

## **Risk Assessment, Mitigations and Cost Estimation September 2023**

### **East Mackay I-78 Well Abandonment Operations OA-2023-001 MGM**

#### **Scope:**

This assessment documents the worst-case scenarios with potential risks to the environment and associated mitigation costs associated with the above Operations Authorization. For ease of analysis, these are grouped into two broad categories.

- Risks associated directly with the well/wellhead and failure of the associated containment systems. (Well Related Risks)  
These risks are unique to petroleum exploration, production, and related operations.
- Risks associated with surface operations (e.g. fluid spills). These are similar for any industrial operation of similar scope. (Surface Risks)

#### **Well Related Risks**

Any operation involving petroleum wells entails a potential risk of uncontrolled flow (up to and including a “blowout”).

For the operations proposed, the probability of an uncontrolled flow is considered extremely small for the following reasons.

1. The well is cased from top to bottom. Unlike drilling operations, no formations are open to the wellbore, except through the perforations in the casing. This factor alone, significantly reduces the potential risk of an uncontrolled flow.
2. The well was drilled to test the productive capability of the Canol and Bluefish formations. Despite hydraulic fracturing, the well was unable to flow reservoir fluids (oil) to flow to surface without nitrogen assistance with coiled tubing.
3. The industry best practice for well control is a “Two Barrier” approach. In this case there are always two barriers in place.
  - a. Primary Barrier – hydrostatic head of the column of fluid in the well.  
As above, the hydrostatic head of reservoir fluid (oil) combined with the lack of natural permeability is sufficient to prevent the well from flowing.  
Once the plug(s) required for abandonment are placed and tested, the well will be displaced to fresh water as required by OROGO.
  - b. Secondary Barrier – A downhole plug set in a profile nipple above the producing zone and/or a back-pressure valve in the tubing hanger. These will be replaced by the service rig blowout preventers (BOPs) on the well during operations.

Despite the extremely low possibility of an uncontrolled flow, the potential severity of the occurrence needs to be considered, in the unlikely event that one should occur.

The effect on the environment and more particularly, mitigation costs would be small for the following reasons:

- 1) The well is sweet with no detection of hydrogen sulfide in the gas analysis.
- 2) There were no significant liquid hydrocarbons reported in the produced gas.

### **Surface Risks**

All Program activities will be confined to ice pads or ice roads which will facilitate thorough clean-up of any accidental spills and protect soils from erosion and contamination.

The following potential spills were identified, and the associated spill prevention/mitigation procedures are listed

- **Diesel Fuel/Gasoline**

Diesel Fuel is the primary fuel source on location. Tanks up to 30 m<sup>3</sup> may be used to store fuel on location. Fuel will be stored in double walled tanks to minimize the risk of a catastrophic spill. Automatic shut-off nozzles and drip trays will be used for fueling to minimize the risk of minor spills.

Should a spill occur, it would be on the ice pad, limiting contamination and facilitating clean-up. Diesel fuel will be transported to location by truck.

Spill contingency supplies and equipment as detailed in the Land Use Permit application will be on site, in addition to the routine construction and road maintenance equipment (e.g. front-end loader). MGM Energy, through its parent company, Paramount Resources Ltd, is a member of the Mackenzie Delta Spill Response Coop (MDSRC). The majority of the MDSRC equipment is currently stored in Norman Wells (reflecting industry activity). In the event of a serious spill, additional equipment would be obtained from this source.

- **Vehicle Fluids (lube oil, hydraulic fluid, antifreeze)**

Drip trays will be placed under vehicles parked for an extended period of time but there is a remote possibility of a mechanical failure resulting in a spill of one of the above fluids. Lube oil and hydraulic oil spills would be minor as the volume of fluid is small and it would be expected to remain on the ice pad surface, facilitating cleanup and preventing contamination of the land. A spill of antifreeze (engine coolant) may penetrate the ice pad due to its properties, requiring removal of more contaminated material. Environmental effects are predicted to be negligible due to minimal volumes (up to 50 liters for a large truck).

- **Drilling Fluids (mud, brine, etc.)**

No drilling fluids or brine are planned for this operation.

- **Gray Water and Sewage**

Due to the remote location, one or more camps will be required. Grey water and/or sewage will be stored in tanks on location, and either treated on site and/or trucked to an approved disposal location. Any spill would be cleaned up with onsite equipment immediately. Residual environmental effects are predicted to be negligible.

- **Cement**

A small amount of cement will be used in the abandonment process. The cement will be mixed and used. The largest volume used at one time (limited by the size of the mixing tanks) is approximately 3m<sup>3</sup>. There is negligible risk of ground contamination due to the nature of mixed cement. Should any of the mixed cement or dry powder be spilled it will be easily cleaned up from the ice surface.

- **Acid and Chemicals**

No acid or other chemicals are currently planned for this operation.

- **Radioactive Materials**

No radioactive sand or other tracers are planned for this program.

### **Discussion and Recommendations**

Considering the above, the worst-case scenario for the environmental (and thus financial) risk associated with the project is that of a diesel fuel spill. As noted, it is expected that any spill would be confined to the location and limited to the surface of the ice pad. There is also the possibility of a spill associated with a transportation incident. In this event there would be no ice pad, but a mitigating factor would be the smaller amount of fuel in the truck.

Due to the remote location and limited size, the “actual loss or damage” would be expected to be limited to the cost of cleanup and local (onsite) mitigation. Due to the precautions above and the fact that the site will be occupied almost continuously during operations, the risk of a spill of the full volume of diesel on site is considered very unlikely but is used below as a worst-case scenario.

To estimate the magnitude cost of cleaning up and remediating a spill we assume:

- 8 days of work by 6 laborers plus indirect costs and accommodation results
- 100 m<sup>3</sup> of contaminated material disposed of at a BC licensed waste facility
- Equipment will be on site from construction and road maintenance activities and additional equipment will be sourced from Norman Wells and Fort Liard as required.

The above worst-case scenario assessment addresses the most likely event to occur with the highest potential for actual loss or damage as a result of a diesel fuel spill. An estimate of the maximum reasonable cost to control and mitigate this event is included in Appendix 1. As described, a worst-case scenario event would be of limited area and clean up would be of short duration. For these reasons, Paramount believes that any loss or damage as defined in 63(3) of the Oil and Gas Operations Act (OGOA) would be minimal and the cost associated with such an event would be essentially limited the cleanup of the spill. Paramount does not believe that there are any other significant risks with potential for loss or damage as defined in the OGOA

In consideration of:

- The above risk analysis
- MGM/Paramount's insurance policy(s) applicable to this operation
- MGM/Paramount's financial strength as evidenced by the Financial Statements provided as part of the Operations Authorization
- MGM/Paramount's past well abandonments performance

Paramount believes there is sufficient proof of financial responsibility, but if required by OROGO, Paramount proposes to issue an Irrevocable Letter of Credit (ILC) in the amount of \$536,866 as detailed in Appendix 1 (attached) as additional evidence of Financial Responsibility.

## Appendix 1

Cost estimate to Mitigate Worst Case Scenario Spill  
at East Mackay I-78

**Initial Clean-up - winter****8 days**

<b>Resource</b>	<b>Unit Cost</b>	<b>Units</b>	<b>Days</b>	<b>Costs</b>
Supervisor	\$ 1,500	2	10	\$30,000
Labour	\$ 600	6	8	\$28,800
Loader/cat	\$ 3,000	1	8	\$24,000
Vaccum/Steam truck Combo Unit	\$ 3,000	2	8	\$48,000
Accomodation	\$ 500	10	10	\$50,000
Consumables	\$ 2,000	1	8	\$16,000
Transport waste to BC Waste Facility	\$ 20,000	2	1	\$40,000
Waste disposal	\$ 18,000	1	5	\$90,000
Environmental Crew	\$ 1,000	2	8	\$16,000
Lab Analysis	\$ 5,000	1	1	\$5,000
Project Management, Regulatory & Administration costs @ 10%				\$34,780
<b>Total Initial Clean up</b>				<b>\$382,580</b>

**Summer Clean-up - Monitor****4 days** Inspection - Minor clean up

<b>Resource</b>	<b>Unit Cost</b>	<b>Units</b>	<b>Days</b>	<b>Extension</b>
Supervisor	\$ 1,500	1	4	\$6,000
Labour	\$ 600	4	4	\$9,600
Air transportation	\$ 2,000	1	2	\$4,000
Accommodations	\$ 300	5	4	\$6,000
Consumables	\$ 1,000	1	4	\$4,000
Helicopter	\$ 9,000	1	1	\$9,000
Lab analysis	\$ 1,000	1	4	\$4,000
Project Management, Regulatory & Administration costs @ 10%				\$4,260
<b>Total Summer 1</b>				<b>\$46,860</b>

**Follow up - year 2**

## Vegetation Monitoring

<b>Resource</b>	<b>Unit Cost</b>	<b>Units</b>	<b>Costs</b>
On site personnel	\$ 5,000	4	\$20,000
Lab analysis	\$ 1,000	1	\$1,000
Helicopter	\$ 9,000	1	\$9,000
Flights etc	\$ 4,000	1	\$4,000
Project Management, Regulatory & Administration costs @ 10%			\$3,400
<b>Total</b>			<b>\$37,400</b>

**Summary**

<b>Phase</b>			
Initial Clean-up			\$382,580
Summer 1	Inspection/clean up		\$46,860
Summer 2	Vegetation Monitoring		\$37,400
Contingency (15%)			\$70,026
<b>TOTAL</b>			<b>\$536,866</b>



# CERTIFICATE OF LIABILITY INSURANCE

This certificate is issued as a matter of information only and confers no rights upon the certificate holder and imposes no liability on the insurer. This certificate does not amend, extend or alter the coverage afforded by the policies below.

<b>1. CERTIFICATE HOLDER - NAME AND MAILING ADDRESS</b>		<b>2. INSURED'S FULL NAME AND MAILING ADDRESS</b>	
Government of the Northwest Territories		Paramount Resources Ltd. and/or MGM Energy Ltd.	
Office of the Regulator of Oil & Gas Operations		4700, Bankers Hall West	
P.O. Box 1320		888 - 3rd Street S.W.	
Yellowknife	NT	POSTAL CODE X1A 2L9	Calgary AB
			POSTAL CODE T2P 5C5

**3. DESCRIPTION OF OPERATIONS/LOCATIONS/AUTOMOBILES/SPECIAL ITEMS TO WHICH THIS CERTIFICATE APPLIES** (but only with respect to the operations of the Named Insured)

Commercial General Liability Policy Includes: Cross Liability, Contractual Liability, Personal Injury, Severability of Interest Clause and Broad Form Property Damage.

Commercial Property Policy includes: "All Risks" Replacement Cost of direct physical loss or damage to property insured, except as excluded by Policy. See Attached...

**4. COVERAGES**

This is to certify that the policies of insurance listed below have been issued to the insured named above for the policy period indicated notwithstanding any requirements, terms or conditions of any contract or other document with respect to which this certificate may be issued or may pertain. The insurance afforded by the policies described herein is subject to all terms, exclusions and conditions of such policies.

**LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS**

TYPE OF INSURANCE	INSURANCE COMPANY AND POLICY NUMBER	EFFECTIVE DATE YYYY/MM/DD	EXPIRY DATE YYYY/MM/DD	LIMITS OF LIABILITY (Canadian dollars unless indicated otherwise)		
				COVERAGE	DED.	AMOUNT OF INSURANCE
<b>COMMERCIAL GENERAL LIABILITY</b> <input type="checkbox"/> CLAIMS MADE <b>OR</b> <input checked="" type="checkbox"/> OCCURRENCE <input checked="" type="checkbox"/> PRODUCTS AND / OR COMPLETED OPERATIONS <input checked="" type="checkbox"/> EMPLOYER'S LIABILITY <input checked="" type="checkbox"/> CROSS LIABILITY  <input checked="" type="checkbox"/> WAIVER OF SUBROGATION  <input checked="" type="checkbox"/> TENANTS LEGAL LIABILITY <input type="checkbox"/> POLLUTION LIABILITY EXTENSION <input type="checkbox"/> <input type="checkbox"/>	Chubb Insurance Company of Canada 37111204	2023/06/01	2024/05/15	COMMERCIAL GENERAL LIABILITY		
				BODILY INJURY AND PROPERTY DAMAGE		
				LIABILITY - GENERAL AGGREGATE		USD \$2,000,000
				- EACH OCCURRENCE		USD \$2,000,000
				PRODUCTS AND COMPLETED OPERATIONS		
				AGGREGATE		USD \$2,000,000
				<input type="checkbox"/> PERSONAL INJURY LIABILITY		
				OR		
				<input checked="" type="checkbox"/> PERSONAL AND ADVERTISING INJURY		
				LIABILITY		USD \$2,000,000
MEDICAL PAYMENTS		USD \$50,000				
TENANTS LEGAL LIABILITY		USD \$2,000,000				
POLLUTION LIABILITY EXTENSION						
<input checked="" type="checkbox"/> NON-OWNED AUTOMOBILES <input checked="" type="checkbox"/> HIRED AUTOMOBILES	Chubb Insurance Company of Canada 37111204	2023/06/01	2024/05/15	NON-OWNED AUTOMOBILES		USD \$2,000,000
				HIRED AUTOMOBILES		USD \$ 75,000
<b>AUTOMOBILE LIABILITY</b> <input type="checkbox"/> DESCRIBED AUTOMOBILES <input checked="" type="checkbox"/> ALL OWNED AUTOMOBILES <input checked="" type="checkbox"/> LEASED AUTOMOBILES ** ** ALL AUTOMOBILES LEASED IN EXCESS OF 30 DAYS WHERE THE INSURED IS REQUIRED TO PROVIDE INSURANCE	Chubb Insurance Company of Canada 99510146	2023/06/01	2024/05/31	BODILY INJURY AND PROPERTY DAMAGE COMBINED		CAD \$2,000,000
				BODILY INJURY (PER PERSON)		
				BODILY INJURY (PER ACCIDENT)		
				PROPERTY DAMAGE		
<b>EXCESS LIABILITY</b> <input checked="" type="checkbox"/> UMBRELLA FORM <input type="checkbox"/>	AXIS Reinsurance Company (Canada Branch) CTX/626480/01/2023	2023/06/01	2024/05/15	EACH OCCURRENCE		USD \$3,000,000
				AGGREGATE		
<b>OTHER LIABILITY (SPECIFY)</b> <input checked="" type="checkbox"/> Commercial Property	Lloyd's Underwriters B1263EA0219123	2023/06/01	2024/05/15	As Per Schedule		
<input checked="" type="checkbox"/> Pollution Legal Liability	Chubb Insurance Company of Canada 37335022	2023/06/01	2024/05/15	Each Incident		USD \$2,000,000

**5. CANCELLATION**

Should any of the above described policies be cancelled before the expiration date thereof, the issuing company will endeavor to mail 30 days written notice to the certificate holder named above, but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives.

<b>6. BROKERAGE/AGENCY FULL NAME AND MAILING ADDRESS</b>		<b>7. ADDITIONAL INSURED NAME AND MAILING ADDRESS</b> (Commercial General Liability- but only with respect to the operations of the Named Insured)	
Gallagher Energy Risk Services			
Suite 1220, 530 8th Ave SW			
Calgary	AB	POSTAL CODE T2P 3S8	
<b>BROKER CLIENT ID:</b>			POSTAL CODE

<b>8. CERTIFICATE AUTHORIZATION</b>		CONTACT NUMBER(S)	
ISSUER Gallagher Energy Risk Services	AUTHORIZED REPRESENTATIVE Jennifer Lu	TYPE Phone	NO. 403-705-5555
		TYPE Fax	NO. 403-705-5556
SIGNATURE OF AUTHORIZED REPRESENTATIVE	DATE 2023/09/21	TYPE	NO.
		EMAIL ADDRESS	

## DESCRIPTIONS Continued.

Including Boiler & Machinery (Equipment Breakdown), Business Interruption, Contingent Business Interruption and Extra Expense.

Excess Liability/Umbrella Policy sits excess of the Commercial General Liability, Pollution Liability and Commercial Automobile Liability Policy.

### Additional Coverages:

1st Excess Liability Policy No. 1000011955231

Insurer: Starr Insurance Company

Effective Date: June 1, 2023

Expiry Date: May 15, 2024

Limit: USD 5,000,000 excess of USD 3,000,000 Policy No. CTX/626480/01/2023

Operator's Extra Expense Policy No. OILCO.023018

Insurer: Lloyd's Underwriters

Effective Date: February 28, 2023

Expiry Date: May 15, 2024

Limit: USD 10,000,000 Any One Occurrence, Cost of Control (100%), Combined Single Limit.