,000
<i>Aquatic</i>	1.6	<b>0.16</b>	79	59	360	230	NA	NA
<i>Livestock</i>	2.2	2,200	16,000	25,000	11,000	8,600	NA	NA

**Tier 1 Guidelines Shaded and Boxed; NA = not applicable; RES = residual hydrocarbon formation; NC = not calculated; and, F3 = ecological endpoints for B(a)P included in F3 guideline.**



# ***IDENTIFY LIMITING PATHWAYS***

---

## ■ ***Human***

- ◆ **Inhalation - B, X, F1, F2**
- ◆ **Drinking Water - E**

## ■ ***Ecological***

- ◆ **Soil Ecological Contact - F3, F4**
- ◆ **Freshwater Aquatic Life - T**

# TIER 2A GUIDELINE PATHWAYS

<i>Pathway</i>	<i>Tier 2 Pathway?</i>
<i>Human</i>	
<i>Ingestion</i>	(YES)
<i>Dermal</i>	(YES)
<i>Inhalation</i>	YES
<i>Groundwater</i>	YES
<i>Ecological</i>	
<i>Soil Contact</i>	NOT AT PRESENT
<i>Aquatic</i>	YES
<i>Livestock</i>	YES

# POTENTIAL TIER 2A PATHWAYS

---

## ■ ***Human***

- ◆ Inhalation - B, X, F1
- ◆ Drinking Water - E

## ■ ***Ecological***

- ◆ Freshwater Aquatic Life - T, F2

# TIER 2A DRINKING WATER GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Precipitation (mm/year)</i>		600	
<i>Groundwater Recharge (mm/year)</i>		60	
<i>Soil Guideline (mg/kg)</i>	<b>Ethylbenzene</b>	<b>0.36</b>	

# TIER 2A DRINKING WATER GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Precipitation (mm/year)</i>		600	350
<i>Groundwater Recharge (mm/year)</i>		60	35
<i>Soil Guideline (mg/kg)</i>	<b>Ethylbenzene</b>	<b>0.36</b>	

# TIER 2A DRINKING WATER GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Precipitation (mm/year)</i>		600	350
<i>Groundwater Recharge (mm/year)</i>		60	35
<i>Soil Guideline (mg/kg)</i>	<b>Ethylbenzene</b>	<b>0.36</b>	<b>0.61</b>

# TIER 2A AQUATIC LIFE GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Distance to Creek (m)</i>		<b>10</b>	
<i>Soil Aquatic Life Guideline (mg/kg)</i>	<b>Toluene</b>	<b>0.16</b>	

# TIER 2A AQUATIC LIFE GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Distance to Creek (m)</i>		10	50
<i>Soil Aquatic Life Guideline (mg/kg)</i>	<b>Toluene</b>	<b>0.16</b>	



# TIER 2A AQUATIC LIFE GUIDELINES

<i>Parameter</i>	<i>Chemical</i>	<i>Tier 1 Value</i>	<i>Tier 2 Value</i>
<i>Distance to Creek (m)</i>		10	50
<i>Soil Aquatic Life Guideline (mg/kg)</i>	<b>Toluene</b>	<b>0.16</b>	<b>49</b>

# TIER 2A GUIDELINES

## COARSE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	F1	F2	F3	F4
<b>Human</b>								
<i>Ingestion</i>	1,200	22,000	10,000	RES	15,000	8,000	18,000	25,000
<i>Dermal</i>	2,700	RES	RES	RES	RES	RES	RES	RES
<i>Inhalation</i>	0.048	120	54	14	30	150	NA	NA
<i>Groundwater</i>	0.22	1.6	0.61	83	3,700	5,100	NA	NA
<b>Ecological</b>								
<i>Soil Contact</i>	8.3	24	91	90	130	450	400	2,800
<i>Soil Ingestion</i>	33	1,800	1,200	4,900	4,000	3,700	6,000	4,000
<i>Aquatic</i>	1.6	49	79	59	360	6,600	NA	NA
<i>Livestock</i>	2.2	2,200	16,000	25,000	11,000	8,600	NA	NA

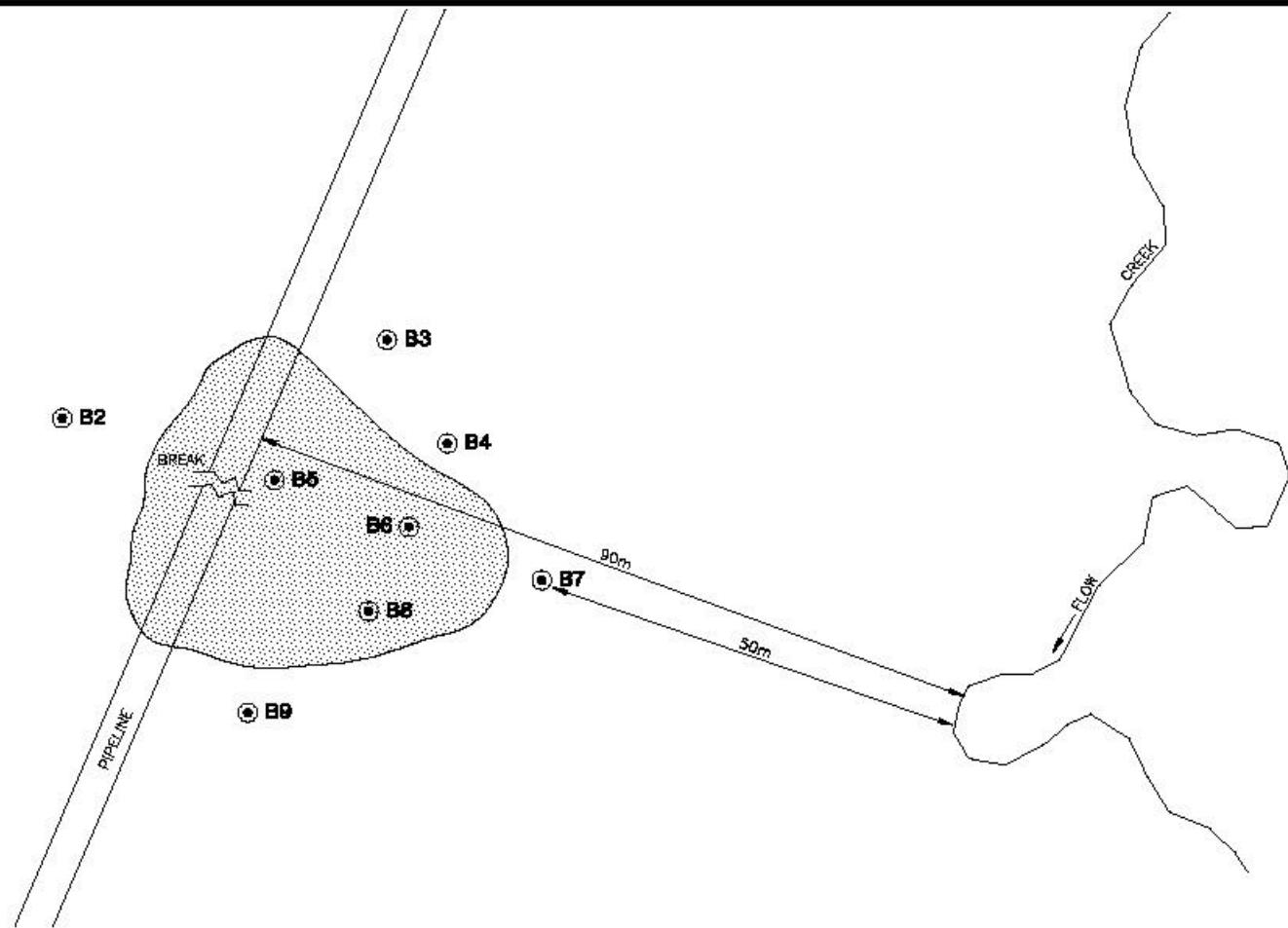
**Tier 2 Guidelines are Shaded and Boxed; NA = not applicable; and, RES = residual hydrocarbon formation.**

# SITE SOIL DATA vs. TIER 2A GUIDELINES


Corehole	Sample Depth (m)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
<b>Tier 2</b>		<b>0.048</b>	<b>1.6</b>	<b>0.61</b>	<b>14</b>	<b>30</b>	<b>150</b>	<b>400</b>	<b>2,800</b>
B1	1.0	<0.05	<0.05	<0.05	<0.05	0	<10	<10	<10
B2	0.3	<0.05	0.11	<0.05	0.15	3	<10	<10	<10
B3	0.3	0.06	0.15	<0.05	0.20	4	<10	<10	<10
B4	0.2	0.20	1.0	0.5	6.4	110	350	150	<10
B5	2.6	30	70	13	93	1,900	4,500	2,700	210
B6	2.1	14	33	6	44	900	2,500	1,600	<10
B7	0.5	0.21	0.48	0.09	0.64	13	50	<10	<10
B8	1.8	1.9	4.4	0.84	5.9	120	300	160	<10
B9	0.9	<0.05	0.07	<0.05	0.10	2	<10	<10	<10

**Blue numbers are Tier 2 guidelines; Values Exceeding Tier 2 Guidelines are Shaded and Boxed.**

⊙ B1  
(Background)



**LEGEND**

- ⊙ B1 SOIL SAMPLE LOCATION
-  AREA OF INITIAL EXCAVATION

NO SCALE

**XYZ ENERGY INC.**

**ABC ENVIRONMENTAL LTD.**

**CASE STUDY 2 - PIPELINE BREAK**

DRAWN BY: C.D.	EDITED BY: -	DATE: JUN 11/01
APPROVED:		FIGURE: <b>2</b>

# **SUMMARY**

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- ***Tier 1 Soil Guideline Process***
- ***Tier 1 Groundwater Guideline Process***
- ***Tier 2 Soil Guideline Process:***
  - ◆ **Identify Limiting Pathway at Tier 1**
  - ◆ **Determine If Guideline Can be Modified**
  - ◆ **Calculate Tier 2 Guideline**