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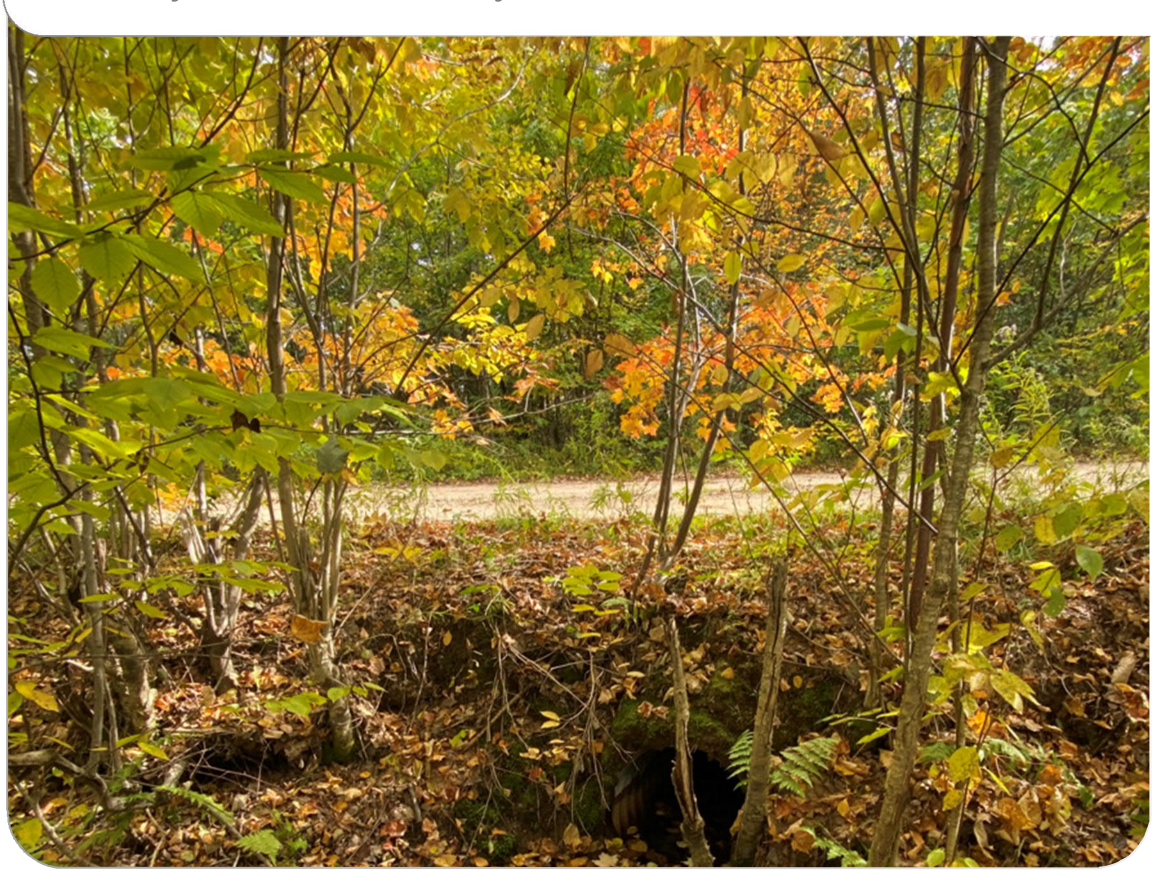
NATURAL FORCES DEVELOPMENTS LP

Comment Responses Regarding Naturally Occurring Uranium

Benjamins Mill Wind Project



December 2022 – 22-4064

December 20, 2022

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Attention: Megan MacIsaac

Comment Responses Regarding Naturally Occurring Uranium Related to the Environmental Assessment of the Benjamins Mill Wind Project

Dillon Consulting Limited (Dillon) is pleased to provide you with the final report for the comment responses regarding naturally occurring uranium related to the Environmental Assessment of the Benjamins Mill Wind Project.

We trust the following meets your present needs. If you have any questions or comments, please contact the undersigned at (902)-450-4000 ext. 5052 at your convenience.

Sincerely,

DILLON CONSULTING LIMITED

Kelly Regan, M.Sc.
Project Manager, Associate

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Enclosure

Our file: 22-4064

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1.0 Introduction

An Environmental Assessment Registration Document (EARD) was submitted to Nova Scotia Environment and Climate Change (NSECC) on January 18, 2022 for the proposed wind project near Benjamins Mill, NS. Comments on the Environmental Assessment (EA) for the Benjamins Mill Wind Project were received by the proponent, Natural Forces (NF), from NSECC. Dillon Consulting Limited (Dillon) was asked by NF to provide technical assistance in support of the response to certain comments specifically related to the presence of uranium in bedrock in the vicinity of the project. The comments addressed by Dillon are the items bolded and italicized in the list of uranium-specific EA comments below:

"In consultation with Natural Resources and Renewables (NRR) Geological Survey Division Mineral and Management Division, provide a comprehensive review and presentation of all historical geoscience data for the project footprint. This includes but is not limited to:

a. Detailed geological map(s) of the development footprint and project area.
b. Uranium distribution map layer(s) based on geological, geophysical and geochemical data.
c. A technical summary that:
    i. Identifies and describes known occurrences of uranium;
    ii. Describes geological controls related to primary occurrences, and potential secondary distribution of uranium;
    iii. Identifies and describes common benchmark standards for naturally occurring uranium mineralization and human health and safety considerations; and
    iv. Identifies and describes the local health and safety risk to known and potential occurrences of uranium mineralization.
d. Provide an avoidance and mitigation plan which includes:
    i. A general exposure assessment related to geoscience site characterization.
    ii. An exposure assessment for planned activities including infrastructure development and all primary or secondary ground disturbance activities."

2.0 Background

Naturally Occurring Radioactive Material (NORM) is defined as, "Materials which may contain any of the primordial radionuclides or radioactive elements as they occur in nature, such as radium, uranium, thorium, potassium, and their radioactive decay products, that are undisturbed as a result of human activities" (U.S. EPA, 2008). These radioactive elements are present at varying concentrations throughout the earth's crust and within the tissues of living organisms. They have the potential to cause cancer if exposures to the radiation emitted during their decay are high enough (WCNC, 1995). NORM concentrations in most natural areas is generally negligible; however, disturbance of these areas (e.g., through industrial processes) may liberate the naturally radioactive materials present, potentially resulting in elevated NORM concentrations and exposure to the radiation emitted by the NORM. Different types of radiation have different penetrating power, and sensitivities to radiation differ with the different parts of the body. Health Canada (2014) identifies the three basic types of radiation emitted by NORM:

- Alpha (α) – heavy charged particles, do not penetrate far, even in air, can be stopped by a piece of paper or clothing;
- Beta (β) – lighter charged particles, more penetrating, but can be stopped by a few cm of plywood; and
- Gamma (γ) – high energy, very penetrating, can be stopped by a meter of concrete or several meters of water.

NORM are measured as either becquerel (Bq) or Sievert (Sv). Becquerel measures the quantity (activity) of radioactivity present (1 Bq = 1 nuclear transformation per second) and indicates the radiation-emitting ability of a substance, but does not differentiate what kind of radiation is emitted. The Sievert (Sv) measures the effective dose of radiation which accounts for the total effect of different types of radiation on different body parts of an organism (Health Canada, 2014).

The average Canadian is exposed to approximately 1.2 milli-Sieverts (mSv) to 3.2 mSv per year of background radiation (radiation from natural sources) (Health Canada, 2014), with radiation emitting from soil and rock (referred to as groundshine) representing 13.3% or 0.35mSv on average of the annual Canadian exposure (Health Canada, 2014).

Hand-held scintillometer readings have been collected over select areas of the site that are proposed for development as part of the project. These measurements, however, report radiation in counts per second and are not directly comparable to the either the Bq or Sv, but rather give an indication of relative radioactivity of the material scanned. Hand-held scintillometer scans can be used to screen and locate sites for additional chemical and radiological sampling and quantitative analysis as needed.

3.0 Benchmarks and Health and Safety Considerations for Naturally Occurring Uranium Mineralization

Uranium is a naturally occurring radioactive element that exists around the world in soils and rock (NSECC, 2022a). Depending on the types of minerals in the soil or bedrock, natural concentrations of uranium vary across NS soils. Groundwater in areas of NS with granite, sandstone and shale bedrock are likely to have naturally occurring uranium present (NSECC, 2022a).

Uranium is both a chemical (measured in units of mass) and a radioactive material (measured in radioactivity such as Bq or Sv), and has various physical and chemical forms (CCME, 2007). Therefore there are both radiological and non-radiological toxicity considerations for uranium, and different guidelines have been developed depending on these considerations. Various national and international guidelines are available for both chemical and radioactive uranium; however, the most applicable for this site are the Canadian guidelines which are discussed in the following sections.

Uranium Non-Radiological Considerations and Human Health Guidelines

The main chemical toxicity effect of uranium is kidney damage (ATSDR, 2013). Chemical uranium is not considered by most regulatory agencies as being carcinogenic (e.g., Health Canada, US Environmental Protection Agency) (CCME, 2007; ATSDR, 2013).

The CCME (2007) has developed human health-based soil quality guidelines for uranium which considers the chemical aspects of naturally occurring uranium (expressed as units of mass) and do not consider radioactivity. The CCME soil quality guidelines for human health (SQG_{HH}) were derived using Health Canada's (1999) tolerable daily intake (TDI) for chemical uranium based on oral ingestion. The Nova Scotia Environment and Climate Change (NSECC, 2022b) Tier I Environmental Quality Standards (EQS) for uranium in soil are the same as the CCME (2007) SQG_{HH}, with the exception of the guidelines for potable groundwater for commercial and industrial land use. The CCME SQG_{HH}, and NSECC Tier I EQS for non-potable and potable water based on land use are provided in Table 1.

Table 1: CCME Human Health-Based Soil Quality Guidelines versus NSECC Human Health Tier I Environmental Quality Standards for Potable and Non-Potable Water

Land Use	CCCME SQG_{HH} (mg/kg)	NS Tier I EQS (Non-Potable) (mg/kg)	NS Tier II EQS (Potable) (mg/kg)
Agricultural	23	23	23
Residential/Parkland	23	23	23
Commercial	33	33	30
Industrial	300	300	30

Notes:
CCME – Canadian Council of Ministers of the Environment
NSECC – Nova Scotia Department of Environment and Climate Change
SQG_{HH} – soil quality guideline for human health
EQS – Environmental Quality Standard

The Health Canada (2022) guideline for Canadian drinking water (including well water) for uranium is 0.02 mg/L (20 µg/L). This guideline was developed in 2019 and is based on kidney effects. The Nova Scotia Environment and Climate Change (NSECC, 2022b) Tier I Environmental Quality Standards (EQS) for uranium in groundwater at a potable site are the same as the Health Canada (2022) guideline.

Uranium is naturally occurring in NS groundwater in areas with granite, sandstone and shale bedrock (NSECC, 2022a). As such, it is not uncommon for the uranium drinking water quality guideline in these areas to be exceeded. NSECC recommends that well water be tested regularly for uranium. NSECC has also developed an interactive map to identify uranium risk in bedrock water wells: (https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Uranium_Risk).

Federal ambient air quality guidelines for chemical uranium were not identified as uranium is not volatile.

Radiological Uranium Considerations and Human Health Guidelines

The primary radiological toxicity concern with uranium and NORM is an increased probability of an individual developing cancer. The ionizing radiation (such as gamma rays) emitted by NORM is a known carcinogen. The ICRP (International Commission on Radiological Protection) considers any exposure to ionizing radiation to be potentially harmful to health (Health Canada, 2014).

In Canada, NORM is managed under the jurisdiction of the provinces and territories which each have their own rules and regulations for the handling and disposal of NORM. To harmonize standards and reduce inconsistencies across the country, federal guidelines were developed. The Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM), were established by the 2011 Canadian NORM Working Group; in which, representation from Nova Scotia was involved (Health Canada, 2014). These Canadian guidelines set out principles and procedures for the detection, classification, handling and management of NORM, in addition to providing guidance for compliance with national transport regulations. The guidance document also provides a framework for regulatory authorities, affected industries and specific workplaces to develop more detailed NORM management practices and guidelines (Health Canada, 2014).

Nova Scotia does not have NORM specific guidelines; however, since NS follows the federal guidance, and by default site-specific NORM management plans will be developed in accordance with the "Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)". The NORM guidelines are applicable for radiological uranium.

The Health Canada NORM guidelines are based on the most recent international standards recommended by the International Commission on Radiological Protection (ICRP) and Canadian Nuclear Safety Commission (CNSC) regulations. The basic principle of the Guidelines is that persons exposed to NORM should be subject to the same radiation exposure standards that apply to persons exposed to CNSC-regulated radioactive materials. No distinction is made regarding the origin of the radiation, whether it is NORM in its natural state or NORM whose concentration of radioactive material has been increased by processing (Technologically Enhanced NORM or TENORM).

The annual effective dose limits for occupationally exposed workers (20 mSv) and incidentally exposed workers (1 mSv) or members of the general public (1 mSv) are provided below in Table 2. Radiation dose limits exclude natural background radiation. Health Canada (2014) has conservatively adopted an incremental dose constraint of 0.3 mSv as a first investigation level (equivalent to a Tier 1 or screening level) to allow for other potential sources of NORM without the annual public limit of 1 mSv being exceeded.

Table 2: Radiation Dose Limits (from Health Canada, 2014)

Affected Group	Annual Effective Dose Limit (mSv)[(a)]	Five Year Cumulative Dose Limit (mSv)
Occupationally Exposed Workers[(b)]	20[(c)]	100
Incidentally Exposed Workers and Members of the Public	1	5

Notes

a These limits are exclusive of natural background and medical exposures. Refer to Appendix D for guidance on dose limit calculations.

b For the balance of a known pregnancy, the effective dose to an occupationally exposed worker must be limited to 4 mSv as stipulated in the "Radiation Protection Regulations", Canadian Nuclear Safety Act. This limit may differ from corresponding dose limits specified in current provincial legislation applicable for exposure to sources of x-rays..

c For occupationally exposed workers, a maximum dose of 50 mSv in one year is allowed, provided that the total effective dose of 100 mSv over a five-year period is maintained. This translates into an average limit of 20 mSv/a.

NORM materials management can be classified as Unrestricted, or Release with Conditions. Under the Unrestricted classification, NORM can be released without restrictions when the associated incremental dose is <0.3 mSv/year. Unconditional derived release limits (UDRLs) meeting this criteria have been developed for both diffuse NORM (i.e., material generally large volume, with relatively low radioactive concentrations, uniformly dispersed) and discrete NORM (i.e., small in size, exceed the concentration criteria for a diffuse source). The sources of uranium at the Benjamins Mill site would be considered a diffuse NORM source as the occurrence would be within the minerals making up rocks and soil occurring spread out over relatively large area. As such, the UDRLs for diffuse NORM provided in Table 3 would apply. Health Canada (2014) provides a ratio approach for determining the sum of exposure to all isotopes of NORM.

Table 3: Unconditional Derived Release Limits – Diffuse NORM Sources (from Health Canada, 2014)

NORM Radionuclide	Derived Release Limit[(a)]		
	Aqueous[(b)] (Bq/L)	Solid (Bq/kg)	Air (Bq/m^3)
Uranium-238 Series (all progeny)	1	300	0.003
Uranium-238 (U-238, Th-234, Pa-234m, U-234)	10	10,000	0.05
Thorium-230	5	10,000	0.01
Radium-226 (in equilibrium with its progeny)	5	300	0.05
Lead-210 (in equilibrium with bismuth-210 and polonium-210)	1	300	0.05
Thorium-232 Series (all progeny)	1	300	0.002
Thorium-232	1	10,000	0.006
Radium-228 (in equilibrium with Ac-228)	5	300	0.005
Thorium-228 (in equilibrium with all its progeny)	1	300	0.003
Potassium-40	n/a[(d)]	17,000[(c)]	n/a

Note: See Health Canada, 2014 for tables notes

While there are no NSECC Tier 1 EQS criteria for NORM, Nova Scotia does recognize the “Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)” and as such potential NORM sources and exposures would be evaluated using the Health Canada framework.

4.0 Local Health and Safety Risks to Known and Potential Occurrences of Uranium Mineralization

Geological Setting and Site Conditions

For the project area, ground surface consists mainly of a thin and discontinuous till veneer overlying granite bedrock. The granite bedrock is often exposed at surface (Stea et al, 1992). The primary bedrock type of the study area is the South Mountain Batholith (SMB) which contains the highest rock-concentrations of uranium in NS (Mercator, 2022). The Millet Brook Uranium Deposit is considered the best-defined and largest uranium deposit in NS, and it is located approximately 600 m south of the Project Area's southeast boundary.

As previously noted, uranium can pose potential chemical and radiological toxicity effects to living organisms including humans. During the construction phase of the project, workers will be on the site for a relatively limited time constructing access roads and foundations then erecting and assembling the wind turbine generators. To identify the potential hazards with working in a high uranium area, the potential occurrences of uranium mineralization within the project area were examined by Mercator (2022).

Mercator Geological Services (Mercator, 2022) conducted a geological study of the Benjamins Mill Wind Project site. To complete the work, they conducted two site visits in July and August, 2022 to three of the twenty-eight proposed project turbine sites (i.e., T15, T25 and T27), and associated proposed access roads. These areas were chosen as they were the closest in location to historical mining explorations such as drill holes, uranium showings, geochemical data anomalies and radiometric anomalies (Mercator, 2022).

Mercator (2022) compiled historical geoscience data for the site, including bedrock uranium distribution, and examined the areas to identify evidence of uranium mineralization, or presence of alteration known to accompany uranium mineralization. In addition they collected background levels of radioactivity using a scintillation counter which provided a total count of gamma radiation in counts per second (cps) during the first site visit; however, it did not discriminate between the main sources of radioactivity (i.e., uranium, thorium and potassium) (Mercator, 2022). The readings were compared to a background alarm threshold of 160 cps which was selected based on the typical reported background levels for NS granite of 100 to 180 cps (O'Reilly et al, 2009). During a follow up site visit, a scintillator with the ability to differentiate between potassium uranium and thorium radiation was used for screening.

During the site visits to the three proposed turbine locations and associated proposed access roads, no significant alteration, uranium mineralization or highly anomalous radiation levels in either bedrock exposures or overburden materials at the sites and along the planned access roads were noted. However, some higher anomalous gamma radiation levels were detected at several locations within or adjacent to the project areas, which were all located along the existing forest access road system off of Pioneer Drive (Mercator, 2022).

The elevated scintillator readings initially identified prompted the additional radiation measurements with the scintillometer with the ability to differentiate between potassium uranium and thorium radiation in addition to several other turbine locations in October 2022.

The scintillometer data were used as an initial screening tool for potential uranium hazards at the site (see Avoidance and Mitigation section below). Once the chemical and radiological sampling for uranium in soils and rock is completed, it will be incorporated into the screening tool to provide a field screening limit or background above which further NORM sampling would be required prior to site development. Figure 1 shows the components that will be used as part of the avoidance and mitigation plan to determine the potential hazards associated with uranium (in soils/rock) at the proposed turbine locations and surrounding site areas.

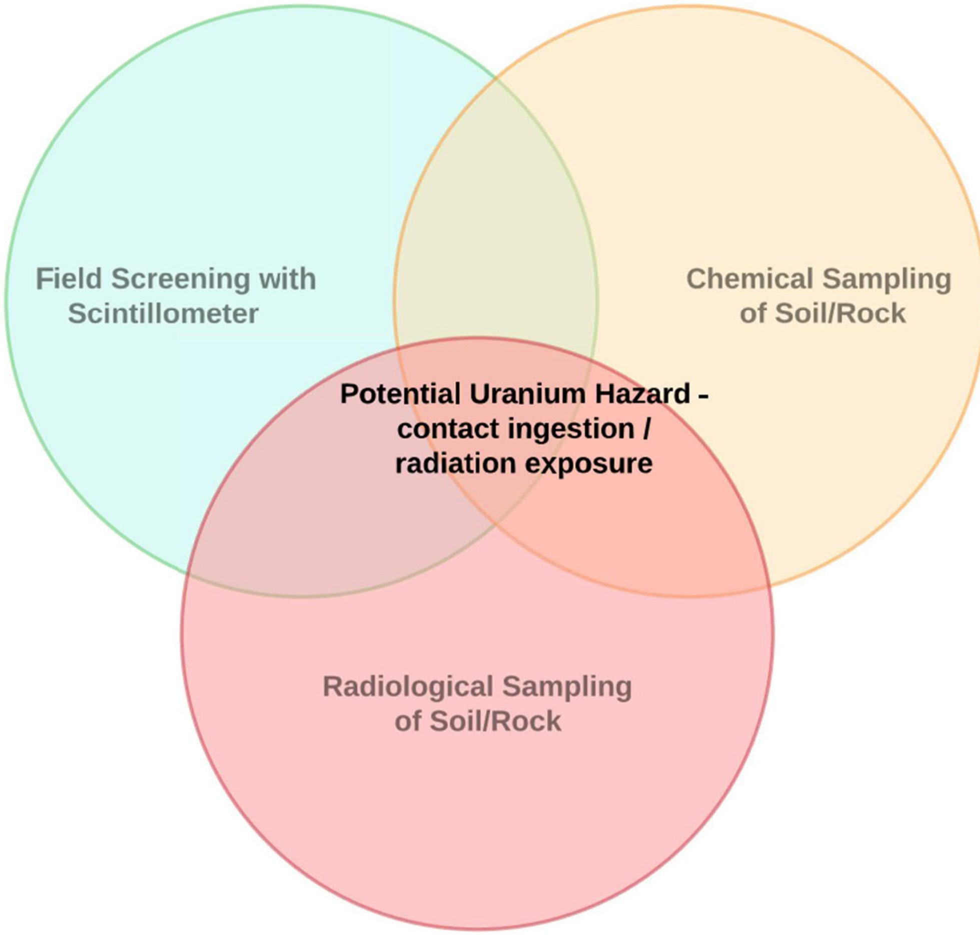

Figure 1: Components to Identify Potential Uranium Hazards on Site

Potential Local Health and Safety Risks

As noted previously NORM are naturally present over the earth's crust and within the tissues of living organisms. Concentrations of NORM in most natural areas is generally negligible; however, NORM can potentially become elevated if areas with higher concentrations are disturbed, exposing and potentially releasing naturally radioactive materials that are present.

People are continually being exposed to natural background radiation, which makes up over half of an average person's yearly exposure to radiation (US EPA, 2022a). Sources of background radiation include, for example, radiation from the sun and outer space, and groundshine (radiation from the ground surface and minerals beneath the surface) from naturally present radioactive minerals in rocks and soils. People may also be exposed to radiation from some medical procedures (Health Canada, 2014).

While people (and all living organisms) are continually being exposed to low levels of radiation which can cause damage to living cells, the body is very efficient at repairing this damage. However, if one is exposed to very high levels of radiation over time, and the damage is not repaired correctly, it can lead to serious health problems such as cancer. Exposure to low levels of radiation, including natural radiation, over time does not cause an immediate health effect, but can result in a small increase in the potential risk of cancer over a lifetime (US EPA, 2002b). Exposures to high levels of radiation, can result in higher potential risks of cancer over a lifetime.

Potential Human Receptors

During the construction phase of the project, the human receptor with the greatest potential for exposure to chemical and radiological uranium is the site construction worker. The site construction worker will be on site for eight (8) to 10 hours per day, five (5) days a week during construction season for up to two (2) years and may be in direct contact with soils/rock potentially containing uranium during access road and foundation construction work.

Other people could potentially use the site passively during the construction phase, such as someone walking through the area for recreational purposes, hunting, ATV use or for activities such as tree cutting. However, access to the site by these individuals during construction will be limited. Security/project staff will be monitoring access to the site during construction, and signs will be posted indicating that the site is not to be trespassed. The site is also remote and is not considered a prime location for recreational hiking beyond hunting and ATV use. Based on the steps that will limit access to the site, even if an occasional site visitor were to passively be on the site, their exposures would be of short duration and infrequent, and lower than that of the construction worker.

Potential Human Exposure Pathways

The main exposure pathway of concern for the project during construction is groundshine exposure to radiological uranium, in particular gamma radiation from the uranium. Inhalation of chemical uranium, which is not volatile, and as such, exposures to chemical uranium via inhalation would be low. Disturbances to uranium rich rocks and soils will be minimal during the construction phase (disturbances basically involve excavating overburden soils to expose the bedrock surface, drilling holes into the bedrock to anchor foundation structures and the construction and backfilling of the foundations). Potential exposures for the construction worker to radiological radiation associated with the project are expected to be low. In addition, construction works will be on-site for a relatively short period of time as noted above and initial scintillometer readings were elevated over background in only some locations within the project area.

For the most part, site construction workers will have limited direct contact with uranium enriched soils/rocks and as such, exposures to alpha and beta radiation is expected to be low. As noted above, Alpha particles are heavy and don't move far from their source, and cannot penetrate the skin. Beta particles are lighter and can travel further than alpha particles; however, they can be stopped with a layer of clothing (US EPA, 2022b). Gamma rays can travel further distances and easily penetrate skin and clothing. Direct contact and incidental ingestion of chemical uranium in soils and soil dust could potentially occur, but is limited by the amount of exposed bedrock and limited soil cover in the area, and can be reduced with proper hand hygiene and dust suppression. While radioactive uranium can be absorbed through the skin, the potential for dermal exposure of chemical uranium is low and can be limited by common personal protective equipment such as gloves, wearing pants, covering skin.

Uranium in groundwater is often a concern in NS, particularly in areas with high uranium in soils. The project area occurs within the SMB granite region, and 25% of wells drilled within the SMB area had uranium concentrations higher than the CDWQG (Mercator, 2022). Although groundwater is potentially an important exposure pathway, this pathway is screened out for the Benjamins Mill project for a number of factors including:

- Construction work on the site is limited to geotechnical work and excavating overburden soils to expose the bedrock surface, drilling holes into the bedrock to anchor foundation structures and the construction and backfilling of the foundations to construct towers above grade, so there is no contact with groundwater and no groundwater disturbances are anticipated).
- Construction workers and occasional site visitors will not be drinking groundwater from the project area. There is no groundwater consumption in the area, the nearest groundwater wells are greater than 1km from the potential turbine locations (NS Groundwater Atlas; NSECC, 2022 - https://fletcher.novascotia.ca/DNRViewer/?viewer=Groundwater).
- This distance of the nearest potable well is greater than the common monitoring distance for blasting which is approximately 800m. No blasting will be occurring in the area.
- Potable water screening for industrial activities are generally conducted for potable neighbours within 1 km of a site, as typically provided in an industrial approval. As no potable wells are noted within 1 km of the site pre- and post-construction groundwater monitoring is not anticipated to be completed.

Summary

The receptor having the greatest exposure potential to chemical and radiological uranium on the site during construction, is the site construction worker. The main pathway of concern is via inhalation of and contact with dust and radiological exposure to uranium via groundshine.

The potential for exposure to construction worker while on site during project construction, is considered to be low (i.e., limited direct contact with soil/bedrock, dust suppression, and appropriate PPE). A screening tool has been developed to identify areas with elevated uranium hazard and avoidance/mitigation measures are provided to reduce potential exposures, thereby reducing potential risks. In addition, disturbance of uranium enriched rocks and soils associated with the project is expected to be minimal, and as such the liberation of radioactive materials from these media is expected to be low.

Potential human receptors (construction workers) for the site are considered industrial as there will be no commercial or residential activity at the sites, no material removal from the site, and no children present.

5.0 Avoidance and Mitigation Plan

Protective measures are being put in place for this project to limit exposures to workers (and the general public) in areas that have the potential for elevated concentrations of radiation. In general, the primary protective measure to reduce exposures to radiological uranium on the site is to understand where they exist, minimize disturbance to this area as much as is feasible, and minimize time spent in the vicinity of the radioactive material as much as possible.

Once potential NORM material is identified (through screening with field reading using a scintillometer), NORM sampling and testing is then required for material that is potentially above background. Work is currently underway to establish the background screening limit using scintillometer readings collected by Mercator and samples being collected for both chemical uranium testing (mg/kg) and NORM isotopic analysis (Bq/kg). As discussed above (in the Background section), scintillometer readings can be used to identify elevated NORM, but cannot be used for regulatory compliance as analysis must be completed for both chemical and radiological content.

The Avoidance and Mitigation plan for the naturally occurring uranium mineralization present in the area is graphically summarized in Figure 2. It is composed of three screening steps with four possible outcomes based on both potential chemical and potential radiological exposure. The screening tool conservatively utilizes the NSECC Human Health Tier I EQS for agricultural, residential, commercial and industrial land use with potable groundwater.

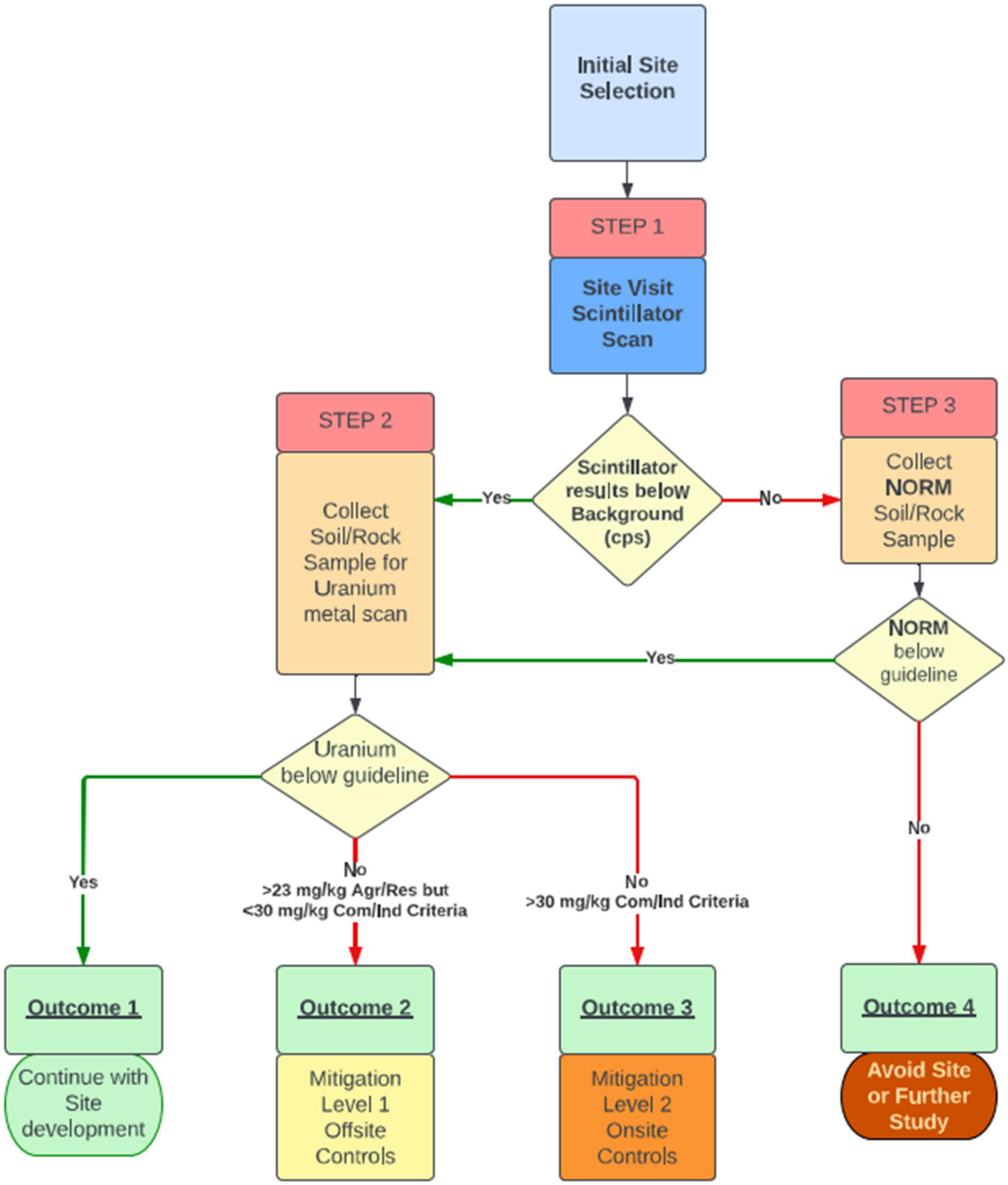

Figure 2: Avoidance and Mitigation Plan for Naturally Occurring Uranium Mineralization

Screening Step 1 occurs during initial site visits and includes the completion of georeferenced scintillometer scans of surface material across the site. Step 2 is the collection of soil/rock samples for uranium chemical concentration (mg/kg) based on the results of the scans; and, Step 3 (when required) is the collection of NORM soil/rock samples for analysis of NORM isotopes. These screening steps are described in more detail in the following paragraphs.

Step 1

This step consists of the collection and recording of georeferenced scintillometer scans of soil/rock within the construction foot print of the project (i.e., everywhere there is going to be construction/ground disturbance). The end result of Screening Step 1 is simply the determination of whether or not NORM radiological sampling is required in addition to uranium chemical sampling.

Step 2

Screening Step 2 also begins during the initial site visit with the collection of a soil/rock sample from the locations of the highest scintillometer readings for chemical analysis of uranium. The scintillometer readings do not have to be above background for this sampling as chemical uranium concentrations above NSECC Tier 1 EQS can still occur if samples are not radiologically elevated. Collected samples should be submitted to an accredited laboratory for uranium soil analysis. Sample results should be assessed relative to the NSECC Tier 1 EQS for uranium which is 23 mg/kg for both agricultural land use and residential land use and 30 mg/kg for both commercial and industrial and use. As presented in Figure 2, results below NSECC Tier 1 EQS indicate no further action is required provided NORM results (if required as per step 1 above when scintillometer readings are above background) are also below background and the UDRLs.

Step 3

If the scans completed in Screening Step 1 indicate readings above the background, Screening Step 3 should be initiated with the collection and submission of NORM samples to Bureau Veritas laboratory for NORM radiological analysis. It should be noted that these analyses typically take upwards of four (4) to six (6) weeks depending on laboratory backlog and extensive analysis time and for this reason NORM sampling, when required, should take place in a manner to prevent construction delays.

If results of NORM analysis are below the UDRLS presented in Table 3 then mitigative measure would simply be driven by Screening Step 2 above, based on the chemical uranium results. If results exceed the UDRLs, then site development should not proceed unless a NORM risk mitigative approach is developed and approved through consultation with NSECC. It should be noted that this approach would likely be time consuming and costly with limited potential for success as there are currently no approved facilities for disposal of NORM within the province. In this case, the simplest approach would likely be to avoid the development of the specific infrastructure.

Based on the results of Steps 1, 2 and 3 there are four possible outcomes as presented in Figure 2. Outcome 1: proceed with construction where chemical and radiological results are below criteria no mitigation is required; Outcome 2: Mitigation Level 1 where chemical results are above agricultural/residential criteria but radiological results are below criteria; Outcome 3: Mitigation Level 2 where chemical results are above commercial/industrial criteria but radiological results are below criteria; and Outcome 4: Avoidance or further study where radiological results are above criteria.

Outcome 1 – No Uranium Mitigation Required

Should both chemical and radiological results be below criteria then construction can proceed without the requirement for additional consideration of uranium.

Outcome 2 - Mitigation Level 1

Should uranium concentrations be above NSECC Tier 1 EQS for agricultural/ residential, but below the NSECC Tier 1 EQS commercial/industrial, Mitigation Level 1 would be required if the location is selected to be developed. This requires the mitigation of potential offsite migration of soil or sediment during construction. Construction will include the following erosion and sediment control measures:

- Limit the removal of riparian zone vegetation;
- Minimize the use of heavy equipment within 30 m of a watercourse to the extent possible;
- Proper erosion and sediment control measures will be installed and checked regularly during the construction phase and prior to, and after, storm events to ensure they are continuing to operate properly to minimize potential effects to adjacent habitat;
- Sufficient staff and equipment to manage erosion and sediment control during storm events and other emergencies will be provided;
- Runoff will be controlled, and sediment will be prevented from leaving the Site at all times; and
- Equipment shall be kept in good working order and maintained to avoid noise disturbances.

Final site grading should also include solid cover/clean fill of sufficient thickness feasible and can be done to a sufficient extent to cover material exceeding NSECC Tier 1 EQS for agricultural/residential to prevent offsite migration of material above the Tier 1 EQS. Further study could also be completed to delineate the uranium chemical concentrations above criteria with additional sampling and potentially avoid this portion of the site.

Outcome 3 – Mitigation Level 2

Should uranium concentration be above NSECC Tier 1 EQS for both agricultural/ residential and commercial/industrial, then Mitigation Level 2 would be required if the location is selected to be developed. This requires the measures from Mitigation Level 1, above, and also requires the addition of prevention of worker exposure through the use of work site signage, and requirement for appropriate personal protective equipment (PPE) during construction. Workers who could potentially come in contact with the material would be required to use respiratory protection for prevention of dust inhalation while on site, and should wear protective clothing and gloves to prevent dermal exposure to the soil/dust while on site. Further study could also be completed to delineate the uranium chemical concentrations above criteria and potentially avoid this portion of the site.

Outcome 4 – Avoidance or Further Study

Should radiological results for NORM be above the UDRLs then the site should not undergo development without further additional study. If the radiological results are below the UDRLs, then the development would default back to the chemical results and Outcomes 1 through 3 above. Further study could also be completed to delineate the UDRL above criteria and potentially avoid this portion(s) of the site(s).

In summary there are four potential outcomes associated with this avoidance and mitigation plan, if a location is selected for development:

1. Outcome 1 Uranium concentrations are below NSECC Tier 1 EQS for all land uses and NORM are below UDRLs – no mitigation required for naturally occurring uranium mineralization.
2. Outcome 2 Uranium concentrations are below NSECC Tier 1 EQS for commercial and industrial land uses but above NSECC Tier 1 EQS for agricultural and residential land uses and NORM are below UDRLs – mitigation level 1 – mitigation of potential offsite migration of soil/sediment is required.
3. Outcome 3 Uranium concentrations are above NSECC Tier 1 EQS for all land uses and NORM are below UDRLs – mitigation level 2 – mitigation of potential worker exposure and offsite migration of soil/sediment is required.
4. Outcome 4 NORM concentrations are above the UDRLs – avoidance of site development.

Should results from any step indicate the need for mitigative measures to develop the site, NF can always revert to the avoidance of site development or conduct further study to delineate the uranium chemical/radiological concentrations above criteria and potentially avoid this portion(s) of the site(s).

6.0 Closing

This report was prepared by Dillon Consulting Limited (Dillon) for Natural Forces Developments Limited Partnership (the Proponent) on behalf of the Benjamin Mills Wind Limited Partnership, in support of the Benjamin Mills Wind Project Addendum (2022). Dillon has used the degree of care and skill ordinarily exercised under similar circumstances at the time the work was performed by reputable members of the environmental consulting profession practicing in Canada. Dillon assumes no responsibility for conditions which were beyond its scope of work. There is no warranty expressed or implied by Dillon.

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7.0 References

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