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ENVIRONMENTAL ASSESSMENT REGISTRATION

WASTE DRILLING MUD TREATMENT PROCESS

SUBMITTED TO:
MINISTER OF ENVIRONMENT AND CONSERVATION
DIRECTOR OF ENVIRONMENTAL ASSESSMENT
PO Box 8700
St. John's, NL
A1B 4J6

PREPARED BY:
CROSBIE INDUSTRIAL SERVICES LIMITED
AN ENVIROSYSTEMS COMPANY

September 2015

ENVIROSYSTEMS

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TABLE OF CONTENTS

1.0	NAME OF UNDERTAKING	2
2.0	PROPONENT	2
3.0	THE UNDERTAKING	3
3.1	Nature of the Undertaking	3
3.2	Purpose/Rationale/Need for Undertaking	4
3.3	Proponents Experience	6
4.0	DESCRIPTION OF THE UNDERTAKING	7
4.1	Geographic Location	7
4.2	Physical Features	8
4.3	Construction	10
4.4	Operation	10
4.5	Occupations	15
4.6	Project Related Documents	16
5.0	APPROVAL OF THE UNDERTAKING	16
6.0	SCHEDULE	16
7.0	FUNDING	16
8.0	CONCLUSION	17
	Appendix A: Laboratory analysis of solids from pilot-scale project	18
	Appendix B: Geographic Location Map	18
	Appendix C: Site Survey	21
	Appendix D: Drilling Mud Treatment Location	22
	Appendix E: Certificate of Commitment to Employment Equity	23
	Appendix F: Certificate of Approval # WMS-07-07-017	26
	Appendix G: EH&S Manual TOC	27
	Appendix H: Comparison of drilling mud treatment processes	30

1.0 NAME OF UNDERTAKING

WASTE DRILLING MUD TREATMENT PROCESS

2.0 PROPONENT

- (i) Name of Corporate Body:
Crosbie Industrial Services Limited, an EnviroSystems company

- (ii) Address:
P.O. Box 8338
422 Logy Bay Road
St. John's, Newfoundland, Canada
A1B 3N7

- (iii) Chief Executive Officer:
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President, CEO and Vice Chairman, EnviroSystems Inc.
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- (iv) Principal Contact Person for purposes of Environmental Assessment:
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3.0 THE UNDERTAKING

3.1 Nature of the Undertaking

Crosbie Industrial Services (CIS), an EnviroSystems Inc. company, is requesting approval for an amendment to its existing Certificate of Approval to operate a Waste Management System to include the treatment of **non-hazardous** waste drilling mud using an indirect thermal desorption process.

Non-Hazardous drill muds are an inevitable waste stream generated by the drilling process of oil exploration activities. They are heterogeneous in nature, composed of significant percentage of hydrocarbons, water, and solids. If disposed as is, the constituents of the drilling mud may leach from the waste material, making them unsuitable for land application or downhole disposal.

Unlike bioremediation where valuable hydrocarbons go to waste, indirect thermal desorption is an industry wide proven technology that is an environmentally beneficial process for separating organic materials from various types of waste including drilling mud for re-use / recycling.

Indirect thermal desorption is **not incineration** but instead a treatment process that safely extracts hydrocarbons from waste drilling muds using indirectly applied heat in an enclosed extraction chamber. Unlike incineration, the process is done without producing harmful air emissions as the contaminants never come into contact with the flame from the heat source.

Approval of this undertaking will provide for a complete local treatment of waste drilling muds where:

1. Generated solids composition will meet CEQG and local landfill disposal criterion for disposal of in an approved landfill;
2. Oil fraction will be recovered and used as an alternative fuel source. Recovered oil will be processed through our existing used oil treatment system in compliance with the Used Oil Control Regulations and our certificate of Approval. The recovered oil will be used as a substitute for bunker C fuels in plants with current Certificates of Approval for used oil in their burners; and
3. Oily Water fraction will be treated on-site in accordance with our existing Certificate of Approval for wastewater treatment to meet the conditions of our Approval and the requirements of the Environmental Control Water and Sewer Regulations for discharge to the sanitary sewer.

Our company currently handles and temporarily stores non-hazardous waste drilling mud at our site on Logy Bay road and has been doing so for many years under our existing Certificate of Approval.

At Envirosystems, our goal is to create enduring partnerships with our customers. More than just a service provider, we are invested in our customers' long-term success. To that end we are continuously engaged in research and development projects that can bring value to our customers. We have recently successfully commissioned other innovative waste treatment projects which will have use in the oil and gas industry.

3.2 Purpose/Rationale/Need for Undertaking

Different separation techniques have been tried in the last several years for the local treatment of oil based drill mud including:

- Centrifugal separation;
- De-emulsification with heat & chemicals; and
- High current electro cell separation.

Total Petroleum Hydrocarbon (TPH) concentration in drilling muds is between 100,000 and 300,000 mg/kg. None of these techniques above achieved the desired results because it left the solids fraction with much more than 1,000 mg/kg TPH, which is a local landfill acceptance criterion.

Recently Crosbie Industrial Services attempted to treat waste drill muds using new technology - Electro Separation Cell Technology, as a pre-treatment step with the possible addition of a pugmill for stabilization at a later time. Although this new technology showed promise to reduce overall volume of waste drill mud by removing much of the oil from the drill mud, in the field the technology had limited success on drill muds generated from Newfoundland offshore drilling operations.

Our clients remain interested in complete local treatment of drilling muds and our objective remains to find a solution/technique for complete local treatment of drilling muds where:

- Generated solids composition will meet CEQG and local landfill disposal criterion for disposal of in an approved landfill;
- Oil fraction will be recovered and used as an alternative fuel source. Recovered oil will be processed through our existing used oil treatment system in compliance with the Used Oil Control Regulations and our certificate of Approval. The recovered oil will be used as a substitute for bunker C fuels in plants with current Certificates of Approval for used oil in their burners; and
- Water fraction will be treated on-site in accordance with our existing Certificate of Approval for wastewater treatment to meet the conditions of our Approval and the requirements of the Environmental Control Water and Sewer Regulations for discharge to the sanitary sewer.

In keeping with this objective, EnviroSystems completed a pilot-scale thermal desorption test on drilling mud samples from Newfoundland operations during the week of May 11, 2015. Thermal Desorption is a remediation process in which volatile contaminants are physically separated from the material and vaporized with elevated temperatures. The vaporized contaminants are removed from the extraction chamber where they are condensed, separated and recovered for recycling, treatment or disposal.

The goal of the evaluation was to demonstrate the ability of the process to minimize hydrocarbon concentration in the solids discharge. Three tests were performed and each product was examined for oil based fluid concentrations.

The pilot-scale test was conducted using industry wide proven technology for the treatment of drill muds – Indirect Thermal Desorption. After passing through the kiln, the vapor entered a multi-clone where the vapor was purified by collecting dust and fine solids while some of the hydrocarbons condensed. Then the vapor was sent to a water scrubber where it condensed into upper and lower fraction, concentrated in oil and water respectively. Lastly, the solids discharge was emitted from the end of the rotary kiln.

Thermal desorption technology produces solids with less than 1,000 mg/kg, typically 100 – 500 mg/kg. The pilot-scale desorption test also showed that the solids can be recycled through the kiln to achieve further hydrocarbon reduction. Please refer to attached Laboratory analysis of solids from pilot-scale project (Appendix A).

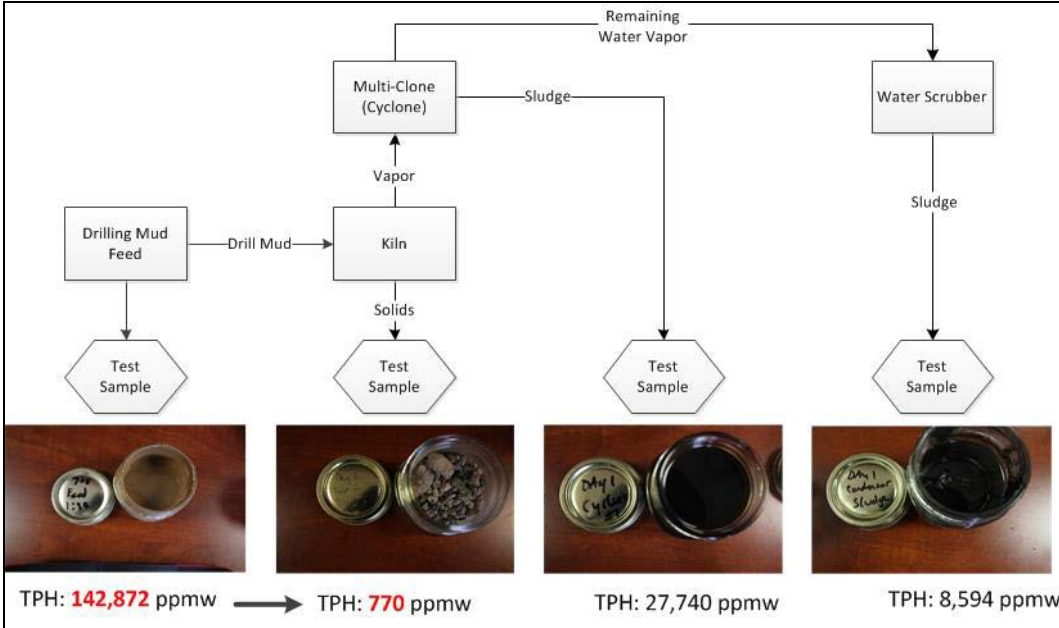


Figure 1: Schematic of Pilot-Scale Process with Separated Products from Desorption Test

The conclusions of this pilot-scale process were:

- The optimal drum temperature for our material was/needs to be between 450 and 625°C in order to remove TPH to the desired level;
- Varying the operating parameters of the rotary kiln do affect the levels of outlet solids hydrocarbon concentration;
- Knowledge of the composition of the drill mud being processed is imperative in accurately setting operating parameters to produce a desired product;
- Residence time of 40 minutes, with the correct operating parameters, produces the desired hydrocarbon content (<1,000 mg/kg) in the solids discharge; and
- Particle size influence on the hydrocarbon content over a sample was found to be inconclusive.

At this time we would like to change operations from Electro Separation Technology/ Pugmill operation to Indirect Thermal Desorption for the treatment of drill muds. The commercial plant will be able to handle processing a wide variety of samples with various oil and water concentrations while minimizing the hydrocarbon content in the solids discharge.

Attached is a table outlining the differences between the drilling mud treatment process described in the original EA Project # 1710 and the thermal desorption process described in this document (Appendix H). This site currently receives and stores these products so changes to the site will be minimal.

In an indirect fired unit, heat is applied to the exterior of the heating chamber and is transferred through the wall of the chamber to the waste material. Neither the burner flames nor the combustion gases come into contact with the waste material or off-gases. Indirect Thermal Desorption process has been employed successfully in many locations, including this Province, as a treatment option for waste drill muds and other contaminated materials.

3.3 Proponents Experience

Envirosystems Inc., a proud Atlantic Canadian organization with headquarters in Dartmouth, NS, is the most comprehensive provider of industrial cleaning and waste management services in Atlantic Canada. We have operating divisions located across the country and more specifically multiple locations in Newfoundland and Labrador, New Brunswick & Nova Scotia.

As a leading provider of waste drilling mud handling and disposal to the Newfoundland oil & gas industry, we manage millions of litres of waste drilling muds each and every year. We operate the most advanced industrial waste water treatment and waste drill mud handling facilities in Atlantic Canada.

EnviroSystems has a core of permanent operators, technicians, engineers, managers and other industry professionals with many years of experience in the industry. The company's commitment to Health, Safety and Environmental compliance is shared by all employees as a matter of personal principle.

The company provides complete cradle to grave management of industrial wastes. EnviroSystems helps customers reduce their environmental liabilities and meet their environmental and product stewardship responsibilities through the full identification of all materials, modern and safe management services, and full compliance with Municipal, Provincial and Federal requirements and regulations.

EnviroSystems Nova Scotia Facility employs a drilling mud treatment strategy designed to reduce the volume of waste sent for disposal by processing spent muds for beneficial reuse as an industrial fuel. Waste drilling mud received at that facility is chemically, thermally and mechanically treated to deliver a waste fuel product for use as an industrial fuel. Their drill mud process, the only one of its kind in Atlantic Canada, reuses drill muds without the environmental impact of disposal and transportation, which contributes to a cleaner environment and helps reduce the carbon footprint of our customer's activities.

We are committed to the region and continue to invest in the communities that we work and live in. We have been helping businesses and governments achieve their industrial and environmental management goals for nearly 20 years.

4.0 DESCRIPTION OF THE UNDERTAKING

4.1 Geographic Location

The proposed storage will be within the existing property boundary of Crosbie Industrial's waste management site located on 422 Logy Bay Road in the Municipality of St. John's. The site has been in operation for more than 30 years and consists of a roughly rectangular parcel of land that covers an approximate area of 0.58 ha and is located approximately 75 metres off the main road and is secured to prevent unauthorized access. Please refer to Appendix B for the geographic location of the existing facilities and Appendix C for the existing site plan.

Please refer to the following figures below for an aerial view of the property along with a proposed equipment location as well as a broader view of the facilities geographic location.



Figure 2: Equipment Location at Logy Bay Road Facility



Figure 3: Logy Bay Road Facility in Relation to Neighboring Properties

4.2 Physical Features

The site is occupied by two buildings and a bulk storage tank farm. The majority of the site that is not occupied by the buildings and tank farm consists of asphalt pavement (Appendix C). There is a berm located along the east property boundary separating the site from a wetland to the east. Commercial-industrial properties are located to the north, south and west of the site. The subject property and adjacent properties are serviced by municipal water and sewer systems, and there are reportedly no active drinking water wells in the surrounding area.

As with the initial application, the drill mud treatment operation will continue to be within the existing property boundary of Crosbie Industrial's waste management site located on 422 Logy Bay Road. The unit will require an approximately foot print 13.5 metres x 25 metres (337.5 square metres) or a variation of that with a similar area. The unit will be placed near the existing tank farm to allow access for feedstock and storage of produced oils and water.

The Drill Mud Thermal Treatment Processing unit will consist of following major components:

1. Indirect Fired Rotary Kiln
2. Oil Quench Scrubber
3. Water Quench Scrubber
4. Oil-Water Separator
5. Thermal Oxidizer

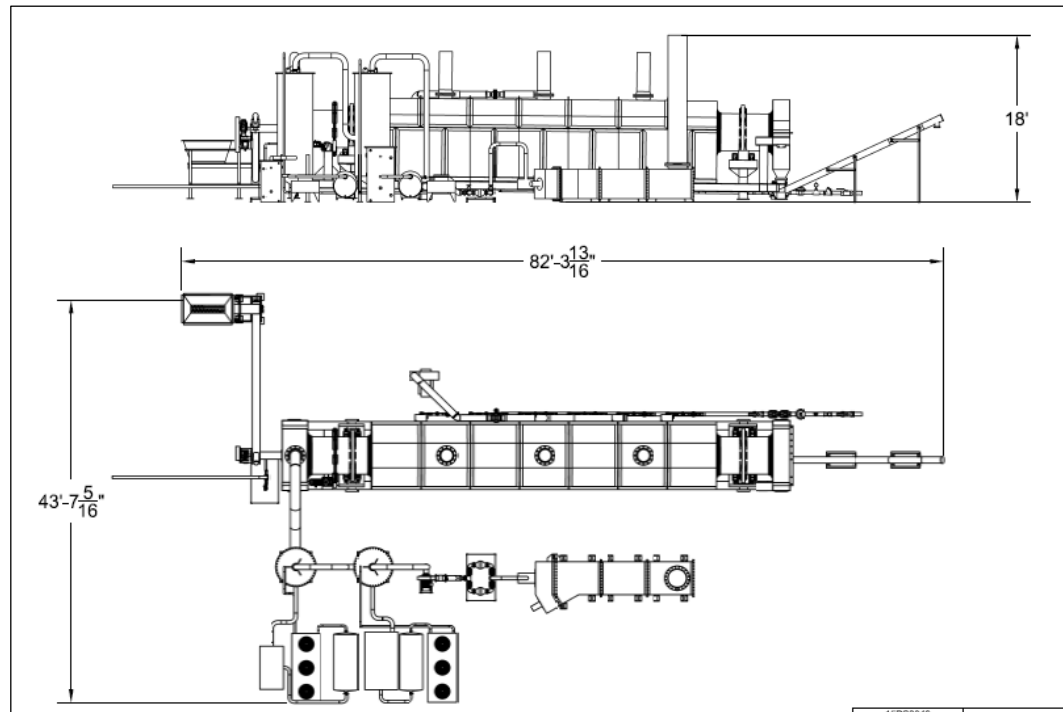


Figure 4: Equipment Footprint

The equipment is mobile and will be shared amongst other EnviroSystems facilities in other provinces.

Located in an industrial area, the site and immediate surrounding area is currently zoned as Commercial Industrial (CI). The site is currently equipped with groundwater-monitoring wells to ensure the environmental integrity of the site.

4.3 Construction

All components are pre-fabricated and would be delivered to Crosbie Industrial Services. Assembly of parts into the Thermal Treatment Processing Unit would take approximately 3-5 working days. Construction (equipment set-up) is expected to commence approximately 6 months after an approval of this undertaking.

There is not expected to be any sources of pollutants during the construction as construction requires only the assembly of the pre-fabricated components. Any small amounts solid waste materials generated during assembly, such as metal pieces will be recycled while general refuse will be collected and disposed of as per local regulations.

The surfaces of the site consist of asphalt pavement and gravel cover. Based on an available topographic map and the observed site topography, regional surface drainage appears to be towards the east-southeast.

Based on available surficial geology maps, the native surficial soils at the site likely consist of glacial deposits, principally comprised of sand and gravel till overlying sedimentary bedrock. The characteristic permeability of sand and gravel till is moderate.

4.4 Operation

Crosbie Industrial Services, an EnviroSystems company, has been operating a waste management system in the Province since 1982. Its experienced staff of environmental technicians, chemists and managers offer comprehensive services in Newfoundland and Labrador for the proper management of industrial waste streams.

CIS will continue to provide safe and environmentally sound industrial services and waste management solutions to our clients in a manner that complies with all conditions of our Certificate of Approval and applicable regulations & guidelines.

Crosbie Industrial plans to remediate drill cuttings in a Thermal Desorption Unit with Vapor Recovery System. The Thermal Desorption Unit's effort is aimed to reduce landfilling of drill cuttings and recycle diesel/oil based drilling fluids. Control technology is designed to ensure no negative environmental impacts incur from running the system.

Thermal desorption is a form of remediation which separates volatile contaminants from soil or sediment through elevated temperatures. In the thermal desorption process, the contaminated materials are heated in order to remove any contaminants. As the material is heated, the contaminants vaporize and become part of the gas

stream flowing through the desorber. The vaporized contaminants are then collected and treated in an air emissions or vapor recovery system.

The following flow chart shows the operational process.

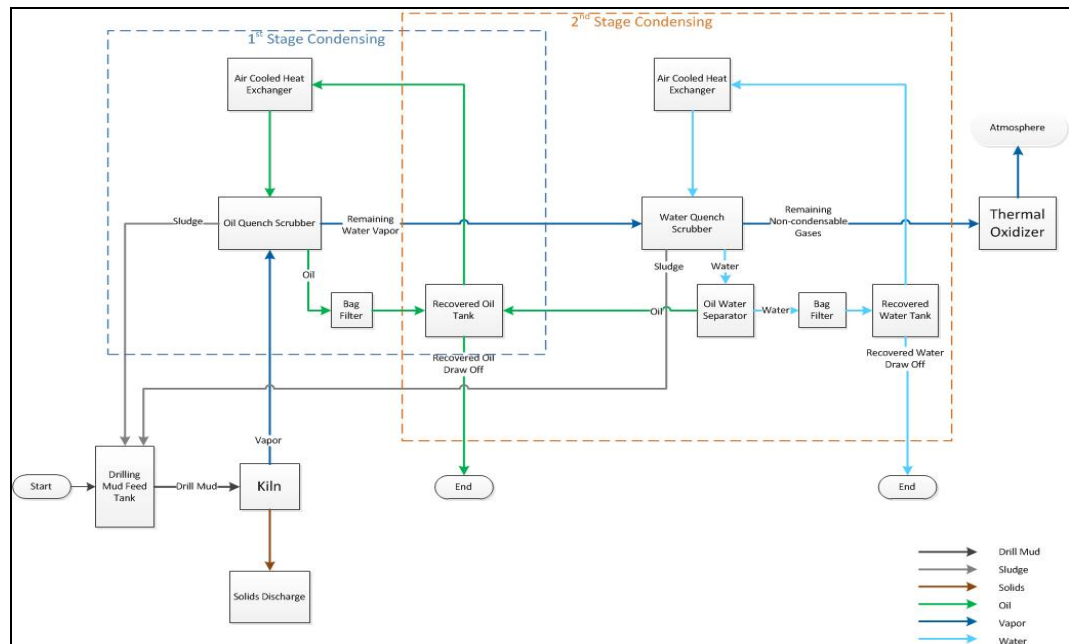


Figure 5: Waste Mud Thermal Desorption Treatment Process Flow Chart

First, the drill mud is pumped from storage tank farm into the kiln to pressure and is subject to heating. The vapor that evolves is drawn off at certain areas on the kiln and sent to an oil quench scrubber which condenses the vapor into product oil and recyclable sludge. The remaining water vapor is sent to a water quench scrubber which condenses the vapor into a water/oil mixture and recyclable sludge to be sent back to the feed hopper. Then, the remaining non-condensable gases are sent to a thermal oxidizer for elimination. The water from the scrubber is pumped into a bag filter and then sent to an oil-water separator where small amounts of purified oil are separated and sent to a recovered oil tank.

Lastly, the remaining water is recycled, sent to a tank for draw off or through a spray pump and heat exchanger to be sent back to the water quench scrubber in order to aid in condensing the incoming vapor. The oil from the oil quench scrubber is pumped to a bag filter and sent to a recovered oil tank that is either drawn off for recycling or sent to a spray pump and air-cooled heat exchanger and finally to the oil quench scrubber in order to aid in condensing the vapor discharge from the kiln.

The waste drill mud which is held in onsite storage tanks would go through the following process:

- Sample product from tank and analyze for percent liquids and solids to determine optimal treatment settings;
- Pump product from storage tank to treatment system to separate and recover oil and residual water;
- Pump oils into existing waste oil tanks for reuse as a fuel in the thermal desorption unit and/or resale as a fuel in an energy recovery system;
- Pump residual waste waters into current water treatment system for processing prior to discharge; and
- Discharge separated solids into waste roll off bins for transportation to disposal site (solids will be analyzed to ensure it meets TPH and leachable metals criterion prior to disposal at local landfill site).

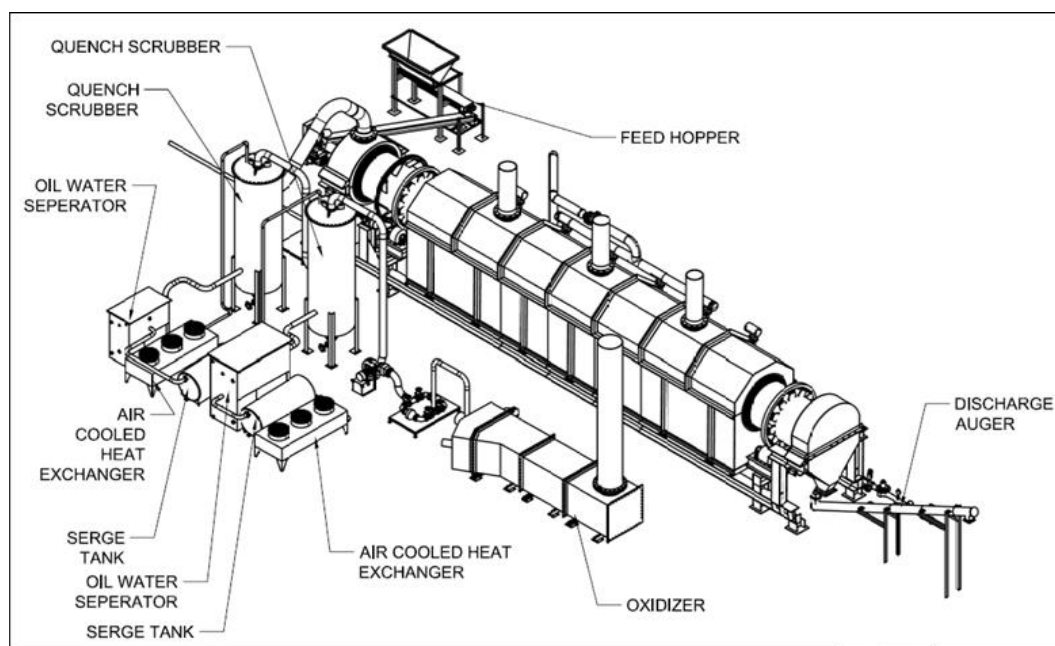


Figure 6: Thermal Desorption Equipment Diagram

A sample of solids generated by the pilot-scale thermal desorption process was sent to a third-party laboratory for a leachate analysis. Leachate analysis was performed in accordance with the US EPA 1311 and EPA 6020A test methods. All leachate test results were found to be below maximum limits for landfill disposal as defined by Leachable Toxic Waste, Testing and Disposal Guidance Document, issued by NL Department of Environment.

Typical testing results from an external lab are shown in Appendix A.

The thermal desorption unit has the potential to process variable composition of drill mud as it has a large range of operating temperatures up to 625°C. The system capacity is 1-2 MT/hour or 14,000 MT/year when operating 350 days/year. The operation will be in effect for as long as the services are required from our clients.

The process will have no significant impact on the natural environment and will not intensify activities at our site. The process will significantly reduce transport of waste drills muds long distances on our roadways (~90% reduction). Smoke and odour from the treatment system is expected to be insignificant as the drill mud is indirectly heated in a closed system where any non-condensable contaminants are pumped to the second part of the process, where the vapor is destroyed by a high temperature thermal oxidizer. Also, high temperature and high efficiency burners will ensure a more complete combustion of fuels used for the primary heat source, so some smoke and odour from the combustion of fuels will be minimal. Noise levels from the operation of the equipment at the source are expected to be less than 85 dB.

The treatment of waste drilling mud is a light industrial use of the property and will not intensify use of the property. Traffic on our public roadways associated with transporting waste drill mud off island for disposal, which is the current practice, will be reduced by approximately 90%.

Crosbie Industrial Services currently accepts waste drill mud at the Logy Bay Road Facility and holds for out of province disposal.

Pollution Prevention and Waste Management

The treatment of drilling muds using Thermal Desorption process has numerous environmental advantages:

- Recovered oil fraction will be used as:
 - Energy source for the process,
 - Substitute for Bunker C fuels in approved facilities, or
 - Recycled drilling fluid.
- Amount of waste going for final disposal will be significantly reduced.
- Generated solids will contain less than 1,000 mg/kg TPH and be disposed at an approved local landfill.
- There will be no waste by-products.
- Traffic on roadways will be reduced by ~ 90%.
- Landfill operator(s) may potentially re-use solids from treatment process as cover material to control odors, vectors, fires, litter and scavenging.

After a batch of spent drill muds is treated, the final product will undergo a testing protocol before shipping to the approved disposal site. Significantly reduced amounts

of solid waste will be disposed in local landfills versus the current practice of trucking large volumes of wastes out of province long distances.

Potential sources of contamination during the operation

Spills of waste materials: The containment systems are designed to contain potential spills within the confines of the systems, land or groundwater contamination should not be an issue.

CIS provides oil spill emergency response services, emergency response equipment and spill kits are readily available at the facilities and staff is fully trained in the proper use of the spill cleanup equipment. Emergency response equipment includes but is not limited to vacuum trucks, vacuum trailers, hydro excavation units, B-Train tank trailers, high-pressure water blasting units as well as an on-site tank farm situated inside a containment berm.

CIS has developed an Emergency Response Plan to outline a predetermined set of instructions with the aim to provide a prompt and coordinated response to any foreseeable emergency associated with the operation, handling and the storage of drill muds. These plans cover the reporting, containment, removal and cleanup of a spill or fire of any material stored on the property. The goal of this plan is to assist in developing a high level of preparedness for response to a spill. As well, the objectives of Crosbie Industrial Services' plan include ensuring the safety of employees, contractors and the public, developing an effective incident reporting system and minimizing any potential damage to the environment or the facilities.

Air Emissions and Dust Control: As a non-incineration treatment process, the only air emissions are from fuel consumption to provide heat in the process chamber. The treatment process produces no more harmful air emissions than a typical industrial boiler.

The equipment will be utilizing No.2 fuel oil and a portion of the recycled oil fraction from the process. All vapors are captured and condensed leaving very minimal emissions. Estimated emissions have been calculated using the US EPA method AP-42 for External Combustion Sources. Actual emissions will be affected by various factors including furnace pressures, quality of the fuel, running time of the plant, feed material properties, etc.

Table 1: Estimated Air Emissions

	NOx, t/yr ³	CO, t/yr ³	SO2, t/yr ³	PM, t/yr ³	CO2, t/yr ³	VOC, t/yr ³
Emissions from the stack of the primary treatment unit ¹	6	1.5	4.26	0.6	6,690	N/A
Vapor Recovery Unit ²	0.3	0.08	0.21	0.03	334.5	0.01

1. Considering firing a No. 2 fuel oil burner at a maximum rate of 10 MMBtu/hr
2. Considering firing a No. 2 fuel oil burner at a maximum rate of 0.5 MMBtu/hr and 99.99% VOC destruction removal efficiency out of the oxidizer
3. Year defined as operating 8 hours/day, 7 days/week, and for 50 weeks/year

Dust emissions will be monitored to ensure particulate release is minimal. Dust control can be accomplished by wetting the solids as it leaves the extraction chamber.

Crosbie Industrial Services and our parent company, Envirosystems Inc., maintain a comprehensive Health, Safety, Environment & Quality program including an auditing program to ensure that all procedures, including the transport, storage, handling and processing of drilling muds, are implemented.

4.5 Occupations

Construction Phase Employment – assembly of the pre-fabricated unit will require 2 employees for a 1 week period. It will also require a subcontracted crane for a one week period for moving and lifting requirements during assembly.

Operational Employment – Unit operations will require 2 full time employees to operate the system. Should volumes support a second shift then operations may require an additional 2 full time employees. It will also require sub-contracted transport of waste roll off bins. Depending on incoming flow this could be 1-2 trucks per operating day.

The following is a list of the anticipated occupations according to the National Occupational Classification:

NOC 9232 - Petroleum, gas and chemical process operators

NOC 7421 – Heavy Duty Equipment Operator

EnviroSystems Inc. is committed to ensure equal opportunity employment. Please see attached Certificate of Commitment to Employment Equity in Appendix E.

4.6 Project Related Documents

Appendix A: Laboratory analysis of solids from pilot-scale project

Appendix B: Geographic Location Map

Appendix C: Site Survey

Appendix D: Drilling Mud Treatment Location

Appendix E: Certificate of Commitment to Employment Equity

Appendix F: Certificate of Approval # WMS-07-07-017

Appendix G: EH&S Manual TOC

Appendix H: Comparison of drilling mud treatment processes

5.0 APPROVAL OF THE UNDERTAKING

Our existing Certificate of Approval # WMS-07-07-017 dated March 26, 2015 (Appendix F) is for the continued operation of a Waste Management System. This undertaking will require an amendment to our existing certificate of approval to include the use of the above waste mud treatment process.

6.0 SCHEDULE

Crosbie Industrial Services has sourced all required equipment to construct the process unit and will be in a position to begin procurement upon approval. There is an approximate 6 month lead time for the equipment so the anticipated date for approved commencement of the drilling mud thermal treatment is approximately 6 months from approval of the undertaking.

Assembly could begin as early as May 1, 2016 and operation would commence by May 8, 2016.

7.0 FUNDING

Funding for the Drill Mud Thermal Treatment Process will be provided by Crosbie Industrial Services (or EnviroSystems Inc.) and construction is not dependent upon external grants or loans.

The estimated capital required for construction and commissioning of this process is \$3,154,500.00.

8.0 CONCLUSION

EnviroSystems and Crosbie Industrial Services are committed to the region and continue to invest in the communities that we work and live in. We have been helping businesses and government achieve their industrial and environmental management goals for nearly 20 years.

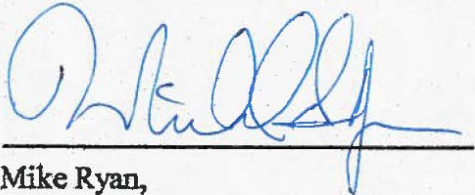
We are very committed to this project. An unrelenting commitment to health and safety is the number one priority of every EnviroSystems company. A core value that is central to everything we do, from pre-job planning to execution and debriefing, safety is deeply instilled within our culture and permeates throughout all levels of our organization.

At EnviroSystems, our goal is to create enduring partnerships with our customers. More than just a service provider, we are invested in our customers' long-term success.

Thermal Desorption is widely used and environmentally acceptable process for the treatment of drilling muds. The process will have no significant impact on the natural environment and will not intensity activities at our site. The process will eliminate double handling of stored drill mud and significantly reduce environmental liability associated with the transport of waste drill muds on our roadways.

Crosbie Industrial Services will make all considerations during construction and operation of the waste drilling mud processing operations to ensure that the environment surrounding the Logy Bay Road facility is not impacted.

September 21, 2015



Mike Ryan,
President, CEO and Vice Chairman
EnviroSystems Inc.
www.envirossystemsglobal.com

Appendix A: Laboratory analysis of solids from pilot-scale project



Success Through Science

Your P.O. #: 35481
Your C.O.C. #: B 079300

Attention: Veselin Milosevic

Atlantic Industrial Service
Akerley Blvd Dartmouth
25 Akerley Blvd
Dartmouth, NS
CANADA B3B 1J7

Report Date: 2015/07/15
Report #: R3574633
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B5D2930
Received: 2015/07/08, 13:06
Sample Matrix: SOLID
Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
Metals Leach TCLP/CGSB extraction	1	2015/07/14	2015/07/14	ATL SOP 00058	EPA 6020A R1 m
TCLP Inorganic extraction - pH	1	N/A	2015/07/14	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	1	N/A	2015/07/14	ATL SOP 00035	EPA 1311 m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key  Rachael Mansfield
15 Jul 2015 17:42:19 -03:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Heather Macumber, Project Manager
Email: HMacumber@maxxam.ca
Phone# (902)420-0203 Ext:226

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Total Cover Pages : 1
Page 1 of 8

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Maxxam Job #: B5D2930
Report Date: 2015/07/15

Atlantic Industrial Service
Your P.O. #: 35481

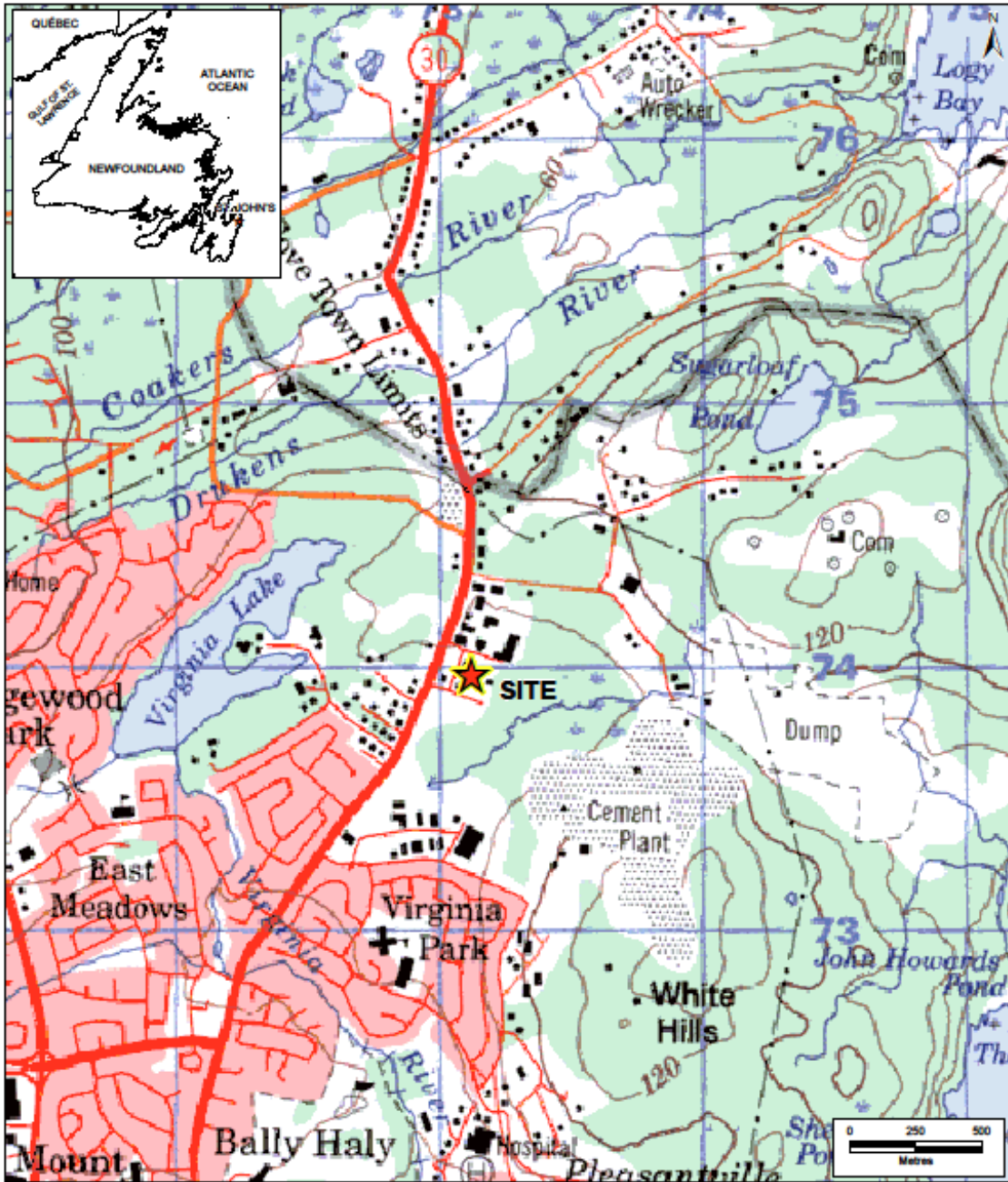
RESULTS OF ANALYSES OF SOLID

Maxxam ID		AOY462	
Sampling Date		2015/07/08	
COC Number		B 079300	
	Units	SAMPLE 5-2C	QC Batch
Inorganics			
Sample Weight (as received)	g	100	4103461
Initial pH	N/A	11	4103462
Final pH	N/A	7.2	4103462
QC Batch = Quality Control Batch			

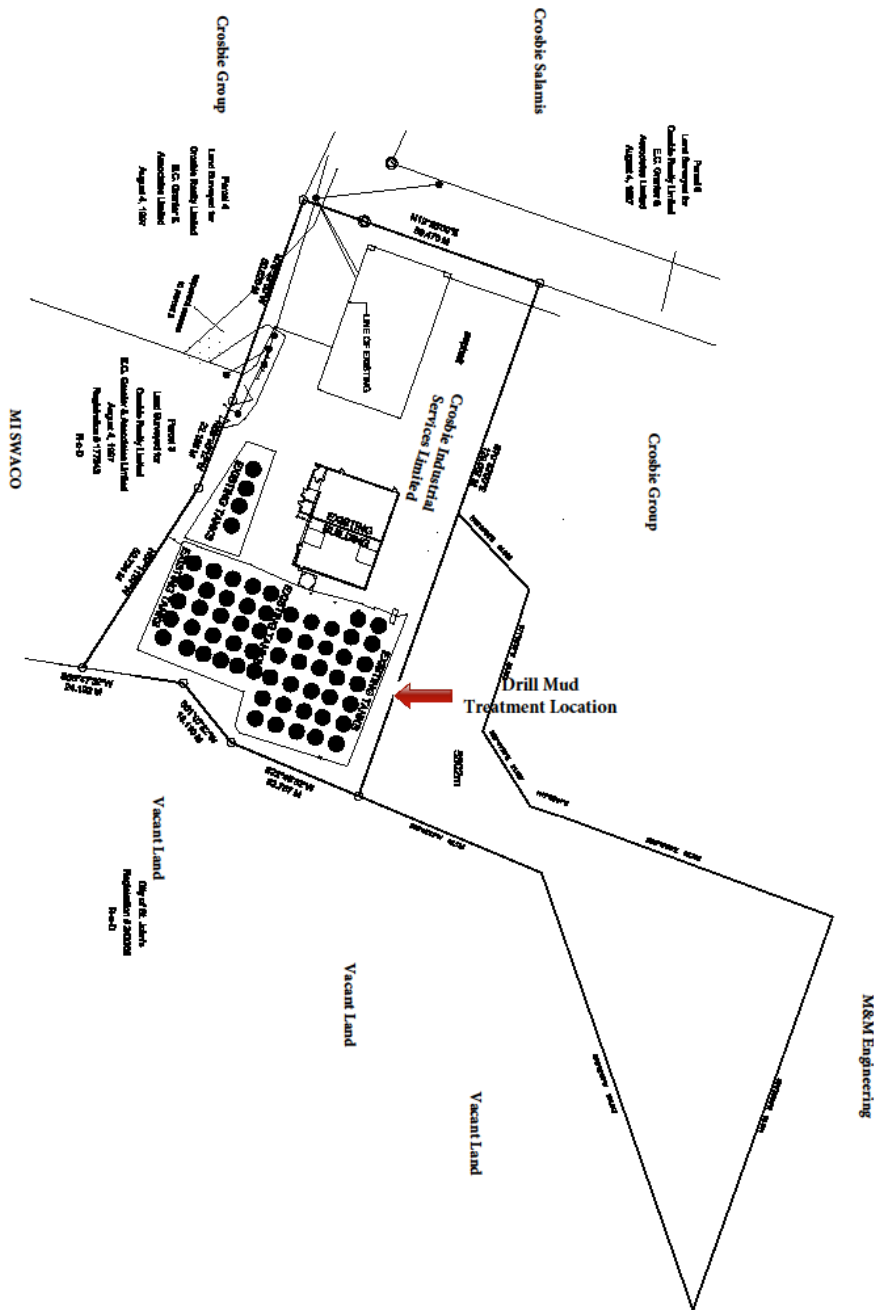
ELEMENTS BY ICP/MS (SOLID)

Maxxam ID		AOY462		
Sampling Date		2015/07/08		
COC Number		B 079300		
	Units	SAMPLE 5-2C	RDL	QC Batch
Metals				
Leachable Aluminum (Al)	ug/L	ND	100	4103728
Leachable Antimony (Sb)	ug/L	51	20	4103728
Leachable Arsenic (As)	ug/L	ND	20	4103728
Leachable Barium (Ba)	ug/L	250	50	4103728
Leachable Beryllium (Be)	ug/L	ND	20	4103728
Leachable Boron (B)	ug/L	720	500	4103728
Leachable Cadmium (Cd)	ug/L	ND	3.0	4103728
Leachable Calcium (Ca)	ug/L	750000	1000	4103728
Leachable Chromium (Cr)	ug/L	ND	20	4103728
Leachable Cobalt (Co)	ug/L	ND	10	4103728
Leachable Copper (Cu)	ug/L	ND	20	4103728
Leachable Iron (Fe)	ug/L	ND	500	4103728
Leachable Lead (Pb)	ug/L	6.2	5.0	4103728
Leachable Lithium (Li)	ug/L	75	20	4103728
Leachable Magnesium (Mg)	ug/L	780000	1000	4103728
Leachable Manganese (Mn)	ug/L	71	20	4103728
Leachable Molybdenum (Mo)	ug/L	39	20	4103728
Leachable Nickel (Ni)	ug/L	ND	20	4103728
Leachable Potassium (K)	ug/L	22000	1000	4103728
Leachable Selenium (Se)	ug/L	ND	10	4103728
Leachable Silver (Ag)	ug/L	ND	5.0	4103728
Leachable Strontium (Sr)	ug/L	1300	50	4103728
Leachable Thallium (Tl)	ug/L	ND	1.0	4103728
Leachable Tin (Sn)	ug/L	ND	20	4103728
Leachable Uranium (U)	ug/L	3.1	1.0	4103728
Leachable Vanadium (V)	ug/L	ND	20	4103728
Leachable Zinc (Zn)	ug/L	57	50	4103728
RDL = Reportable Detection Limit QC Batch = Quality Control Batch ND = Not detected				

Appendix B: Geographic Location Map



Appendix C: Site Survey



Appendix D: Drilling Mud Treatment Location





NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

CLIENT:	CROSBIE INDUSTRIAL SERVICES LIMITED		
PROJECT TITLE:	MUD TREATMENT EQUIPMENT		
DRAWING TITLE:	SITE PLAN		
SCALE:	1:1000	DATE:	SEPT. 18, 2015
DRAWN BY:	CS	EDITED BY:	
DRAWING No.:	121413752-EE-02	CHECKED BY:	
		CAD FILE:	121413752-dwg1.dwg
		REV. No.	0




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Appendix E: Certificate of Commitment to Employment Equity

+ Human Resources and Skills Development Canada / Ressources humaines et Développement des compétences Canada
 Labour Branch / Direction générale du travail
 Federal Contractors Program / Programme de contrats fédéraux

OFFICIAL USE ONLY
 Certificate N° : 020095

Certificate of Commitment to Implement Employment Equity

ORGANIZATION			
Legal Name of Organization ENVIROSYSTEMS Incorporated		Parent company is located outside Canada <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Operating Name (if different)		Procurement Business N° : # 127856987 PG0001	
Employer's North American Industry Classification System (NAICS) Code Number 324190		Total no. employees in Canada (Full-Time/Part-Time/Temporary) ▶ 418	
HEAD OFFICE			
Address (street, building, etc.) 11 Brown Avenue		City Dartmouth	Province Nova Scotia
		Postal Code B3B 1Z7	
		Telephone 1-902-481-1511	Fax 1-902-481-8051
EMPLOYMENT EQUITY CONTACT			
Name Joseph Landry		Title Business Development	
Telephone 1-902-481-1511	E-mail jlandry@envirosystems.ca		
CERTIFICATION			
The above-named organization:			
<ul style="list-style-type: none"> • having a workforce of 100 or more permanent full-time, permanent part-time and/or temporary employees in Canada, AND • intending to bid on, or being in receipt of, a Government of Canada goods or services contract valued at \$200,000.00 or more, 			
hereby certifies its commitment to implement and/or renew its commitment to employment equity, if awarded the aforementioned contract, in keeping with the Criteria for Implementation under the Federal Contractors Program for Employment Equity.			
SIGNATORY			
NOTE: The signatory must be the Chief Executive Officer OR a prescribed person in a senior management position with authority to act on behalf of the organization.			
Name (print) Michael G. Ryan		Title CEO	
Signature 		Date September 21, 2009	
RETURN INSTRUCTIONS			
IMPORTANT			
<ul style="list-style-type: none"> • Your organization will be required to implement an Employment Equity Program once awarded a contract of \$200,000 or more. You could then be subject to a compliance review which could take up to a year to complete. • Please fax a copy of the signed form to the Labour Branch, at 819-963-8768. 			

LAD 100 (9/01) (1)

Canada

Appendix F: Certificate of Approval # WMS-07-07-017


**Newfoundland
Labrador**
GOVERNMENT
OF
NEWFOUNDLAND AND LABRADOR
Department of Environment and Conservation
CERTIFICATE OF APPROVAL

Pursuant to the *Environmental Protection Act, SNI, 2002, Sections 16, 78 and 83.*

Issued:	March 26, 2015	Approval No.:	WMS-07-07-017
Expiration:	March 31, 2018	File No.:	
Proponent:	Crosbie Industrial Services Limited P.O. Box 8338 St. John's, NL, A1B 3N7		
Attention:	Mr. Roy Baker		
Re:	Collection of Liquid Wastes (Province-Wide) Fixed Oily Water System (St. John's)		

Approval is hereby given for the continued province-wide operation of a waste management system operation consisting: a) collection of liquid wastes, b.) collection and storage of oily water; and c) permanent oily water treatment unit.

This approval does not release the holder from the obligation to obtain appropriate approvals from other concerned provincial, federal and municipal agencies. Approval from the Department of Environment and Conservation (the Department) shall be obtained prior to any significant change in the design, construction, installation, or operation of the facility, including any future expansion of the works. This certificate shall not be sold, assigned, transferred, leased, mortgaged, sublet or otherwise alienated by the holder without obtaining written prior approval from the Minister.

This approval is subject to the terms and conditions as contained in Appendices 'A, B, C, D and E' attached hereto, as may be revised from time to time by the Department. Appendices 'A, B, C, D and E' forms part and parcel of this certificate of approval. Failure to comply with any of the terms and conditions may render this certificate of approval null and void, may require the proponent to cease all activities associated with this certificate of approval, may place the proponent and its agent(s) in violation of the *Environmental Protection Act, SNI, 2002, c. E-14-2*, and will make the proponent responsible for taking such remedial measures as may be prescribed by the Department. The Department reserves the right to add, delete, modify or revoke this approval at any time.


For MINISTER

EnviroSystems Occupational Health and Safety Management System Framework



This manual describes the Occupational Health and Safety Management System implemented within EnviroSystems. This system is based on the principles of the BSI OHSAS 18001 Standard.

ENVIROSYSTEMS

11 Brown Avenue
Dartmouth, Nova Scotia
B3B 1Z3

2012 Edition

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ENVIROSYSTEMS OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM IS ADMINISTERED BY THE DIRECTOR OF HEALTH, SAFETY AND ENVIRONMENT.

AUTHORITY AND RESPONSIBILITY FOR IMPLEMENTATION OF THE MANAGEMENT SYSTEM IS CONTROLLED BY ENVIROSYSTEMS.

QUESTIONS REGARDING ANY PART OF THIS PROGRAM MAY BE ADDRESSED TO:

**SCOTT SANGSTER
DIRECTOR OF HEALTH, SAFETY & ENVIRONMENT
11 BROWN AVENUE
DARTMOUTH, NOVA SCOTIA
B3B 1Z7
PHONE: 902-481-8052
FAX: 902-442-0624**

This manual describes the Occupational Health and Safety Management System implemented at EnviroSystems. This system is based on the principles of the BSI OHSAS 18001 Standard. This publication may not be reproduced without the express written consent of EnviroSystems.

Implementation Date: March 30, 2012

Last Revision Date: N/A

Next Review Date: January 2013

VERSION #2012 – 1.0

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Page | 2

TABLE OF CONTENTS

INTRODUCTION 4

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT HIERARCHY 5

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM STRUCTURE 6

PHASE 1: OH&S POLICY 7

 ELEMENT 1.1 - POLICY AND LEADERSHIP 7

 ELEMENT 1.2 - STRUCTURE, RESPONSIBILITY AND ACCOUNTABILITY 8

PHASE 2: PLANNING 9

 ELEMENT 2.1 - PROJECT PLANNING 9

 ELEMENT 2.2 - HAZARD IDENTIFICATION AND CONTROL 10

 ELEMENT 2.3 - LEGAL AND OTHER REQUIREMENTS 11

 ELEMENT 2.4 - OBJECTIVES AND TARGETS 11

PHASE 3: IMPLEMENTATION & OPERATION 12

 ELEMENT 3.1 - SUPPORTING DOCUMENTATION 12

 ELEMENT 3.2 - COMPANY RULES 13

 ELEMENT 3.3 - PERSONAL PROTECTIVE EQUIPMENT 14

 ELEMENT 3.4 - PREVENTATIVE MAINTENANCE 14

 ELEMENT 3.5 - TRANSPORTATION COMPLIANCE 15

 ELEMENT 3.6 - TRAINING & AWARENESS 16

 ELEMENT 3.7 - EMERGENCY PREPAREDNESS 17

 ELEMENT 3.8 - MANAGEMENT OF CHANGE 18

 ELEMENT 3.9 - COMMUNICATIONS 19

 ELEMENT 3.10 - DOCUMENT CONTROL 20

PHASE 4: CHECKING AND CORRECTIVE ACTIONS 21

 ELEMENT 4.1 - PERFORMANCE INDICATORS 21

 ELEMENT 4.2 - INCIDENT MANAGEMENT 22

 ELEMENT 4.3 - WORKPLACE INSPECTIONS AND OBSERVATION 23

 ELEMENT 4.4 - MANAGEMENT SYSTEM AUDITS 24

PHASE 5: MANAGEMENT REVIEW 25

 ELEMENT 5.1 - MANAGEMENT REVIEW AND CONTINUAL IMPROVEMENT 25

REVISION LOG 26

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Appendix H: Comparison of drilling mud treatment processes

Process described in the original EA Project # 1710 and the thermal desorption process described in this document	Pretreatment using Electro-Separation Cell Technology, Solidification and Stabilization	Thermal Desorption
Purpose of the project	Full local treatment option for drill muds that allows for: - local disposal of the generated solids and - recovery/ recycling/ reuse of oil fraction.	Full local treatment option for drill muds that allows for: - local disposal of the generated solids and - recovery/ recycling/ reuse of oil fraction.
Foot Print	30' x 20' for treatment unit, similar square footage to house the unit, a loading rack and a 350 bbl lime storage tank.	82' x 44' for entire unit.
Process Capacity	3,500-5,000 MT/year	14,000 MT/year
Process	Physical-Chemical	Physical separation
Treatment Steps	<ol style="list-style-type: none"> 1. Pretreatment of incoming drilling mud (using ESC technology) to reduce liquids content. 2. Separation and treatment of oil and water. 3. Treatment of solids by solidification and stabilization. 4. Final landfill disposal upon laboratory quality check. 	<ol style="list-style-type: none"> 1. Indirectly heating drilling muds to separate contaminants from the material. 2. Condensing contaminants into concentrated liquid form (oil). 3. Treatment of oil and water. 4. Landfill disposal of solids.
Storage of Drilling Muds	CIS currently receives and stores drilling muds so changes to the site will be minimal.	CIS currently receives and stores drilling muds so changes to the site will be minimal.
Additives used in the process	Lime, Calcium oxide (CaO)	N/A
Final Products	Recovered oil - treated through present used oil treatment system in compliance with the Used Oil Control Regulations and our certificate of approval. The recovered oil would be used: - as a substitute for bunker C fuels in approved facilities.	Recovered oil - treated through present used oil treatment system in compliance with the Used Oil Control Regulations and our certificate of approval. The recovered oil would be used: - as energy source for the process (primarily), - as a substitute for bunker C fuels in approved facilities, or - as recycled drilling fluid.
	Wastewater - would be treated through our water treatment system to meet requirements of the Environmental Control Water and Sewer Regulations and our COA for discharge to a sanitary sewer.	Wastewater - would be treated through our water treatment system to meet requirements of the Environmental Control Water and Sewer Regulations and our COA for discharge to a sanitary sewer.

	Solidified/ Stabilized Solids - would contain the remaining contents of the drill mud underflow in a stabilized non-leachable form. Would be sent to approved facility for disposal.	Solids - would contain less than 1,000 mg/kg TPH and be disposed at local landfill and for metals meet the CCME Canadian Soil Quality Guidelines for industrial land use or pass the Toxicity Characteristic Leaching Procedure for leachability of metals.
Amount of waste going for final disposal	Greater than original amount of waste due to the amount of additive being used. Typically: 10-20% increase in the total waste amount, rarely: up to 35% increase in the total amount requiring final disposal.	Significantly lower than original amount of waste.
Waste By-product	Limestone	None
Air Emissions	The pugmill treatment process will create a dust through mixing of the material. The covered design of the pugmill minimizes the release of these dust particles.	Control technology is designed around US EPA standards to ensure no negative environmental impacts incur from running the system. Estimated air emissions have been calculated.
Traffic on public roadways		Reduced by ~90%