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TRANSMITTAL

TRANSMITTAL No. **21-2895-001-0004**
PROJECT: 21-2895-001 Potash Solution Mining - Regulatory Approval and Licencing Support

TO: Jennifer Winsor P.Eng.
Manitoba Environment, Climate and Parks
Environmental Approvals Branch
1007 Century Street
Winnipeg, MB R3H 0W4

FROM: Shaun Moffatt
KGS Group

DATE: February 15, 2022

SUBJECT: Response to Public and TAC Comments - PADCOM Potash Solution Mining Project (File 6126.00)

SUBMITTED FOR
☐ Approval ☐ Review And Comment
☐ As Requested ☑ Your Use

SENT VIA: Email

DOCUMENT	DESCRIPTION	STATUS
PADCOM_Response to Public and TAC Comments	Response to Public and TAC Comments - PADCOM Potash Solution Mining Project (File 6126.00) Rev. Final [Feb 15, 2022]	Issued for Use

REMARKS:

Dear Jennifer Winsor,

Please find the attached documents with the associated information listed on the transmittal.

Should you have any questions, please contact me at our office.

Regards,

Shaun Moffatt

SENT BY: Josephine Rokyta [Document Control]

COPIES TO:

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KGS Group

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J. Bert Smith
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Potash and Agri Development Corporation of Manitoba

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February 15, 2022

Manitoba Environment, Climate and Parks
Environmental Approvals Branch
1007 Century Street
Winnipeg, Manitoba R3H 0W4

Attention: Jennifer Winsor, P.Eng.
Senior Environmental Engineer

Re: PADCOM Potash Solution Mining Project (File 6126.00)
Response to Public and TAC Comments

Dear Jennifer Winsor:

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) is submitting this letter on behalf of Potash and Agri Development Corporation of Manitoba Ltd. (PADCOM) in response to questions from the public and the Technical Advisory Committee (TAC) relating to the Environment Act Proposal (EAP) application that was originally submitted by PADCOM on September 2, 2021. The EAP was submitted to obtain the required Environment Act Licence for a proposed Potash Solution Mining Project (the Project). Enclosed with this letter is a table and supporting attachments providing additional details and clarification in response to the public and TAC comments and questions that have been compiled from the public registry website for the Project. Comments from six of the nine public members were in support of the project with no questions or concerns presented and comments from four of the 14 TAC organizations indicated that they did not have any concerns. While these comments have been compiled in the enclosed table no response was required.

Please do not hesitate to contact the undersigned if you have any questions or require additional information.

Prepared By:

[redacted]

Shaun Moffatt, M.Sc.
Senior Environmental Scientist

Approved By:

[redacted]

Jason Mann, M.Sc., P.Geo.. F(C
Environmental Department Head/Associate Principal

SFM/jr
Attachments

cc: Daymon Guillas

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STATEMENT OF LIMITATIONS AND CONDITIONS

Limitations

This report has been prepared for Potash and Agri Development Corporation of Manitoba (PADCOM) in accordance with the agreement between KGS Group and PADCOM (the "Agreement"). This report represents KGS Group's professional judgment and exercising due care consistent with the preparation of similar reports. The information, data, recommendations and conclusions in this report are subject to the constraints and limitations in the Agreement and the qualifications in this report. This report must be read as a whole, and sections or parts should not be read out of context.

This report is based on information made available to KGS Group by PADCOM. Unless stated otherwise, KGS Group has not verified the accuracy, completeness or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith. KGS Group shall not be responsible for conditions/issues it was not authorized or able to investigate or which were beyond the scope of its work. The information and conclusions provided in this report apply only as they existed at the time of KGS Group's work.

Third Party Use of Report

Any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

Geo-Environmental Statement of Limitations

KGS Group prepared the geo-environmental conclusions and recommendations for this report in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this report is based on the information that was made available to KGS Group during the investigation and upon the services described, which were performed within the time and budgetary requirements of PADCOM. As this report is based on the available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate or contradicted by additional information. KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated.

TABLE

KGS
GROUP

Summary of Responses to Technical Advisory Committee Comments on the PADCOM Potash Solution Mining Project - Environment Act Proposal (EAP) Application

ID #	Commentor Acronym	Comment	Response
MOG-1	ARD - MOG	All drawings and figures should be to scale, with legend, scale bar and north arrow.	Figures 7, 14 and 36 from the EAP have been revised as requested to provide legends, scale bars and north arrows as requested and are provided as Figure KGS-01, KGS-02 and KGS-03, respectively, in Attachment 1.
MOG-2	ARD - MOG	EAP Pg. 10, Section 1.1 Project Overview - Require clarification on the extraction amounts and the number of drill holes.	PADCOM is targeting to mine 100,000 tonnes/year at this site. After discussion with MECP, the Project included the potential to increase capacity up to 250,000 tonnes/year, although it is unlikely that this would occur within 2-years as described in the EAP. Only two production wells (reversible between intake and injection) will be drilled for this project along with a downhole brine injection well.
MOG-3	ARD - MOG	EAP Pg. 20, Section 1.4 Project Location and Land Tenure - Detailed map with scale and legend, a survey drawing of the area would address this.	Figure 7 from the EAP has been revised as requested to provide legends, scale bars and north arrows as requested and is provided as Figure KGS-01 in Attachment 1.
MOG-4	ARD - MOG	EAP Pg. 26, Section 2.2.1 The Beechy Solution Potash Mining Technology - Need more information and clarification on the extraction process.	Section 2.2.1 of the EAP is a high-level overview of the process, whereas section 2.7 provides more information and details on the process which is also shown graphically in Figure 16 - Plant Process Flow Chart.
MOG-5	ARD - MOG	EAP Pg. 31 - Scaled diagrams needed to make further comments.	Figure 14 from the EAP has been revised as requested to provide legends, scale bars and north arrows as requested and is provided as Figure KGS-02 in Attachment 1.
MOG-6	ARD - MOG	EAP Pg. 38, Section 2.7.6 Process Water Pond (and Borrow Pit) - Need more information on proposed location and type of the material excavated from the pond.	The process water pond is located at west edge of the property, as shown in Figure KGS-02 and KGS-03, which is the direction of the local groundwater flow as well as surface water flow at the site. The description of the existing soils foundations in the vicinity of the proposed process water pond and plant, is based on 6 testpits (Figure KGS-02) and visual site interpretations completed by Harvey Haugen of Beechy Potash. The foundation soils comprise an upper layer of grey high plasticity glaciolacustrine clay. There is a 0.2 m thick water bearing granular zone at approximately 1 m depth. Seepage from this surficial aquifer layer into the testpits was slow and limited, indicative of a semipervious, possibly discontinuous granular zone. The granular zone was underlaid by a brown high plasticity clay zone that extended to approximately 3 m depth with refusal on shale bedrock.
MOG-7	ARD - MOG	EAP Pg. 41, Section 2.8.2 Subsidence - Scaled, high resolution imagery diagrams and site specific subsidence study needed to make a comment and further clarification on how to detect and measure subsidence.	Greater details regarding subsidence are provided in Attachment 2.
MOG-8	ARD - MOG	EAP Pg. 42, Table 4 - Need more information on the study source.	The estimated surface subsidence that will occur was determined based on volumetric calculations provided in Attachment 2. The uniform estimate of subsidence reflects a projection at 45 degrees from the mined ore body upward to surface, consistent with that determined by the Solution Mining Research Institute of Austria. The actual subsidence is anticipated to not be uniform, but more dish shaped. The maximum subsidence could potentially reflect the maximum ore body vertical height cavern (0.84 m), with limited subsidence of 10 to 20% of the cavern height occurring beyond the mine footprint projection. This subsidence is anticipated to occur progressively possibly for over a 100-year period beyond mine closure.

ID #	Commentor Acronym	Comment	Response
MOG-9	ARD - MOG	EAP Pg. 75, Section 7 Decommissioning - Further clarification needed to make a comment.	It is not clear what further clarification is needed as the decommissioning activities have been described as best as they can at this time. PADCOM is committed to restoring the site to original site conditions and decommissioning the production and brine injection wells no longer being used in accordance with the appropriate regulatory requirements when it comes time to decommissioning. This could include as an example conducting an Environmental Site Assessment to identify the presence or absence of impacts at the site and site remediation as required.
GMS-1	ARD - GMS	Sections 2.7.7, 2.11, 6.1.4, and 6.1.5 provide information on the proposed brine injection/disposal well. The EAP does not provide detailed construction information for the proposed injection/disposal well, states two possible disposal formations, and does not detail how groundwater that has the potential to provide potable water or water that could be treated to be potable will be protected. Because of the depths of the solution production and injection wells, these will be regulated under The Oil and Gas Act. It is recommended that the wells be thoroughly cased/grouted through all potable water aquifers or aquifers that the water can be potentially treated for potable water use.	The brine injection well will be constructed to allow for disposal of brine within the Winnipeg Formation sandstone, which is a non potable saline aquifer within the Ordovician directly underlain by the Precambrian. This geological unit is used extensively for brine disposal in the oil and gas industry within western Manitoba and in Saskatchewan. The brine injection well design and construction will be in accordance with the Manitoba Oil and Gas Act and Regulations. For example, the well will be cased, and the annular space cemented over the entire well length from ground surface to the top of the Winnipeg sandstone. A packer assembly will also be used during brine injection to reduce well casing pressures during well injection operations. Monitoring of mud loss during drilling, and well testing of the properties of the Winnipeg Formation will be included during brine well installation to understand the formation static pressure condition and permeability, as needed to inform brine injection volume and pressure conditions that may be expected during potash mining operations.
GMS-2	ARD - GMS	Section 4.1.4 indicates that six, test holes/water wells were drilled on the Site as part of the Site foundation study. Construction details for these wells were not provided. These well records should be submitted as part of the EAP application and may require submission to ARD under the Groundwater and Water Well Act.	These six testholes were shallow holes that were drilled with a post hole auger to a maximum depth of 3 m or until refusal when reaching bedrock. They were drilled to identify the soils foundation characteristics, assess the piezometric surface and measure conductivity at the site, as described in the EAP. These testholes were backfilled and not advanced to wells such that there are no well records to be submitted.
GMS-3	ARD - GMS	As described in the application, the groundwater quality beneath the site is at risk of degradation from the operation. It is recommended that the operation provide a plan that will protect groundwater in the area. (See comment for description of potential concerns).	Please see response to WQMS-1 and WQMS-2. Along with monitoring of the closed loop characteristics of the process stream, the planned operations and management described for the process water pond (and its planned groundwater cutoff), groundwater monitoring wells will be installed within the shallow groundwater granular zone on the downgradient side of the process water pond, and near the property boundaries. Groundwater levels will be measured, flow directions determined, and wells will be sampled twice per year (spring and fall) to assess potential groundwater impacts from the project site. A baseline water quality from these wells will be established prior to site operations. Groundwater laboratory analyses will include routine analysis (e.g., major ions), and metals. Field chemistry (temperature, electrical conductivity, and pH) will be measured at the time of field sampling.

ID #	Commentor Acronym	Comment	Response
AQS-1	MECP - AQS	Based on the provided information, it is expected that the proposed potash mine and potash processing plant may not produce any significant impact on air quality in the surrounding area. However, AQS suggests that the proponent should conform to the Environment and Climate Change Canada's "Code of Practice for the Management of PM2.5 Emissions in the Potash Sector in Canada" appropriately.	PADCOM acknowledges this comment and confirms that it will adhere to the Environment and Climate Change Canada's "Code of Practice for the Management of PM2.5 Emissions in the Potash Sector in Canada" where appropriate and related to solution mining.
ODW-1	MECP - ODW	Section 2.11 and 6.1.4, Brine Disposal, did not provide sufficient information detailing the proposed brine disposal into the aquifer/s, and did not provide sufficient information for the Office of Drinking Water to assess the potential impacts to drinking water using those aquifer/s as raw water source/s. The proposal did not provide sufficient information detailing potential impacts to drinking water (regulated by The Drinking Water Safety Act and Regulations) via groundwater.	Please see response to GMS-1. Brine disposal will be conducted within a properly constructed and licenced well to the Winnipeg Formation sandstone, which underlies and is isolated from all overlying potable aquifer systems in the region. The brine Injection well will not be installed in time for the production test. As such any brine requiring disposal during the production test phase of the project will be collected at site, transported, and disposed of at an existing and approved/licenced 3rd party deep well disposal site within Manitoba or eastern Saskatchewan.
DWRL-1	MECP - DWRL	PADCOM is required to submit an application for a Water Rights Licence. Authorization from the Water Use Licensing Section, of the Drainage and Water Rights Licensing Branch, is required before any supply well exploration drilling activities begin.	PADCOM is no longer planning to drill a groundwater supply well as process water will instead be trucked to the site. PADCOM understands that if at any point during operation they decide to install a groundwater well that an application will need to be submitted for a Water Rights Licence.
WRO-1	MECP - WRO	Any water control works would require a license or registration. Water control works are defined as: - any dyke, dam, surface or subsurface drain, drainage, improved natural waterway, canal, tunnel, bridge, culvert borehole or contrivance for carrying or conducting water, that (a) temporarily or permanently alters or may alter the flow or level of water, including but not limited to water in a water body, by any means, including drainage, or (b) changes or may change the location or direction of flow of water, including but not limited to water in a water body, by any means, including drainage.	PADCOM acknowledges this comment and confirms that it will apply for a Water Control Work Registration Certificate for the proposed site drainage works with MECP through the on-line water licencing portal in accordance with the Water Rights Regulation. The proposed site drainage would likely meet the definition of Class A — Minor Surface Drains Construction, which includes construction of surface drains with a depth not exceeding 12 inches below natural prairie level and not result in the drainage of Class 6 or 7 soils or unimproved organic soils. If the drainage works are determined not to be registerable then PADCOM will apply for a Water Control Works Licence.

ID #	Commentor Acronym	Comment	Response
WQMS-1	ARD - WQMS	The EAP prepared by PADCOM considers the Potash Solution Mining Project to have a negligible impact on surface water. However, few details are provided as to how the environmental impact assessment was determined. Unfortunately, the absence of defined evaluation criteria (magnitude, direction, duration, frequency, reversibility) from the EAP limited the overall characterization of the impacts. In addition, few details were provided regarding the environmental risks to surface waters and mitigation measures in place to manage this risk.	As described in the response to WQMS-2 on-site drainage will be collected in a process water pond sized to accommodate a 1 in 50-year rainfall event with the water used as makeup water in the mining process. Any potential leak or spill from the production or brine injection wells and the pipe gallery connected to the processing facility would also be contained on-site and collected in the process water pond and recirculated back into the system. Between the site containment, drainage system and process water pond there is very little risk of impacted surface water leaving the site. Because the process water pond is pumped dry 90% of the time, in the very infrequent occurrence and short duration of a rainfall greater than a 1 in 50-year event, the water that would outflow from the process water pond would be predominately rainwater with little to no measurable potash salts. As such the potential adverse effect to surrounding surface water would be very low magnitude, very infrequent, localized to the drainage ditches immediately surrounding the site and only a short duration and therefore not considered significant.
WQMS-2	ARD - WQMS	PADCOM is proposing to build a surface water runoff collection system (comprised of perimeter trenches, a borrow pit, a process water pond, and a pumping system) in an effort to limit the release of contaminated water to the natural environment. Unfortunately, few specifications and engineering designs of the water collection system are provided. The WQMS recommends that PADCOM provide additional details regarding how the surface water will be captured, how much water will be stored in the pond, what type of intense rainfall event the collection system can withstand, and how this water will be recycled / reused within the processing facility.	The existing natural drainage pattern and channels surrounding the site will prevent water from flowing onto the site. The existing shallow surficial granular zone at the site, combined with site drainage control features will capture and route any runoff and seepage from the plant/work areas to the process water pond, as shown on Figure KGS-03 (Attachment 1). A perimeter slurry cutoff wall will extend 1 m below the surficial granular aquifer zone into the brown high plasticity clay and extend around the outer perimeter of the plant, production and disposal wells, pond and access roads, thereby directing any impacted groundwater to the pond. In addition, there will be an internal drainage tile grid to intercept any impacted seepage from the plant area and route the discharge to the pond. There will also be a storage drain surface ditch system along the perimeter site access road loop to intercept and route surface runoff to the pond. Water collected in the pond will be circulated back into the process and used as makeup water in the mine operation. The pond is roughly oval and approximately 32 m long by 22 m wide and 3 m deep, with a volume of 930 m^3 (245,900 gallons), capable of accommodating a 1 in 50-year rainfall event. Water will not be stored in the pond as it will be pumped dry 90% of the time with the water stored in a 400-barrel (16,000 gallon) tank within the processing building to be used as makeup water. As such, water will only be in the pond during spring runoff and rain events and only for as much time as is required to pump the pond dry again. At 100,000 tonnes/year potash production capacity 6.48 m^3 (1,712 gallons) of makeup water are required to be added per hour.
WQMS-3	ARD - WQMS	PADCOM suggests that the new innovative approach to potash mining will reduce the amount of water used and eliminates the need for a tailings pond/outdoor stockpiled product. However, the WQMS wonders if the water pond is essentially a small tailings pond.	A tailings pond is an area of refused mining tailings where the waterborne refuse material is pumped into a pond to allow the sedimentation of solids from the water. The proposed solution mining process crystallizes the potash salts that are pumped from the production well such that there are no mine tailings to be stored above ground. The process water pond is designed to collect and manage runoff within the plant site and use this water on a continuous basis for makeup water for the mining process.

ID #	Commentor Acronym	Comment	Response
WQMS-4	ARD - WQMS	Figure 36, which provides a schematic of the site drainage plan, includes the locations where the drainage tiles, storage drain, and slurry walls are to be installed; however, does not describe where the pond will be positioned and how the pond will be constructed (e.g., slope, materials).	Figure 36 from the EAP has been revised as requested to provide legends, scale bars, north arrow and the location of the process water pond and is provided in Attachment 1. Details of the pond construction are provided in the response to WWQMS-2.
WQMS-5	ARD - WQMS	PADCOM's proposal suggests that any contamination issues in the pond will be dealt with by diluting with more freshwater runoff. However, for many contaminants (e.g., bioaccumulative metals), dilution is not the solution.	As described in the response to WQMS-1 because the process water pond is pumped dry 90% of the time the water that would outflow from the process water pond during a rainfall greater than a 1 in 50-year event would be predominately rainwater with little to no measurable potash salts. Because the pond is pumped dry there is no opportunity for contaminants of concern to bioaccumulate. Additionally, the brine disposal injection well is used periodically to reduce the buildup and accumulation of magnesium in the mining system, which will also reduce accumulation of other ions such as KCl and NaCl.
WQMS-6	ARD - WQMS	The WQMS would be concerned if contaminated surface runoff from the property (or pond) is released to the natural environment during snowmelt or intense rainfall events. It is understood that the pond will be pumped down to minimum levels to accommodate surface runoff from the site. However, the EAP states that during an extreme rainfall event, surface runoff will be handled by allowing the excess flow to bypass the pond. The WQMS is concerned that bypassing the system could result in the discharge of deleterious substances to the natural environment. Although there are no lakes, rivers, and streams located within the project site, there are fish bearing waterbodies nearby (e.g., Assiniboine River located ~1.5 km east) that is anticipated to receive surface runoff from the project site. It is recommended that PADCOM provide additional details as to what this bypass system entails and where the water will be pumped to if the pond is too full to control the amount of surface runoff and the plant is unable to cope with additional water.	As described in the responses to WQMS-1 and WQMS-5 water would only be released from the site during the very infrequent occurrence of a rainfall greater than a 1 in 50-year event. Additionally, because the pond is pumped dry 90% of the time the water discharged would be predominately rainwater with little to no measurable potash salts. The process water pond will be equipped with an overflow weir and outlet channel with erosion protection to discharge excess rainwater in a controlled manner for rainfall events greater than a 1 in 50-year event. This outlet channel will tie into the existing natural drainage surrounding the property as shown in Figure KGS-03 (Attachment 1).

ID #	Commentor Acronym	Comment	Response
WQMS-7	ARD - WQMS	The WQMS recommends that PADCOM regularly monitor and inspect the water collection system to ensure it is working efficiently and that deleterious substances (e.g., nutrients, ionic constituents such as magnesium, potassium, and chloride) are not being discharged off the property. Staff in the WQMS would be concerned if water quality in the Assiniboine River (or further downstream) were to deteriorate (e.g., increased salinity, increased nutrient loading) as a result of the proposed project.	As described in the response to WQMS-5 any water discharged from the site would be predominately rainwater with little to no measurable impacts to surrounding surface water quality. Regardless, PADCOM is prepared to monitor the water quality in the process water pond. The water level in the pond will be estimated each morning and the conductivity of water pumped from the pond to the plant will be monitored daily. If an extreme rainfall event occurs that results in release of water from the pond, then the conductivity of the water being released will be monitored and the event reported to MECP. In addition to daily conductivity measurements the pond water will be analyzed for concentrations of K, Na, Ca, Mg, SO4, Cl and carbonates following a variable frequency. These will be measured once a month during the initial start-up phase until concentrations are within a predictable range. Following the initial start-up phase the frequency will be reduced with samples collected 3 months later, then 6 months later and then once per year.
WFRE-1	MECP - WFRE	A search of the Conservation Data Center Biotics Database should be requested by the proponent for the project area. Ground-based surveys for rare species and species listed under ESEA and federally listed Species at Risk may be required for the mine site, well sites, and pipelines routes intersecting or within applicable setback distances of suitable habitat. If rare and/or endangered species are located nearby, mitigations may be required.	A search of the Manitoba Conservation Data Centre (CDC) has been completed and indicated that there are no occurrences of Endangered or Threatened species listed under ESEA or SARA recorded at or within 2 km of the site. Two bird species, bobolink and barn swallow, which are listed as threatened are present in the regional area outside of the 2 km buffer around the site and beyond the applicable setback distances. Considering the results of the CDC search, the previously disturbed condition of the site and the relatively small area of disturbance proposed ground-based surveys were not required and there are no mitigation measures required to address Endangered or Threatened species.
WFRE-2	MECP - WFRE	The project area is located in a region that has game species (moose, deer, elk) which are important for rights-based and licenced hunters, as well as many at-risk bird species (Sprague's pipit and Chestnut-collared Longspur) just south of the site. Even a small development can have impacts on local wildlife (such as disruption to songbird breeding). A more thorough listing of wildlife in the area, as well as mitigation measures, should be included in the wildlife section. It is unacceptable to say that there is "no evidence that this area is home to wildlife" without providing evidence that due diligence has been done.	The project area is located within the St. Lazare Ecodistrict of the Aspen Parkland Ecoregion. A list of the vegetation, mammal and bird species tracked by the CDC for this Ecoregion is provided in Attachment 3. While these species are provincially tracked most of them are globally secure and as noted in the response to WFRE-1 a search of the CDC indicated that there are no occurrences of Endangered or Threatened Species at Risk recorded at or within 2 km of the site. Wildlife that are widespread throughout the Ecoregion include deer, coyote, red fox, ground squirrel, cottontail rabbit, hare, striped skunk, voles and mice, however, wildlife has been affected by agricultural development. As described within the EAP the proposed plant site is located on previously disturbed land that was cleared for agricultural use and the abandoned town of Harrowby. Additionally, railway avenue is immediately adjacent the site with an active railway across the road and a Bunge processing facility within 500 m to the north, as well, the surrounding area was materially changed during the sale of the Manitoba Potash lands. As such, species sensitive to human disturbance are not anticipated to be present in the area. The vegetation observed on site consists of seeded grass with only a few trees and no evidence of wildlife nesting or denning at the site. Considering the proposed Project and existing site ownership and conditions, the project is not anticipated to cause adverse effects to wildlife or species at risk. Regardless, typical mitigation measures that will be implemented include minimizing the loss and disturbance of vegetation, limiting project activities to designated areas, providing wildlife awareness information to equipment operators, following wildlife timing windows to avoid breeding bird season and adhering to speed limits.

ID #	Commentor Acronym	Comment	Response
WFRE-3	MECP - WFRE	The EAP makes reference to well sites and pipelines that will be required for mine operations. These sites should be identified and a wildlife/habitat assessment should be completed and included in the Wildlife section of the EAP. If proposed well sites and pipeline routes have not yet been identified, there should be a required commitment to conduct an EAP as it is relevant to the environmental footprint of the mine.	The two production wells and one brine injection well are located within the 1 ha plant site immediately southwest of the processing plant building with the only pipelines in a pipe gallery approximately 50 m long, connecting these wells to the equipment within the building, as shown in Figure KGS-02 (Attachment 1). The proposed plant site is located on privately owned land that was previously cleared and disturbed for agricultural use, with no evidence of wildlife nesting or denning at the site. As noted in response to WFRE-1 a search of the CDC indicated that there are no occurrences of Endangered or Threatened species listed under ESEA or SARA recorded at or within 2 km of the site. Two bird species, bobolink and barn swallow, which are listed as threatened are present in the regional area outside of the 2 km buffer around the site and beyond the applicable setback distances.
FPB-1	ARD - FPB	No concerns.	N/A
MTI-1	MTI	No concerns from MTI branches; Roadside Development, Western Regional Operations, and Water Management Planning and Standards.	N/A
PPS-1	MECP - PPS	No concerns.	N/A
PB-1	ARD - PB	There are no known Petroleum Deposits or infrastructure in the area and therefore PB has no concerns.	N/A
ECE-1	MECP - ECE	Section 2.9.4 mentions the use and storage of 'light crude'. This may fall under the Storage and Handling of Petroleum and Allied Petroleum Products Regulation MR 188.2001. Further clarification is required to determine if this product is subject to the regulation.	The Safety Data Sheet (SDS) for the Sweet Crude Oil (SDS #21341) that PADCOM will be using on-site is provided in Attachment 4. As noted in the SDS the Sweet Crude Oil is 100% Petroleum Crude Oil (contains benzene, toluene, xylene) and based on discussions with MECP it meets the definition of a petroleum product in the Code of Practice. As such, the use and storage of this product will be in compliance with MR 188.2001. During the initial testing phase 230L drums will be used to store the oil on-site rather than the 25,000 L tanker vehicle as originally proposed in the EAP to be in compliance with MR 188.2001.
ECE-2	MECP - ECE	Section 6.1.1 proposes the use of a 10,000 litre sewage holding tank that will be truck hauled to the Russell wastewater treatment lagoon. Please clarify the type and estimated volume of wastewater to be hauled there. ECE Branch has received an Application to Register a 2000 gallon holding tank to service the office building.	While the EAP proposed the use of a 10,000 L sewage holding tank PADCOM will instead be using a 7,570 L (2,000 gallon) sewage holding tank and submitted an Application to Register the tank with the ECE Branch, as noted. Only domestic wastewater from the office washrooms and lunchroom will be stored in the sewage holding tank as the mining process does not generate any other wastewater. Based on an anticipated 10 staff on-site (3 in office and 7 in plant) and an average generation of 35 gallons of wastewater per person per day the holding tank will need to be emptied and truck hauled to the Russell wastewater treatment lagoon approximately every 5 to 6 days.

Summary of Responses to Technical Advisory Committee Comments on the PADCOM Potash Solution Mining Project - Environment Act Proposal (EAP) Application

ID #	Commentor Acronym	Comment	Response
LB-1	ARD - LB	Location of the Potash plant has no impacts to Crown Land under the Crown lands Act. Area of interest is expressed to be generally Township 19, 20, and 21 in the proposal. There are a few crown land parcels dispersed along those townships. It appears from the report that the general activity would be subsurface, although that is not clear. For any occupation to occur on the land, an application to crown land tenure will be required, for any work activity to occur on Crown land unders the Crown Lands Act will require a Crown Lands Permit.	The only Project development at surface is at the potash plant site, which as noted is on private land and not Crown Land. PADCOM acknowledges that if there is any future development or project activities that occur on Crown Land that a Crown Lands Permit will be required.

Notes:

ARD = Agriculture and Resource Development
MECP = Manitoba Environment, Climate and Parks
MTI = Manitoba Transportation and Infrastructure
MOG = Mining, Oil and Gas
GMS = Groundwater Management Section
AQS = Air Quality Section
ODW = Office of Drinking Water
DWRL = Drainage and Water Rights Licensing
WRO = Water Resource Officer
WQMS = Water Quality Management Section
WFRE = Wildlife, Fisheries and Resource Enforcement
FPB = Forestry and Peatlands Branch
PPS = Parks and Protected Spaces
PB = Petroleum Branch
ECE = Environmental Compliance and Enforcement
LB = Lands Branch

ID #	Commentor Acronym	Comment	Response
WTFMB-1	WTFMB	The Manitoba Approvals and Licensing process should not proceed until the minster has made a decision on the CEC Hearings or has provided written reasons as to why hearings are not being held.	This is a comment addressed to Manitoba Environment, Climate and Parks (MECP) Environmental Approvals Branch (EAB). No response required from PADCOM.
WTFMB-2	WTFMB	The additional relevant information in the form of a full environmental impact statement should include all information documented as missing in this and other submissions to the Manitoba approvals process.	As requested by EAB, PADCOM is providing a letter response providing additional information to address comments and questions. The EAB has not directed PADCOM to revise and resubmit the EAP.
WTFMB-3	WTFMB	The proponent is obligated to contact the IAAC about federally regulated issues to determine if the project should be designated. The proponent must supply information to the IAAC that is missing in the EAP such as the extent and locations the brine and hot water pipelines to be built over the duration of the project that may impact fisheries from spills, information on GHG implications, information on water levels, and any other information the IAAC may need to asses the project impacts within federal jurisdiction.	A letter report was submitted to IAAC on December 13, 2021, providing responses to a request from IAAC for additional information to support their determination regarding whether the Project should be designated under the Impact Assessment Act.
WTFMB-4	WTFMB	This evidence establishes that the estimates in the EAP of 0.5 tonnes of water required to produce one tonne of potash are inaccurate and far below what would actually be required. (see equations, figure and calculations in WTFMB comment when responding).	The water calculations presented by WTFMB assume that all water is added which is not how the solution mining works. The process water for the mine is circulated and reused with water only added to make up volume created in the cavern by dissolution of KCl. As presented in Table 3 of the EAP 16.6 tonnes of water will need to be added per hour during the 7,700 hours of operation per year. This equates to 127,820 tonnes of water added to mine 250,000 tonnes of potash, or 0.51 tonnes of water per 1 tonne of potash.
WTFMB-5	WTFMB	The Assiniboine West Watershed District of southwest Manitoba as specified under the Manitoba Watershed Districts Act and the Saskatchewan Water Security Agency must be consulted to review this project and determine the sustainability of this large draw of water from the Hatfield Valley Aquifer and all other interconnected groundwater resources. Regional groundwater modelling must be done to evaluate the sustainability of the aquifer system and the effect of all the accumulated withdrawals on water resources in the area and on the water levels in the Assiniboine River pertaining to the Navigable Water Act.	While the EAP indicated installation of a groundwater well, considering the relatively small volume of process water required, estimated to be 142.6 m^3/day (37,700 gallons/day) at the 100,000 tonnes or potash/year capacity, water will instead be trucked to the site from the nearby Russell Municipal water plant and no groundwater well installed. Likewise, even if PADCOM increases the production capacity to 250,000 tonnes of potash/year they will still truck water to the site rather than installing a groundwater well. As the Project is no longer proposing installation of a groundwater well there is no need for regional groundwater modelling to assess sustainability of the aquifer and no potential to affect water levels on the Assiniboine River located approximately 1 km east of the plant site.
WTFMB-6	WTFMB	The city of Brandon, the town of St. Lazare and other nearby towns must be consulted regarding the potential harm to their drinking water supply from brine spills.	Please see responses to ODW-1, GMS-1, GMS-3, and WQMS-2. The total volume of brine held in the plant at any one time is approximately 200 m^3. The selective solution mining system is a closed loop process, which will be monitored throughout operations for any loss of system fluids during operation of the mine. It is extremely unlikely that the entire volume of operational fluids would ever be discharged from the system. Surface drainage from the site is controlled, and any spill of a volume capable to discharge from the site would be responded using containment and remedial measures (e.g. temporary damming, and pumping to storage). This would prevent offsite migration via the surface drainage system, thus preventing it from reaching the Assiniboine River.

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WTFMB-7	WTFMB	The EAP gives contradictory information on GHG emission rates. Which value is to be used 0.25 tonnes of CO2, 0.121 tonnes of CO2 or 596 g of CO2 per tonne of potash?	GHG emission rates have been calculated for various scenarios representing the initial start-up phase and operating at the target capacity of 100,000 tonnes of potash/year, as well as possible future expansion to 250,000 tonnes of potash/year, with consideration of the different energy sources available for use at the various stages. The GHG emission rate calculations are presented in Attachment 5. As shown in the calculation operation with propane results in higher GHG emissions compared to electrical power.
WTFMB-8	WTFMB	The large energy and potential GHG emissions for heating of aquifer water has been omitted from the PADCOM EAP. The energy required to cool and reheat the brine is not quantified. It appears, therefore, the propane heating emissions of 35.7 kt CO2 apply only to the drying of the potash. The IAAC guidelines require a proponent to estimate any GHG emissions associated with the project. The proponent must submit the EAP to the IAAC together with estimates of total GHG emissions.	Aquifer water is not heated and therefore has not been included in the GHG emission calculations that are presented in Attachment 5. The process, as shown in the EAP, cools hot saturated brine from the mine in a series of crystallizers. The cold brine off the last stage is used to cool the preceding stages in a countercurrent flow. With enough crystallizers most of the heat is recovered to produce warm brine for return to the mine, however, some heat is lost and has to be replaced. The design proposed in the EAP recovers about 1/2 of the heat using 4 crystallizers per row. The GHG calculations provided do include the energy requirement for brine heating.
WTFMB-9	WTFMB	In conformance with the SAAC requirements to provide a credible plan that describes how the project will achieve net-zero emissions by 2050, the licence conditions for the project should include a stipulation for a deadline to transition from propane to electrical heat pumps for drying the potash. Diesel generators should not be allowed for the large amount of energy required to heat the aquifer water, heat and cool brine and provide power for other plant needs. PADCOM should be required to build windmills to provide the large amount of power required for this mining operation in order to meet GHG targets for net zero emissions by 2020.	While the EAP originally proposed using a diesel generator to provide supplemental power during the initial 3-month testing phase, with the delay in project approvals the plant will be connected to electric power prior to start. As such, diesel is only used in mobile equipment as shown in the GHG emission calculations provided in Attachment 5. The request for the licence to include a condition providing a timeframe to transition from propane to electric is a comment addressed to MECP EAB, however, as shown in the calculations PADCOM proposes to transition to electric power prior to any future expansion beyond the 100,000 tonnes/year. In considering potential means of powering the project, it was found that electricity from the Manitoba Hydro grid would be preferable over the long-term as it has relatively low GHG emissions given the high use of hydropower. Onsite windmill use would have potential environmental effects and energy storage concerns. Per Part 3 of Environment and Climate Change Canada's National Inventory Report 1990-2019: Greenhouse Gas Sources and Sinks in Canada (2021), Manitoba's 2019 generation intensity is 1 2 g CO2eq/kWh (consumption intensity is 1 3 g CO2eq/kWh), whereas the wind energy chapter of the IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation indicates a lifecycle emissions intensity of 8 to 20 g CO2eq/kWh for wind energy. (Generation intensity data provided by Manitoba Hydro shows 0 88 g CO2eq/kWh in 2019 and 0.44 g CO2eq/kWh in 2020.) Given the various benefits, such as low GHG emissions from using Manitoba's grid electricity along with the facility's proposed location close to the grid, it was decided that transitioning to using Manitoba's grid electricity would be the preferred choice.
WTFMB-10	WTFMB	One injection well is documented in the processing plant area that would be used to control magnesium levels in the brine mine feed. The reason for control of magnesium levels is not given. This is another example of missing information in the EAP. It appears that magnesium, prior to treatment in the processing plant, must be removed from the ore as an undesirable component of the potash fertilizer.	Magnesium is extremely soluble so it will slowly build up in the circulating brine used in the mining process. When the brine becomes saturated with magnesium it limits the ability to dissolve potash and therefore needs to be disposed of in the injection well. Magnesium does not show up in the end potash fertilizer product.
WTFMB-11	WTFMB	The geological formation for brine disposal injection is not specified. The Cretaceous age Swan River Formation (or Manville) or the Devonian Winnipegosis Formation are given as possibilities. The research on the suitability of these formations to accept the large quantities of brine disposal should be done before the project is approved.	Please see responses to TAC comments GMS-1 and ODW-1. The PADCOM project requires a maximum brine disposal rate into the Winnipeg Formation estimated at 100 USgpm (0.38 m^3/min), which is anticipated to be infrequently required as described in response to comment WFTMB-12. For comparison, the Winnipeg Formation Sandstone nonpotable saline aquifer is the same formation that Mosaic uses to dispose 15,000 USgpm (56.8 m^3/min) of water/brine and have been doing so for the last 20 years or more.

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WTFMB-12	WTFMB	The quantity of brine that must be disposed per year and the number of and locations of the brine disposal wells must be specified.	A single brine injection well is proposed at the site as shown in Figure KGS-02 (Attachment 1). The buildup of magnesium in the brine requiring disposal will be dependent on the amount of magnesium in the ore. The nearest hole to the current mined area has about 0.25% magnesium. Based on this magnesium concentration it has been conservatively estimated that the brine injection well may be used up to 4 times a month with an injection pump rate of 100 USgpm (0.38 m^3/min) over a period of 10.5 hours each time equating to approximately 3,024,000 gallons/year (11,450 m^3/year).
WTFMB-13	WTFMB	A Theis solution should be carried out using the properties of the aquifer used for brine disposal to determine the pressure build up and feasibility of injection over the long term. The pressure from brine injection should not exceed the fracture pressure for the aquifer caprock	Please see responses to TAC comments GMS-1 and ODW-1.
WTFMB-14	WTFMB	Any abandoned or active exploration or oil wells that penetrate to the brine injection formation wells, that could act as upward conduits to potable aquifers for injected brine, must be identified and avoided. Considering that there are two active oil fields nearby the project area, the Manson and Birdtail, there will likely be numerous abandoned deep wells.	Please see responses to TAC comments GMS-1 and ODW-1. It is also our understanding that these oil and gas exploration wells are completed within the carbonate strata at a substantially shallower depth overlying the Winnipeg Formation sandstone, which is a distinct unit targeted for brine disposal. As such, any vertical interconnection via these wells is not anticipated. In addition, the oil and gas exploration wells are in general located more than 5 km to the south of the proposed PADCOM site. Because of these factors, and because the injection of brine will be done based on industry practices and site-specific formation characteristics (e.g. static pressure conditions and permeability), it is not anticipated that any pressure placed on the Winnipeg sandstone will be communicated to any oil and gas exploration wells in the region. A search of the oil and gas well database can also be completed for additional confirmation of this interpretation, and to identify any possible associated risks.
WTFMB-15	WTFMB	As required in the CEC hearings for the Canamax original potash mine proposal of 1989, the ground around brine disposal and withdrawal wells should be frozen to prevent leakage to potable aquifers near the surface.	The original Canamax proposal was for a traditional underground mining operation, requiring substantial access shafts and groundwater control to facilitate the shaft installations and construction of the underground works. Ground freezing was proposed for that project to control groundwater flows around the large vertical shaft excavations. The brine injection well construction will include casing and cementing of the annular space through all formations above the Winnipeg Formation. As such no ground freezing is necessary. Please see responses to TAC comments GMS-1 and ODW-1.
WTFMB-16	WTFMB	Leak detection and automatic shutdown for the hot water and brine pipelines is not discussed and should be a licensing condition for the Project. Accurate real time volume measurements of the amount of brine entering the pipeline system and the amount leaving, together with an automated mass balance check that shuts down the pipelines when a volume discrepancy is recorded must be installed.	The selective solution mining system is a closed loop process, which will be monitored for any loss of system fluids throughout operation of the mine. As the aboveground pipe gallery is only approximately 50 m in length from the wells to the plant leak detection and volume monitoring are not required. PADCOM will however, be conducting hourly visual observations of the pipe gallery for any leakage. Additionally, these pipelines are within the slurry wall and perimeter drains, so any leaks would be captured and directed to the process water pond as described in the response to TAC comment WQMS-2.
WTFMB-17	WTFMB	Brine spills and leaks are considered only within the plant site area. Potential brine leakage from the pipelines necessary to convey brine throughout the 212 sq. mile project area is not discussed. Potential pollution of surface waters, domestic and irrigation wells, crop and pasture land, and fish habitat from pipeline brine spills is not evaluated.	Brine spills and leaks are considered only within the plant site area because the two production wells, one brine injection well and pipe gallery proposed are located within the 1 ha plant site. The 212 square miles referenced, and shown in the EAP Figure 9, is the entire mineral rights holdings in both the North Block and South Block and not what is proposed to be developed. There are no pipelines that extend beyond the 1 ha plant site.

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WTFMB-18	WTFMB	Groundwater and brine transport modelling for different leakage scenarios including a large spill and gradual ongoing undetected smaller leaks should be done to quantify the risk and detriment from leakage.	Please see responses to TAC comments GMS-1 and ODW-1. Brine injection will be facilitated through a cased well with annular space fully cemented, from ground surface to the Winnipeg Formation (the brine disposal formation). Brine injection will be completed through a pipe stem and packer assembly internal and separate to the well casing and sealed at the top of the brine disposal zone. As such, the installed well casing is not subjected to brine injection pressures. In addition, brine injection to the Winnipeg Formation will be done following industry standard guidelines and based on site specific static pressure and permeability characteristics of the brine disposal zone at the PADCOM site. Brine transport modeling for leakage scenarios is unnecessary. With respect to surface spills, please also see responses to GMS-3, WQMS-2, and WTFMB-6.
WTFMB-19	WTFMB	In the processing plant, crude oil at 2 litres per tonne of potash is to be used as a dust suppressant. Crude oil is known to contain carcinogens such as benzene and PAH's and other toxic organic compounds. A representative value for benzene content in crude oil is 0.52 weight%. Clearly a non toxic substitute must be used for a dust suppressant.	The use of small quantities of crude oil as a dust suppressant is an industry standard in potash mining. While it is acknowledged that crude oil is a hazardous material there is no other accepted non-toxic substitute.
WTFMB-20	WTFMB	The extreme toxicity of octadecyl amine to aquatic organisms would violate the Fisheries Act under federal jurisdiction. The risk to the fisheries must be reported to the IAAC. Use of a non toxic anti-caking agent must be a licence condition for this project. Octadecyl amine should not be allowed.	The nearest surface water is a wetland slough area located approximately 350 m southeast of the site between Railway Avenue and the rail line, whereas the Assiniboine River is approximately 1 km east of the site. As described in the responses to TAC comments WQMS-1 and WQMS-5 surface water runoff from the building and the site will be collected in a process water storage pond with water only released from the site during the very infrequent occurrence of a rainfall greater than a 1 in 50-year event. Additionally, because the pond is pumped dry 90% of the time the water discharged would be predominately rainwater with little to no contaminants of concern. Therefore, there is no potential to impact fish and fish habitat. MECP will be responsible for determining conditions of the licence, however, use of Octadecylamine as an anti-caking agent is an industry standard.
WTFMB-21	WTFMB	Toxic heavy metals and selenium are often found in subsurface mineral deposits. Elevated levels of chromium and lead have been found in potash fertilizer in Bangladesh. The conditions in the Bangladesh study may not be applicable to the PADCOM mine however the evidence from Bangladesh establishes that heavy metals can occur in potash. Ore samples from the PADCOM potash deposit must be analyzed for heavy metal, fluoride, radium and selenium content.	PADCOM potash ore samples were not analyzed for heavy metal, fluoride, radium and selenium as there has been no evidence to date of this being a concern in the nearby Saskatchewan potash mining industry which targets the extension of the same potash deposit. The Saskatchewan potash industry does comprehensive resource testing, through the Saskatchewan Research Council, to satisfy international standards for potash, which includes metals analyzed by Inductively Coupled Plasma (ICP) analytical methods.
WTFMB-22	WTFMB	Hydrogen sulphide (H2S) contamination of potash ore has been reported in Saskatchewan. The H2S develops as a result of the mining process. Organic material introduced from aquifer water that can be used as a food source by sulphate reducing bacteria that release H2S. The levels of H2S in the recovery brine should be monitored. One mitigation scheme that should be investigated is the removal of organic content from the aquifer water.	As described on the Saskatchewan Research Council website this is more of a problem in solution mining that uses crystallization cooling ponds at surface, which is not proposed as part of the PADCOM project. There is very limited risk of organic material getting into the brine solution at the site from the process water pond, based on its planned mode of operation. See also response to TAC comment WQMS-2. (https://www.src.sk.ca/blog/potash-mining-challenges-and-solutions-dealing-hydrogen-sulfide)
WTFMB-23	WTFMB	A potash stockpile in the processing plant could generate harmful levels of PM10 ad PM2.5 particulate. Ventilation design to minimize particulate exposure to workers and PM2.5 and PM10 and particulate level monitors should be specified in the EAP.	Crystallized product is uniform and dust is minimal, regardless all product is treated with dust control at the dryer and dust collection is provided at transfer points. Additionally, as described in the response to TAC comment AQS-1 PADCOM confirms that it will adhere to the Environment and Climate Change Canada's "Code of Practice for the Management of PM2.5 Emissions in the Potash Sector in Canada" where appropriate and related to solution mining.

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WTFMB-24	WTFMB	The EAP states that no surface pipelines would be used implying all the pipelines to convey hot water, recovered brine and brine disposal would be buried. The location, number of such pipelines and landowner agreements for the pipelines over the approximately 212 square miles of project area is not mentioned.	The only pipelines required for the project are located on private property at the 1 ha plant site. These are within a pipe gallery approximately 50 m long connecting the two production wells and one brine injection well immediately southwest of the processing plant building with the equipment within the building. The 212 square miles referenced is the entire mineral rights holdings in both the North Block and South Block and not what this project is proposing to develop. There are no pipelines beyond the 1 ha plant site and therefore no landowner agreements required.
WTFMB-25	WTFMB	The IAAC, CP Rail, CN Rail have not been notified and permission obtained for PADCOM pipeline crossings of federally regulated railways as required under the Canada Railway Safety Act Standards Respecting Pipeline Crossing Under Railways.	There are no pipelines beyond the 1 ha plant site, which is private property, and therefore no pipeline crossings of federally regulated railways.
WTFMB-26	WTFMB	The IAAC and Manitoba Hydro have not been notified and permission obtained for the PADCOM pipeline crossings of the Birtle interprovincial transmission line as required by the Canada Energy Regulator Act.	There are no pipelines beyond the 1 ha plant site, which is private property, and therefore no pipeline crossings of the Birtle interprovincial transmission line.
WTFMB-27	WTFMB	The proponent has not identified the PADCOM pipeline crossings of provincial roads and has not notified and obtained permission from Manitoba Infrastructure for the crossing of the provincial roads.	There are no pipelines beyond the 1 ha plant site, which is private property, and therefore no pipeline crossings of provincial roads.
WTFMB-28	WTFMB	The proponent has not identified the municipal roads to be crossed by the PADCOM pipelines and obtained permission from the municipalities.	There are no pipelines beyond the 1 ha plant site, which is private property, and therefore no pipeline crossings of municipal roads.
WTFMB-29	WTFMB	Many rivers and streams must be eventually crossed by the brine pipelines including the Qu'Appelle River. All fish bearing water courses that must be eventually crossed by PADCOM brine pipelines must be identified and the DFO and IAAC notified of these crossings. Mitigation measures to minimize the risk of brine spills and detriment to fish habitat in consultation with the DFO and the Fish and Fish Habitat Protection Program under the Fisheries Act and Species at Risk Act must be implemented.	There are no pipelines beyond the 1 ha plant site and therefore no pipeline crossings of waterways. Based on the proposed Project and existing environment conditions described in the EAP there is no in-water construction activities as there are no waterbodies on or near the site and there are no brine pipelines crossing streams or rivers and therefore no potential concern to impact fish and fish habitat.
WTFMB-30	WTFMB	There are 12 units of The Upper Assiniboine Wildlife Management Area stretching from north of St. Lazare, south to Miniota and southeast to the Oak Lake area. The project infringement on these wildlife management areas must be determined and avoided.	The Upper Assiniboine Wildlife Management Area is located approximately 25 km south of the 1 ha plant site where project disturbances will occur and therefore it is not anticipated to be affected.
WTFMB-31	WTFMB	PADCOM has entered in agreements with Gambler and Birdtail Sioux First Nations however it appears no grass roots community based consultation under the auspices of the Crown was undertaken with the First Nations as required according to Section 35 of the Constitution Act.	Section 35 Consultation is the responsibility of the Crown and not the proponent. PADCOM has however, involved the communities of Gambler First Nation, Birdtail Sioux First Nation and Waywayseecappo First Nation since 2014 with Gambler First Nation and Birdtail Sioux First Nation entering a Memorandum of Understandings with PADCOM in 2015. Additionally, the Gambler First Nation is a 20% shareholder in the Project which will ensure continued Indigenous engagement throughout the Project operation.

ID #	Commentor Acronym	Comment	Response
WTFMB-32	WTFMB	There is no mention of consultation with the Métis concerning their traditional harvesting areas within the 212 square miles of the PADCOM project area such as the Spy-Hill community pasture. A community based Crown led Section 35 consultation should be conducted before this project proceeds. The Section 35 consultation should communicate with all Métis landowners in the area.	Section 35 Consultation is the responsibility of the Crown and not the proponent. As previously noted the 212 square miles referenced, and shown in the EAP Figure 9, is the entire mineral rights holdings in both the North Block and South Block and not what is proposed to be developed. The Project that PADCOM is proposing and has applied to be licenced is for mining a high-grade vein of potash below the surface of Sections 21 and 28-20-28 WPM. The only surface infrastructure proposed will be within an approximately 1 ha area plant site located on previously disturbed and privately owned land within part of the NW ¼ of 28-20-28 WPM.
WTFMB-33	WTFMB	The Tri-Roads Planning District does not contain the Southern Block PADCOM development area or important rural towns such as St. Lazare and Miniota. Well publicized community meetings must be held to cover the entire north and south block areas in St. Lazare, Miniota, Brandon and other nearby towns. The community meetings must provide comprehensive information on the project and explain how the risk of brine contamination of groundwater, local drinking water supplies and agricultural land, would be mitigated. Brandon must be involved because the city's drinking water is sourced from the Assiniboine River which could be affected by a brine spill.	As previously noted, the Project that PADCOM is proposing and has applied to be licenced is for mining a high-grade vein of potash below the surface of Sections 21 and 28-20-28 WPM and not the entire North and South Blocks of mineral rights. The only surface infrastructure proposed will be within an approximately 1 ha area plant site located on privately owned land within part of the NW ¼ of 28-20-28 WPM. Please also see responses to ODW-1, GMS-1, GMS-3, WQMS-2, WTFMB-6, and WTFMB-18.
TB-1	Tangi Bell	According to Manitoba Classes of Development Regulation potash mine and mills fall under a Class 3 Development. In 1988, public hearings by the Clean Environment Commission were provided for the development of a potash mine at Russell, Manitoba by Canamax Resources. I request written reason as to why this proposed project is being handled differently and not assessed under Class 3 developments.	This is a comment addressed to MECP EAB. No response required from PADCOM.
TB-2	Tangi Bell	A 10 km radius is identified for potential effects from the project (3.2 Spatial Boundaries). This radius extends outside of Manitoba and would then dictate agreement from the province of Saskatchewan as per section 13.1 of the Manitoba Environment Act.	The 10 km radius for the Regional Project Area is to look at larger regional socio-economic effects. While the radius extends into Saskatchewan there are no anticipated adverse changes to the environment that will occur on lands outside of Manitoba. There will be little to no adverse effect to the public or Indigenous peoples as the Project is a small-scale potash solution mine with low emissions and water consumption. In comparison the Project will provide definite and measurable public and Indigenous benefits in the form of local contract services, employment and social royalties, in addition to the tax revenues for the Municipality of Russell-Binscarth and Manitoba royalty tax.
TB-3	Tangi Bell	Although the Hatfield Aquifer is mainly in Saskatchewan it extends into Manitoba and will be used by the proponent; a Water Rights License should be required from the Saskatchewan Water Security Agency.	As described in response to WTFMB-5, while the EAP indicated installation of a groundwater well, considering the relatively small volume of process water required water will instead be trucked to the site from the nearby Russell Municipal water plant and no groundwater well installed. As such a Water Rights Licence will not be required from either Manitoba or Saskatchewan.

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TB-4	Tangi Bell	Leaks/spills/contamination from the mill site and mining will flow to the Assiniboine River which flows into the Red River and Lake Winnipeg. Provide a fish and fish habitat assessment.	As described in the responses to TAC comments WQMS-1 and WQMS-5 surface water runoff from the building and the site will be collected in a process water pond, which would also capture any leaks or spills. Water from the pond is recirculated back into the process such that it is only released from the site during the very infrequent occurrence of a rainfall greater than a 1 in 50-year event. Because the pond is pumped dry 90% of the time the water discharged would be predominately rainwater with little to no contaminants of concern. The nearest surface water is a wetland slough area located approximately 350 m southeast of the site between Railway Avenue and the rail line, whereas the Assiniboine River is approximately 1 km east of the site. Therefore, there is no potential to impact fish and fish habitat and no need to complete a fish and fish habitat assessment.
TB-5	Tangi Bell	Provide groundwater and surface water monitoring, a study of impacts from a brine release to the environment, groundwater and water bodies and plans for mitigation of these impacts.	Please see responses to ODW-1, GMS-1, GMS-3, WQMS-2, WTFMB-6, and WTFMB-18.
TB-6	Tangi Bell	What emergency measures will be provided to those obtaining drinking water from the Assiniboine River or from private wells in the event of contamination from a brine spill?	Release of contaminants to the Assiniboine River is not anticipated, as described in the response to comment WQMS-2 and because of the closed loop nature of the selective surface mining process proposed by PADCOM. Please also see responses to ODW-1, GMS-1, GMS-3, WTFMB-6, and WTFMB-18.
TB-7	Tangi Bell	The project indicates “no overland brine pipelines” but the North Block area alone covers 3 townships; 19,20, 21, Range 29WPM1. A South Block is discussed, referenced, and shown in figures 3 and 9 however it is not made clear that it will never be developed. If not by pipeline, how does the brine make its way to the plant for the entire duration of the 100+ year project?	The only pipelines required for the project are located on private property at the 1 ha plant site. These are within a pipe gallery approximately 50 m long connecting the two production wells and one brine injection well immediately southwest of the processing plant building with the equipment within the building. The 212 square miles referenced is the entire mineral rights holdings in both the North Block and South Block and not what this project is proposing to develop.
TB-8	Tangi Bell	Leak detection, monitoring, cathodic protection, must be installed on the system. How are leaks/spills monitored? How are corrosion and abrasion conditions from solution mining handled?	See the response provided to comment WTFMB-16.
TB-9	Tangi Bell	Provide a study on potential brine leaks to the underlying aquifer systems and water bodies including the Assiniboine River.	See the response provided to TB-6.
TB-10	Tangi Bell	The PADCOM EAP makes assumptions on “Biological Environment 4.2” wildlife, vegetation and fish; it lacks a detailed and thoughtful ecosystem study. It is insufficient for a 100+year potash mine/processing plant Environment Act Proposal. Provide a comprehensive assessment of ecosystems, wildlife in the entire project area including fish and fish habitat assessment.	See the response provided to TAC comment WFRE-2.

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TB-11	Tangi Bell	Provide a noise and light pollution study and impacts to wildlife, livestock and residents from all project operations including a cumulative impact study from neighbouring industry.	It will be up to MECP to determine whether a noise and/or light assessment will be required as a clause in the licence. It is important to note however, that there were no noise or light impact concerns identified at the Tri-roads planning district public hearing and no conditions included in the permit. The site will have two yard lights, similar to a farm site, and there will be soffit lights on the office. The EAP described the ambient noise levels from Bunge and it is anticipated that the noise from this site will be negligible with little to no cumulative effect anticipated. Noise sources would predominately be from loading trucks, estimated at approximately 7 per day. While the plant will be operated 24 hours a day truck hauling will only be done during daylight hours and the closest noise receptor is 1.6 km away. See the response provided to TAC comment WFRE-2 with regards to impacts to wildlife.
TB-12	Tangi Bell	The project will go beyond 2050 requiring the project to meet Canada GHG emission reduction targets under Bill C-12 Canadian Net Zero Emissions Accountability Act and the Strategic Assessment of Climate Change (SACC). The project must comply to Bill C-12 and SACC.	As shown in the GHG emission calculations that are presented in Attachment 5 and as described in the response to comment WTFMB-9, PADCOM no longer proposes to use a diesel generator and plans to transition away from using propane so that the mining process will approach zero carbon emissions in the future.
TB-13	Tangi Bell	Canada can only reduce fertilizer emissions 30% below 2020 levels by 2030 by sustainable farming practices that do not rely on synthetic fertilizers. How does an additional potash mine and mill enable Canada to reduce fertilizer emissions?	The potash mine is being proposed to provide economic development in southwestern Manitoba and to meet the current requirements for fertilizer. It is not in the scope of an EAP to discuss changing farming practices. With that said, the proposed mining process is unique in that it can approach zero carbon emissions as described in the response to TB-12. Mining potash as proposed with lower GHG emissions than traditional mining processes will help Canada to reduce fertilizer emissions.
TB-14	Tangi Bell	As a new project that bases itself on reducing GHG emissions it is concerning that the project has not considered producing its own energy rather than relying on fossil fuels, Hydro or combination thereof.	As described in the response to WTFMB-9 given the various benefits, such as low GHG emissions from using Manitoba's grid electricity along with the facility's proposed location close to the grid, it was decided that transitioning to using Manitoba's grid electricity would be the preferred choice.
TB-15	Tangi Bell	Provide GHG calculations for all energy choices stated in the proposal for the planned 250,000 tonnes production per year.	As described in the response to WTFMB-7 GHG emission rate calculations are provided for the various energy uses at the various stages of development and are presented in Attachment 5.
TB-16	Tangi Bell	Provide GHG calculations for heating the freshwater, cooling the brine for crystallization, drying the potash, and reheating the brine for injection.	The GHG emission rate calculations presented in Attachment 5 include estimates for the various process components.
TB-17	Tangi Bell	Provide GHG calculations for equipment used to load the product and for truck and rail transport.	The GHG emission rate calculations presented in Attachment 5 include estimates for equipment used to load the product. Rail is only a future possibility, and it is unknown if it will even be utilized. Transport trucks will be used and will be loaded at the facility, with the customer taking responsibility for the product after the product is loaded onto the truck. The eventual destination of the product is unknown, therefore estimates of transportation emissions cannot be completed at this time.
TB-18	Tangi Bell	Provide an economic feasibility report for supplying the plant with a new larger gas line required for the plant. Provide GHG emissions for all probable new connections in providing the new gas line from other industry and agriculture.	At this time an economic feasibility report of a new larger gas line has not been conducted. A dedicated gas line would only be potentially considered if the facility expanded to the 250,000 tonnes of potash/year. The potential for a dedicated gas pipeline compared to electric power supply would be assessed at that time. An assessment of GHG emissions for other potential future users of a gas utility are beyond the scope of the EAP for this project.

ID #	Commentor Acronym	Comment	Response
TB-19	Tangi Bell	Statements for time frames contradict other time frames in the proposal. The test and information and data contained in the Proposal seems to be for extraction volumes below the planned project capacity of 250,000 tonnes per year. The proposal does not match the final project, emission calculations do not match the final project etc; the proposal is not developed to a level appropriate of a credible, comprehensive environmental assessment that will protect the environment and thus human health.	The Project that PADCOM is proposing and has applied to be licenced is for mining a high-grade vein of potash below the surface of Sections 21 and 28-20-28 WPM and not the entire North and South Blocks of mineral rights. The only surface infrastructure proposed will be within an approximately 1 ha area plant site located on privately owned land within part of the NW ¼ of 28-20-28 WPM. PADCOM is targeting to mine 100,000 tonnes of potash/year at this site, however, after discussion with MECP, the Project included the potential to increase capacity up to 250,000 tonnes of potash/year, although it is unlikely that this would occur within 2-years as described in the EAP.
TB-20	Tangi Bell	The proposal indicates looking at possible direct loading from the processing facility to railcar in the project planning phase (Sec. 1.5) for 250,000 tonnes per year production and operations phase (Sec. 3.1.2). The facility design does not provide for this probability; rail load out, car storage/rail yard, spur line(s). The proposal should provide this information for rail assessment, to assess if feasible, what impacts will occur to neighbouring industries, residents and wildlife, increased rail traffic, noise and vibration.	The processing plant site was selected partially because of the possibility to accommodate shipping product by rail in the future. This, however, is not what is being proposed at part of this project. Shipping by rail would only be a future possibility and was therefore not investigated to any detail. The plan as proposed for this project is to supply all product to a single offtake customer, with PADCOM only responsible for loading the trucks at the processing plant. The customer will be responsible for trucking the product and is considering local facilities for transfer of product.
TB-21	Tangi Bell	The proposal files transportation of the product under “ancillary projects” (Sec. 2.12) however transport is a necessary component of the project (Sec. 3.1.2) and critical to its success, produces effects (road dust, infrastructure wear and tear, fugitive salt dust and potential contamination of vegetation, soil, and water systems, GHG) and should be assessed under this proposal, not dismissed from the project to a “trucking contractor”. Provide a site plan for planned rail load out and rail yard. Provide a traffic study and mitigation plans on 250,000 tonne planned production capacity. Provide a traffic study and mitigation plans on impacts to wildlife, livestock and residents. Provide mitigation of fugitive salt dust in transportation.	As described in the response to comment TB-20 shipping by rail is only a future possibility and not proposed at this time. As such, a site plan for rail sidings and loading would be developed at a future date, if shipping by rail is proposed. Based on the 100,000 tonnes of potash/year capacity with 42 tonnes/truck load, it is estimated that 2,381 truckloads will be needed per year or 7 trucks per day. The processing plant site was selected for the proximity to Highway 16 and existing nearby industrial development. Trucks would only travel approximately 3.2 km to reach Highway 16, of which approximately 1 km is paved, so there is little concern for road dust. Additionally, there are only two occupied homes south of the proposed Project that would be using the municipal gravel access road so there will be little social disturbance. Impacts to the municipal road condition from increased project traffic will be managed by PADCOM contributing to maintenance of the affected gravel municipal road. The addition of 7 trucks/day from the PADCOM project would be an increase of less than 0.5% of the existing 1,640 annual average daily traffic recorded by MTI on Highway 16. Regardless of the minimal anticipated adverse effects, PADCOM will employ standard mitigation practices such as adhering to speed limits, covering all loads being hauled and informing drivers about the risk of vehicle-wildlife collisions.
TB-22	Tangi Bell	The proposal does not contain material safety data sheet on all “chemicals” used. Amine is soluble in benzene which is found in crude oil. Both are toxic to aquatic life. Provide study on how chemicals and combining the chemicals will impact the environment.	As described in the EAP, only two chemicals are used in the mining process including Akzonobel Armeen HT (octadecyl amine) to prevent the product from caking and small quantities of crude oil as a dust suppressant. The SDS for these products are provided in Attachment 4. As described in the response to comments WTFMB-19 and 20, while it is acknowledged that these are hazardous materials, there is little risk for these to run-off from the site, use of these products is an industry standard and there is no other accepted non-toxic substitute.
TB-23	Tangi Bell	Applying amine and crude oil, a fossil fuel, to the potash will inevitably introduce it to the food chain, groundwater and water ways through agricultural operations, drainage practices, rain and snowfall. Source and use non toxic dust control and anti-caking agents.	As described in the response to comments WTFMB-19 and 20, while it is acknowledged that these are hazardous materials, use of these products is an industry standard and there is no other accepted non-toxic substitute.

ID #	Commentor Acronym	Comment	Response
TB-24	Tangi Bell	The technique has not progressed outside of the lab although the founder of Beechy has approached many in the Saskatchewan potash industry. Horizontal selective solution mining or potash is unproven. Why has the experienced Saskatchewan potash industry not team up with Beechy or trial the technique?	Selective solution mining was the first method tried in Saskatchewan. Several pilot stage plants were run in the 1950's and 60's. Beechy came up with the technique starting around 2000 and proposed a mine in Manitoba in 2001. The breakthrough in technique came from study of the previous attempts, modelling the procedure and laboratory tests. Two selective mines are currently in progress in Saskatchewan. These include Western Potash, with holes drilled and a partial plant, and Gensource with plans for a number of mines. Additionally, Buffalo Potash very recently started. All are modelled after a presentation provided to them by Beechy demonstrating this technique.
TB-25	Tangi Bell	No reference material is provided to support the statement of an environmental assessment exemption. It is unclear if the two small scale mines in Saskatchewan mentioned use the novel horizontal selective solution mining process. Regardless, under Manitoba Legislation potash mines and processing facilities are considered Class 3 developments and this project is avoiding conveyance of public hearings. I request written reason(s) as to why the Clean Environment Commission has not been convened.	The request for why the Clean Environment Commission has not been convened is a comment addressed to MECP EAB. While the Classes of Development Regulation lists Potash Mining as a Class 3 development, discussion with MECP indicated that this was based on anticipation that all potash mines would be large scale underground mining operation. MECP determined that the proposed small scale PADCOM solution potash mine is considered a Class 2 Development. This is similar to recent decisions made by Saskatchewan that determined two potash solution mines planned or under construction in Saskatchewan, that are larger than the PADCOM project, have not required a provincial Environmental Impact Statement as they were deemed "Not a Development". Please refer to public information for Gensource and Western Potash.
TB-26	Tangi Bell	Under “2.13 Alternative” the proposal is written in such a way that if the Beechy technology fails to live up to “laboratory testing and modelling” the only alternative is “conventional solution mine or typical underground mine”. Is the project licensing solely for the Beechy technology? Manitoba Conservation and Climate needs to clarify this section and ensure only the Beechy technology is under review for licensing.	This is a comment addressed to MECP EAB. No response required from PADCOM, regardless, as described in the EAP the proposed Project is for a potash solution mine. There is an experimental aspect to the project. Adjustments will be made but will be done within the current layout, such as optimization of temperature flow etc.
TB-27	Tangi Bell	After continued use as a dumping zone for injecting materials, has the ability for these formations to accept further material been analyzed and calculated? Please determine if the formation can handle additional volumes of injected material from this 100+ year project. What is the safe pressurization for these formations?	Please see responses to ODW-1, GMS-1, GMS-3, WQMS-2, WTFMB-11, WTFMB-12, and WTFMB-18.
TB-28	Tangi Bell	How does this 1 brine injection well service a project estimated at 100+ years? How many production wells are drilled for the entire project? How many injection wells are drilled for the entire project?	The Project as proposed consists of two production wells and one brine injection well that will be located within the site and connected by an above ground pipe gallery approximately 50 m in length to the equipment within the processing plant as shown on Figure KGS-02 (Attachment 1). The two production wells and downhole brine injection well are expected to last up to 40 years operating at a capacity of 100,000 tonnes of potash/year.

ID #	Commentor Acronym	Comment	Response
TB-29	Tangi Bell	For 250,000 tonnes of potash water consumption would be 33,000,000 gallons. This amount of water is permanently removed from the aquifer system. The proposal lacks critical studies on sustainable water draw from the Hatfield Valley Aquifer and if additional use from the PADCOM potash mine and processing plant would compromise present users on both sides of the provincial border. Is there sufficient knowledge of the aquifer systems in Manitoba? What is the sustainable yield of the aquifer from all users and can it handle the addition of this potash mine that has a 100+ year life?	There are several existing Municipality of Binscarth-Russell well sources in the region of the project that have been used thus far to facilitate drilling of the potash production wells, and which may also be used in the initial stages of the project (e g. potash production testing phase) for a process water supply. These well sources include the South Community Well, and the Spear Lake Community well. In addition, the Town of Russell water plant, and the prior community supply wells in the Village of Binscarth may be potentially available existing water sources (Binscarth is now supplied via pipeline from the new Russell water plant, and the prior supply wells in Binscarth remain available; the main Binscarth well with an approximate pumping capacity of 9 L/s). The Town of Russell water plant and wells have a treated water capacity of 41 L/sec, of which approximately 24 L/sec is in active use. Two water wells supplying the Russell treatment plant have raw water supply capacities of approximately 70 L/s, and 100L/s. The groundwater wells for Russell are located in an aquifer beneath SE-16-21-27W, approximately 10 km east of Russell. This water source was selected following a groundwater study of potential options and field testing to confirm the availability of suitable groundwater resources. This aquifer has also been the source of water for Russell for the past three decades. It is considered a reliable and sustainable aquifer. There is also the possibility for PADCOM use of the Town of Russell waterplant backwash water, a discharge flow of water to waste that is a byproduct of the treatment process, currently discharged directly to Spear Lake. This is a flow of approximately 7 L/sec (604,800 L/day; 110 USgpm). Water usage for the PADCOM project is estimated at 13,195,000 gallons/year (100,000 tonnes/year potash capacity), and up to 32,987,500 gallons/year (250,000 tonnes/year potash capacity). These water volumes are in the order of a 100 USgppm (approximately 6.5 L/s) supply for the larger 250,000 tonne/year potash production capacity. Based on the information provided above, there is the ability to source the required water supply from existing and active well sources, in the region of the PADCOM project. Should PADCOM wish to establish their own well water supply, the exploration/investigation, testing, and licensing of the potential supply would require provincial permitting, along with the services of a hydrogeologist licensed to practice within the Province of Manitoba. The groundwater exploration and water rights licensing process in Manitoba involves a full hydrogeological analysis and assessment of any aquifer source. Any establishment of a well water supply in Manitoba must pass the rigor of study by licensed professionals, with review and approvals by provincial experts. For interest and comparison purposes, Canada Golden Fortune is licensed to withdraw 3,200,000 m3/year (about 421 m3/hr) from the Hatfield aquifer north of Grenfell, Saskatchewan. The water use required by the PADCOM project is of a much smaller scale, and the incremental withdrawal from the aquifer system, should PADCOM pursue their own water source within the Hatfield aquifer, would be reviewed and vetted by Manitoba hydrogeologists during the investigation/exploration permitting, testing, and eventual water rights licensing process that would be required.
TB-30	Tangi Bell	It is unclear if indigenous consultations have occurred for all community members. It is unclear what public consultations have taken place and the outcome(s).	PADCOM has involved the communities of Gambler First Nation, Birdtail Sioux First Nation and Waywayseecappo First Nation since 2014 with Gambler First Nation and Birdtail Sioux First Nation entering a Memorandum of Understandings with PADCOM in 2015. Additionally, the Gambler First Nation is a 20% shareholder in the Project which will ensure continued Indigenous engagement throughout the Project operation. Table 9 in Section 5 of the EAP listed the public engagement activities undertaken for the Project which included meetings with the Town of Russell and the Municipality of Russell-Binscarth between 2012 and 2021 along with the Tri-Roads Planning District Public Hearing in January 2021. There were approximately 55 people in attendance at the January 2021 Public Hearing, including the two Municipal councils of the Tri-Roads Planning District. There were no public concerns raised at this hearing and generally people were in support of the Project being a small local mining operation as it would not bring in a large workforce from out of the area that could affect housing prices and increase traffic. In addition to these public engagement activities, PADCOM met with the three neighbouring landowners in the Harrowby area surrounding the Project.
HD-1	Hanna Drielick	I feel that the development of this mine will effect me in a positive way. I sincerely believe that this will create good jobs in our area and I hope to be able to apply for one of these jobs.	N/A

ID #	Commentor Acronym	Comment	Response
DT-1	Dana Tanner	I am writing this letter in support to the Potash Solution Mine.	N/A
TT-1	Tara Tanner	I, as a Manitoban, feel it would be great to have a potash mine in Manitoba, as the closest one is in Saskatchewan. It would create some jobs for local people and be able to create a revenue for Manitoba.	N/A
RLD-1	Rose LeDoux	I am very excited to have such a viable, valuable, and beneficial project coming to the Russell/Binscarth/Gambler area.	N/A
KLD	Kellie LeDoux	I, Councilor Kellie LeDoux of Gambler First Nation, would like to send in my support to the PADCOM mining solution company, recognizing it to be a great business venture and employment opportunity for our surrounding area of Russell/Binscarth/Gambler.	N/A
MO-1	Mackenzie Olynyk	I am in full support for this corporation and have been waiting eagerly for some time to see this operation begin.	N/A
MbEN-1	Manitoba Eco-Network	Given the size and scope of the project, the novel and unused mining technology proposed and the lack of detailed information provided to date, MbEN requests you consider PADCOM's proposed Potash Mine and Processing Plant as a Class 3 Development and require a Clean Environment Commission public hearing with participant funding.	This is a comment addressed to MECP EAB. No response required from PADCOM.
MbEN-2	Manitoba Eco-Network	The novel mining process, described as selective solution mining technology has been proposed in other jurisdictions in Canada. There is no discussion on the feasibility and/or success of this technology, nor any reference and reporting of those activities and studies from other jurisdictions.	The technology is supported by two technical papers delivered at the Solution Mining Research Institute. These include: - The Application of Polythermic Solution Mining Techniques and Curved Flow Design to the Solution Mining of Potash. - A review of Historic Developments in Potash mining, a Scientific Approach to Correcting Assumptions used in Current Designs, and Identification of New Principles for solution Mining.
MbEN-3	Manitoba Eco-Network	The full footprint of the project (i.e., 100 years at 250,000 tonnes potash extracted per year) has not been identified according to the mineral rights held, nor have the mineral rights been adequately geographically identified.	The Project that PADCOM is proposing and has applied to be licenced is for mining a high-grade vein of potash below the surface of Sections 21 and 28-20-28 WPM and not the entire North and South Blocks of mineral rights. Considering that the proposed Project would have an approximately 40-year operation life at 100,000 tonnes of potash/year PADCOM currently has no plans to develop any additional potash resources. If in the future PADCOM decides to develop any additional potash resources beyond the two current sections of land they would be required to complete another Environment Act Licence application with the associated environmental assessment. It is anticipated that any future development would also be restricted to within the 48 square mile North Block.
MbEN-4	Manitoba Eco-Network	The project schedule provided in the EAP and description of activities does not identify the full footprint of the project at 250,000 tonnes per year. It is our assumption that there will be a network of gathering pipelines leading to the processing facility to collect potash from the horizontal wells, to force hot water to collect the potash, and inject spent brine into the Winnipeg Formation.	The Project that PADCOM is proposing as submitted in the EAP is for mining a high-grade vein of potash below the surface of Sections 21 and 28-20-28 WPM. The only surface infrastructure proposed will be within an approximately 1 ha area plant site located on privately owned land within part of the NW ¼ of 28-20-28 WPM. This will include two production wells, a brine injection well, the plant and an office building. The only pipelines required for the project are located within a pipe gallery approximately 50 m long connecting the two production wells and one brine injection well immediately southwest of the processing plant building with the equipment within the building.

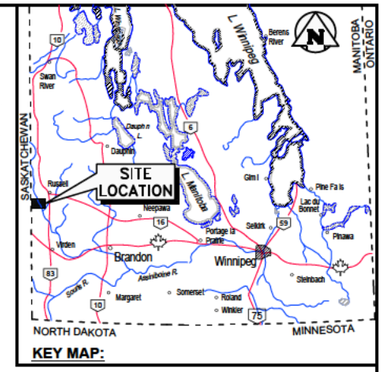
ID #	Commentor Acronym	Comment	Response
MbEN-5	Manitoba Eco-Network	There is also no accurate depiction of energy used, at what places and magnitude, and type, over the life of the project. A more accurate depiction of energy use will provide the true magnitude of greenhouse gas emissions of the project.	As described in the response to WTFMB-7 GHG emission rate calculations are provided for the various energy uses at the various stages of development and are presented in Attachment 5.
MbEN-6	Manitoba Eco-Network	There is no mention of how this project is financed, nor any indication as to how much governments may or have invested into the project to date in the form of grants, loans or subsidies (direct or indirect).	Except for a $300,000 grant from the Manitoba Mineral Development Fund the project will be entirely self-funded.
MbEN-7	Manitoba Eco-Network	There are a whole host of approvals, licenses, permits, authorizations, etc. from various agencies that have not been identified. Without the full project footprint of 250,000 tonnes per year at 100 years plus, it is impossible to provide comment at this point in time.	The full project footprint includes the two production wells, one brine injection well and the processing plant and office building as previously described. The approvals and permits required include the following: • A licence under The Environment Act (Manitoba) - process started by submission of the EAP. • A licence under The Oil and Gas Act (Manitoba) - well Licence No. 11641 and 11642 were issued for the two production wells on December 3, 2021 and PADCOM is in the final stages of obtaining the Well Licence for the brine injection well. • A Certificate of Approval in accordance with the Tri-Roads Zoning By-Law - a conditional use Certificate of Approval to proceed with the project was issued January 28, 2021. • Building permits from the Municipality of Russell-Binscarth (office building) and the Office of the Fire Commissioner (processing plant) - the building permit to construct the proposed office building has been obtained and PADCOM is in the process of obtaining a building permit to construct the proposed processing plant.
MbEN-8	Manitoba Eco-Network	Public consultation has not occurred for this proposal. Considering that the EAP has been submitted and the Environmental Approval process is in place, having public consultations led by the proponent would be meaningless. As mentioned, we suggest that the CEC conduct a public outreach program as part of their investigation into this project through the hearing process.	This is a comment addressed to MECP EAB. No response required from PADCOM; regardless public consultation has occurred as described in the response to comment TB-30.

ATTACHMENT 1

Revised Figures

KGS GROUP

11x17V2.1



KEY MAP:

LEGEND:

- CP RAILWAY
- EASEMENTS
- SECTION LINE
- PROPERTY IN PROCESS OF LEASING TO PADCOM
- ADDITIONAL PADCOM PROPERTY
- PROPERTY OWNED BY OTHER
- PROPOSED BUILDINGS

REFERENCE:

INFORMATION SOURCE: DESIGN AND LAYOUT PROVIDED BY CHENG MIAO AND HARVEY HAUGEN, BEECHY POTASH FIGURES
IMAGE SOURCE: BING JANUARY 2022

25 0 25 50 75m
SCALE: 1:2000

SITE PLAN
SCALE: 1:2000

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	22/02/15	ISSUED FOR INFORMATION	SFM	JDM

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POTASH AND AGRI DEVELOPMENT CORPORATION

PADCOM POTASH SOLUTION MINING PROJECT

SITE PLAN AND LAND OWNERSHIP

FEBRUARY 2022	KGS-01	REV. 0

Filename: P:\Projects\2021\21-2895-001\Dwg\Env\21-2895-001 KGS FIG-01 - Tab:Rev 0 Plotted By: pdeffner 2202/15 [Tue 8:58am]
11"x17" PLOT SCALE: 1"=2"

11x17V2.1

SITE PLAN
SCALE: 1:800

KEY MAP:

LEGEND:

- CP RAILWAY
- TP6 — PROPOSED TEST HOLES
- PROPOSED WELLS
- W — ABOVE GROUND PIPE GALLERY
- PROPERTY OWNED BY OTHER
- PROPOSED BUILDINGS

REFERENCE:

INFORMATION SOURCE: DESIGN AND LAYOUT PROVIDED BY CHENG MIAO AND HARVEY HAUGEN, BEECHY POTASH FIGURES
IMAGE SOURCE: BING JANUARY 2022

10 0 10 20 30m
SCALE: 1:800

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	22/02/15	ISSUED FOR INFORMATION	SFM	JDM

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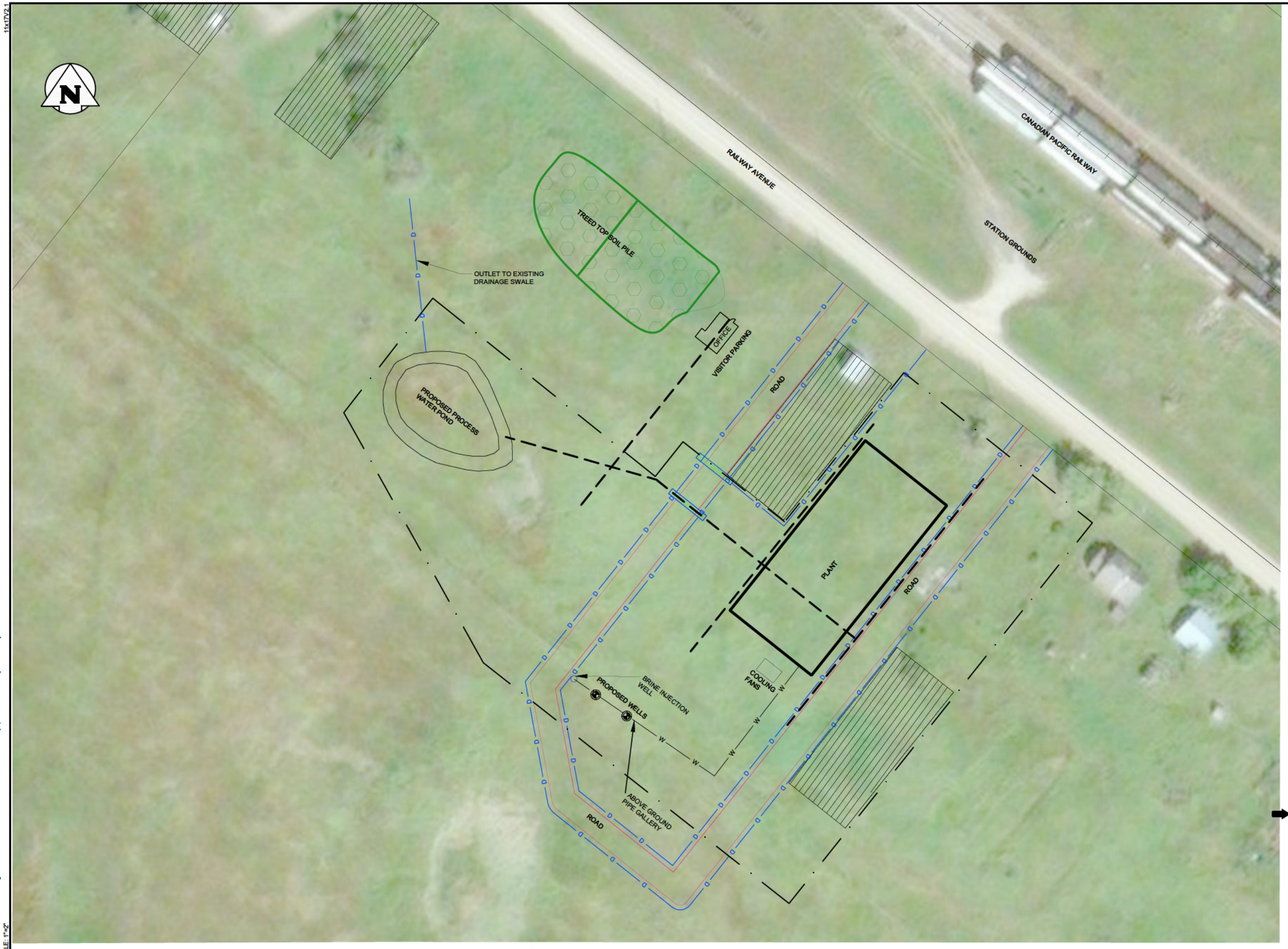
POTASH AND AGRI DEVELOPMENT CORPORATION

PADCOM POTASH SOLUTION
MINING PROJECT

SITE PLAN WITH TEST HOLES AND WELLS

FEBRUARY 2022 | KGS-02 | REV. 0

11x17V2.1



SITE PLAN
SCALE: 1:800

KEY MAP:

LEGEND:

- CP RAILWAY
- DRAINAGE TILE
- SLURRY WALL
- D — STORAGE DRAIN
- PROPOSED WELLS
- CULVERT
- W — ABOVE GROUND PIPE GALLERY
- PROPERTY OWNED BY OTHER

REFERENCE:

INFORMATION SOURCE: DESIGN AND LAYOUT PROVIDED BY CHENG MIAO AND HARVEY HAUGEN, BEECHY POTASH FIGURES
IMAGE SOURCE: BING JANUARY 2022

10 0 10 20 30m
SCALE: 1:800

NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
0	22/02/15	ISSUED FOR INFORMATION	SFM	JDM

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POTASH AND AGRI DEVELOPMENT CORPORATION

PADCOM POTASH SOLUTION
MINING PROJECT

SITE DRAINAGE PLAN

FEBRUARY 2022	KGS-03	REV. 0

Filename: P:\Projects\2021\21-2895-001\Dwg\Env\21-2895-001 KGS FIG-03 - Tab:Rev 0 Plotted By: pdeffner 22/02/15 [Tue 8:56am]
11"x17" PLOT SCALE: 1"=2"

ATTACHMENT 2

Subsidence Estimation

KGS GROUP

Subsidence Over Selective Solution Mined Out Potash

The EAP presented a simplified drawing and estimate of long-term subsidence caused by selective solution mining. The basis for this estimate is provided below based on information provided by Harvey Haugen, Beechy Potash, January 2022.

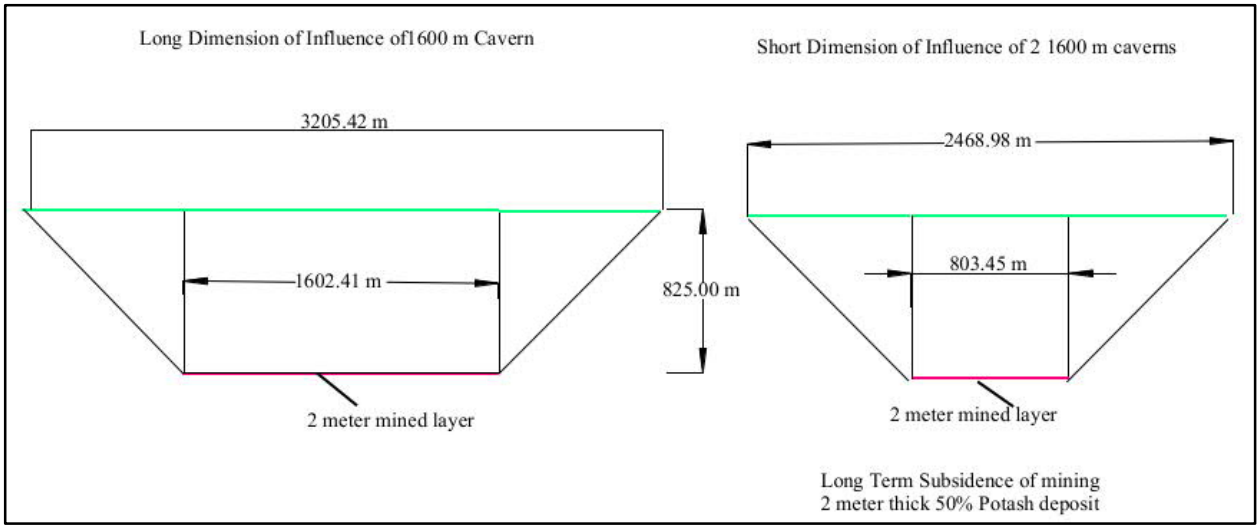
The mine plan represents a long “wall mining” technique. The plastic potash ore body will gradually close in on the mined-out cavern, after the mining extraction is completed. Based on the Beechy method, the potassium chloride component (KCL) is dissolved out by the circulating selective solutioning, leaving over half of the original ore (the salt portion) in place in the cavern. The effect of closure and subsidence related to creating this minor thin cavern, which is estimated to be less than 1 m in height at a depth of 825 m below surface, is anticipated to be insignificant, compared to conventional shaft mining or current solution mining methods which create much larger cavern voids.

The estimated subsidence can be calculated based on the ore volume mined from the potash bed. A subsidence prediction was made for the proposed 100,000 tonne per year mine after 20 years of operation. The potash ore body was assumed to have a vertical mined height of 2 metres, consisting of 50% potash.

The estimated vertical cavern height created by removing the potassium chloride was calculated for the PADCOM Mine as follows:

Ore mined	100,000 Tonnes per year
Extraction	80% (mined 2 m of ore body with a total height of 2.5 m)
Ore Grade	50% KCl
Ore density	2 t/m^3
Horizontal run	1600 m
Mined width	800 m
Mined area	1,280,000 m^2
Mined height	2 m
Potash density	1.86 t/m^3
Ore removed	2,000,000 tonnes in 20 years
Cavern Volume	1,075,000 m^3 (Total Weight/Density = 2,000,000/ 1.86)
Cavern Height	0.84 metres (Volume/Area = 1,075,000/1,280,000)

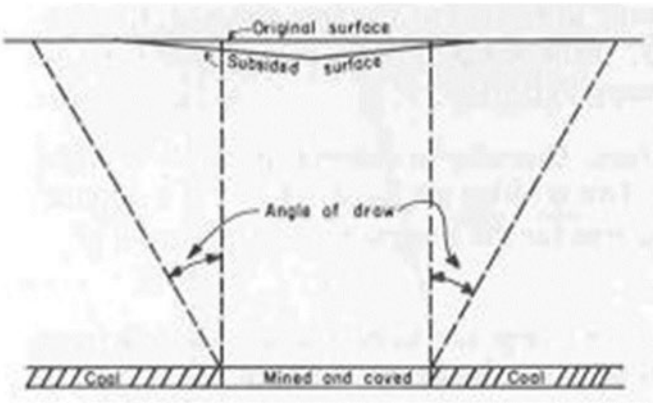
It is recognized in the industry that subsidence is projected to occur at 45 degrees outward from the cavern edge (referred to as angle of draw; Solution Mining Research Institute presentation Salzburg Austria 2016). In this case the mined surface is 1,280,000 m^2. The projection to ground surface on which subsidence is observed is over an area in the order of 8,000,000 m^2, as illustrated below (3,200 m by 2,500 m = 8,000,000 m^2).



Assuming uniform subsidence projected over the entire area, the final vertical subsidence at surface would be 0.14 m (by area ratios of 1.28/8.0 M m^2 or 0.16% of the extracted 0.84 m height). The actual subsidence at surface is not anticipated to be uniform, but actually more dish shaped.

It is important to understand that this subsidence would occur progressively, beginning soon after the ore is extracted, then slowing but continuing until the total estimated settlement is reached, possibly 100 years after the mining is completed. It is also important to recognize that the mining is progressive in the current design, advancing from two separate wells with curved horizontal fronts.

The actual subsidence surface will not be uniform but is anticipated to be a curved dish shaped bowl, as shown in the sketch.



A reference on estimating this subsidence of underground mines is provided in:
Archived: Interstate Technical Group on Abandoned Underground Mines - Mine Workshops - Geohazards - Geotech - Bridges & Structures - Federal Highway Administration (dot.gov)

The mechanics of subsidence illustrated in the above figure, is taken from this reference. Note that the angle of draw (45 degrees) is not the key component in determining the subsidence, since there are other stratigraphic factors more important in influencing potential impacts at surface. The estimated total subsidence could occur over possibly 100 years, expressed as a dish shaped subsidence rather than a uniform

subsidence. This could result in a maximum drop of 0.84 metres (estimated cavern height) at the centre of the mined area and reduced subsidence outward to the development width, with maybe 10 to 20% of the subsidence estimated to occur beyond the draw or projected surface limits of the mined area.

The actual subsidence that occurs will be determined from periodic high-resolution imagery and ground surveys, compared to the preconstruction conditions.

ATTACHMENT 3

Conservation Data Centre Species Information

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Agriculture

Get Started

Conservation Data Centre

Ecoregions

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Filter By Cateogory: Plant

Filter By Ecoregion: Aspen Parkland

Ecoregions

Show All entries Search:

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Achnatherum hymenoides	Indian Rice Grass	S2
Aspen Parkland	Plant	Achnatherum richardsonii	Richardson Needle Grass	S1S2
Aspen Parkland	Plant	Acmispon americanus	Prairie Trefoil	S2S3
Aspen Parkland	Plant	Agalinis aspera	Rough Agalinis	S2
Aspen Parkland	Plant	Alisma gramineum	Narrow-leaved Water-plantain	S1
Aspen Parkland	Plant	Ambrosia acanthicarpa	Sandbur	S1
Aspen Parkland	Plant	Andropogon hallii	Sand Bluestem	S2
Aspen Parkland	Plant	Aristida purpurea var. longiseta	Red Three-awn	S1?
Aspen Parkland	Plant	Arnica fulgens	Shining Arnica	S2
Aspen Parkland	Plant	Artemisia cana ssp. cana	Silver Sagebrush	S1
Aspen Parkland	Plant	Asclepias lanuginosa	Hairy Milkweed	S2S3
Aspen Parkland	Plant	Asclepias verticillata	Whorled Milkweed	S3
Aspen Parkland	Plant	Asclepias viridiflora	Green Milkweed	S3

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Astragalus gilviflorus	Cushion Milkvetch	S1
Aspen Parkland	Plant	Astragalus pectinatus	Narrow-leaved Milkvetch	S2
Aspen Parkland	Plant	Atriplex argentea var. argentea	Silver Saltbush	S2
Aspen Parkland	Plant	Boltonia asteroides var. recognita	White Boltonia	S2S3
Aspen Parkland	Plant	Botrychium campestre	Prairie Moonwort	S1
Aspen Parkland	Plant	Bouteloua curtipendula	Side-oats Grama	S2
Aspen Parkland	Plant	Bouteloua dactyloides	Buffalograss	S1
Aspen Parkland	Plant	Bromus kalmii	Wild Chess	S2S3
Aspen Parkland	Plant	Bromus porteri	Porter's Chess	S2S3
Aspen Parkland	Plant	Calamagrostis montanensis	Plains Reed Grass	S3
Aspen Parkland	Plant	Callitriche heterophylla	Larger Water-starwort	S1?
Aspen Parkland	Plant	Carex cristatella	Crested Sedge	S1?
Aspen Parkland	Plant	Carex cryptolepis	Northeastern Sedge	S1
Aspen Parkland	Plant	Carex emoryi	Emory's Sedge	S2?
Aspen Parkland	Plant	Carex gravida	Heavy Sedge	S1
Aspen Parkland	Plant	Carex hallii	Hall's Sedge	S1S2
Aspen Parkland	Plant	Carex hystericina	Porcupine Sedge	S3
Aspen Parkland	Plant	Carex parryana	Parry's Sedge	S3
Aspen Parkland	Plant	Carex pedunculata	Stalked Sedge	S3
Aspen Parkland	Plant	Carex sterilis	Dioecious Sedge	S2
Aspen Parkland	Plant	Carex supina ssp. spaniocarpa	Weak Sedge	S2S3
Aspen Parkland	Plant	Carex tetanica	Rigid Sedge	S3
Aspen Parkland	Plant	Carex xerantica	White-scaled Sedge	S2
Aspen Parkland	Plant	Celtis occidentalis	Hackberry	S1?

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Chenopodium subglabrum	Smooth Goosefoot	S1
Aspen Parkland	Plant	Circaea canadensis ssp. canadensis	Large Enchanter's-nightshade	S2
Aspen Parkland	Plant	Clematis ligusticifolia	Western Virgin's-bower	S1
Aspen Parkland	Plant	Clematis virginiana	Virgin's-bower	S2?
Aspen Parkland	Plant	Coreopsis tinctoria	Common Tickseed	S1
Aspen Parkland	Plant	Corispermum americanum var. americanum	American Bugseed	S3
Aspen Parkland	Plant	Corispermum hookeri var. hookeri	Hooker's Bugseed	S1
Aspen Parkland	Plant	Corispermum pallasii	Pallas' Bugseed	SH
Aspen Parkland	Plant	Corispermum villosum	Hairy Bugseed	S1S2
Aspen Parkland	Plant	Cornus alternifolia	Alternate-leaved Dogwood	S3
Aspen Parkland	Plant	Coryphantha vivipara	Pincushion Cactus	S1?
Aspen Parkland	Plant	Cryptotaenia canadensis	Canadian Honewort	S1
Aspen Parkland	Plant	Cycloloma atriplicifolium	Winged Pigseed	S2S3
Aspen Parkland	Plant	Cymopterus glomeratus	Plains Cymopterus	S2S3
Aspen Parkland	Plant	Cyperus houghtonii	Houghton's Umbrella-sedge	S2S3
Aspen Parkland	Plant	Cyperus schweinitzii	Schweinitz's Flatsedge	S2
Aspen Parkland	Plant	Cypripedium candidum	Small White Lady's-slipper	S1
Aspen Parkland	Plant	Dalea villosa var. villosa	Hairy Prairie-clover	S2S3
Aspen Parkland	Plant	Desmodium canadense	Beggar's-lice	S2
Aspen Parkland	Plant	Dichanthelium linearifolium	White-haired Panic-grass	S2?
Aspen Parkland	Plant	Dichanthelium wilcoxianum	Sand Millet	S2?

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Eleocharis engelmannii	Engelmann's Spike-rush	S1S2
Aspen Parkland	Plant	Elymus hystrix	Bottle-brush Grass	S2
Aspen Parkland	Plant	Eragrostis hypnoides	Creeping Teal Love Grass	S3
Aspen Parkland	Plant	Erigeron caespitosus	Tufted Fleabane	S1
Aspen Parkland	Plant	Eriogonum flavum	Yellow Eriogonum	S2S3
Aspen Parkland	Plant	Erythranthe geyeri	Smooth Monkeyflower	S1
Aspen Parkland	Plant	Euphorbia geyeri	Prostrate Spurge	S2
Aspen Parkland	Plant	Festuca hallii	Plains Rough Fescue	S3
Aspen Parkland	Plant	Festuca subverticillata	Nodding Fescue	S1
Aspen Parkland	Plant	Galium aparine	Cleavers	S3
Aspen Parkland	Plant	Helianthus nuttallii ssp. rydbergii	Tuberous-rooted Sunflower	S2
Aspen Parkland	Plant	Heliotropium curassavicum	Seaside Heliotrope	SH
Aspen Parkland	Plant	Juncus interior	Inland Rush	S1
Aspen Parkland	Plant	Krascheninnikovia lanata	Winterfat	S1?
Aspen Parkland	Plant	Leersia oryzoides	Rice Cutgrass	S3
Aspen Parkland	Plant	Lemna turionifera	Turion Duckweed	S1
Aspen Parkland	Plant	Linum sulcatum	Grooved Yellow Flax	S3
Aspen Parkland	Plant	Lomatium foeniculaceum	Hairy-fruited Parsley	S3
Aspen Parkland	Plant	Lomatium macrocarpum	Long-fruited Parsley	S2S3
Aspen Parkland	Plant	Lomatium orientale	White-flowered Parsley	S1S2
Aspen Parkland	Plant	Lomatogonium rotatum	Marsh Felwort	S2S3
Aspen Parkland	Plant	Malaxis monophyllos	White Adder's-mouth	S2?

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Malaxis paludosa	Bog Adder's-mouth	S1?
Aspen Parkland	Plant	Menispermum canadense	Canada Moonseed	S3
Aspen Parkland	Plant	Mentzelia decapetala	Gumbo-lily	SH
Aspen Parkland	Plant	Mertensia lanceolata	Tall Lungwort	S2
Aspen Parkland	Plant	Musineon divaricatum	Leafy Musineon	S1S2
Aspen Parkland	Plant	Myosurus minimus	Least Mousetail	S1?
Aspen Parkland	Plant	Orobanche ludoviciana	Louisiana Broom-rape	S2
Aspen Parkland	Plant	Osmorhiza claytonii	Hairy Sweet Cicely	S2?
Aspen Parkland	Plant	Ostrya virginiana	Hop-hornbeam	S2
Aspen Parkland	Plant	Oxytropis sericea	Early Yellow Locoweed	S1
Aspen Parkland	Plant	Penstemon nitidus	Smooth Blue Beard-tongue	S2
Aspen Parkland	Plant	Penstemon procerus	Slender Beard-tongue	S1S2
Aspen Parkland	Plant	Phlox hoodii	Moss Pink	S3
Aspen Parkland	Plant	Phryma leptostachya	Lopseed	S3
Aspen Parkland	Plant	Piptatheropsis micrantha	Little-seed Rice Grass	S2
Aspen Parkland	Plant	Plagiobothrys scouleri var. scouleri	Scouler's Popcornflower	S1
Aspen Parkland	Plant	Plantago elongata ssp. elongata	Linear Leaved-plantain	S2
Aspen Parkland	Plant	Poa cusickii	Mutton-grass	S2
Aspen Parkland	Plant	Poa fendleriana	Mutton Grass	S2
Aspen Parkland	Plant	Polanisia dodecandra ssp. dodecandra	Clammyweed	S1
Aspen Parkland	Plant	Polanisia dodecandra ssp. trachysperma	Clammyweed	S1
Aspen Parkland	Plant	Polygala verticillata	Whorled Milkwort	S2
Aspen Parkland	Plant	Polygala verticillata var. isocycla	Whorled Milkwort	S2

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Plant	Potamogeton amplifolius	Large-leaved Pondweed	S3
Aspen Parkland	Plant	Potamogeton illinoensis	Illinois Pondweed	S1?
Aspen Parkland	Plant	Potentilla gracilis var. flabelliformis	Graceful Cinquefoil	S1
Aspen Parkland	Plant	Potentilla plattensis	Platte River Cinquefoil	S2
Aspen Parkland	Plant	Rhynchospora alba	White Beakrush	S3
Aspen Parkland	Plant	Rhynchospora capillacea	Horned Beakrush	S2S3
Aspen Parkland	Plant	Sanguinaria canadensis	Blood-root	S2
Aspen Parkland	Plant	Sceptridium multifidum	Leathery Grape-fern	S3
Aspen Parkland	Plant	Schedonnardus paniculatus	Tumble-grass	S2
Aspen Parkland	Plant	Selaginella densa	Prairie Spike-moss	S3
Aspen Parkland	Plant	Shinnersoseris rostrata	Annual Skeletonweed	S1S2
Aspen Parkland	Plant	Sisyrinchium campestre	White-eyed Grass	S3
Aspen Parkland	Plant	Sisyrinchium mucronatum	Michaux's Blue-eyed Grass	S1
Aspen Parkland	Plant	Sporobolus neglectus	Annual Dropseed	S2S3
Aspen Parkland	Plant	Thermopsis rhombifolia	Golden Bean	S2S3
Aspen Parkland	Plant	Townsendia exscapa	Silky Townsend-daisy	S2
Aspen Parkland	Plant	Tradescantia occidentalis	Western Spiderwort	S1
Aspen Parkland	Plant	Uvularia sessilifolia	Small Bellwort	S2
Aspen Parkland	Plant	Verbena bracteata	Bracted Vervain	S3

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Filter By Ecoregion: Aspen Parkland

Ecoregions

Show All entries Search:

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Mammal	Mustela frenata	Long-tailed Weasel	S3
Aspen Parkland	Mammal	Odocoileus hemionus	Mule or Black-tailed Deer	S3

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Filter By Ecoregion: Aspen Parkland

Ecoregions

Show All entries Search:

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Bird	Aechmophorus occidentalis	Western Grebe	S4B
Aspen Parkland	Bird	Ammodramus bairdii	Baird's Sparrow	S1B
Aspen Parkland	Bird	Ammodramus savannarum	Grasshopper Sparrow	S3B
Aspen Parkland	Bird	Anthus spragueii	Sprague's Pipit	S2B
Aspen Parkland	Bird	Ardea alba	Great Egret	S2S3B
Aspen Parkland	Bird	Ardea herodias	Great Blue Heron	S5B
Aspen Parkland	Bird	Asio flammeus	Short-eared Owl	S2S3B
Aspen Parkland	Bird	Athene cunicularia	Burrowing Owl	S1B
Aspen Parkland	Bird	Bubulcus ibis	Cattle Egret	S2B
Aspen Parkland	Bird	Buteo regalis	Ferruginous Hawk	S1B
Aspen Parkland	Bird	Calamospiza melanocorys	Lark Bunting	S1B
Aspen Parkland	Bird	Calcarius ornatus	Chestnut-collared Longspur	S2B

Ecoregion	Category	Scientific Name	Common Name	S Rank
Aspen Parkland	Bird	Cardellina canadensis	Canada Warbler	S3B
Aspen Parkland	Bird	Chaetura pelagica	Chimney Swift	S2B
Aspen Parkland	Bird	Charadrius melodus	Piping Plover	S1B
Aspen Parkland	Bird	Chlidonias niger	Black Tern	S4B
Aspen Parkland	Bird	Chordeiles minor	Common Nighthawk	S3B
Aspen Parkland	Bird	Contopus cooperi	Olive-sided Flycatcher	S3B
Aspen Parkland	Bird	Contopus virens	Eastern Wood-pewee	S4B
Aspen Parkland	Bird	Coturnicops noveboracensis	Yellow Rail	S3B
Aspen Parkland	Bird	Cygnus buccinator	Trumpeter Swan	S1B
Aspen Parkland	Bird	Dolichonyx oryzivorus	Bobolink	S4B
Aspen Parkland	Bird	Empidonax traillii	Willow Flycatcher	S3B
Aspen Parkland	Bird	Eremophila alpestris	Horned Lark	S3B,SUM
Aspen Parkland	Bird	Hirundo rustica	Barn Swallow	S4B
Aspen Parkland	Bird	Ixobrychus exilis	Least Bittern	S2B
Aspen Parkland	Bird	Lanius ludovicianus excubitorides	Loggerhead Shrike	S1B
Aspen Parkland	Bird	Larus delawarensis	Ring-billed Gull	S5B
Aspen Parkland	Bird	Melanerpes erythrocephalus	Red-headed Woodpecker	S3B
Aspen Parkland	Bird	Nycticorax nycticorax	Black-crowned Night-heron	S4B
Aspen Parkland	Bird	Phalacrocorax auritus	Double-crested Cormorant	S5B
Aspen Parkland	Bird	Plegadis chihi	White-faced Ibis	S1B
Aspen Parkland	Bird	Podiceps auritus	Horned Grebe	S4B
Aspen Parkland	Bird	Podiceps nigricollis	Eared Grebe	S4B
Aspen Parkland	Bird	Riparia riparia	Bank Swallow	S5B
Aspen Parkland	Bird	Sayornis saya	Say's Phoebe	S3B
Aspen Parkland	Bird	Sterna forsteri	Forster's Tern	S4B
Aspen Parkland	Bird	Vermivora chrysoptera	Golden-winged Warbler	S3B

Shaun Moffatt

From:	Murray, Colin (ARD) <Colin.Murray@gov.mb.ca>
Sent:	Saturday, December 11, 2021 3:00 PM
To:	Shaun Moffatt
Subject:	DR S Moffatt KGS 20211201 PADCOM site
Attachments:	PADCOMM Site and b2k.zip; DR S Moffatt KGS 20211201 PADCOM site.xlsx

Hi Shaun
Thank you for your information request. I completed a search of the Manitoba Conservation Data Centre's (CDC) rare species database for your area of interest. This includes the primary location in the area of Harrowby as defined in the request; and a 2km radius buffer from the footprint boundary.

I am attaching a Microsoft Excel spreadsheet summarizing these occurrences. The spreadsheet includes scientific and common names, the provincial (SRank) rank for each species as well as the Manitoba Endangered Species and Ecosystem Act, and the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at Risk Act (SARA) designations. I'm also including the ESRI Shapefiles used to fulfill the request.

Further information on this ranking system can be found on our website at:
http://www.natureserve.org/conservation-tools/conservation-status-assessment.
These designations can be found at:
http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php,
https://www.cosewic.ca/index.php/en-ca/ and
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1.

Manitoba's recommended setback distances can be found at:
https://www.gov.mb.ca/sd/pubs/conservation-data-centre/mbcdc_bird_setbacks.pdf.

The information provided in this letter is based on existing data known to the Manitoba Conservation Data Centre of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of CDC staff and others who have shared their data, and reflect our current state of knowledge. An absence of data does not confirm the absence of any rare or endangered species. Many areas of the province have never been thoroughly surveyed, therefore, the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should not be regarded as a final statement on the occurrence of any species of concern, nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilized.

Third party requests for products wholly or partially derived from our Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC

as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

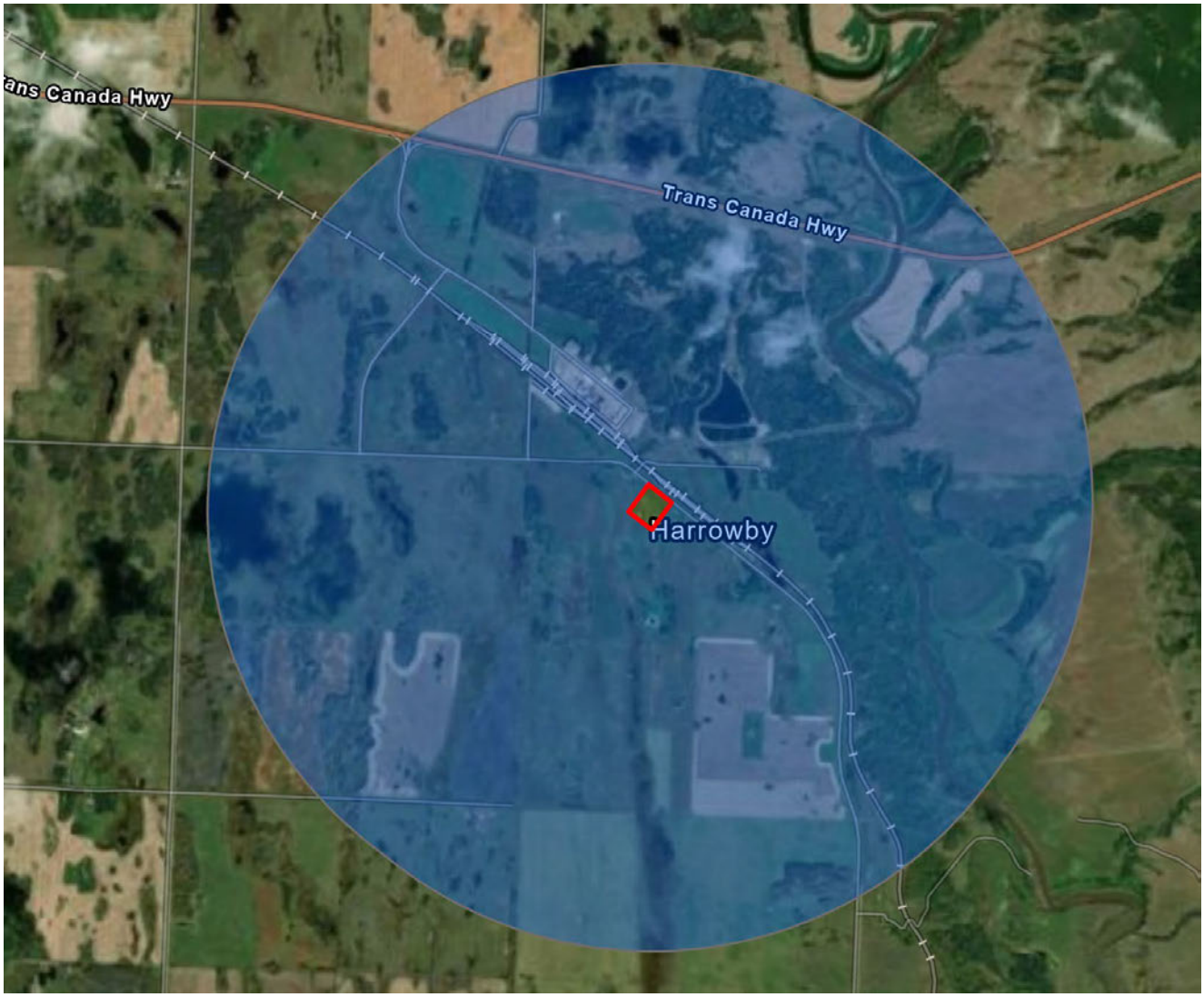
We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7760.

Colin

Reference screen clip:
Site:

Site and two kilometer buffer:



Colin Murray
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Manitoba Agriculture and Resource Development
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Visit our website: https://www.manitoba.ca/fish-wildlife/cdc/index.html
Follow us on Twitter: twitter.com/MBGovAg
View our videos on YouTube: youtube.com/ManitobaAgriculture

From: Shaun Moffatt <smoffatt@kgsgroup.com>
Sent: December 1, 2021 3:19 PM
To: Murray, Colin (ARD) <Colin.Murray@gov.mb.ca>
Cc: Jason Mann <jmann@kgsgroup.com>; Josephine Rokyta <jrokyta@kgsgroup.com>
Subject: Species at Risk Request -PADCOM Mine Site

Colin

KGS Group is helping Potash and Agri Development Corporation of Manitoba Ltd. (PADCOM) respond to an information request from the Impact Assessment Agency of Canada's (IAAC) regarding a proposed Potash Solution Mining Project. The Project will consist of two production wells, a processing plant and office building on a site located west of Russel Manitoba in the Hamlet of Harrowby. Considering the previous disturbance and agricultural use at this site I am not anticipating that the project will affect any Species at Risk. However, to ensure proper due diligence, a desktop evaluation for the potential presence of Species at Risk and suitable habitat is being conducted.

A KMZ file showing the approximate site is attached for reference.

We are requesting information regarding the locations of any plant, wildlife or aquatic Species at Risk occurrences on or near the project site. The information will be used to assess potential project impacts on Species at Risk and their habitat (if any).

If you have any questions, please don't hesitate to contact me, thanks.

Josephine – Can you please formally log this email request in Document Control under KGS Project 21-2895-001.

Shaun Moffatt M.Sc.
SENIOR ENVIRONMENTAL SCIENTIST

KGS GROUP

P 204-896-1209 ext 467
D 204-318-2054 C 204-396-2502
smoffatt@kgsgroup.com | kgsgroup.com
3rd Floor - 865 Waverley St
Winnipeg, MB R3T 5P4

SEARCH CRITERIA	SITE	SCINAME	COMNAME	S_RANK	ESEA	SARA	COSEWIC	FIRSTOBS	LASTOBS	EO_RANK	REPACC
Within	PADCOM SITE	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary	PADCOM SITE	Musineon divaricatum	Leafy Musineon	S1S2				6/14/1952	6/14/1952	H - Historical	Low
Records in general area outside of buffer of	PADCOM SITE	Coturnicops noveboracensis	Yellow Rail	S3B		Special Concern	Special Concern	6/25/2010	6/25/2010	E - Verified extant (viability not assessed)	Medium
Records in general area outside of buffer of	PADCOM SITE	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Threatened	6/25/2010	6/25/2010	E - Verified extant (viability not assessed)	Medium
Records in general area outside of buffer of	PADCOM SITE	Hirundo rustica	Barn Swallow	S4B		Threatened	Threatened	6/25/2010	6/25/2010	E - Verified extant (viability not assessed)	Medium

ATTACHMENT 4

Safety Data Sheets

KGS GROUP

SAFETY DATA SHEET

SECTION 1 IDENTIFICATION

PRODUCT

Product Name: **CRUDE OIL, SWEET**
Product Description: Petroleum Crude Oil
SDS Number: 21341

Intended Use: Feedstock

COMPANY IDENTIFICATION

Supplier: **Imperial Oil - Crude Oil Supply & Marketing**
P.O. Box 2480, Station M
Calgary, ALBERTA T2P 3M9 Canada

24 Hour Emergency Telephone	1-866-232-9563
Transportation Emergency Phone Number	1-866-232-9563
Supplier General Contact	1-800-567-3776

SECTION 2 HAZARD IDENTIFICATION

This material is considered to be hazardous according to regulatory guidelines.

This product has been classified in accordance with hazard criteria of the Hazardous Products Regulations (HPR) SOR/2015-17 and the SDS contains all the information required by the HPR SOR/2015-17.

CLASSIFICATION:

Flammable Liquids — Category 2
Eye Irritation — Category 2A
Carcinogenicity — Category 1B
Specific Target Organ Toxicity — Single Exposure (Central Nervous System) — Category 3
Specific Target Organ Toxicity — Repeated Exposure — Category 2
Aspiration Hazard — Category 1

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H225: Highly flammable liquid and vapour. H304: May be fatal if swallowed and enters airways. H319: Causes serious eye irritation. H336: May cause drowsiness or dizziness. H350: May cause cancer. H373: May cause damage to organs through prolonged or repeated exposure. Blood, Liver, Spleen, Thymus

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P233: Keep container tightly closed. P240: Ground and bond container and receiving equipment. P241: Use explosion-proof electrical, ventilating and lighting equipment. P242: Use non-sparking tools. P243: Take action to prevent static discharges. P260: Do not breathe mist / vapours. P264: Wash skin thoroughly after handling. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P308 + P313: IF exposed or concerned: Get medical advice/attention. P312: Call a POISON CENTER or doctor/physician if you feel unwell. P331: Do NOT induce vomiting. P337 + P313: If eye irritation persists: Get medical advice/attention. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish. P391: Collect spillage.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: PETROLEUM CRUDE OIL

Other hazard information:

Health Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

Physical Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an ignition. Material can release vapours that readily form flammable mixtures. Vapour accumulation could flash and/or explode if ignited.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Hydrogen sulphide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulphide include respiratory and

eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odour does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. Repeated exposure may cause skin dryness or cracking. May be irritating to the skin, nose, throat, and lungs. May cause central nervous system depression. Exposure to benzene is associated with cancer (acute myeloid leukaemia and myelodysplastic syndrome), damage to the blood-producing system, and serious blood disorders (see Section 11).

ENVIRONMENTAL HAZARDS

Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID:	Health:	2	Flammability:	3	Reactivity:	0
HMIS Hazard ID:	Health:	2*	Flammability:	3	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) in Hazardous product

Name	CAS#	Concentration*	GHS Hazard Codes
PETROLEUM CRUDE OIL	8002-05-9	100%	H225, H304, H336, H350(1B), H319(2A), H373, H401, H411

Hazardous Constituent(s) Contained in Complex Substance(s)

Name	CAS#	Concentration*	GHS Hazard Codes
BENZENE	71-43-2	0.1 - < 1%	H225, H303, H304, H340(1B), H350(1A), H315, H319(2A), H372, H401, H412
CYCLOHEXANE	110-82-7	1 - < 5%	H225, H304, H336, H315, H400(M factor 1), H410(M factor 1)
HYDROGEN SULFIDE	7783-06-4	0.002 - 0.005%	H220, H280, H330(2), H400(M factor 1)
N-HEXANE	110-54-3	1 - < 5%	H225, H304, H336, H361(F), H315, H373, H401, H411
NAPHTHALENE	91-20-3	1 - < 5%	H228(2), H302, H351, H400(M factor 1), H410(M factor 1)
TOLUENE	108-88-3	1 - < 5%	H225, H304, H336, H361(D), H315, H373, H401, H412
XYLENES	1330-20-7	1 - < 5%	H226, H303, H304, H312, H332, H335, H315, H320(2B), H373, H401, H412

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4 FIRST-AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately. This material, or a component, may be associated with cardiac sensitization following very high exposures (well above occupational exposure limits) or with concurrent exposure to high stress levels or heart-stimulating substances like epinephrine. Administration of such substances should be avoided.

SECTION 5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. If a leak or spill has not ignited, use water spray to disperse the vapours and to protect personnel attempting to stop a leak. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Extremely Flammable. Vapour is flammable and heavier than air. Vapour may travel across the ground and reach remote ignition sources, causing a flashback fire danger. Exposure to fire can generate toxic fumes. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Hydrogen sulphide, Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulphur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: -20°C (-4°F) - 35°C (95°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required, due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: half-face or full-face respirator with filter(s) for organic vapor and, when applicable, H2S, or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Chemical goggles are recommended if splashes or contact with eyes is possible. Work gloves that are resistant to aromatic hydrocarbons are recommended. If contact with hot product is possible or anticipated, gloves should be heat-resistant and thermally insulated. Note: gloves made of PVA are not water-resistant, and are not suitable for emergency use. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic and, if necessary, heat resistant and thermal insulated material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapour-suppressing foam may be used to reduce vapour. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapour, but may not prevent ignition in enclosed spaces.

Water Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. Do not confine in area of spill. Advise occupants and shipping in downwind areas of fire and explosion hazard and warn them to stay clear. Warn other shipping. Allow liquid to evaporate from the surface. Remove from the surface by skimming or with suitable absorbents. If permitted by regulatory authorities, the use of suitable dispersants should be considered where permitted in local oil spill contingency plans. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material;

however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Use booms as a barrier to protect shorelines. Use containment booms when the ambient temperature is below the flash point of the material. Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

H2S is present. Avoid all personal contact. Crude oils can contain trace levels of natural impurities including heavy metals, such as mercury, nickel or lead, as well as naturally occurring radioactive material. As the impurity content may concentrate during refining/processing, process operations, including equipment, materials and products should be evaluated to identify and manage any potential risks to health, safety or the environment or regulatory concerns.

Prevent exposure to ignition sources, for example use non-sparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapour may be evolved from heated or agitated material. Use only with adequate ventilation. Do not enter storage areas or confined spaces unless adequately ventilated. The toxic and olfactory (sense of smell) fatigue properties of hydrogen sulfide require that air monitoring alarms and respiratory protection be used where the concentration might be expected to reach a harmful level, such as in an enclosed space, heated transport vessel, or in a spill or leak situation.

Material may contain trace amounts of naturally occurring radioactive material (NORM), which will accumulate in process equipment and storage vessels. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.

STORAGE

Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. The type of container used to store the material may affect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Outside or detached storage preferred. Storage containers should be earthed and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Substance Name	Form	Limit/Standard			Note	Source
BENZENE		STEL	1 ppm		Skin	Supplier
BENZENE		TWA	0.5 ppm		Skin	Supplier
BENZENE		STEL	2.5 ppm		Skin	ACGIH
BENZENE		TWA	0.5 ppm		Skin	ACGIH
CYCLOHEXANE		TWA	100 ppm			ACGIH
HYDROGEN SULFIDE		STEL	14 mg/m3	10 ppm		Supplier
HYDROGEN SULFIDE		TWA	7 mg/m3	5 ppm		Supplier
HYDROGEN SULFIDE		STEL	5 ppm			ACGIH
HYDROGEN SULFIDE		TWA	1 ppm			ACGIH
N-HEXANE		TWA	50 ppm		Skin	ACGIH
NAPHTHALENE		TWA	10 ppm		Skin	ACGIH
TOLUENE		TWA	20 ppm			ACGIH
XYLENES		STEL	150 ppm			ACGIH
XYLENES		TWA	100 ppm			ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapours may accumulate.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material

include:

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: Chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Dark Brown
Odour: Rotten Egg
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.661 - 1.013
Flammability (Solid, Gas): N/A
Flash Point [Method]: -20°C (-4°F) - 35°C (95°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: >= 20°C (68°F)
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: 0 kPa (0 mm Hg) at 20°C - 106.4 kPa (800 mm Hg) at 20ºC
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: <7 cSt (7 mm2/sec) at 40ºC
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D

Melting Point: N/A
Pour Point: < 32°C (90°F)

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Not determined.
Irritation: No end point data for material.	Elevated temperatures or mechanical action may form vapours, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.
Ingestion	
Acute Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 402
Skin Corrosion/Irritation: Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation: Data available.	Irritating and will injure eye tissue. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: Data available.	Not expected to be a skin sensitizer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 406
Aspiration: Data available.	May be fatal if swallowed and enters airways. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: Data available.	Not expected to be a germ cell mutagen. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 471 474 479
Carcinogenicity: Data available.	Caused cancer in laboratory animals. Based on test data for

	structurally similar materials. Test(s) equivalent or similar to OECD Guideline 451
Reproductive Toxicity: Data available.	Not expected to be a reproductive toxicant. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 414 421
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: Data available.	May cause drowsiness or dizziness. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401 402
Repeated Exposure: Data available.	Concentrated, prolonged or deliberate exposure may cause organ damage. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 411

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
HYDROGEN SULFIDE	Inhalation Lethality: 4 hour(s) LC50 444 ppm (Gas) (Rat)
NAPHTHALENE	Inhalation Lethality: 4 hour(s) LC50 > 0.4 mg/l (Max attainable vapor conc.) (Rat); Oral Lethality: LD 50 533 mg/kg (Mouse)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Blood, Liver, Spleen, Thymus

Vapour/aerosol concentrations above recommended exposure levels are irritating to the eyes and respiratory tract, may cause headaches, dizziness, anaesthesia, drowsiness, unconsciousness and other central nervous system effects including death. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion and blurred vision) and/or damage. Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema. Exposure to this material, or one of its components, in situations where there is the potential for high levels, such as in confined spaces or with abuse, may result in abnormal heart rhythm (arrhythmia). High-level exposure to hydrocarbons (above occupational exposure limits) may initiate arrhythmia in a worker that is undergoing stress or is taking a heart-stimulating substance such as epinephrine, a nasal decongestant, or an asthma or cardiovascular drug.
Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone marrow.

Contains:

BENZENE: Caused cancer (acute myeloid leukemia and myelodysplastic syndrome), damage to the blood-producing system, and serious blood disorders in human studies. Caused genetic effects and effects on the immune system in laboratory animal and some human studies. Caused toxicity to the fetus and cancer in laboratory animal studies.
Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone marrow.
HYDROGEN SULPHIDE: Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to

cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage. NAPHTHALENE: Exposure to high concentrations of naphthalene may cause destruction of red blood cells, anemia, and cataracts. Naphthalene caused cancer in laboratory animal studies, but the relevance of these findings to humans is uncertain.

N-HEXANE: Prolonged and/or repeated exposures to n-Hexane can cause progressive and potentially irreversible damage to the peripheral nervous system (e.g. fingers, feet, arms, legs, etc.). Simultaneous exposure to Methyl Ethyl Ketone (MEK) or Methyl Isobutyl Ketone (MIBK) and n-Hexane can potentiate the risk of adverse effects from n-Hexane on the peripheral nervous system. n-Hexane has been shown to cause testicular damage at high doses in male rats. The relevance of this effect for humans is unknown. TOLUENE : Concentrated, prolonged or deliberate inhalation may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals (> 1500 ppm) have been reported to cause adverse fetal developmental effects. ETHYLBENZENE: Caused cancer in laboratory animal studies. The relevance of these findings to humans is uncertain.

CMR Status:

Chemical Name	CAS Number	List Citations
BENZENE	71-43-2	1, 5
ETHYL BENZENE	100-41-4	3
NAPHTHALENE	91-20-3	3

--REGULATORY LISTS SEARCHED--

1 = IARC 1
2 = IARC 2A
3 = IARC 2B
4 = ACGIH ALL
5 = ACGIH A1
6 = ACGIH A2

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Low molecular wt. component -- Expected to be inherently biodegradable
High molecular wt. component -- Expected to biodegrade slowly.

Photolysis:

More water soluble component -- Expected to degrade at a moderate rate in water when exposed to

sunlight.

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Components -- Has the potential to bioaccumulate.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	48 hour(s)	Invertebrate	EC50 10 - 100 mg/l: data for similar materials

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (TDG)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
UN Number: 1267
Packing Group: I
Special Provisions: 92,106,150

LAND (DOT)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
ID Number: 1267
Packing Group: I
ERG Number: 128
Label(s): 3

Transport Document Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

SEA (IMDG)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
EMS Number: F-E, S-E
UN Number: 1267
Packing Group: I
Marine Pollutant: Yes
Label(s): 3
Transport Document Name:

AIR (IATA)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
UN Number: 1267
Packing Group: I
Label(s) / Mark(s): 3
Transport Document Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

SECTION 15 REGULATORY INFORMATION

CEPA: All components of this product are either on the Domestic Substance List (DSL) or are exempt.

Listed or exempt from listing/notification on the following chemical inventories: AIIC, DSL, ENCS, IECSC, KECI, PICCS, TSCA

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
BENZENE	71-43-2	6
CYCLOHEXANE	110-82-7	6
ETHYL BENZENE	100-41-4	6
N-HEXANE	110-54-3	6
NAPHTHALENE	91-20-3	6
TOLUENE	108-88-3	6
XYLENES	1330-20-7	6

--REGULATORY LISTS SEARCHED--

1 = TSCA 4
2 = TSCA 5a2
3 = TSCA 5e
4 = TSCA 6
5 = TSCA 12b
6 = NPRI

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H220: Extremely flammable gas; Flammable Gas, Cat 1
H225: Highly flammable liquid and vapour; Flammable Liquid, Cat 2
H226: Flammable liquid and vapour; Flammable Liquid, Cat 3
H280: Contains gas under pressure; may explode if heated; Pressurized Gas
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H303: May be harmful if swallowed; Acute Tox Oral, Cat 5
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
H312: Harmful in contact with skin; Acute Tox Dermal, Cat 4
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H319(2A): Causes serious eye irritation; Serious Eye Damage/Irr, Cat 2A
H320(2B): Causes eye irritation; Serious Eye Damage/Irr, Cat 2B
H330(2): Fatal if inhaled; Acute Tox Inh, Cat 2
H332: Harmful if inhaled; Acute Tox Inh, Cat 4
H335: May cause respiratory irritation; Target Organ Single, Resp Irr
H336: May cause drowsiness or dizziness; Target Organ Single, Narcotic
H340(1B): May cause genetic defects; Germ Cell Mutagenicity, Cat 1B
H350(1A): May cause cancer; Carcinogenicity, Cat 1A
H350(1B): May cause cancer; Carcinogenicity, Cat 1B
H351: Suspected of causing cancer; GHS Carcinogenicity, Cat 2
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H372: Causes damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 1
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1
H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2
H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Composition: Component table information was modified.
GHS Health Symbol information was modified.
GHS Physical/Chemical Symbol information was modified.
GHS Target Organ List information was added.
GHS Target Organ List information was deleted.
Section 08: Exposure Limits Table information was modified.
Section 11 Substance Toxicology table information was modified.
Section 11: Target Organ Toxicity Repeat - Organ Systems information was added.
Section 11: Target Organ Toxicity Repeat Exposure - Target Organ List information was deleted.
Section 11: Tox List Cited Table information was modified.
Section 15: Canadian List Citations Table information was modified.
Section 15: National Chemical Inventory Listing information was modified.
Section 16: HCode Key information was modified.

THIS SDS COVERS THE FOLLOWING MATERIALS: BAKKEN SASKATCHEWAN | BC LT | BONNIE GLEN SWEET | DRAYTON VALLEY SWEET | GIBSONS MIXED BLEND SWEET-HARDISTY | KOCH SWEET BLEND | MIXED BLEND SWEET | NEXUS SWEET | NORMAN WELLS | ONT. SWEET | PEACE SWEET | RAINBOW | RANGELAND LT SWEET | SWAN HILLS | TERRA NOVA | WTI LIGHT

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DGN: 7123505 (1022935)

SAFETY DATA SHEET

ARMEEN 18D FLAKE (FX)

Version 1 Revision Date 06/09/2014 Print Date 04/22/2015 US / Z8

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	ARMEEN 18D FLAKE (FX)
Product Use Description	:	Corrosion inhibitor Surfactant
Company	:	Akzo Nobel Surface Chemistry LLC 525 West Van Buren Chicago IL 60607 USA
Telephone	:	+18009069977
Fax	:	+13125447188
E-mail address	:	
Emergency telephone	:	Chemtrec: 800-424-9300 Canutec: 613-996-6666 Medical/Handling: 914-693-6946

2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	solid
Color	white
Odor	slight, ammoniacal

GHS Classification

Skin irritation	:	Category 2
Serious eye damage	:	Category 1
Specific target organ systemic toxicity - repeated exposure (Oral)	:	Category 2 (Gastrointestinal tract)
Aspiration hazard	:	Category 1
Acute aquatic toxicity	:	Category 1
Chronic aquatic toxicity	:	Category 1

GHS Label element

Hazard pictograms :

Signal Word : Danger

Hazard Statements : H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.

H318 Causes serious eye damage.
H373 May cause damage to organs (Gastrointestinal tract) through prolonged or repeated exposure if swallowed.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary Statements : **Prevention:**
P260 Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P280 Wear eye protection/ face protection.
Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/ physician.
P331 Do NOT induce vomiting.

Potential Health Effects

Inhalation : Inhalation of aerosols may cause irritation to mucous membranes.
Thermal decomposition can lead to release of irritating gases and vapors.
May be fatal if swallowed and enters airways.
Inhalation may cause central nervous system effects.

Skin : Causes skin irritation.
The product may be absorbed through the skin.

Eyes : Vapor in the eyes may cause irritation and pain.
Causes serious eye damage.

Ingestion : May be harmful if swallowed.
May be fatal if swallowed and enters airways.

Aggravated Medical Condition : None known.

Symptoms of Overexposure : No information available.

Carcinogenicity:

IARC : No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA : No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

NTP : No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

ACGIH : No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous ingredients

Chemical Name	CAS-No.	Classification	Concentration [%]
Octadecylamine	124-30-1	Skin Irrit. 2; H315 Eye Dam. 1; H318 STOT RE 2; H373 Asp. Tox. 1; H304 Aquatic Acute 1; H400 Aquatic Chronic 1; H410 M-Factor (Acute): 10	90 - 100

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

General advice : Immediate medical attention is required.
Move out of dangerous area.
Show this material safety data sheet to the doctor in attendance.

Inhalation : Obtain medical attention immediately.

Skin contact : Take off contaminated clothing and shoes immediately.
Carefully remove paste or solidified product.
Wash skin immediately with 0,5 % acetic acid in water, and then with soap and water.
If skin irritation persists, call a physician.
Skin irritation, if untreated, may be prolonged and serious (e.g., necrosis). This may be prevented by early treatment with medium strenght corticosteroids.

Eye contact : In case of contact with eyes, rinse immediately with 0.5% acetic acid in water for a few minutes, followed by rinsing with plenty of water.
Get medical attention immediately. Continue to rinse during transport of patient.
Remove contact lenses.
Protect unharmed eye.
Keep eye wide open while rinsing.

Ingestion : Clean mouth with water and drink afterwards plenty of water.
Do NOT induce vomiting.
Never give anything by mouth to an unconscious person.
Take victim immediately to hospital.

Notes to physician

Symptoms : No information available.

Risks : No information available.

Treatment : No information available.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during fire fighting / Specific hazards arising from the chemical	:	Treat as oil fire. Do not use a solid water stream as it may scatter and spread fire. Water spray may be ineffective unless used by experienced firefighters. Do not allow run-off from fire fighting to enter drains or water courses.
Combustion products	:	Carbon oxides Nitrogen oxides (NOx)
Special protective equipment for fire-fighters	:	In the event of fire, wear self-contained breathing apparatus.
Further information	:	Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

See also Section 9. Physical and chemical properties: Safety data

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Use personal protective equipment. Wear respiratory protection. Ensure adequate ventilation.
Environmental precautions	:	Do not flush into surface water or sanitary sewer system. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods for cleaning up / Methods for containment	:	Pick up and arrange disposal without creating dust. Keep in suitable, closed containers for disposal.
Additional advice	:	For personal protection see section 8.

7. HANDLING AND STORAGE

Handling

Advice on safe handling	:	For personal protection see section 8. Avoid formation of respirable particles. Do not breathe vapors/dust. Smoking, eating and drinking should be prohibited in the application area. Dispose of rinse water in accordance with local and national regulations. Avoid contact with skin, eyes and clothing.
Advice on protection against fire and explosion	:	Provide appropriate exhaust ventilation at places where dust is formed.

Storage

Requirements for storage areas and containers	:	Prevent unauthorized access. Keep container tightly closed in a dry and well-ventilated place. Avoid elevated temperatures. Reacts with copper, aluminum, zinc and their alloys
Other data	:	No decomposition if stored and applied as directed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

Contains no substances with occupational exposure limit values.

Engineering measures

Provide eyewash station and safety shower. Keep solutions of 0.5% acetic acid in water close at hand.

Personal protective equipment

Eye/face protection	:	Tightly fitting safety goggles
Hand protection	:	Glove material: Nitrile rubber
	:	Glove material: butyl-rubber
Skin and body protection	:	Protective suit
Respiratory protection	:	In the case of dust, vapor or aerosol formation use respirator with an approved filter. Wear full face mask supplied with: Combination filter: ABEKP.
Hygiene measures	:	Avoid contact with skin, eyes and clothing. When using do not eat or drink. When using do not smoke. Dry-clean contaminated clothing before reuse.

Environmental exposure controls

General advice	:	Do not flush into surface water or sanitary sewer system. If the product contaminates rivers and lakes or drains inform respective authorities.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	:	solid
Color	:	white
Odor	:	slight ammoniacal

Odor Threshold	:	No data available

Safety data

pH	:	not applicable
Melting point/range	:	50 - 60 °C
Boiling point/boiling range	:	> 300 °C
Flash point	:	150 - 199 °C Method: Pensky-Martens ISO 2719
Ignition temperature	:	> 100 °C
Evaporation rate	:	not applicable
Flammability (solid, gas)	:	The product is not flammable.
Lower explosion limit	:	not applicable
Upper explosion limit	:	not applicable
Vapor pressure	:	< 0.1 hPa at 20 °C
Relative vapor density	:	not applicable
Density	:	790 kg/m3 at 60 °C
Relative density	:	0.94 at 20 °C
Water solubility	:	insoluble
Solubility in other solvents	:	Soluble in hydrocarbons
Partition coefficient: n-octanol/water	:	No data available
Autoignition temperature	:	ca. 265 °C
Decomposition temperature	:	No data available
Viscosity, dynamic	:	4.17 mPa.s at 60 °C
Viscosity, kinematic	:	ca. 8.9 mm2/s at 60 °C
Explosive properties	:	Not explosive
Oxidizing properties	:	The substance or mixture is not classified as oxidizing.

This material safety datasheet only contains information relating to safety and does not replace any product information or product specification.

10. STABILITY AND REACTIVITY

Conditions to avoid	:	None known.
Materials to avoid	:	Reacts with copper, aluminum, zinc and their alloys

Hazardous decomposition products	:	No hazardous decomposition products are known.
Thermal decomposition	:	No data available
Reactivity	:	Stable under normal conditions.
Chemical stability	:	Stable under recommended storage conditions.
Hazardous reactions	:	No dangerous reaction known under conditions of normal use.

11. TOXICOLOGICAL INFORMATION

PRODUCT INFORMATION:

Toxicology Assessment

Further information : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity:

IARC	:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA	:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
ACGIH	:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

TOXICOLOGY DATA FOR THE INGREDIENTS:

Test result

Component: Octadecylamine

Acute oral toxicity	:	LD50: > 2,000 - 5,000 mg/kg Species: rat Method: OECD Test Guideline 401
Skin irritation	:	Result: Irritating to skin.
Eye irritation	:	Result: Risk of serious damage to eyes.
Target Organ Systemic Toxicant - Repeated exposure	:	Routes of exposure: Oral Target Organs: Gastrointestinal tract May cause damage to organs through prolonged or repeated exposure.
Aspiration toxicity	:	May be fatal if swallowed and enters airways.

12. ECOLOGICAL INFORMATION

PRODUCT INFORMATION:

Ecotoxicology Assessment

Additional ecological information : An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

Further information on ecology

Hazardous to the ozone layer

Regulation : 40 CFR Protection of Environment; Part 82 Protection of Stratospheric Ozone - CAA Section 602 Class I Substances

Remarks : This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

INGREDIENTS:

Test result

Component: Octadecylamine

Ecotoxicity effects

Toxicity to fish : LC50: > 0.01 - 0.1 mg/l
Exposure time: 96 h
Species: Pimephales promelas (fathead minnow)
Method: OECD Test Guideline 203
Read-across (Analogy)

Toxicity to daphnia and other aquatic invertebrates : EC50: > 0.01 - 0.1 mg/l
Exposure time: 48 h
Species: Daphnia magna (Water flea)
Method: OECD Test Guideline 202
Read-across (Analogy)

Toxicity to algae : EC50: > 0.01 - 0.1 mg/l
Exposure time: 72 h
Species: Scenedesmus subspicatus (algae)
Method: OECD Test Guideline 201

M-Factor : 10

Elimination information (persistence and degradability)

Bioaccumulation : Bioconcentration factor (BCF): > 500

Mobility : No data available

Biodegradability : Result: Readily biodegradable.
Biodegradation: > 60 %

Exposure time: 28 d
Method: OECD Test Guideline 301D
Read-across (Analogy)

Further information on ecology

Biochemical Oxygen Demand (BOD) : No data available

13. DISPOSAL CONSIDERATIONS

Product : The product should not be allowed to enter drains, water courses or the soil.
Do not contaminate ponds, waterways or ditches with chemical or used container.
Hazardous waste
Dispose of contents/container in accordance with local regulation.

: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Contaminated packaging : Empty remaining contents.
Dispose of as unused product.

14. TRANSPORT INFORMATION

International regulation

IATA-DGR

UN/ID No.	:	UN 3077
Proper shipping name	:	Environmentally hazardous substance, solid, n.o.s. (Alkylamine)
Class	:	9
Packing group	:	III
Labels	:	9
Packing instruction (cargo aircraft)	:	956
Packing instruction (passenger aircraft)	:	956
Packing instruction (LQ)	:	Y956
Environmentally hazardous	:	yes

IMDG-Code

UN number	:	UN 3077
Proper shipping name	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Alkylamine)
Class	:	9
Packing group	:	III
Labels	:	9
EmS Code	:	F-A, S-F
Marine pollutant	:	yes (Alkylamine)

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable for product as supplied.

Domestic regulation

49 CFR
Not regulated as a dangerous good
TDG
Not regulated as a dangerous good
NOM-002-SCT
Not regulated as a dangerous good

15. REGULATORY INFORMATION

Notification status

CH INV	:	YES. On the inventory, or in compliance with the inventory
TSCA	:	YES. All chemical substances in this product are either listed on the TSCA Inventory or in compliance with a TSCA Inventory exemption.
DSL	:	YES. All components of this product are on the Canadian DSL.
AICS	:	YES. On the inventory, or in compliance with the inventory
NZIoC	:	YES. On the inventory, or in compliance with the inventory
ENCS	:	YES. On the inventory, or in compliance with the inventory
ISHL	:	YES. On the inventory, or in compliance with the inventory
KECI	:	YES. On the inventory, or in compliance with the inventory
PICCS	:	YES. On the inventory, or in compliance with the inventory
IECSC	:	YES. On the inventory, or in compliance with the inventory

For explanation of abbreviations, see section 16.

OSHA Hazards : Moderate skin irritant, Severe eye irritant

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : Acute Health Hazard

SARA 302 : SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 12 (40 CFR 61).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

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California Prop. 65

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

16. OTHER INFORMATION

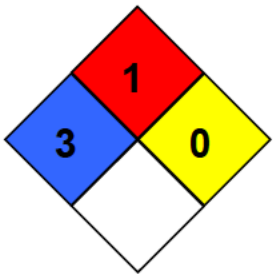
Full text of H-Statements

H304	:	May be fatal if swallowed and enters airways.
H315	:	Causes skin irritation.
H318	:	Causes serious eye damage.
H373	:	May cause damage to organs through prolonged or repeated exposure if swallowed.
H400	:	Very toxic to aquatic life.
H410	:	Very toxic to aquatic life with long lasting effects.

Further information

HMIS Classification : Health Hazard: 3
Flammability: 1
Physical hazards: 0

NFPA Classification : Health Hazard: 3
Fire Hazard: 1
Reactivity Hazard: 0



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Notification status explanation

REACH	1907/2006 (EU)
CH INV	Switzerland. New notified substances and declared preparations
TSCA	United States TSCA Inventory
DSL	Canadian Domestic Substances List (DSL)
AICS	Australia Inventory of Chemical Substances (AICS)
NZIoC	New Zealand. Inventory of Chemical Substances
ENCS	Japan. ENCS - Existing and New Chemical Substances Inventory
ISHL	Japan. ISHL - Inventory of Chemical Substances (METI)
KECI	Korea. Korean Existing Chemicals Inventory (KECI)
PICCS	Philippines Inventory of Chemicals and Chemical Substances (PICCS)
IECSC	China. Inventory of Existing Chemical Substances in China (IECSC)

Further information

Revision Date	06/09/2014

The information in this material safety data sheet should be provided to all who will use, handle, store, transport or otherwise be exposed to this product. The user must determine the appropriate measures that need to be implemented for the use and handling of this product in the c ontext of the user's operations and use of this product. The information contained herein supersedes all previously issued bulletins on the subject matter covered. If the date on this document is more than three years old,call to make certain that this sheet is current. No warranty is made as to the product's merchantability or fitness for any particular purpose, or that any suggested use will not infringe any patent. User must determine for himself, by preliminary tests or otherwise, the suitability of this product for his purposes, including mixing with other products. Nothing contained herein shall be construed as granting or extending any license under any patent.

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

ATTACHMENT 5

Greenhouse Gas Emissions Calculations

KGS GROUP

PADCOM Potash Solution Mining Project - Greenhouse Gas Emissions Calculation

	First 3 Months	1st Year	Future Expansion
Production Quantity (t)	19,804	100,001	249,569
GHG Emissions Estimate - Propane Consumption			
Propane Consumption (GJ)	31,335	141,939	-
CO_2 Emission Factor (t/GJ)[1]	0.0593	0.0593	0.0593
CO_2 Global Warming Potential (GWP) [2]	1	1	1
CO_2 Emissions from Propane Consumption (t CO_2 eq)	1,859	8,423	-
CH_4 Emission Factor (t/GJ)[3]	9.4E-07	9.4E-07	9.4E-07
CH_4 Global Warming Potential (GWP) [4]	25	25	25
CH_4 Emissions from Propane Consumption (t CO_2 eq)	0.74	3.34	-
N_2O Emission Factor (t/GJ)[5]	4.23E-06	4.23E-06	4.23E-06
N_2O Global Warming Potential (GWP) [6]	298	298	298
N_2O Emissions from Propane Consumption (t CO_2 eq)	40	179	-
Total GHG Emissions - Propane Consumption (t CO_2 eq)	1,900	8,605	-
GHG Emissions Estimate - Diesel Consumption			
Diesel Consumption (L)	34,069	132,489	264,979
CO_2 Emission Factor (t/L)[7]	0.0026805	0.0026805	0.0026805
CO_2 Global Warming Potential (GWP) [2]	1	1	1
CO_2 Emissions from Diesel Consumption (t CO_2 eq)	91.32	355.14	710.28
CH_4 Emission Factor (t/L)[8]	7.3E-08	7.3E-08	7.3E-08
CH_4 Global Warming Potential (GWP) [4]	25	25	25
CH_4 Emissions from Diesel Consumption (t CO_2 eq)	0.06	0.24	0.48
N_2O Emission Factor (t/L)[9]	2.2E-08	2.2E-08	2.2E-08
N_2O Global Warming Potential (GWP) [6]	298	298	298
N_2O Emissions from Diesel Consumption (t CO_2 eq)	0.2	0.9	1.7
Total GHG Emissions - Diesel Consumption (t CO_2 eq)	92	356	712
GHG Emissions Estimate - Power Consumption			
Power Consumption (GWh)	1.17	4.69	105.05
Manitoba Generation Intensity (t CO_2 eq/GWh)[10]	1.2	1.2	1.2
GHG Emissions from Power Consumption (t CO_2 eq)	1.41	5.63	126.06
Total GHG Emissions per time period (t CO_2 eq)	1,993	8,967	839
GHG Emissions per tonne of potash (t CO_2 eq / t potash)	0.1006	0.0897	0.0034

Assumptions:

Production values, fuel and electricity usage are currently known best estimates completed by PADCOM.

1st year values start after the first 3 months.

Future expansion values are yearly estimates starting after operation switches to full power supply.

PADCOM Potash Solution Mining Project - Greenhouse Gas Emissions Calculation

Emission in details

Production Estimate

	First 3 Months	1st Year	Future Expansion
Capacity (t/h)	10	13	32
Machine Hours (h)	1980	7,700	7,700
Annual Production (t)	19,804	100,001	249,569

Utilities Consumption Estimate - Propane

Process	First 3 Months	1st Year	Future Expansion
Brine Heating (GJ)	24,922	111,984	0
Product dryer (GJ)	4,324	21,831	0
Mine heating (GJ)	2,089	8,124	0
Overall Consumption (GJ)	31,335	141,939	0
Product Consumption (GJ/t)	1.58	1.42	-

Utilities Consumption Estimate - Diesel

Process	First 3 Months	1st Year	Future Expansion
Mobile Vehicle (L)	34,069	132,489	264,979
Overall Consumption (L)	34,069	132,489	264,979
Product Consumption (L/t)	1.72	1.32	1.06

Utilities Consumption Estimate - Power

Process	First 3 Months	1st Year	Future Expansion
Brine Heating (kWh)	962,500	3,850,000	87,239,972
Product dryer (kWh)	0	0	15,134,450
Mine heating (kWh)	0	0	2,256,647
Brine Pumping (kWh)	62,964	251,856	125,928
Crystalizers (kWh)	66,825	267,300	133,650
Centrifuges (kWh)	8,910	35,640	17,820
Dryer (kWh)	15,593	62,370	31,185
Cooling System (kWh)	34,155	136,620	68,310
Boiler (kWh)	10,395	41,580	20,790
Water System (kWh)	4,455	17,820	8,910
Building Lighting & Heating (kWh)	5,184	20,736	10,368
Product Loading (kWh)	1,485	5,940	2,970
Overall Consumption (kWh)	1,172,466	4,689,862	105,051,001
Product Consumption (kWh/t)	59.20	46.90	420.93

Energy Consumption Estimation Summary

	First 3 Months	1st Year	Future Expansion
Propane Consumption (GJ)	31,335	141,939	-
Propane Consumption (GJ/t)	1.58	1.42	-
Diesel Consumption (GJ)	1,318	5,125	10,249
Diesel Consumption (GJ/t)	0.07	0.05	0.04
Power Consumption (GJ)	4,221	16,884	378,184
Power Consumption (GJ/t)	0.21	0.17	1.52
Energy Consumption Total (GJ)	36,873	163,947	388,433
Energy Intensity (GJ/t)	1.86	1.64	1.56

Notes:

1 – Propane combustion CO_2 emission factor of 0.0593 t/GJ is calculated using the emission factor of 1515 g/L for Propane, all other uses, from Table A6.1-4 Emission Factors for Natural Gas Liquids in Part 2 of ECCC's NIR and the propane energy conversion factor from CER's Energy Conversion Tables of 1 m^3 = 25.53 GJ.
The following calculation is used: (1515 g/L)*(1 m^3/25.53 GJ)*(1000 L/1 m^3)*(1 t/1000000 g)

2 – CO_2 Global Warming Potential (GWP) of 1 is per the 100-Year GWP listed in Table 1-1, IPCC Global Warming Potentials (GWPs) in Part 1 of ECCC's NIR.

3 – Propane combustion CH_4 emission factor of 9.4 x 10^{-7} t/GJ is calculated using the emission factor of 0.024 g/L for Propane, all other uses, from Table A6.1-4 Emission Factors for Natural Gas Liquids in Part 2 of ECCC's NIR and the propane energy conversion factor from CER's Energy Conversion Tables of 1 m3 = 25.53 GJ.
The following calculation is used: (0.024 g/L)*(1 m^3/25.53 GJ)*(1000 L/1 m^3)*(1 t/1000000 g)

4 – CH_4 Global Warming Potential (GWP) of 25 is per the 100-Year GWP listed in Table 1-1, IPCC Global Warming Potentials (GWPs) in Part 1 of ECCC's NIR.

5 – Propane combustion N_2O emission factor of 4.23 x 10^{-6} t/GJ is calculated using the emission factor of 0.108 g/L for Propane, all other uses, from Table A6.1-4 Emission Factors for Natural Gas Liquids in Part 2 of ECCC's NIR and the propane energy conversion factor from CER's Energy Conversion Tables of 1 m^3 = 25.53 GJ.
The following calculation is used: (0.108 g/L)*(1 m^3/25.53 GJ)*(1000 L/1 m^3)*(1 t/1000000 g)

6 – N_2O Global Warming Potential (GWP) of 298 is per the 100-Year GWP listed in Table 1-1, IPCC Global Warming Potentials (GWPs) in Part 1 of ECCC's NIR.

7 – Diesel combustion CO_2 emission factor of 0.0026805 t/L is the converted value of 2680.5 g/L for Off-road Diesel ≥ 19kW, Tier 1-3 from Table A6.1-14 Emission Factors for Energy Mobile Combustion Sources in Part 2 of ECCC's NIR. The final mix of mobile equipment is unknown at this time; therefore, this source was chosen as a best approximation.

8 – Diesel combustion CH_4 emission factor of 7.3 x 10^{-8} t/L is the converted value of 0.073 g/L for Off-road Diesel ≥ 19kW, Tier 1-3 from Table A6.1-14 Emission Factors for Energy Mobile Combustion Sources in Part 2 of ECCC's NIR. The final mix of mobile equipment is unknown at this time; therefore, this source was chosen as a best approximation.

9 – Diesel combustion N_2O emission factor of 2.2 x 10^{-8} t/L is the converted value of 0.022 g/L for Off-road Diesel ≥ 19kW, Tier 1-3 from Table A6.1-14 Emission Factors for Energy Mobile Combustion Sources in Part 2 of ECCC's NIR. The final mix of mobile equipment is unknown at this time; therefore, this source was chosen as a best approximation.

10 – Power consumption emission factor of 1.2 t CO_2 eq / GWh is the converted value of 1.2 g CO_2 eq / kWh, which is Manitoba's 2019 Generation Intensity from Table A13-8 Electricity Generation and GHG Emission Details for Manitoba found in Part 3 of ECCC's NIR.

Units and abbreviations used:

GJ = Gigajoule; GWh = gigawatt-hour; h = hour; kWh = kilowatt-hour; L = litre; m^3 = cubic metres; t = tonne = metric ton
CH_4 = methane; CO_2 = carbon dioxide; CO_2 eq = carbon dioxide equivalent; GHG = greenhouse gas; N_2O = nitrous oxide

References:

Canada Energy Regulator (CER). 2016. Energy conversion tables. Accessed February 8, 2022: https://apps.cer-rec.gc.ca/Conversion/conversion-tables.aspx?GoCTemplateCulture=en-CA

Environment and Climate Change Canada (ECCC). 2021. National Inventory Report 1990-2019: Greenhouse Gas Sources and Sinks in Canada (NIR). Accessed February 8, 2022: https://unfccc.int/documents/271493