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From Grey Soup to Green Salad: Transforming Oily Waste into a Soil Amendment

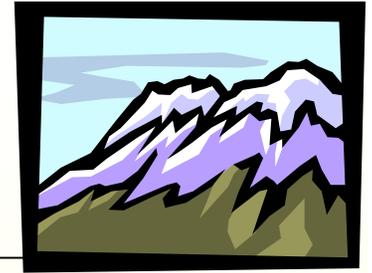
Ari Laurell

*Technical Account Manager
Unique Oilfield Technology
Services*

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Case Study: Husky Cordell 6-11-43-16W5



- **Step 1: Background**
- **Step 2: Biotreatment**
- **Step 3: Remediation**
- **Step 4: Closure**

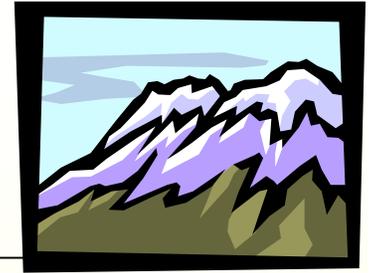


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Background



- **Area: Nordegg (43 Km)**
- **Elevation: 1,390 m (4,622 ft)**
- **Soil: Silty Clay Loam**
- **Access: Steep Grade & Tight Turns**
- **Drilled: Fall '98**
- **Nearest Landfill: 300+ kms**
- **OBM: Canoil (Non-Invert)**
- **Sumps: None**
- **Fluid Recovery & Recycling: Yes**

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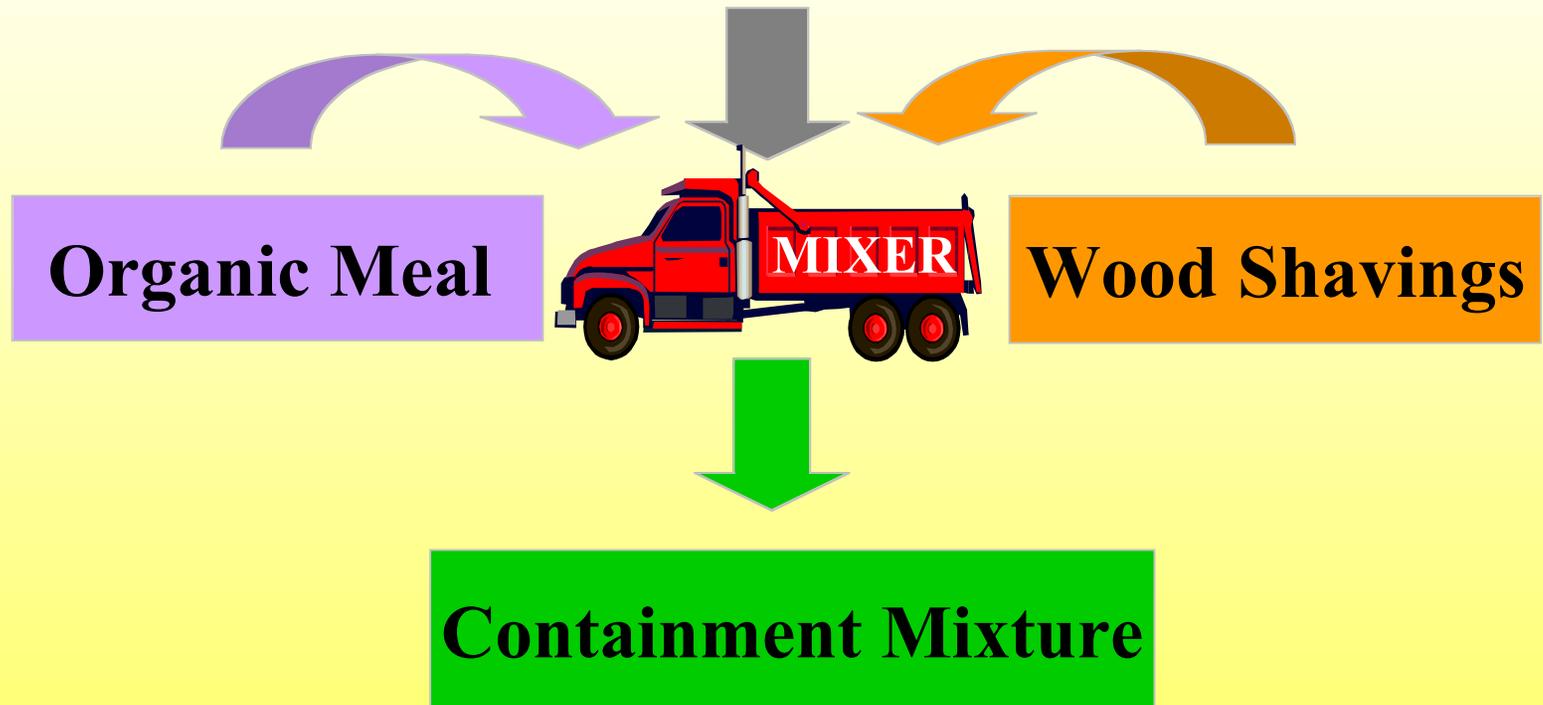
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Biotreatment

CDN Patent 2,257,706



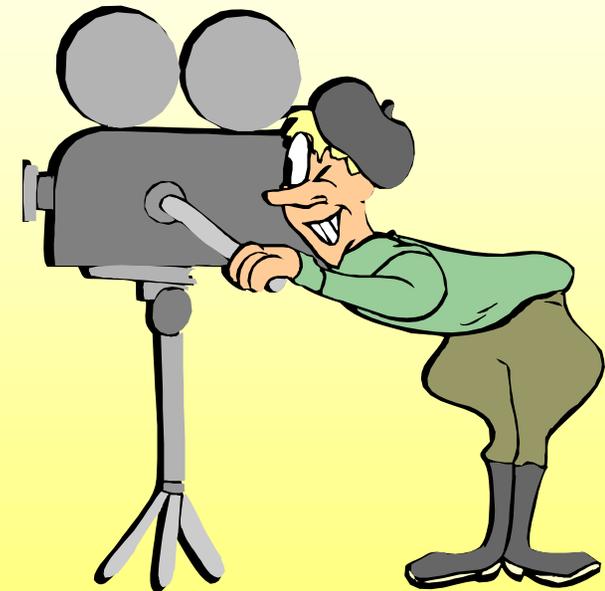
Raw Drill Cuttings



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Demonstration

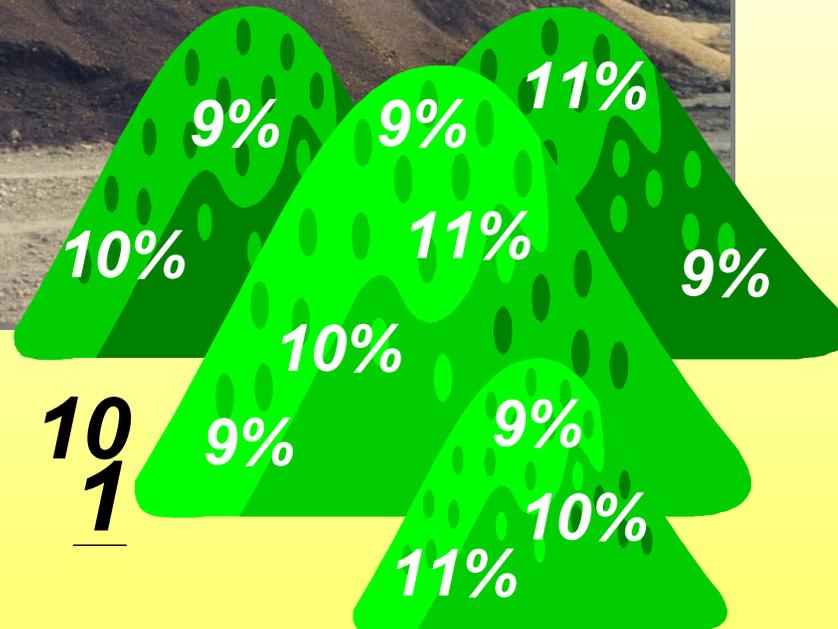
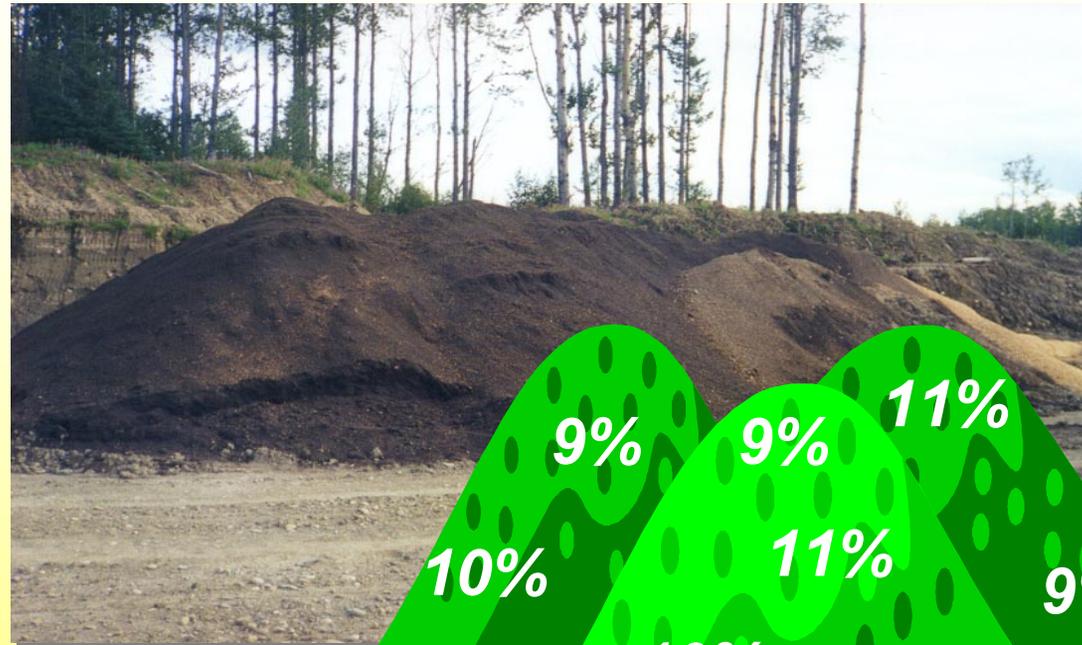


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Biotreatment

CDN Patent 2,257,706

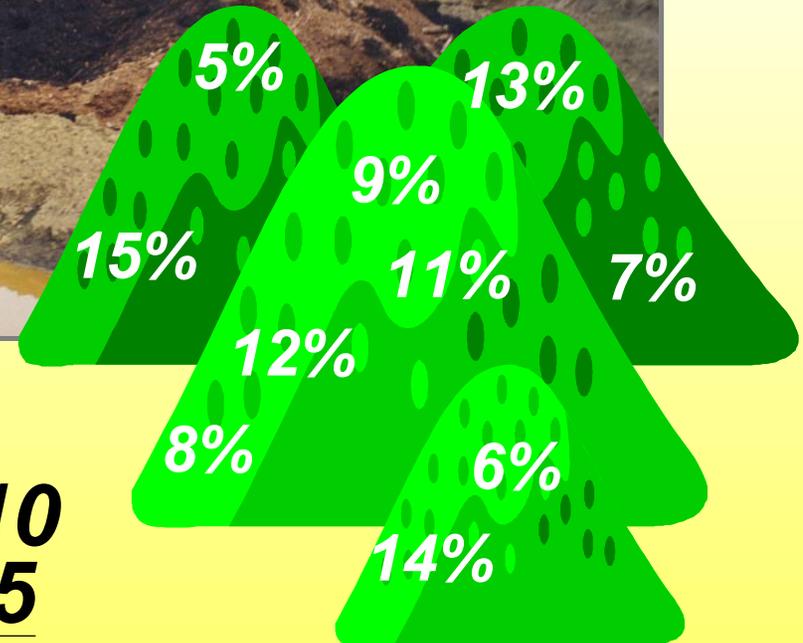


Average: 10
Variability: 1

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Biotreatment



Variability: 10
Average: 5

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Summary



Parameters	Biotreatment	
	Before	After
Oil Content	15%	12%
Variability (+/-)	3.0%	0.3%
Volume (m ³)	~90	~300
Weight (Tonne)	160	200
Bulk Density (Kg/m ³)	1,850	650
Leachability (mg/L)	50,000	15
Chlorides (Kg)	248	240
Sodium (Kg)	155	150

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Remediation



- **Land Application Approval**
(Section 5 Guide 50)
 - **Waste Characterization**
 - **Site Characterization**
 - **Salt & Metal Loading**
 - **Monitoring & Maintenance**
- **Map**

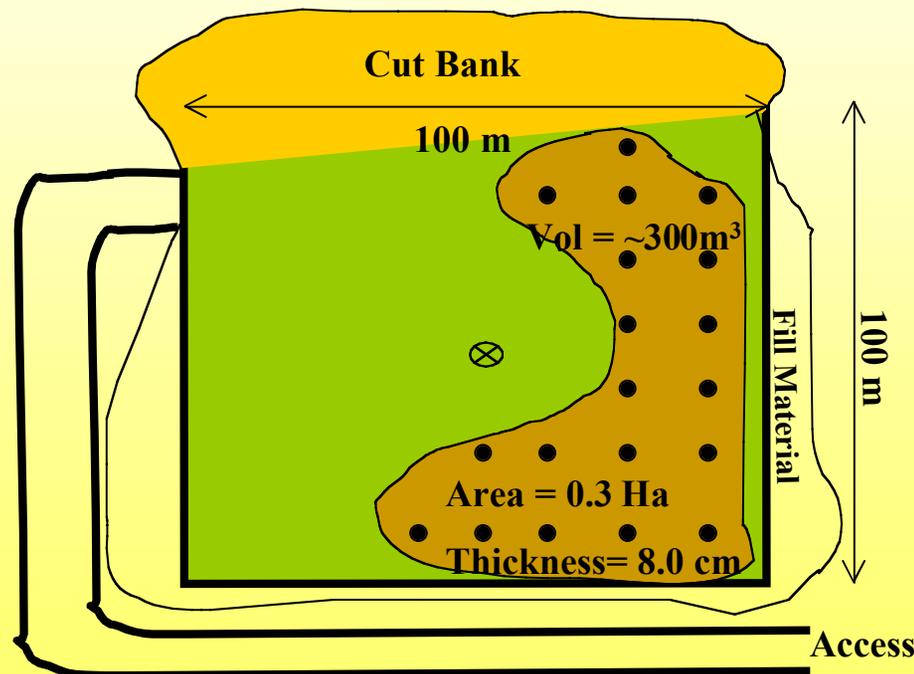


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Remediation

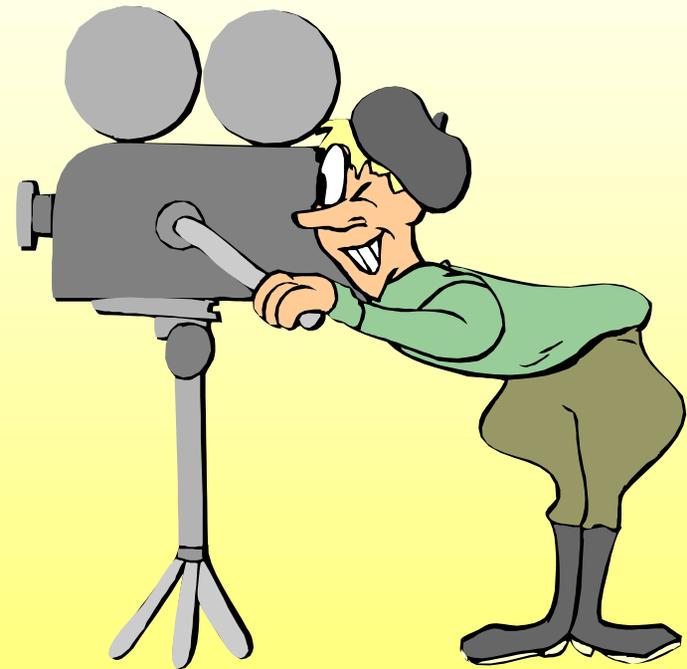
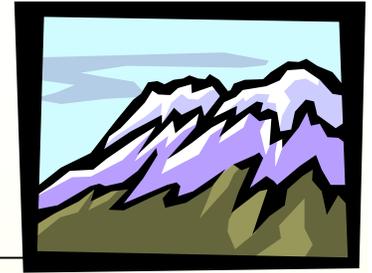


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Demonstration



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Remediation



- **Maintenance & Monitoring**



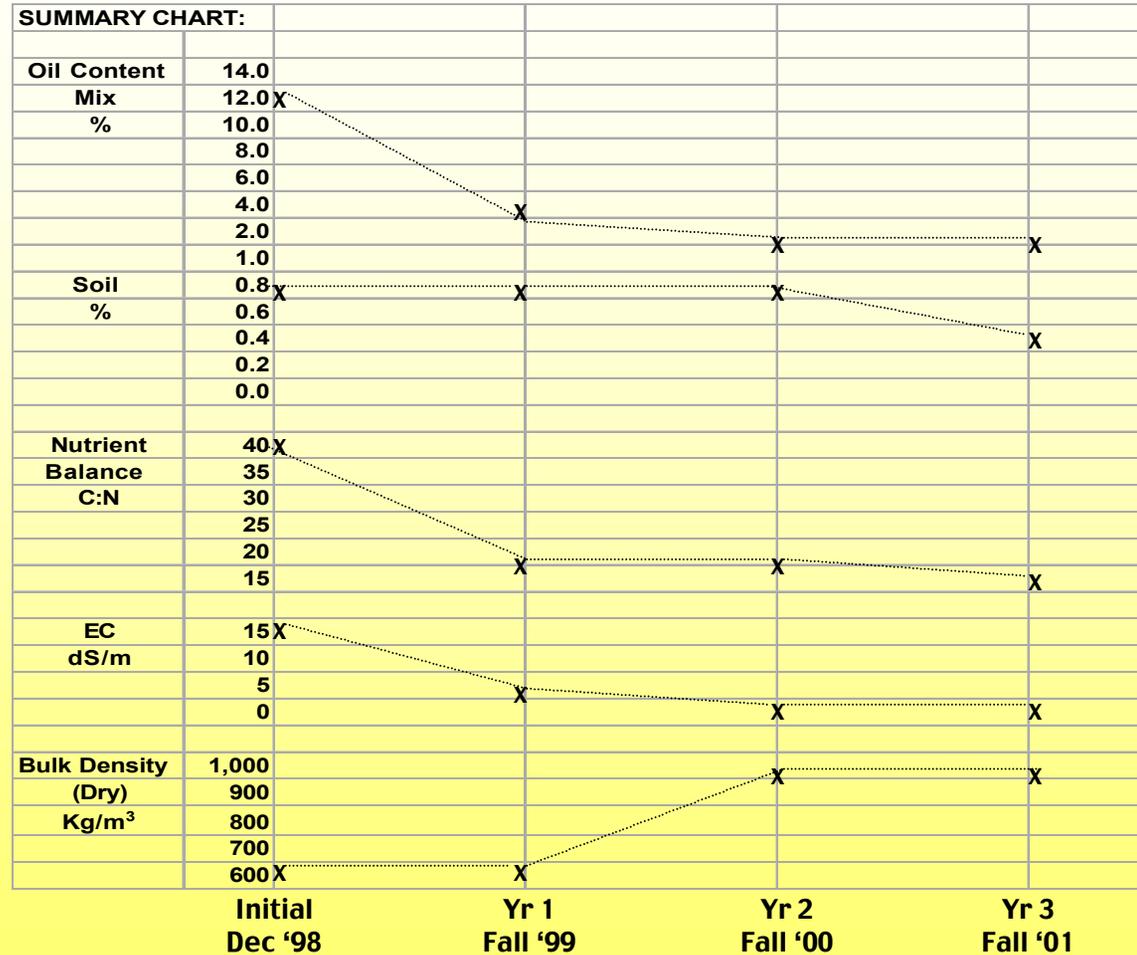
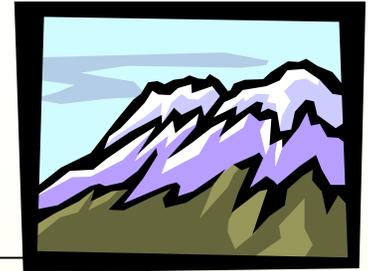
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Remediation

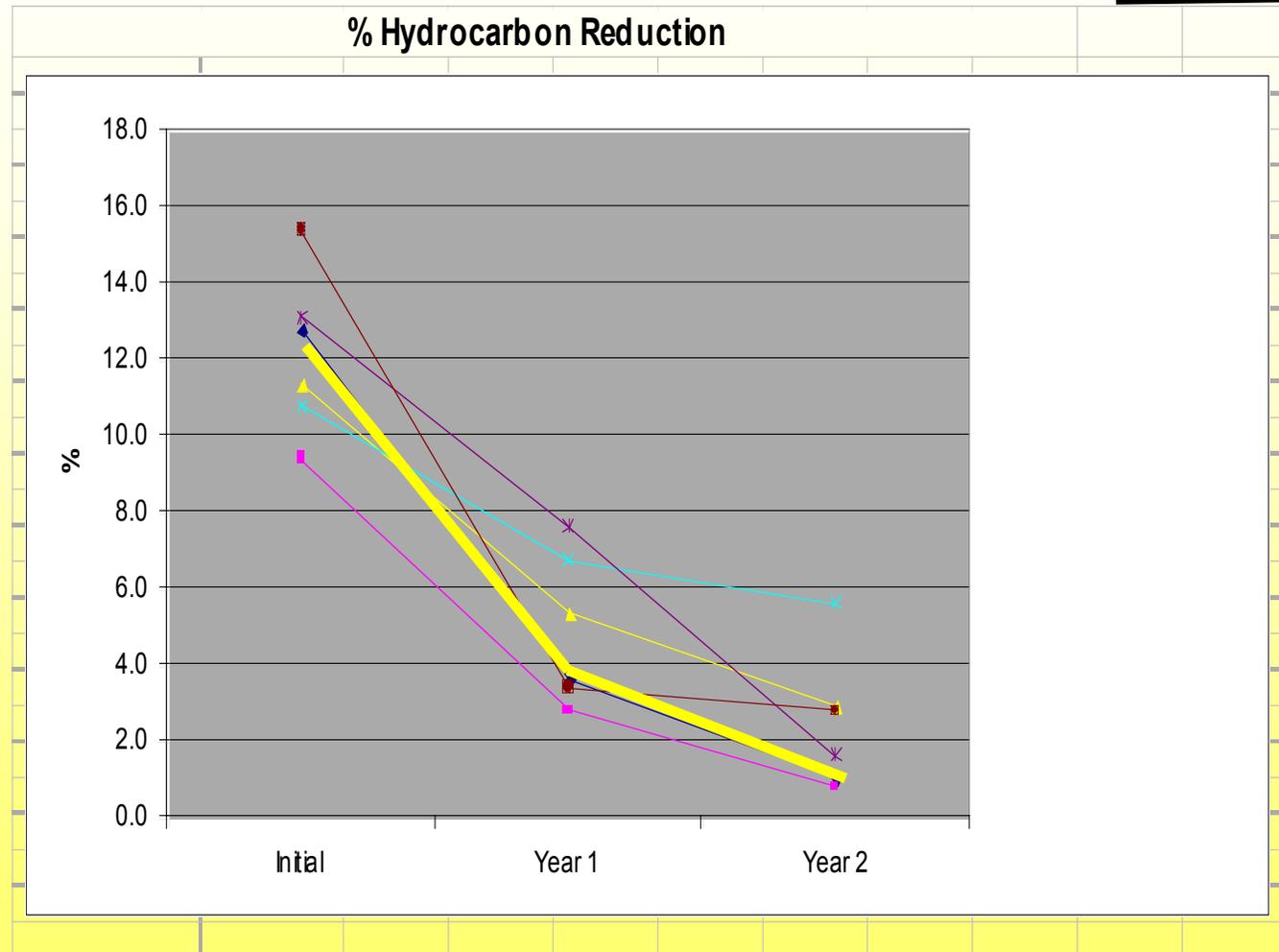
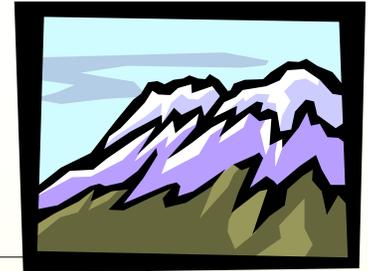


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Remediation

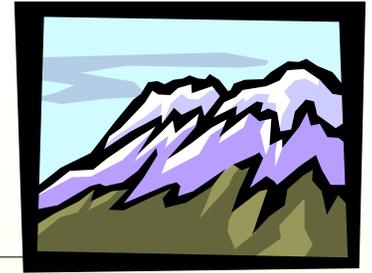


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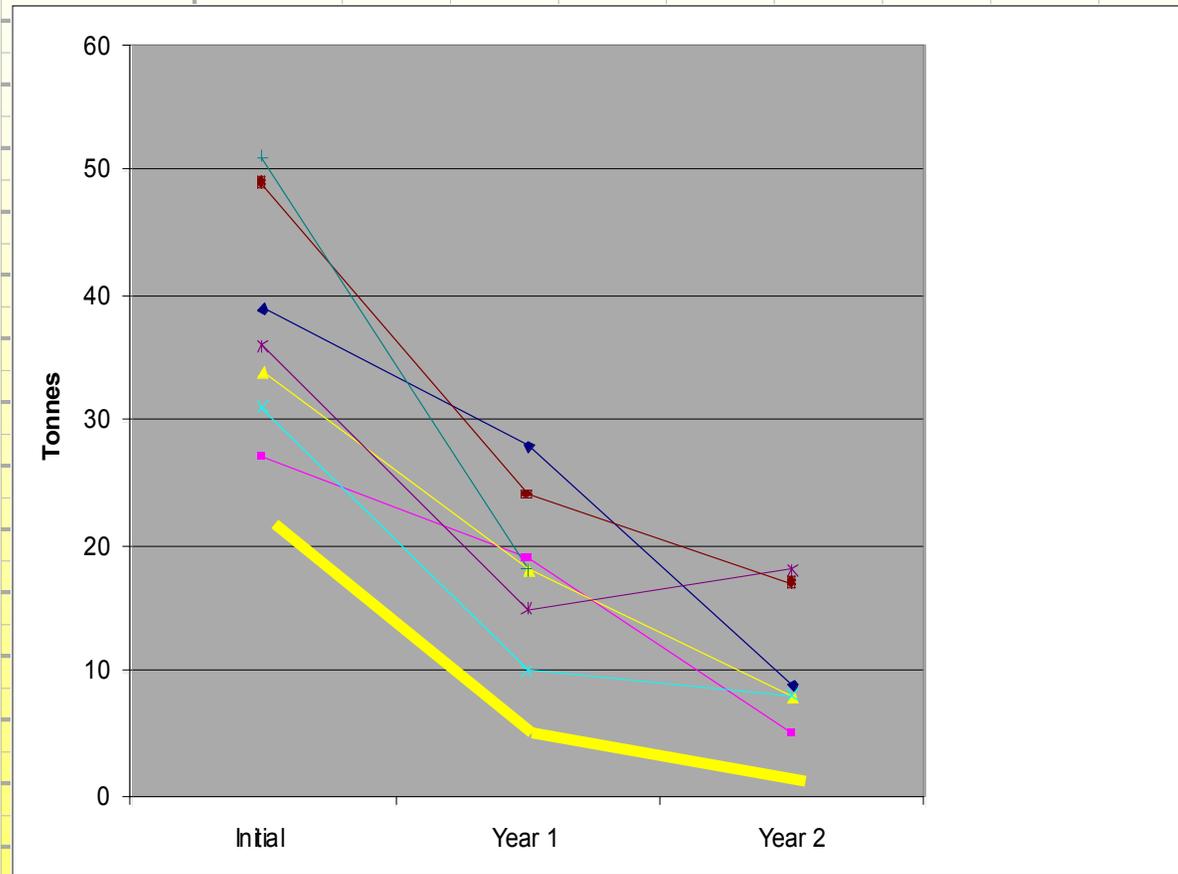
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Remediation



Hydrocarbon Tonnage Reduction



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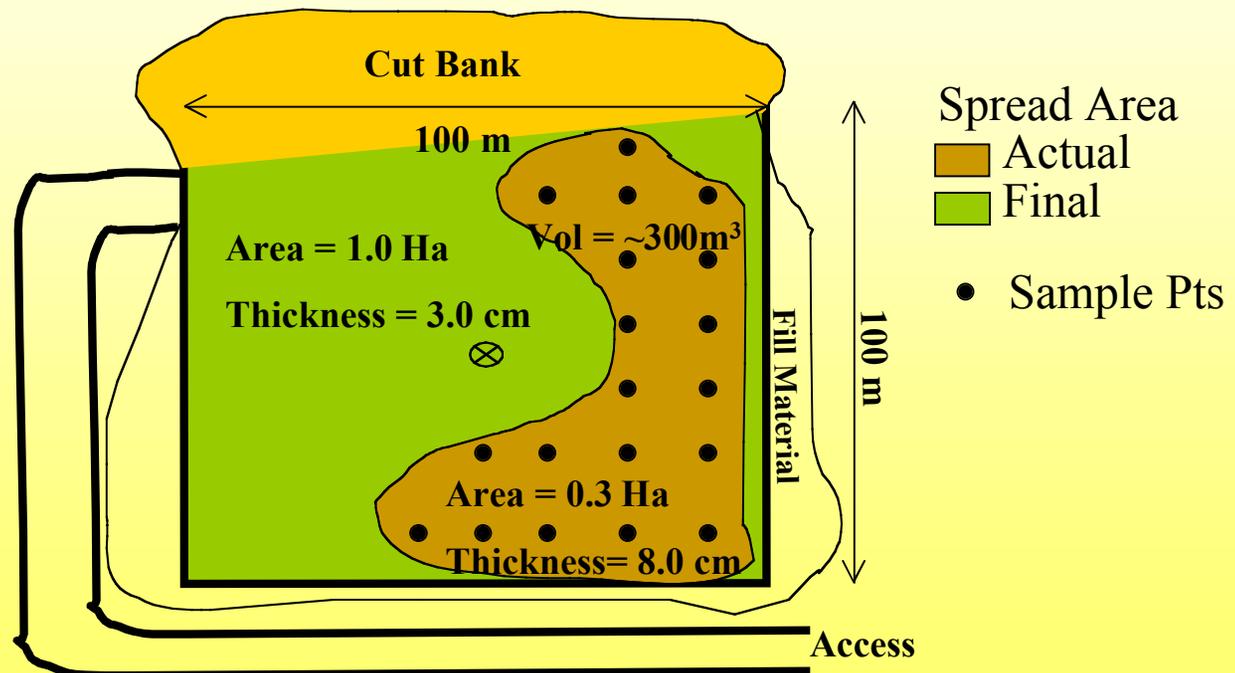
Remediation



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Test Mixing



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Closure



Summary		
	Soil & Mix	
Parameters	Results	Tier 1
Oil Content (ppm)		
Benzene	<0.02	0.05
Toluene	<0.02	0.10
Ethylbenzene	<0.02	0.50
Xylene	<0.02	1.00
F1 (C6-C10)	<1	260
F2 (C11-C16)	68	900
F3 (C17-C34)	814	800
F4 (C35+)	44	5,600
Metals (mg/Kg)		
Cadmium	0.3	1
Chromium	21	100
Copper	26	80
Lead	16	50
Nickel	34	40
Vanadium	25	100
Zinc	72	120
Salts		
pH	7.7	6-8.5
EC (dS/m)	0.5	<2
SAR	0.2	6
Nutrients		
C:N Ratio	14:1	25:1
Other		
Bulk Density (Kg/m ³)	1,450	N/A



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Closure

“presented data demonstrate that the biotreatment mixture (blend of OBM drill cuttings, canola meal and wood bulking) has degraded to the point where it is no longer a limiting factor to the reclamation of the site”

Alberta **GOVERNMENT OF ALBERTA** **PETROCANADA** **Husky Energy UNOTEC**

MEMORANDUM OF UNDERSTANDING

File No.: MSL 217311

Legal Location: 06-11-043-16W5M

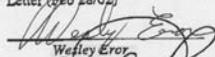
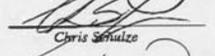
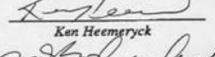
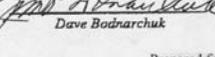
Contacts: Mr. Dave Bodnarchuk (Husky)
Mr. Ken Heemeryck (Husky)
Mr. Chris Schulze (Petro-Can)
Mr. Don Thompson (Petro-Can)
Mr. Ari Laurell (UNOTEC)

Approval(s):
Field and laboratory data presented in the Feb 28th letter *Re: Oil-Based Mud Waste Closure on Husky et al Cordel 6-11-43-16W5 (MSL No. 217311)* demonstrate that the biotreatment mixture (blend of OBM drill cuttings, canola meal and wood bulking) has degraded to the point where it is no longer a limiting factor to the reclamation of the site

As such, the following conditions requests are approved:
-Discontinue regular monitoring and maintenance of the land treatment area
-Re-spread the biotreatment over the entire lease area when equipment becomes available

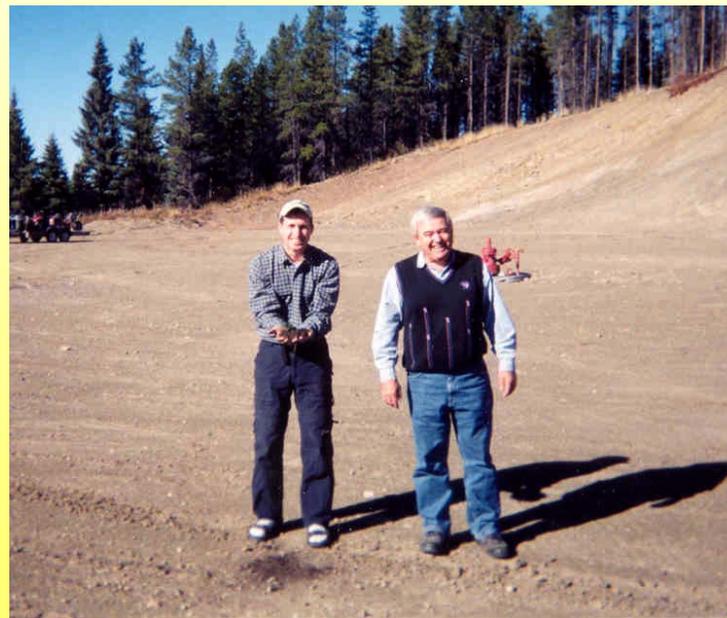
Condition(s):
Following re-spreading, a confirmatory sample must be collected
This sample will be a final composite consisting of biotreatment mixture and receiving soil
Sample must be analyzed according to closure criteria

Attachment(s):
Letter (Feb 28/02)

 Wesley Eror	April 9/2002 Date
 Don Thompson	4/03/02 Date
 Chris Schulze	03/28/02 Date
 Ken Heemeryck	04/02/02 Date
 Dave Bodnarchuk	April 3, 2002 Date

Prepared for Wes Eror, Regulatory Officer
Alberta Sustainable Resource Development (Formerly AEP)

Closure



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