

CASE STUDY 1 - FLARE PIT

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CASE STUDY OVERVIEW

■ ***Case Study 1 - Flare Pit***

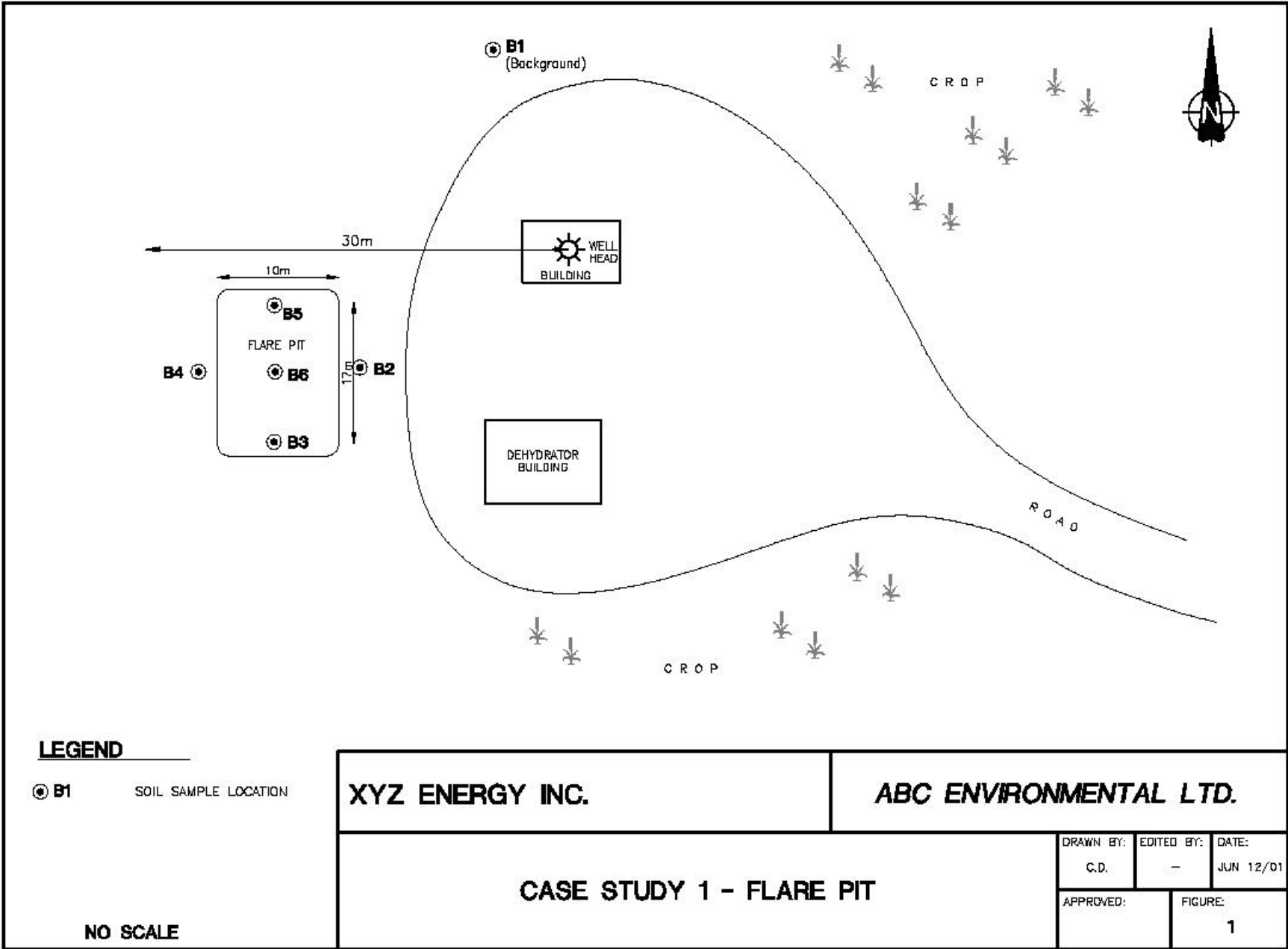
- ◆ **Illustrate Tier 1 Guideline Use**
- ◆ **Subsoil Guidelines**
- ◆ **PAH Analysis**

■ ***Case Study 2 - Pipeline Break***

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

CASE STUDY 1

- ***Scenario - Decommissioning a Flare Pit***
- ***Guideline Selection 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**
 - ◆ **Select Tier 1 Guidelines**



LEGEND

⊙ B1 SOIL SAMPLE LOCATION

NO SCALE

XYZ ENERGY INC.

ABC ENVIRONMENTAL LTD.

CASE STUDY 1 - FLARE PIT

DRAWN BY: C.D.	EDITED BY: -	DATE: JUN 12/01
APPROVED:		FIGURE: 1

PHYSICAL SETTING

- ***Agricultural Land in Alberta Foothills***
- ***20-40 m of Till Over Bedrock Aquifer***
- ***Flare Pit Within 30 m of Wellhead***
- ***No Creeks Within 300 m***
- ***Uniform Silty Clay Till***
- ***Groundwater Not Considered in This Example***

CONTAMINANT SITUATION

- ***Hydrocarbon Data From 6 Boreholes (1 Background)***
- ***Surface Soil and Subsoil Samples Available***
- ***PAH Data Collected from Borehole B6 Only***
- ***Salts, and Metals Not Considered Here***

SITE BTEX AND PHC DATA

Bore-hole	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)
B1	1.0	<0.05	<0.05	<0.05	<0.05	<20	<10	<10	<10
B2	0.3	<0.05	<0.05	<0.05	0.8	<20	<10	120	80
B3	0.3	<0.05	0.5	<0.05	1.2	<20	<10	40	<10
B4	0.5	1.2	3.9	0.5	6.7	<20	470	1,800	2,000
	1.6	0.3	1.0	0.1	1.7	<20	120	420	490
B5	1.2	0.8	2.6	0.3	4.4	30	310	1,500	1,800
	1.8	0.3	0.8	0.1	1.4	<20	100	530	650
B6	0.9	3.0	10	1.3	17	200	1,200	3,500	4,500
	2.1	1.7	5.5	0.7	9.4	110	660	1,925	2,475

SITE PAH DATA (BH6, 0.9 m)

PAH Compound	Measured Concentration (mg/kg)	Relative Carcinogenic Potency (mg/kg)	Concentration as Equivalent B(a)P (mg/kg)
Benzo[a]pyrene	1.1	1	1.10
Benzo[a]anthracene	0.1	0.1	0.01
Benzo[b]fluoranthene	0.7	0.1	0.07
Benzo[j]fluoranthene	0.4	0.1	0.04
Benzo[k]fluoranthene	0.3	0.1	0.03
Chrysene	3.4	0.0044	0.01
Dibenzo[a,h]anthracene	<0.01	1.1	-
Indeno[1,2,3-cd]pyrene	<0.01	0.2	-
TOTAL			1.3

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

IDENTIFY SOIL DEPTH, TYPE AND LAND USE

- ***Soil Depth - Surface Soil and Subsoil***
- ***Soil Type - Fine***
 - ◆ **Use Guidelines in User Guide Tables 3 and 5**
- ***Land Use - Agricultural***
 - ◆ **Use Second “Block” in Tables 3 and 5**

SURFACE SOIL - APPLICABLE "BLOCK"

FINE SURFACE SOIL – AGRICULTURAL (mg/kg)

<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>F3</i>	<i>F4</i>
<i>Human</i>									
<i>Ingestion</i>	1,200	22,000	10,000	RES	4.9	15,000	8,000	18,000	25,000
<i>Dermal</i>	2,700	RES	RES	RES	4.3	RES	RES	RES	RES
<i>Inhalation</i>	1.9	4,600	2,000	500	NA	940	5,200	NA	NA
<i>Groundwater</i>	0.073	0.86	0.19	25	NA	1,900	2,600	NA	NA
<i>Ecological</i>									
<i>Soil Contact</i>	14	300	450	1,200	F3	260	900	800	5,600
<i>Soil Ingestion</i>	33	1,800	1,200	4,900	F3	4,000	3,700	6,000	4,000
<i>Aquatic</i>	RES	RES	RES	RES	F3	TBD	TBD	NA	NA
<i>Livestock</i>	RES	RES	RES	RES	F3	TBD	TBD	NA	NA

NA = not applicable; RES = residual hydrocarbon formation; F3 = ecological endpoints for B(a)P included in F3 guideline; and TBD = to be determined.

EXCLUDE INAPPLICABLE PATHWAYS

■ ***Human Pathways***

- ◆ **Human Drinking Water**
- ◆ **Inhalation (within 30m of wellhead)**

■ ***Ecological Pathways***

- ◆ **Freshwater Aquatic Life**

TIER 1 SURFACE SOIL GUIDELINES

FINE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	B(a)P	F1	F2	F3	F4
Human									
<i>Ingestion</i>	1,200	22,000	10,000	RES	4.9	15,000	8,000	18,000	25,000
<i>Dermal</i>	2,700	RES	RES	RES	4.3	RES	RES	RES	RES
Ecological									
<i>Soil Contact</i>	14	300	450	1,200	F3	260	900	800	5,600
<i>Soil Ingestion</i>	33	1,800	1,200	4,900	F3	4,000	3,700	6,000	4,000

RES = residual hydrocarbon formation; and F3 = ecological endpoints for B(a)P included in F3 guideline.

TIER 1 SURFACE SOIL GUIDELINES

FINE SURFACE SOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	B(a)P	F1	F2	F3	F4
Human									
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
Ecological									
Soil Contact	14	300	450	1,200	F3	260	900	800	5,600
Soil Ingestion	33	1,800	1,200	4,900	F3	4,000	3,700	6,000	4,000

Tier 1 Guidelines are Shaded and Boxed; RES = residual hydrocarbon formation; and F3 = ecological endpoints for B(a)P included in F3 guideline.

SUBSOIL - APPLICABLE "BLOCK"

FINE SUBSOIL – AGRICULTURAL (mg/kg)

Pathway	B	T	E	X	B(a)P	F1	F2	F3	F4
<i>Human</i>									
<i>Ingestion</i>	RES	RES	RES	RES	RES	RES	RES	RES	RES
<i>Dermal</i>	RES	RES	RES	RES	RES	RES	RES	RES	RES
<i>Inhalation</i>	1.9	4,600	2,000	500	NA	940	5,200	NA	NA
<i>Groundwater</i>	0.073	0.86	0.19	25	NA	1,900	2,600	NA	NA
<i>Ecological</i>									
<i>Soil Contact</i>	28	300	450	1,200	F3	750	2,200	3,500	10,000
<i>Soil Ingestion</i>	NA	NA	NA	NA	NA	NA	NA	NA	NA
<i>Aquatic</i>	RES	RES	RES	RES	F3	TBD	TBD	NA	NA
<i>Livestock</i>	RES	RES	RES	RES	F3	TBD	TBD	NA	NA

NA = not applicable; RES = residual hydrocarbon formation; NC = not calculated; F3 = ecological endpoints for B(a)P included in F3 guideline; and TBD = to be determined

EXCLUDE INAPPLICABLE PATHWAYS

- ***Human Pathways***

- ◆ **Human Drinking Water**
- ◆ **Inhalation (within 30m of wellhead)**

TIER 1 SUBSOIL GUIDELINES

FINE SUBSOIL – AGRICULTURAL (mg/kg)

<i>Pathway</i>	<i>B</i>	<i>T</i>	<i>E</i>	<i>X</i>	<i>F1</i>	<i>F2</i>	<i>F3</i>	<i>F4</i>
<i>Ecological</i>								
<i>Soil Contact</i>	28	300	450	1,200	750	2,200	3,500	10,000

SURFACE SOIL DATA VS. TIER 1 GUIDELINES

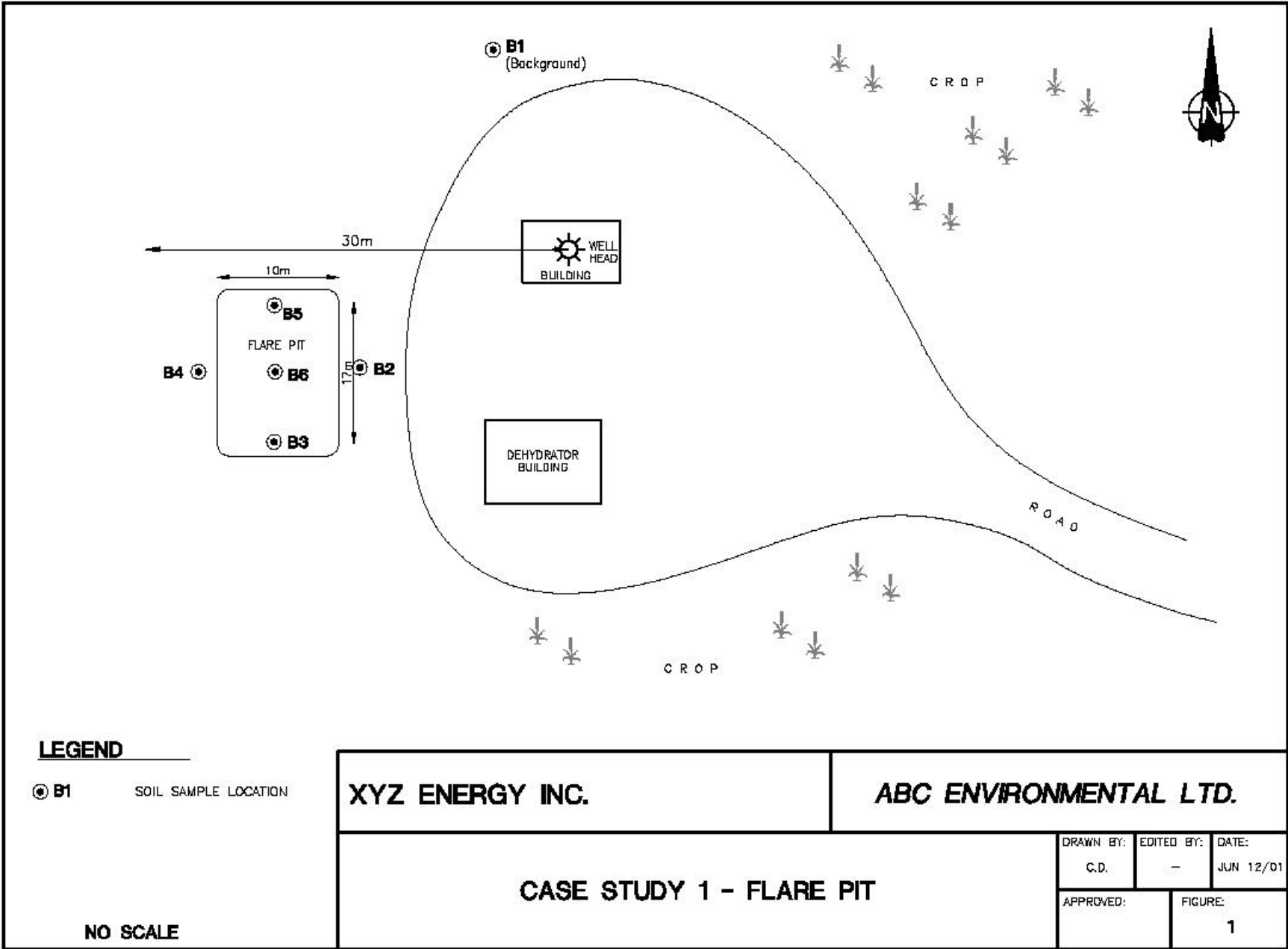
Borehole	Sample Depth (m)	B (mg/kg)	T (mg/kg)	E (mg/kg)	X (mg/kg)	B(a)P (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Guideline		14	300	450	1,200	4.3	260	900	800	4,000
B1	1.0	<0.05	<0.05	<0.05	<0.05	-	<20	<10	<10	<10
B2	0.3	<0.05	<0.05	<0.05	0.8	-	<20	<10	120	80
B3	0.3	<0.05	0.5	<0.05	1.2	-	<20	<10	40	<10
B4	0.5	1.2	3.9	0.5	6.7	-	<20	470	1,800	2,000
B5	1.2	0.8	2.6	0.3	4.4	-	30	310	1,500	1,800
B6	0.9	3.0	10	1.3	17	1.3	200	1,200	3,500	4,500

Blue = Tier 1 guideline; Values Exceeding Tier 1 Guidelines Shaded and Boxed.

SUBSOIL DATA VS. TIER 1 GUIDELINES

<i>Borehole</i>	<i>Sample Depth</i> (m)	<i>B</i> (mg/kg)	<i>T</i> (mg/kg)	<i>E</i> (mg/kg)	<i>X</i> (mg/kg)	<i>F1</i> (mg/kg)	<i>F2</i> (mg/kg)	<i>F3</i> (mg/kg)	<i>F4</i> (mg/kg)
Guideline		28	300	450	1,200	750	2,200	3,500	10,000
B4	1.6	0.3	1.0	0.1	1.7	<20	120	420	490
B5	1.8	0.3	0.8	0.1	1.4	<20	100	530	650
B6	2.1	1.7	5.5	0.7	9.4	110	660	1,925	2,475

Blue = Tier 1 guideline; Values Exceeding Guidelines Shaded and Boxed.



SUMMARY

■ ***Tier 1 Guideline Selection Process***

- ◆ **Soil Type**
- ◆ **Surface Soil +/- Subsurface Soil**
- ◆ **Land Use**
- ◆ **Exclude Inapplicable Pathways**
- ◆ **Identify Limiting Guideline for Each Chemical**