

Québec, February 10<sup>th</sup>, 2021

Mister Marc Croteau  
Deputy Minister and Provincial Administrator of the James Bay and Northern Quebec Agreement  
Department of environmental assessment of mining and northern projects, and strategic environmental  
assessment  
Ministère de l'Environnement et de la Lutte contre les Changements Climatiques  
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V/Réf. : 3215-14-007

**Subject: Modification request for the certificate of authorization of the Nunavik Nickel Project,  
Canadian Royalties Inc. (CRI)  
Tailing management at the Expo Mine**

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Sir,

We are submitting to you this request for modification of the certificate of authorization (CA) Nunavik Nickel Mining Project (V / Ref.: 3215-14-007) under article 201 of Chapter II of the Environmental Quality Act (EQA) for the modification of the mine tailing management plan at the Expo mine.

The mining company Canadian Royalties Inc. (CRI) has been operating the Nunavik Nickel Project (PNNi) since 2008 in Nunavik in the far North of the province of Quebec. The PNNi project was the subject to a first environmental and social impact study in 2007, which led to the obtaining of the CA relating to the whole PNNi on March 20, 2008, under article 201 of the EQA.

Condition 4.5 of the Global CA, stipulates that CRI must present to the Administrator the terms governing the use of the Expo pit for tailing management as well as the monitoring of the evolution of the water level in the pit to ensure that the flooding of tailings will be an effective measure in the short and long term to counter acid mine drainage (AMD). This modification request is part of this process.

## **1. Context**

### ***Object of the request***

The PNNi consists of the exploitation of polymetallic deposits whose main metals of interest are nickel (Ni) and copper (Cu). A port complex at Deception Bay as well as an industrial complex at the Expo site were developed at the end of the 2000s. The mine has a series of mineral deposits (Expo, Mesamax, Allammaq, Méquillon, Ivakkak and Puimajuq) which extend over 60 km.

The total ore reserves of the six currently authorized deposits are approximately 14,90 Mt plus the potential of an additional 2,02 Mt. Ore from each deposit is trucked to the Expo site for processing. Ore is processed at a nominal rate of 4,500 t / d. The Expo industrial site has two tailing disposal cells lined with a geomembrane (cells 1 and 2) and a waste rock disposal cell.

Taking into account all the authorized deposits as well as following the last update pertaining to resources and lifetime production of tailings, the capacity of the two cells of the tailing pond will be exceeded sooner than planned. CRI therefore wishes to modify the tailing management plan planned during the operating phase of the project in order to allow the deposition of these additional tailings in the Expo pit from 2022 to 2024. This request aims to meet the requirements of article 201 of the EQA.

We should mention that this request does not address the production of tailings that would result from the exploitation of future deposits not yet authorized for the project. These will be addressed in a subsequent modification request. The capacity of the Expo pit is more than sufficient since it theoretically could contain tailings until 2028.

### ***Legislative and historical framework of permits, certificates and authorizations issued***

The property is located in the portion of Quebec territory covered by the environmental impact assessment and review procedure in a northern environment north of the 55th parallel as defined in Chapter II of the Environment Quality Act (EQA). During the environmental and social impact study (April 2007, section 3.2), two alternative locations were analyzed for the tailing and waste rock disposal facility, the first located north of the Expo pit and the second to the south. The first option was chosen and integrated into the preliminary mining concept, in order to reduce costs and atmospheric emissions of pollutants linked to transport, but also, because this location offered the advantage to dispose of mining residues in the Expo pit, thus limiting footprint using the existing pit to store tailings.

The chosen concept was presented in the ESIA in order to obtain the Global CA. It implies that at the end of the mining operations of the Expo deposit, the pit would be used to collect tailings from the exploitation of the Méquillon deposit. Subsequently, the in-pit tailings deposition was specified in the request for a certificate of authorization for mining activities under article 22 submitted in November 2010 (section 5.6.7.1) and obtained by the MELCC on July 20, 2011. The tailing management plan specified the in-pit tailings deposition during the eighth year of operation, following the filling of the existing cells.

Since then, several addenda to the impact study have been made and various modifications to the Global CA have been issued, in particular for the addition of the Allammaq, Puimajuq and Expo Ouest deposits, the increase in the ore processing rate to 4,500 daily tonnes, the widening of roads, the relocation of the collection basin and the discharge point of the Méquillon satellite mine as well as the operation of various quarries and sand pits. Any additional tailings deposition related to new deposits, if any, will be included in a modification request that will be submitted for this purpose.

## ***Identification of the proponent***

Canadian Royalties Inc.

### Correspondence

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### Contact person

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Environment Superintendent  
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A copy of the resolution of the board of directors of the mining society Canadian Royalties Inc. authorizing Mr. Stéphane Twigg to make the necessary commitments to obtain the certificates of authorization and to present the request is attached in Appendix 1. In addition, a copy of the duly signed Déclaration du demandeur ou du titulaire (Applicant's declaration) form is attached in Appendix 2.

## **2. Modification request for the certificate of authorization 3215-14-007**

### ***Site location***

The PNNi is located in the far north of the province of Quebec, in Nunavik. More specifically, the PNNi, currently encompasses six deposits (Expo, Mesamax, Méquillon, Ivakkak, Allammaq and Puimajuq), is located approximately 80 km west of Kangiqsujaq, 140 km southeast of Salluit and approximately 20 km south of Katinniq. The mining complex is located north of the Pingualuit National Park. The location of the Expo pit can be found in appendix 3.

The PNNi is located at the head of the Puvirnituk River watershed on Class III lands under the James Bay and Northern Quebec Agreement where the exploitation of mineral resources is allowed.

The central geographic coordinates (Degrees, NAD 83) of the Expo pit are the following:

- Latitude 61° 33' 19.75''
- Longitude 73° 26' 57.44''

### ***Justification of the proposed modification for tailings management***

The mine tailings production lifetime is now estimated at around 10 Mm<sup>3</sup>, or around 14,90 Mt in total for mining operations until October 2024.

The total storage capacity of the current tailing ponds (cells 1 and 2) is approximately 8.10 Mm<sup>3</sup>. As of August 26, 2019, the occupancy volume of the cells was 4.92 Mm<sup>3</sup>. The residual storage capacity in the cells is therefore approximately 3.18 Mm<sup>3</sup> (4.72 Mt).

Based on the anticipated ore production, the storage capacity of cells 1 and 2 will be reached in July 2022. Also, when the cells will be close to complete filling, it is considered that the unloading in these cells will have to be paused to complete the pumping of the residual water before being able to resume unloading in

the cells until complete filling. This operational flexibility allows to optimize the filling of the two cells, as well as to anticipate the start of the deposition of tailings in the Expo pit in May 2022.

The Expo site tailing facility design report (Golder, September 2020) describes the project and the justifications. This report is presented in Appendix 4.

Based on the currently proven ore reserve, i.e. for a production capacity up to 2024, ore production will generate an estimated surplus of tailings of 1.96 Mm<sup>3</sup> (2.91 Mt). CRI therefore wishes to manage this excess residue by depositing them in the adjacent Expo pit. The projected production of tailings from authorized deposits is presented in the table below.

**Table: Tailings yearly production**

Years	Ore	Tailings		Tailings deposition in cells 1 and 2		Tailings deposition in the Expo pit	
	(t)	(t)	(m <sup>3</sup> )	(t)	(m <sup>3</sup> )	(t)	(m <sup>3</sup> )
2019	686 320	624 252	445 894	686 320	445 894	0	0
2020	1 647 000	1 498 052	1 070 037	1 647 000	1 070 037	0	0
2021	1 642 500	1 493 959	1 067 114	1 642 500	1 067 114	0	0
2022	1 642 500	1 493 959	1 067 114	746 980	533 557	746 980	533 557
2023	1 642 500	1 493 959	1 067 114	0	0	1 642 500	1 067 114
2024	1 388 524	1 262 952	902 108	0	0	1 388 524	902 108
<b>Total</b>	<b>8 649 344</b>	<b>7 867 134</b>	<b>5 619 381</b>	<b>4 722 800</b>	<b>3 116 602</b>	<b>3 778 004</b>	<b>2 502 779</b>

***Considered and chosen concept***

As mentioned above, both of the chosen concept previously presented in the ESIA in order to obtain the Global CA (April 2007) as well as the tailing management plan provided for the request the CA for mining activities under article 22 (obtained July 20, 2011) included, at some point in the operation schedule, the in-pit tailings deposition.

The alternative option would be to add another cell to the existing tailing facility. It would require:

- A permanent additional land use footprint.
- A more complex structural construction, requiring the installation of a waste rock dike from satellite deposits or the production of crushed material in an authorized quarry as well as the installation of a geomembrane system and an outlet.
- The emission of GHGs and additional atmospheric contaminants for construction as well as for the transport of waste rock to the Expo site.
- No gain on the restoration and stabilization of the expo pit.

The management of additional tailings in the Expo pit was therefore presented as the most advantageous solution, since it minimizes the environmental impacts while being the least expensive.

### ***Pit characteristics***

According to Golder's report (2020), the Expo pit is approximately 930 m long in the east to west direction and approximately 380 m wide in the north to south direction. The pit bottom elevation is approximately at 460 m while the lowest elevation along the pit rim is at 535.4 m.

The walls of the pit are formed of 57% Metasediments, 32% Peridotite and 11% Sulphide. It should be noted that the lithologic units of Metasediments and Peridotite are both potentially acid generating and metal leaching.

### ***Tailings characteristics***

Tailings that will be stored in the pit are potentially acid generating and metal leaching. Contact water is acidic and contains high concentrations of sulfate and various metals. Although tailings discharged from the ore processing plant are expected to be neutral (due to the addition of lime), the controlled water in the tailing pond is acidic due to geochemical processes in the pond. Tailings stored in the Expo pit could therefore also generate acidity. The following subsection (Filling and site restoration) as well as section 4 (Mitigation, monitoring and follow-up) present the methods that will be used to counter AMD.

### ***Filling method and restoration measures***

Currently, tailings are pumped into cells 1 and 2. The deposition of mine tailings in the Expo pit will be similar to what is currently authorized for the cells. Indeed, tailings should be unloaded at two outlet points located at the western and eastern ends of the open pit. As the Expo pit will serve as a water storage for cells 1 and 2, the in-pit tailings deposition will be done under water in 2022.

The pit will then be filled with tailings to an elevation of approximately 484 m, ie to a thickness of approximately 35 m representing more than 1.96 Mm<sup>3</sup> (2.91 Mt). At the end of the operation, the supernatant above tailings will be treated by the water treatment unit at the Expo industrial complex. Subsequently, tailings of the pit will be submerged by 50 m of water coming from Bombardier Lake to reach an elevation of approximately 535 m in total, which is the lowest elevation along the edge of the pit.

This tailings flooding method significantly reduces the potential oxidation of tailings and metal leaching. The layer of water reduces the amount of oxygen available for sulphide minerals present in tailings. The method is based on a low solubility of oxygen in water compared to that of air.

Since restoration measures must be reviewed by the MERN, an update of the closure plan addressing the pit closure in relation to the present modification of the tailings' management method was submitted to the MERN in parallel to the current request. Following the usual process, the MERN will then seek the MELCC's opinion on the document before final approval of the plan is given. For information, highlights of the closure plan projected for the Expo pit are presented in Appendix 8. Details are also available in the design report in Appendix 4.

### ***Stability of the open pit walls***

Open pit wall stability analysis was carried out during various stages of the Expo in-pit tailings deposition (Golder, 2020). The analyses included different deposition stages assuming completely saturated condition in the ultramafic and metasediments rock units.

Both circular and non-circular failure modes were analyzed. Non-circular failures yielded lower results, particularly in cases where the failure occurs along the bedding in the metasediments. The safety factor calculated was more than the minimum required, which is 1.2, indicating that the pit walls will be stable.

The final pit before the start of tailings filling yielded the lowest factor of safety. The safety factor of the pit wall increased once tailings are deposited. Tailings were shown to act as a support to the pit slope and to improve the overall stability. Details of the stability assessment are presented in Appendix F Golder's report (2020).

### *Considerations in relation to the local climate*

#### Hydrogeology

The 2007 impact study (Génivar) showed that cold temperatures keep a continuous permafrost in this region. Groundwater flow in permafrost environments is very different from that observed in regions without permafrost. Since permafrost provides an impermeable layer, groundwater movement is restricted exclusively to talik areas during the year or within unfrozen mollisol during summer. Interstitial water present in rock cracks and in surface deposits is frozen all year round except during seasonal thaws, for a thickness of the mollisol restrained to the first 2 to 3 metres. The flow of water inside the mollisol follows with the slope of the microtopology formed by the thaw front as it progresses through the soil during the summer season.

The model results show that deposition of tailings inside the pit followed by formation of a pit like will cause permafrost to thaw to a depth of about 22 cm below the base of the pit. The model also showed that the ground between the Expo pit and the tailing cells will remain mostly frozen during all times, which would prevent groundwater flow between the Expo pit and tailing areas. Although permafrost would warm up progressively in the long term, the models showed that the extent of this unfrozen zone would not increase over a period of 100 years. Figures showing the permafrost modelling are presented in Appendix E of the design report.

#### Precipitation

According to Golder's report (2020), the average annual total precipitation (rainfall and snowfall) for the site, from 1981 to 2019, is approximately 600 mm. The maximum average precipitation of 103 mm is reached in July. It was estimated in the impact study that the effect of climate change could increase annual precipitation by about 10% in northern Quebec (Génivar, 2007).

### **3. Impacts identification and assessment**

Within the context of the work covered by this authorization request, no additional impact on the natural environment is expected. The open pit tailing management plan and tailings flooding is the option which most minimizes environmental impacts. Regarding tailings, only the final destination of the mine tailings will be changed. Tailings are currently accumulated in a tailing pond and will also be accumulated in the existing Expo pit. The conveying process of tailings will remain the same, only new pipes on the already impacted environments will be put in place. Thus, no additional effect on the natural environment is expected. Adding tailings to the pit has a positive effect on the stability of the pit walls. In addition, the risks associated with the migration of groundwater are limited by the presence of permafrost which isolates the pit from its environment. This management method has limited effects on atmospheric emissions and GHGs.

### **4. Mitigation, monitoring and follow-up measures**

CRI will put in place mitigation, monitoring and follow-up measures to ensure that the tailings management method in the pit and flooding of the pit is effective and remains effective over time to counter AMD.

### ***Mitigation measures***

While developing the in-pit deposition method, CRI carried out modelling to ensure that the AMD was controlled and that the applicable criteria were met. In fact, modelling has shown that maintaining the hardness of the pit water at 400 mg / L eq. CaCO<sub>3</sub> helps limit the AMD and ensures that the discharge of the overflow to the tributary of the Puvirnituk River meets the applicable criteria. The maintenance of hardness will be done by adding chemicals (e.g. calcium chloride) to the pit.

It should be noted that a restoration plan is currently being revised to include in-pit tailing management.

### ***Monitoring of the tailing facility***

The monitoring will be carried out in accordance with the *Monitoring procedure for mining facilities, and management of tailings, waste rock and water* (PRO-NMIN-1505-01a-F, Appendix 5).

### ***Follow-up program***

During the operation period, ie the pit filling period, monitoring of the AMD will continue as specified in monitoring 27 of the CRI Environmental Monitoring Plan (Appendix 6). During the post-operation period, CRI will set up environmental monitoring to ensure that the measures in place are working properly.

## **5. Communications with partners and stockholders**

### ***Nunavik Nickel Committee***

The PNNi includes a specific agreement on the repercussions and benefits for the Inuit community (better known by the acronym IBA for *Impact and Benefit Agreement*), the Nunavik Nickel Agreement, between the Makivik Corporation, the Nunaturlik landholding corporation of the northern village of Kangiqsujuaq, the Qarqalik landholding corporation of the northern village of Salluit, the northern village of Puvirnituk and Canadian Royalties Inc. It addresses the communication aspect of the project throughout its lifetime. Thus, the *Nunavik Nickel Committee* (NNC) made up of signatory members (4 members from the Inuit parties and 4 members from CRI) meets on a biannual basis to discuss issues related to the PNNi. In addition, an Inuit liaison officer employed by CRI monitors communications with the communities. In 2019, NNC met on May 3<sup>rd</sup> and November 4<sup>th</sup> at the PNNi site. Social, environmental and technical aspects related to the operations and administration of the IBA were discussed. The changes to the tailing management plan were presented during the meeting held on December 11<sup>th</sup>, 2020 (Appendix 7).

### ***Communication and monitoring program with communities***

A communication and monitoring program with the communities has been set up under the conditions issued by the global Board of Directors and the two follow-ups resulting from these conditions are integrated into our environmental monitoring program. The results of these monitoring are presented annually as part of the PNNi monitoring report, submitted to stakeholders.

In 2019, the Department of the Environment, with the Inuit Liaison Officer, decided to resume the visits to the communities which was a component covered by the Agreement. A visit took place on January 22<sup>nd</sup>, 2020, between the northern village of Puvirnituk and CRI. During this visit, two members of the Department of the Environment (one of whom is Inuit) presented a summary of the PNNi, i.e. the current projects, those in development, and those to come, as well as the environmental monitoring of the environmental

assessments. It should be noted that the activities planned during these visits are discussed during the meetings of the NNC and the annual environmental monitoring report is sent to the members of this same committee. Also, the environment superintendent was present during the Kuujjuaq Mining Workshop held in the spring of 2019. This forum is an opportunity to meet, on an informal basis, several members of the communities covered by the Agreement. Unfortunately, planned visits to Salluit and Wakeham had not occurred due to the ongoing Covid-19 pandemic.

The transfer of information between CRI, stakeholders and targeted communities, via the NNC, is in the process of continuous improvement. CRI maintains an open and transparent approach, not only regarding environmental issues, but also future projects. We hope that the hiring of the Inuit Liaison Officer in 2017 will help maintain an open and transparent dialogue between stakeholders and it will improve communication and feedback with communities. CRI wishes the satisfaction of the Inuit members with regard to the communication of our results and consequently is open to any proposal to improve the information dissemination mechanism.

Hoping everything satisfies the requirements,  
Best regards.



Stéphane Twigg  
Environment Superintendent

c.c. (electronic correspondence):  
Mrs. Marie-Michelle Vézina – MELCC

## **List of appendices enclosed in attachments**

- Appendix 1 :** Copy of the Resolution of the Board of Directors of CRI (Résolution du conseil d'administration), September 11<sup>th</sup>, 2019
- Appendix 2 :** Copy of the applicant's declaration (Déclaration du demandeur ou du titulaire), September 12<sup>th</sup>, 2019
- Appendix 3 :** Map 1 – Project location (Golder), December 22<sup>nd</sup>, 2020
- Appendix 4 :** Report : Conceptual design of the Expo in-pit tailing facility (Golder), December 22<sup>nd</sup>, 2020
- Appendix 5 :** Monitoring procedure for mining facilities, and management of tailings, waste rock and water (CRI), 2020
- Appendix 6 :** Environmental monitoring plan V.4 – 27<sup>th</sup> Monitoring (WSP), June 2015
- Appendix 7 :** CCN committee meeting report (IBA), December 11<sup>th</sup> 2020
- Appendix 8 :** Summary of the closure plan projected for the Expo pit

## **APPENDIX 1**

Copy of the Resolution of the Board of Directors of CRI (Résolution du Conseil d'administration),  
September 11<sup>th</sup>, 2019

(enclosed in attachments)

**APPENDIX 2**

Copy of the applicant's declaration (Déclaration du demandeur ou du titulaire), September 12th, 2019

(enclosed in attachments)

### **APPENDIX 3**

Map 1 – Project location (Golder), December 22<sup>nd</sup>, 2020

(enclosed in attachments)

## **APPENDIX 4**

Report : Conceptual design of the Expo in-pit tailing facility (Golder), December 22<sup>nd</sup>, 2020

(enclosed in attachments)

## **APPENDIX 5**

Monitoring procedure for mining facilities, and management of tailings, waste rock and water (CRI), 2020

(enclosed in attachments)

**APPENDIX 6**

Environmental monitoring plan V.4 – 27<sup>th</sup> Monitoring (WSP), June 2015

(enclosed in attachments)

**APPENDIX 7**

CCN committee meeting report (IBA), December 11<sup>th</sup>, 2020

(enclosed in attachments)

## **APPENDIX 8**

Summary of the closure plan projected for the Expo pit

(enclosed in attachments)