

Wolverine Mine

2014 ANNUAL REPORT

LAND TREATMENT FACILITY

PERMIT 24-022

Prepared by: Yukon Zinc Corporation Vancouver, British Columbia March 31, 2015

1. Summary of soil volumes:

Status of soil	Volume of soil (m ³)
Total volume in the facility at the beginning of the reporting year	293
Added during the reporting year	2
Removed during the reporting year	0
Total volume in the facility at the end of the reporting year	295 ¹

Notes:

1. This volume covers ~50% of the total lined surface area in the LTF and acts as an effective boundary layer, which YZC currently has no intention of removing in 2015.

2. Summary of water volumes:

Status of water	Volume of water (m ³)
Total volume in the facility at the beginning of the reporting year	0
Added during the reporting year	0 ^{1.}
Removed during the reporting year	572
Applied to soil during the reporting year	0
Total volume in the facility at the end of the reporting year	0
Discrepancies (estimated loss due to evaporation/infiltration)	0 ^{2.}

Notes:

- 1. No water was added to the facility; however, due to the size of the facility, snow melts and rain water contributed to the cumulative volume.
- 2. There is no estimate of loss due to evaporation/infiltration. It is assumed that all precipitation accumulated in the collection sump, and was subsequently removed from the facility into the Tailings Storage Facility.

3. List of all soil and water that was present in the facility at any point during the reporting year:

3.1 Soil Volumes and Status:

The total volume of material in the LTF at the beginning of 2014 was 293 m³. No treated soil was removed in 2014. During 2014, approximately 2 m³ of contaminated soil and snow/ice was placed within the facility. At the end of 2014, the total volume of contaminated materials within the LTF was approximately 295 m³.

As indicated in Table 3.1, material that was suspected to be contaminated was deposited into the LTF in 2014 includes ~1.5 m³ of waste oil contaminated material and ~0.7 m³ of glycol contaminated soil. These deposits were placed in the appropriate labelled sections of the LTF, and levelled out to below the berm height of 0.5 m.

Table 3.1 Soil Present in the Facility at end of 2014 from 2008-20143

Year Accepted	Material Details	Volume (m³)	Date(s) of tillage / turning	Samples taken	Date removed from LTF
2008	2008 Site spills	1	None	None	N/A
2008	2008 Camp Generator pad excavation	10	None	None	N/A
2009	Fuel Truck Roll-over Spill	192	None	5 (initial samples taken during excavation of spill site)	N/A
2009	Packer Roll-over Spill	3	None	None	N/A
2009	Accumulation of small spills during 2009	7	None	None	N/A
2010	April 24: Soil from a spill	9	None	2 (initial samples taken during transfer of materials into the farm)	N/A
2010	Accumulation of small spills during 2010	9	None	None	N/A
2011	May 5: Soil from a spill	11	None	2	N/A
2011	Accumulation of small spills during 2011	3	None	5 (August 4 th - samples of various sites within the facility)	N/A
2012	June 5: soil contaminated with waste oil	13	None	1	N/A
2012	August 20: soil contaminated with Glycol	3	None	1	N/A
2013	January 18: snow and ice contaminated with oil	0.25	None	None	N/A
2013	March 3: soil contaminated with Glycol	0.05	None	None	N/A
2013	March 24: soil contaminated with oil	3	None	1	N/A
2013	April 24: soil contaminated with Glycol	1	None	1	N/A
2013	May 30: soil contaminated with	14	None	None ¹	N/A

Year Accepted	Material Details	Volume (m³)	Date(s) of tillage / turning	Samples taken	Date removed from LTF
	diesel				
2013	September 7: soil contaminated with oil	0.02	None	None	N/A
2013	October 25: soil contaminated with oil	2.3	None	None	N/A
2013	October 25: soil contaminated with diesel	0.5	None	None	N/A
2013	December 22: soil/snow contaminated with oil	1.5	None	None	N/A
2014	March 12: soil contaminated with glycol	0.4	None	None	N/A
2014	April 28: soil contaminated with oil	0.5	None	None	N/A
2014	July 8: soil contaminated with oil	1	None	1	N/A
2014	November 26: soil contaminated with glycol	0.3	None	1	N/A

1 A confirmatory sample was taken from the spill site, but characterization samples were not taken due to a technician error. Characterization samples were taken from contaminated material that was added to the LTF in 2014.

3.2 Runoff Water Volumes and Discharges:

Throughout the ice-free period in 2014 runoff from the facility accumulated in the lined sump located in the western corner of the facility. A vacuum truck was used to pump out the sump water periodically as required. Water was discharged into the tailings storage facility for storage and treatment prior to discharge to the environment. The total volume pumped from the collection sump in 2014 was estimated to be 572 m³.

4. Were any of the stockpiles listed in the table above found to meet or exceed special waste criteria?

Yes 🛛 No

5. Details on tillage/turning:

A 966 Loader was used to spread out the material in each designated section of the LTF to ensure the level of all material was below the berm. A Bobcat was also used to

spread the material out where the material was thinner, as a precaution to avoid tearing the liner.

6. Were any nutrients added during the reporting year?

Yes 🖂 N	ю
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Documents attached 🗌 Yes 🖾 No

7. Figure attached showing the entire facility and the location of contaminated material from each source:

See Attachment 7.1.

8. Laboratory reports for samples taken to characterize any soil or water accepted for treatment during the reporting year:

A sample was taken to characterize the 1 m^3 of contaminated material from the oil spill that occurred on July 8th, 2014. A sample was also taken to characterize the 0.3 m³ of contaminated material from the glycol spill that occurred on November 26th, 2014. The analytical results are provided in Attachment 8.1.

9. Laboratory reports for any interim or confirmatory samples taken to remediation progress during the reporting year:

No interim samples were taken in 2014.

10. Laboratory reports for samples taken to characterize runoff from the facility during the reporting year:

No samples were taken to characterize the runoff from the facility in 2014.

11. Results of any pH analyses

The results of pH analyses for the soil samples are contained within laboratory results provided in Attachment 8.1.

12. Groundwater elevations

There are no groundwater wells at the facility.

13. Groundwater analyses

See Section 12.

14. Other attachments

None

15. Sampling, monitoring, and work plan for the entire facility for the current calendar year:

Sampling, monitoring and operation of the facility were conducted as per Yukon Zinc's Land Treatment Facility Operation and Monitoring Manual as provided in Attachment 15.1.

Operations were conducted to ensure compliance with the Permit, and to encourage remediation of any accepted hydrocarbon contaminated material which included, but was not limited to:

- Visual monitoring every two weeks, using the monitoring form provided in YZCs Operating and Monitoring Manual. Monitoring was conducted more frequently during periods of snow melt and heavy rain.
- Clear signage at the entrance to the facility as well as signage to indicate the separate sections of the facility (i.e., diesel, oil, gas, and glycol)
- A spill kit placed at the entrance to the facility
- The annual report for 2015 will be submitted no later than March 31st, 2016.
- 16. Any other pertinent information regarding activities undertaken at the facility during the reporting year:

N/A

I, Robin McCall, am the authorized representative of the permittee named above, and I certify that the information provided with this form is correct and complete to the best of my knowledge.

Robin McCall NAME

Environmental Superintendent TITLE

SIGNATURE

March 22, 2015

17. Attachment 7.1: Figure showing the entire facility and the location of contaminated material deposited



18. Attachment 8.1: Soil sample laboratory results

Maxxam

Your P.O. #: 108376 Your C.O.C. #: 08394726

Attention:Robin McCall

YUKON ZINC CORPORATION PO Box 57 Whitehorse, YT CANADA Y1A 5X9

> Report Date: 2014/07/29 Report #: R1612074 Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B458745 Received: 2014/07/11, 09:40

Sample Matrix: Soil # Samples Received: 1

		Date	Date		
Analyses	Quantity	Extracted	Analyzed	Laboratory Method	Analytical Method
ABN Compounds in Soil by GC/MS	1	2014/07/22	2014/07/25	BBY8SOP-00023	EPA SW846 3540C
BTEX/MTBE Soil LH, VH, F1 SIM/MS	1	2014/07/13	2014/07/15	BBY8-SOP-00010	EPA SW846 8260C
Moisture	1	N/A	2014/07/14	BBY8SOP-00017	Ont MOE -E 3139
pH (2:1 DI Water Extract)	1	2014/07/15	2014/07/15	BBY6SOP-00028	BC Env Lab Manual
BC Hydrocarbons in Soil by GC/FID	1	2014/07/13	2014/07/16	BBY8SOP-00029	BC Env Lab Manual
Volatile HC-BTEX	1	N/A	2014/07/15	BBY WI-00033	BC MOE Lab Method

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager. Graham Rudkin, Project Manager, Environmental Email: GRudkin@maxxam.ca Phone# (604)638-5926 Ext:5926

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Maxxam ID		KB5158	
Sampling Date		2014/07/08 12:45	
COC Number		08394726	
	Units	KM26.2- HYDRAULIC OIL	QC Batch
Physical Properties			

RESULTS OF CHEMICAL ANALYSES OF SOIL



PHYSICAL TESTING (SOIL)

Maxxam ID		KB5158				
Sampling Date		2014/07/08 12:45				
COC Number		08394726				
	Units	KM26.2- HYDRAULIC OIL	RDL	QC Batch		
Physical Properties						
Physical Properties						
Physical Properties Moisture	%	5.1	0.30	7561502		



SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		KB5158				
Sampling Date		2014/07/08				
COO Number		12:45	+			
COC Number		08394726	+			
	Units	COLL	RDL	QC Batch		
SEMI-VOLATILE ORGANICS						
Phenol	mg/kg	<0.30 (1)	0.30	7574271		
2-chlorophenol	mg/kg	<0.40 (1)	0.40	7574271		
1,3-dichlorobenzene	mg/kg	<0.50 (1)	0.50	7574271		
1,4-dichlorobenzene	mg/kg	<0.50 (1)	0.50	7574271		
1,2-dichlorobenzene	mg/kg	<0.50 (1)	0.50	7574271		
2-methylphenol	mg/kg	<0.25 (1)	0.25	7574271		
Hexachloroethane	mg/kg	<0.30 (1)	0.30	7574271		
m,p-Cresol	mg/kg	<0.25 (1)	0.25	7574271		
Nitrobenzene	mg/kg	<0.35 (1)	0.35	7574271		
2-nitrophenol	mg/kg	<0.25 (1)	0.25	7574271		
2,4-dimethylphenol	mg/kg	<0.25 (1)	0.25	7574271		
2,4 + 2,5-Dichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
1,2,4-trichlorobenzene	mg/kg	<0.30 (1)	0.30	7574271		
2,6-dichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
Hexachlorobutadiene	mg/kg	<0.25 (1)	0.25	7574271		
4-chloro-3-methylphenol	mg/kg	<0.35 (1)	0.35	7574271		
Hexachlorocyclopentadiene	mg/kg	<1.0 (1)	1.0	7574271		
2,4,5-trichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
2,4,6-trichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
2,3,5-trichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
2,3,4-trichlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
Dimethyl phthalate	mg/kg	<0.35 (1)	0.35	7574271		
2,6-dinitrotoluene	mg/kg	<0.25 (1)	0.25	7574271		
2,4-dinitrophenol	mg/kg	<2.5 (1)	2.5	7574271		
2,3,4,6-tetrachlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
2,3,4,5-tetrachlorophenol	mg/kg	<0.35 (1)	0.35	7574271		
4-nitrophenol	mg/kg	<0.25 (1)	0.25	7574271		
Diethyl phthalate	mg/kg	<0.45 (1)	0.45	7574271		
2,4-dinitrotoluene	mg/kg	<0.25 (1)	0.25	7574271		
4,6-dinitro-2-methylphenol	mg/kg	<2.5 (1)	2.5	7574271		
Hexachlorobenzene	mg/kg	<0.30 (1)	0.30	7574271		
Pentachlorophenol	mg/kg	<0.10 (1)	0.10	7574271		
Di-n-butyl phthalate	mg/kg	<0.35 (1)	0.35	7574271		
RDL = Reportable Detection Lir	nit					
(1) Detection limits raised due	to dilution	as a result of sample mat	rix inte	eference.		
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SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		KB5158		
Sampling Date		2014/07/08	Ţ	
Samping Date		12:45		
COC Number		08394726		
	Units	KM26.2- HYDRAULIC OIL	RDL	QC Batch
Butyl benzyl phthalate	mg/kg	<0.50 (1)	0.50	7574271
Bis(2-ethylhexyl)phthalate	mg/kg	<50 (1)	50	7574271
Di-n-octyl phthalate	mg/kg	<0.50 (1)	0.50	7574271
Isophorone	mg/kg	<0.30 (1)	0.30	7574271
Naphthalene	mg/kg	<0.35 (1)	0.35	7574271
1-Methylnaphthalene	mg/kg	<0.15 (1)	0.15	7574271
2-Methylnaphthalene	mg/kg	<0.15 (1)	0.15	7574271
2-chloronaphthalene	mg/kg	<0.40 (1)	0.40	7574271
Acenaphthylene	mg/kg	<0.45 (1)	0.45	7574271
Acenaphthene	mg/kg	<0.45 (1)	0.45	7574271
Dibenzofuran	mg/kg	<0.50 (1)	0.50	7574271
Fluorene	mg/kg	<0.45 (1)	0.45	7574271
Phenanthrene	mg/kg	<0.40 (1)	0.40	7574271
Anthracene	mg/kg	<0.40 (1)	0.40	7574271
Fluoranthene	mg/kg	<0.40 (1)	0.40	7574271
Pyrene	mg/kg	<0.40 (1)	0.40	7574271
3,3'-Dichlorobenzidine	mg/kg	<2.5 (1)	2.5	7574271
Benzo(a)anthracene	mg/kg	<0.35 (1)	0.35	7574271
Chrysene	mg/kg	<0.45 (1)	0.45	7574271
Benzo(b&j)fluoranthene	mg/kg	<0.35 (1)	0.35	7574271
Benzo(k)fluoranthene	mg/kg	<0.35 (1)	0.35	7574271
Benzo(a)pyrene	mg/kg	<0.35 (1)	0.35	7574271
Perylene	mg/kg	<0.35 (1)	0.35	7574271
Indeno(1,2,3-cd)pyrene	mg/kg	<0.35 (1)	0.35	7574271
Dibenz(a,h)anthracene	mg/kg	<0.40 (1)	0.40	7574271
Benzo(g,h,i)perylene	mg/kg	<0.40 (1)	0.40	7574271
Bis(2-chloroethyl)ether	mg/kg	<0.30 (1)	0.30	7574271
Bis(2-chloroisopropyl)ether	mg/kg	<1.0 (1)	1.0	7574271
N-nitroso-di-n-propylamine	mg/kg	<0.30 (1)	0.30	7574271
Bis(2-chloroethoxy)methane	mg/kg	<0.40 (1)	0.40	7574271
4-chlorophenyl phenyl ether	mg/kg	<0.35 (1)	0.35	7574271
N-nitrosodiphenylamine	mg/kg	<0.40 (1)	0.40	7574271
4-bromophenyl phenyl ether	mg/kg	<0.30 (1)	0.30	7574271
RDL = Reportable Detection Lim	nit		·	
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SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		KB5158				
Sampling Date		2014/07/08 12:45				
COC Number		08394726				
	Units	KM26.2- HYDRAULIC OIL	RDL	QC Batch		
Surrogate Recovery (%)						
2,4,6-TRIBROMOPHENOL (sur.)	%	105		7574271		
2-FLUOROBIPHENYL (sur.)	%	115		7574271		
D5-NITROBENZENE (sur.)	%	108		7574271		
D5-PHENOL (sur.)	%	83		7574271		
TERPHENYL-D14 (sur.)	%	121		7574271		
RDL = Reportable Detection Limi	t					



TOTAL PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		KB5158				
Sampling Data		2014/07/08				
Sampling Date		12:45				
COC Number		08394726				
	Unite	KM26.2- HYDRAULIC	וחפ	OC Batch		
	Units	OIL	NDL	QC Batch		
Hydrocarbons						
EPH (C10-C19)	mg/kg	358	100	7563469		
EPH (C19-C32)	mg/kg	18600	100	7563469		
Surrogate Recovery (%)						
O-TERPHENYL (sur.)	%	84		7563469		
RDL = Reportable Detection Limit						



BCCSR BTEX/VPH BY HS IN SOIL (SOIL)

Maxxam ID		KB5158		
Sampling Date		2014/07/08 12:45		
COC Number		08394726		
	Units	KM26.2- HYDRAULIC OIL	RDL	QC Batch
Volatiles		_		
VPH (VH6 to 10 - BTEX)	mg/kg	<10	10	7560982
Methyl-tert-butylether (MTBE)	mg/kg	<0.10	0.10	7563712
Benzene	mg/kg	<0.0050	0.0050	7563712
Toluene	mg/kg	0.023	0.020	7563712
Ethylbenzene	mg/kg	<0.010	0.010	7563712
m & p-Xylene	mg/kg	<0.040	0.040	7563712
o-Xylene	mg/kg	<0.040	0.040	7563712
Styrene	mg/kg	<0.030	0.030	7563712
Xylenes (Total)	mg/kg	<0.040	0.040	7563712
VH C6-C10	mg/kg	<10	10	7563712
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	105		7563712
4-Bromofluorobenzene (sur.)	%	93		7563712
D10-ETHYLBENZENE (sur.)	%	78		7563712
D4-1,2-Dichloroethane (sur.)	%	105		7563712
RDL = Reportable Detection Limit	it			



Success Through Science®

YUKON ZINC CORPORATION Your P.O. #: 108376 Sampler Initials: AK

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1 5.3°C

Results relate only to the items tested.



Report Date: 2014/07/29

YUKON ZINC CORPORATION Your P.O. #: 108376 Sampler Initials: AK

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

prely T

Andy Lu, Data Validation Coordinator

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M	a	Xam	
		Analytics Inc	

2

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 Fax.:
 (604) 444-4511

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 Toll-Free:
 1-800-440-4808

CHAIN-OF CUSTODY RECORD AND ANALYSIS REQUEST

PAGE _1_OF_1_

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KM26.2 - Hydraulic Oil		(LAB USE ONLY)			08/07/2014	12:45	1.4	m V	m X	W X	-		-	-	-	+-	-	1	11.14	1.	-	-	+
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TAT (Turnaround Time) LESS THAN 5 DAY TAT MUST HAVE PRIOR APPROVAL	PO NUMBER OR QUOTE NUMBER: 108376	SPECIAL DETECTION	LIMITS 7	CONTA	MINANT TYPE:				CCM CSR AB T DTH	E IER 1 ER	AF	RIVAL MPERA	TURE	- "C:	DU	LAE IE DA	TE:	ONE	Y	LOG	IN CH	ECK:	311 <u>0</u>
* Some exceptions apply - please contact laboratory DARD 5 BUSINESS DAYS X	ACCOUNTING CONTACT:	SPECIAL REPORTING	OR BILLI	ING INS	TRUCTIONS:			# JA	RS U	SED:		5,5	,6										
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CUSTODY	RELINQUINSHED BY:	DATE: DD/MM/YY		ii.	TIME:			REC	EIVE	DBYI	ABOR	ATORY:											

BC Hydrocarbons in Soil by GC/FID Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



Your P.O. #: 108376 Your C.O.C. #: 08399484

Attention:Robin McCall

YUKON ZINC CORPORATION PO Box 57 Whitehorse, YT CANADA Y1A 5X9

> Report Date: 2014/12/09 Report #: R1701855 Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B4B0590 Received: 2014/12/05, 10:10

Sample Matrix: Soil # Samples Received: 1

		Date	Date		
Analyses	Quantity	Extracted	Analyzed	Laboratory Method	Analytical Method
Glycols in Soil	1	2014/12/05	2014/12/08	BBY5SOP-00001	EPA 8015c R3 m
Elements by ICPMS (total)	1	2014/12/08	2014/12/09	BBY7SOP-00001	EPA 6020a R1 m
Moisture	1	N/A	2014/12/08	BBY8SOP-00017	OMOE E3139 3.1 m
pH (2:1 DI Water Extract)	1	2014/12/08	2014/12/08	BBY6SOP-00028	BCMOE BCLM Mar2005 m

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager. Graham Rudkin, Project Manager, Environmental Email: GRudkin@maxxam.ca Phone# (604)638-5926 Ext:5926

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YUKON ZINC CORPORATION Your P.O. #: 108376

GLYCOLS BY GC-FID (SOIL)

Maxxam ID		LH7563		
Sampling Date		2014/12/02		
		10:45		
COC Number		08399484		
	Units	BP-GLYCOL CO NFIRMATORY	RDL	QC Batch
Glycols				
Extractable (Water) Ethylene Glycol	mg/kg	<10	10	7744829
Extractable (Water) Diethylene Glycol	mg/kg	<10	10	7744829
Extractable (Water) Triethylene Glycol	mg/kg	<10	10	7744829
Extractable (Water) Tetraethylene Glycol	mg/kg	<10	10	7744829
Extractable (Water) Propylene Glycol	mg/kg	<10	10	7744829
Surrogate Recovery (%)			•	
Extractable (Water) SULFOLANE (sur.)	%	60		7744829
RDL = Reportable Detection Limit				



Report Date: 2014/12/09

YUKON ZINC CORPORATION Your P.O. #: 108376

PHYSICAL TESTING (SOIL)

Maxxam ID		LH7563							
Sampling Date		2014/12/02 10:45							
COC Number		08399484							
	Units	BP-GLYCOL CO NFIRMATORY	RDL	QC Batch					
Physical Properties									
Moisture	%	4.7	0.30	7745014					
RDL = Reportable Detection Limit									



Report Date: 2014/12/09

YUKON ZINC CORPORATION Your P.O. #: 108376

CSR/CCME METALS IN SOIL (SOIL)

Maxxam ID		LH7563		
Sampling Date		2014/12/02		
· · · · · · · · · · · · · · · · · · ·		10:45		
COC Number		08399484		
	Units	BP-GLYCOL CO NFIRMATORY	RDL	QC Batch
Physical Properties				
Soluble (2:1) pH	рН	8.46	N/A	7746863
Total Metals by ICPMS			_	
Total Aluminum (Al)	mg/kg	8270	100	7746860
Total Antimony (Sb)	mg/kg	2.00	0.10	7746860
Total Arsenic (As)	mg/kg	15.6	0.50	7746860
Total Barium (Ba)	mg/kg	149	0.10	7746860
Total Beryllium (Be)	mg/kg	<0.40	0.40	7746860
Total Bismuth (Bi)	mg/kg	0.11	0.10	7746860
Total Cadmium (Cd)	mg/kg	0.805	0.050	7746860
Total Calcium (Ca)	mg/kg	8940	100	7746860
Total Chromium (Cr)	mg/kg	98.2	1.0	7746860
Total Cobalt (Co)	mg/kg	12.9	0.30	7746860
Total Copper (Cu)	mg/kg	40.8	0.50	7746860
Total Iron (Fe)	mg/kg	23600	100	7746860
Total Lead (Pb)	mg/kg	12.0	0.10	7746860
Total Magnesium (Mg)	mg/kg	13100	100	7746860
Total Manganese (Mn)	mg/kg	553	0.20	7746860
Total Mercury (Hg)	mg/kg	0.135	0.050	7746860
Total Molybdenum (Mo)	mg/kg	2.56	0.10	7746860
Total Nickel (Ni)	mg/kg	101	0.80	7746860
Total Phosphorus (P)	mg/kg	491	10	7746860
Total Potassium (K)	mg/kg	510	100	7746860
Total Selenium (Se)	mg/kg	1.36	0.50	7746860
Total Silver (Ag)	mg/kg	0.233	0.050	7746860
Total Sodium (Na)	mg/kg	<100	100	7746860
Total Strontium (Sr)	mg/kg	35.8	0.10	7746860
Total Thallium (Tl)	mg/kg	0.100	0.050	7746860
Total Tin (Sn)	mg/kg	0.19	0.10	7746860
Total Titanium (Ti)	mg/kg	385	1.0	7746860
Total Vanadium (V)	mg/kg	31.4	2.0	7746860
Total Zinc (Zn)	mg/kg	96.3	1.0	7746860
Total Zirconium (Zr)	mg/kg	6.41	0.50	7746860
RDL = Reportable Detection L	imit			
N/A = Not Applicable				



Maxxam Job #: B4B0590 Report Date: 2014/12/09 Success Through Science®

YUKON ZINC CORPORATION Your P.O. #: 108376

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1 2.0°C

Results relate only to the items tested.



Maxxam Job #: B4B0590 Report Date: 2014/12/09 Success Through Science®

YUKON ZINC CORPORATION Your P.O. #: 108376

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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19. Attachment 15.1: Land Treatment Facility Operation and Monitoring Manual (March 2014)



Wolverine Mine

LAND TREATMENT FACILITY

PERMIT NO. 4202-24-022

OPERATION AND MONITORING MANUAL

Prepared by: Yukon Zinc Corporation Vancouver, British Columbia

March 16, 2014

Table of Contents

Table	of Contents	. i
List of	Tables	. i
List of	Appendices	. i
1	Introduction	.1
2	Operation	.1
2.1	Incoming Material	.1
2.2	Operation Activities	.1
3	Monitoring	.2
3.1	Soil	.2
3.2	Water	.2

List of Tables

Table 3-1	Water Quality	Analytical	Requirements)
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List of Appendices

Appendix A	LTF Details and Monitoring Checklist
Appendix B	Protocol 11: Sampling Procedures for Land Treatment Facilities

1 Introduction

This manual presents operation and monitoring information pertaining to the Yukon Zinc (YZC) Wolverine Project Land Treatment Facility (LTF) as per permit no. 4202-24-022 (Appendix A). The LTF consists of two hydrocarbon contaminated soil treatment cells (Appendix A):

Cell 1: Built in September 2007, a 50 m by 55 m cell with approximate capacity of 328 m³; and

Cell 2: An extension to the 50 m x 55 m cell of 35 m which would increase the cell capacity by 264 m³.

This manual, along with the permit, will be read and followed by all personnel associated with the operation of the facility, including employees, contractors or volunteers. All associated personnel have been trained in handling, management and water/soil sampling techniques of any contaminated material covered in this permit. This training was (and any future training will be) overseen by Lorax Environmental Services. This manual may be updated as needed to fulfill the requirements of the permit.

2 **Operation**

2.1 Incoming Material

The cells will be used to remediate hydrocarbon-contaminated material that is generated by activities conducted at the Wolverine Mine. Material contaminated by other sources will be stored on-site as per YZC's Waste Management Permit #81-014. Material will be tested prior to deposition in the LTF to ensure that the hydrocarbon content is below 30,000 ppm. If the material has a hydrocarbon greater than 30,000 ppm, it is designated as a special waste, and a special waste permit will be applied for from the Yukon Government Environmental Programs Branch.

As material from different sources is placed in the cell, its approximate location will be recorded for future sampling campaigns. All records will be kept on-site by the on-site Environmental Superintendent.

2.2 **Operation Activities**

Sign are posted at the facility to identify that the facility contains contaminated material and that spill kits are readily available.

As the Wolverine Mine is a restricted access site, with no access by the public, no unauthorized persons will have access to the site.

Activity will be minimal at the LTF during the winter months of November through March (or during times when the material is snow covered). Once the melt occurs, the cells and water collection sump will be monitored to ensure that water levels remain below the bermed sides. If the water is approaching the top of the berm it will be pumped out using a Vacuum Truck and transported to the Tailings Storage Facility. The volume pumped will be recorded and communicated to the Yukon Government. The water collection sump will be monitored as per the monitoring program described in Section 3.

From April to October the height of the material within the cells will either be kept at less than 0.5 m (i.e., below the berm) and will be tilled as required. The material in Cell 2/3 originates from various sources, and as such will be kept in distinct areas, and when tilled inadvertent mixing of piles will be avoided. As long as the material is > 0.30 m, machinery can drive on the material to distribute and till material within the cell.

All sampling taken from the LTF will follow *Protocol No 5: Petroleum Hydrocarbon Analytical Methods and Standards*. If such sampling passes the lowest contamination threshold, analytical results will be provided to the Branch and, once approval is given, it will be used within the mine site industrial area for fill or reclamation activities.

The pH of the contaminated material will be kept between 6.5 and 8.5. pH will be measured by paste pH using a distilled water mixture, measured by on-site pH meters and confirmed with analytical results as detailed below.

3 Monitoring

3.1 Soil

The LTF will be monitored at least every two weeks from April 1st to October 31st and more often during inclement weather. The on-site Environmental Technician will fill out the checklist provided in Appendix A each monitoring period, and copies of the completed checklists will be kept for a minimum of three years.

As the Wolverine Lake area is characterized by long, cold winters and very wet summers, the bioremediation of the soils stored at the LTF is expected to be slow. After initial characterization, interim sampling will be conducted. Analytical results will be kept on-site and for a minimum of three years.

Sampling will be conducted as the Yukon Protocol for the Contaminated Sites Regulation under the Environment Act: Protocol No. 11: Sampling Procedures for Land Treatment Facilities, provided in Appendix B.

3.2 Water

Water in the collection sump will be transported to the Tailings Storage Facility using a Vacuum Truck. Volumes taken from the LTF will be recorded, and submitted to the Branch yearly in the Annual Report. If water accidentally discharges from the LTF collection sump, a water quality sample will be taken and submitted to the Branch in a report describing the Unauthorized Discharge.

Samples are analyzed at Maxxam Analytics as per the following analytical requirements:

 Table 3-1 Water Quality Analytical Requirements

Volume required	Analysis
1 x 250 mL plastic bottle	Total Metals
1 x 250 mL plastic bottle	Dissolved Metals
1 x 1 L plastic bottle	Nutrients/Physical Parameters
3 x 40 mL vials	BTEX/VPH
1 x 500 mL amber glass bottle	
2 x 250 mL amber glass bottle	LEPH/HEPH

Appendix A

Permits, Drawings and Monitoring Checklist

Date: Environmental Tec Time: Weather Condition	chnicia ns:	n:	
Time: Weather Condition Signs posted Spill kit in place Berms in good condition	15:		
 Signs posted Spill kit in place Berms in good condition 			
Spill kit in placeBerms in good condition			
Berms in good condition			
\Box Pile height <0.5 m			
□ Seepage check			
□ Water level below upper liner limit			
Water moved to empty fuel drums:		Yes	
		No	
How many drums were filled:			
Tilling occurred: Yes Date:			
□ No			
Separation between piles maintained			
Samples taken: Yes			
Comments/Actions Required:			

Appendix B

Protocol 11: Sampling Procedures for Land Treatment Facilities



PROTOCOL FOR THE CONTAMINATED SITES REGULATION UNDER THE ENVIRONMENT ACT

PROTOCOL NO. 11: Sampling Procedures for Land Treatment Facilities

Prepared pursuant to Part 6 – Administration, Section 21, Contaminated Sites Regulation, OIC 2002/171

SAMPLING PROCEDURES FOR LAND TREATMENT FACILITIES

1.0 Introduction

Land treatment facilities are used to remediate soil contaminated with petroleum hydrocarbons. When soil is removed from a land treatment facility, it must be clean enough to be used as fill or cover at other sites. Some contaminants cannot be remediated in a land treatment facility, and not all contaminants remediate at the same rate. For these reasons, it is important to correctly characterize the contaminants in the soil when it is placed in the facility, to monitor the progress of its remediation, and to ensure that remediation was successful before the soil is removed.

Section 21(1) of the *Contaminated Sites Regulation*, OIC 2002/171 authorizes the Minister to approve or adopt protocols for sampling soil, sediment, water, snow and other environmental media. In accordance with Section 21(1), this protocol has been designed to ensure that standardized and consistent approaches to sampling procedures are used when sampling soil at land treatment facilities.

2.0 Initial Characterization

If available site assessment data is not sufficient to characterize contaminated material destined for a land treatment facility at a rate of one sample for every 50 m³ of material, the material should be sampled as it is excavated to meet that sample density. If field testing results or knowledge of site characteristics or spill conditions suggest that the material may be special waste, the required sample density is one sample for every 10 m³ of material. If any of the material is confirmed to be special waste, the land treatment facility receiving the material must hold a special waste permit, or the material must be removed from the facility according to the requirements of the land treatment facility permit.

3.0 Interim Sampling

After contaminated material has been sampled, excavated, and placed in a land treatment facility, there may be a need to analyze samples of the soil to help gauge the rate of soil remediation. <u>Provided that this interim sampling and analysis is not required by a permit or other legal obligation</u>, any sample density may be used, keeping in mind that a greater number of samples will allow for greater confidence in the accuracy of the results.

Interim sampling is to be used only to estimate the rate of remediation; it may not be sufficiently rigorous to be considered confirmatory sampling as described below. In the event that interim sampling conducted at a sample density lower than that normally required to demonstrate regulatory compliance shows that the soil has been sufficiently remediated to meet the criteria specified in *Schedules 1 and 2* of Yukon's *Contaminated Sites Regulation* (CSR), the proponent must still conduct proper confirmatory sampling as described below in order to demonstrate compliance with the CSR.

In most cases where soil has been transferred to a land treatment facility, prior analytical testing will have been completed to determine the initial or interim level of contamination in the soil. This information can be used, in conjunction with knowledge of the remediation activities being carried out at the facility (tillage, nutrient/water addition, etc.), and of the climate conditions during the period of remediation, to predict the approximate duration of treatment that will be

necessary to reduce the contaminant levels to meet the criteria specified in Schedules 1 and 2 of the CSR.

4.0 Confirmatory Sampling for Soil Removal

If previous analytical results, duration and type of remediation activities, and site conditions indicate that a given stockpile has likely remediated sufficiently so that the soil will meet the standards applicable to the proposed receiving site as specified in the CSR, and provided that the soil has been tilled or turned at least once since the time it arrived at the facility (to reduce variation within the piles), the operator can request approval to remove the soil from the LTF.

To support a removal request, the operator must conduct confirmatory sampling, taking one representative sample for every 50 m³ if the material is destined for a site with agricultural land use, or one representative sample for every 100 m³ if the land use at the destination is not agricultural. Representative samples are formed by combining a number of grab samples from throughout the volume of soil to be represented.

Samples shall be analyzed as prescribed in *Protocol 5: Petroleum Hydrocarbon Analytical Methods and Standards*. Where there is reason to believe that contaminants other than petroleum hydrocarbons may be present in the soil, the samples shall be analyzed for those parameters as well.

When confirmatory samples indicate that the contaminant levels in the soil to be removed are below the standards that apply at the proposed receiving location as specified in the CSR, the land treatment facility operator must submit the results to the Standards & Approvals section of the Environmental Programs Branch for approval along with a request identifying the proposed receiving location. The date that the material was last tilled or turned must also be included with your submission. The material may be removed from the facility only after receiving the written approval of the Standards & Approvals section.

At facilities with natural liners, the liner material must be tested after material is removed from a treatment cell. Samples are to be taken as described for decommissioning below, and analyzed for all contaminants known to have been present in the removed material at any point during its course of treatment. That portion of the treatment cell shall not be used again to store or treat contaminated material until the concentrations of all contaminants in the liner material are below the CSR standards for the applicable land use at the LTF site.

5.0 Decommissioning

A decommissioning plan must be submitted to the Standards & Approvals section for approval at least three months prior to the planned decommissioning of the facility. The plan must include a schedule for decommissioning, the results of sampling demonstrating the contaminant levels in all soil being treated in the LTF, details of the proposed disposition of remaining soil, a description of the intended future use of the site, and a description of how the site will be restored for future uses.

When a land treatment facility is decommissioned, the site must be shown not to be contaminated before it can be abandoned. In the case of a facility with an artificial liner, this requires sampling the native soil below the liner; if a natural liner is used, the liner soil itself is sampled. The berm material enclosing the facility must also be sampled to demonstrate that it is

not contaminated above CSR standards. Sampling should also be conducted on any other area of the site where contamination is suspected due to operation of the facility.

Samples should be taken such that one sample represents 100 m³ of soil. When sampling the base of the LTF, the site should be divided into a grid with squares no larger than 26 x 26 m. In each grid square, 5 grab samples taken from a depth of no more than 15 cm should be combined to form a single sample representative of the soil in that grid square. The five samples should be arranged roughly in the pattern shown in Figure 1 to maximize coverage. These dimensions of 26 m x 26 m x 15 cm make for a soil volume of approximately 100 m³ per grid square.



liner sampling.

The berm material surrounding the facility should be sampled at a rate of one sample per 100 m³ of material. Each sample should be comprised of several grab samples (aliquots) taken throughout a volume of berm material representing 100 m³. Other areas of the site where contamination is suspected should also be sampled at a rate of one sample per 100 m³.

If sampling results indicate that contaminants are present at concentrations equal to or greater than applicable CSR standards, remediation of the site will be required. Any contaminated soil generated during remedial activities will need to be transported to another permitted facility.

If groundwater monitoring wells have been installed at the LTF site for groundwater monitoring purposes, these wells must be decommissioned in accordance with Protocol 7: Groundwater Monitoring Well Installation, Sampling and Decommissioning.

Following decommissioning of the LTF, the permittee is required to submit a report to the Standards & Approvals section demonstrating that no contamination remains onsite and that the decommissioning was carried out in accordance with the approved plan.

6.0 Effective Date

The effective date of this protocol shall be **March 1, 2011** and it shall remain in effect until replaced or rescinded by the Standards & Approvals section.

7.0 Additional Information

For more information on contaminated sites or this protocol, please contact:

Standards & Approvals Environmental Programs Branch (V-8) Environment Yukon Box 2703, Whitehorse, YT Y1A 2C6 T: 867-667-5683 or 1-800-661-0408 ext. 5683 F: 867-393-6205 E: envprot@gov.yk.ca

Approved:

Shanon Jersen

Date: March 1, 2011

Manager, Standards and Approvals Section Environmental Programs Branch Environment Yukon