

Rook I Project

Alternative Camp Location Assessment

Final Report

Submitted to:

Saskatchewan Ministry of Environment,
Environmental Assessment and Stewardship Branch

Submitted by:

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Abbreviations and Units of Measure

Abbreviation	Definition
AAAQO	Alberta Ambient Air Quality Objectives
AEGL	Acute Exposure Guideline Level
AERMOD	American Meteorological Society / Environmental Protection Agency Regulatory Model
AIChE- CCPS	American Institute of Chemical Engineers, Center for Chemical Process Safety
ALARP	as low as reasonably practicable
ALOHA	Areal Locations of Hazardous Atmospheres
ARF	airborne release fraction
CAAQS	Canadian Ambient Air Quality Standards
CACs	criteria air contaminants
CEA Agency	Canadian Environmental Assessment Agency
CEAA 2012	<i>Canadian Environmental Assessment Act, 2012</i>
CH ₄	methane
CNSC	Canadian Nuclear Safety Commission
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
DR	damage ratio
EA	Environmental Assessment
EASB	Environmental Assessment and Stewardship Branch
EIS	Environmental Impact Statement
ENV	Saskatchewan Ministry of Environment
ERPG	Emergency Response Planning Guideline
ETP	effluent treatment plant
GHG	greenhouse gas
H ₂ SO ₄	sulphuric acid
hr	hour
HVAC	heating, ventilation, and air conditioning
ILP	Institution of Lighting Professionals
IMS	Integrated Management System
IT	information technology
LNG	liquified natural gas
LPF	leak path factor
MAR	material at risk
MECP	Ontario Ministry of the Environment, Conservation and Parks
N ₂ O	nitrous oxide
NexGen	NexGen Energy Ltd.
NO ₂	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
Notice of Decision	Notice of Ministerial Decision Pursuant to Section 15 of <i>The Environmental Assessment Act</i>
NPAG	non-potentially acid generating
OAAQC	Ontario Ambient Air Quality Criteria
OECD	Organisation for Economic Co-operation and Development
OHS	occupational health and safety
PAG	potentially acid generating
PM ₁₀	particulate matter with a nominal diameter of 10 microns or less

Abbreviation	Definition
PM _{2.5}	particulate matter with a nominal diameter of 2.5 microns or less
PPE	personal protective equipment
Project	Rook I Project
RF	respirable fraction
RFD	reasonably foreseeable development
SAAQs	Saskatchewan Ambient Air Quality Standards
SO ₂	sulphur dioxide
STP	sewage treatment plant
TCEQ	Texas Commission on Environmental Quality
TSD	Technical Support Document
TSP	total suspended particulates
U ₃ O ₈	triuranium octoxide
UGTMF	underground tailings management facility
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency.
USNRC	United States Nuclear Regulatory Commission
VC	valued component
W1	worst-case weather conditions
W2	typical weather conditions
WRSA	waste rock storage area

Unit	Definition
%	percent
>	greater than
<	less than
≤	less than or equal to
µm	micron
µg/m ³	micrograms per cubic metre
Bq/m ³	becquerels per cubic metre
dBA	A-weighted decibel
g/L	grams per litre
g/s	grams per second
kg	kilogram
kg/d	kilograms per day
kg/lb	kilograms per pound
kg/lb/s	kilograms per pound per second
kg/m ³	kilograms per cubic metre
kg/s	kilograms per second
kg/t	kilograms per tonne
km	kilometre
L	litre
L/m ² /s	litres per square metres per second
L/s	litres per second
lb/s	pounds per second
m ³	cubic metres

Unit	Definition
m ³ /h	cubic metres per hour
m ³ /s	cubic metres per second
m	metre
mag/arcsec ²	magnitude per square second of arc
mg	milligram
mg/m ³	milligrams per cubic metre
min	minute
mlux	millilux, 0.001 lumens per square metre
m/s	metres per second
mSv/yr	millisieverts per year
ppm	parts per million
t	tonnes
t CO ₂ e	tonnes of carbon dioxide equivalent
t/d	tonnes per day
t/h	tonnes per hour

Executive Summary

Introduction and Report Purpose (Section 1)

NexGen Energy Ltd. (NexGen) is proposing to develop a new uranium mining and milling operation in northwestern Saskatchewan, called the Rook I Project (Project). The proposed Project is subject to both provincial and federal Environmental Assessment (EA) processes, would be licensed as a nuclear facility by the Canadian Nuclear Safety Commission (CNSC), and would be subject to various provincial and federal permits and approvals. The EA for the Project has been advanced under a cooperative federal and provincial review, subject to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and *The Environmental Assessment Act* of Saskatchewan, respectively. On 8 November 2023, the Saskatchewan Minister of Environment issued a Notice of Ministerial Decision Pursuant to Section 15 of *The Environmental Assessment Act* (Notice of Decision) approving NexGen to proceed with the development of the Project subject to terms and conditions. As part of the Notice of Decision, Conditions 8, 9, and 10 stipulate requirements of NexGen to propose and receive approval for an alternative camp location for the Project. Specifically, these conditions are stated as follows:

Condition 8: This approval excludes an environmental approval with respect to the currently proposed location of the camp (referenced as the west location in the alternatives assessment within the statement).

Condition 9: The proponent shall submit proposed changes to the project, including a suitable alternative camp location, for subsequent review and approval under section 16 of the Act [*The Environmental Assessment Act*].

Condition 10: As part of a change request as outlined in condition 9, the proponent shall complete an assessment of the selected alternative camp location and submit a final report to the Ministry of Environment, Environmental Assessment and Stewardship Branch for approval prior to receiving an approval to construct a pollutant control facility. The scope of the alternative camp assessment shall be specific to the selected camp location and consider impacts to human health and safety and mitigation measures to be implemented including:

- a. Noise and light effects from both traffic in proximity to the camp and from processing facilities.
- b. Air and dust emission impacts on the selected camp location. Including potential impacts from the accident and malfunction bounding scenarios provided in section 21 of the statement that would result in the release of air or dust emissions.
- c. Proposed monitoring and mitigation measures to limit impacts to human health and safety.
- d. Identify upset conditions, including but not limited to: fire; facility/equipment failure; radiological events; and spill events, and provide the measures to be taken to protect human health and safety should these upset conditions occur.
- e. The AERMOD [American Meteorological Society / Environmental Protection Agency Regulatory Model] electronic package used for the assessment.

The final report provided herein represents an application for approval (Application) of the alternative (i.e., new) Project camp location under Section 16 of *The Environmental Assessment Act*. The purpose of this Application is to meet the requirements of Conditions 8, 9, and 10 of the Notice of Decision. The Application provides an assessment of alternatives for the selection of the preferred camp location, an outline of the camp design features, an evaluation to confirm that residual effects classifications for valued components (VCs) and

intermediate components would not be affected as a result of relocating the camp, and an assessment of effects to workers at the camp, including potential effects associated with accidents and malfunctions.

New Camp Location Alternatives Assessment (Section 2)

To determine a suitable camp location, four potential sites were considered as part of a screening-level alternatives assessment: two slightly revised locations from the Project Environmental Impact Statement (EIS; i.e., revised east and revised south options), and two new locations (i.e., central and southwest options). These locations were compared to the west location, which was the selected camp alternative proposed in the Project EIS.

The revised south option (i.e., new camp location) was selected as the preferred alternative for the Project. Overall, this alternative rated second to the EIS camp location in the screening assessment and is located away from the main mining and milling areas, providing workers an opportunity to be better separated from active work areas while not on shift.

New Camp Design Features (Section 3)

The design of the new camp for the proposed Project is not anticipated to change from the design presented in the Project EIS, aside from modifications necessary to accommodate the new location. These would include the following:

- Additional clearing, grubbing, and stripping at the location of the new camp and for the overhead transmission line corridor that would service the camp.
- Additional water management structures, including water collection, pumping, and pipeline infrastructure.
- Transporting of workers to and from the mine terrace by bus to support Project Construction, Operations, and Reclamation and Closure (i.e., Closure) activities.

Although the new camp location would result in a modification of the Project footprint, the new camp location and any supporting infrastructure would be located within the maximum disturbance area that was assessed within the Project EIS. Additionally, while the relocation of the camp requires additional surface water management and transmission line infrastructure, there are no anticipated changes to the water volumes withdrawn and diverted, or to the quality of any effluent discharged by the Project. However, as the new camp location would be farther away from the primary mining activities and require bussing of staff to and from the camp to work areas, there could be potential changes to air emissions, which would represent the only camp-related Project interaction that would have the potential of producing effects different than the effects predicted in the Project EIS.

New Camp Location Assessment (Section 4.1)

A screening-level analysis was conducted to evaluate whether Project activities associated with the new camp location could have the potential to affect the residual effects classifications for VCs and intermediate components assessed in the Project EIS. As modified air emissions represent the only Project interaction with the potential to change predicted effects to VCs and intermediate components, the only VCs and intermediate components that required evaluation were the following:

- **Valued components:** climate change, fish and fish habitat, human health, Indigenous land and resource use, and other land and resource use.
- **Intermediate components:** air quality and surface water quality.

The evaluation concluded that the change in camp location results in either no or negligible increases to the predicted concentrations of critical air contaminants or greenhouse gases. As a result, there are no predicted changes to the residual effects classifications for any VCs or intermediate components assessed in the Project EIS. For this reason, no additional mitigation measures are proposed or required in this regard to further protect people or the environment.

Notice of Ministerial Decision Evaluation Requirements (Section 4.2)

The evaluation required under Condition 10 of the Notice of Decision specifically considered effects to workers at the camp under standard operating conditions as well as through potential accidents and malfunctions, which includes upset conditions.

Air Quality, Dust, Noise, and Light (Standard Operating Conditions) (Section 4.2.1)

All concentrations of Project criteria air contaminants at the new camp location are predicted to be below the air quality screening values, indicating that no health effects are anticipated to workers at the new camp location.

Outdoor noise levels at the new camp location are generally expected to be substantially quieter than the EIS camp location. In addition, the continuous/steady-state and periodic indoor noise levels at the new camp location are expected to be below Health Canada's (2023) sleep disturbance thresholds for these types of noise; therefore, no sleep disturbance effect is predicted at the new camp location from Project activities.

The EIS camp location and the new camp location are identical in results with respect to light trespass. Windows in camp bedrooms would be equipped with blackout curtains to block light from outdoor sources. Sky glow levels are predicted to be lower at the new camp location than at the EIS camp location.

Accident and Malfunctions (Section 4.2.2)

Two key steps were undertaken to complete the updated accidents and malfunctions assessment:

1. The original screening assessment completed as part of the hazard identification process (EIS TSD VIII, Accidents and Malfunctions Report, Appendix A) was reconsidered to confirm the results, and the identification of the bounding scenarios that were carried forward for further assessment in the Project EIS.
2. The detailed assessment of designated bounding scenarios was reconsidered to assess whether overall risks to human health and the biophysical environment are different than the risks described in the Project EIS.

The review of original hazard identification / screening process did not identify any further relevant scenarios that warranted assessment and confirmed that the bounding scenarios selected for assessment were appropriate. With respect to the bounding scenarios, the re-evaluation determined that the risk characterization for four of the six bounding scenarios would not change as a result of a relocated camp; these four bounding scenarios were not further assessed. The other two bounding scenarios (i.e., Bounding Scenario 3 – Solvent Extraction Fire or Explosion and Bounding Scenario 6 – Acid Plant Tail Gas Scrubber Failure) were quantitatively re-assessed in consideration of the new camp location. The quantification of effects included the assessment of

the fate and transport of a chemical or radiological release and associated exposures related to the scenario. The results of these two bounding scenario assessments are as follows:

- **Bounding Scenario 3:** The overall risk ranking (i.e., low) and probability of occurrence (i.e., unlikely) for this scenario is unchanged relative to the Project EIS for a camp worker who is situated at the new camp location; however, the consequence rating is reduced from 'minor to moderate' to 'negligible'.
- **Bounding Scenario 6:** The overall risk ranking (i.e., low) for a worker at the new camp location is slightly different relative to the Project EIS risk ranking (i.e., low to moderate), as the consequence rating is reduced from 'minor to moderate' to 'negligible'. The probability of occurrence (i.e., likely) for this scenario is unchanged relative to the Project EIS.

Mitigation and Monitoring (Section 5)

For the new camp location, as the camp design would not change and VC and intermediate component residual effects classifications would remain the same as what was presented in the Project EIS, and as potential effects to workers are expected to be less than the potential effects that would be experienced at the EIS camp location, no new mitigation measures are required or proposed. The existing mitigation measures stated within the Project EIS would remain protective of people (including workers at the camp) and the environment.

NexGen is responsible for and committed to providing for the health and safety of workers and the public and the protection of the environment. To fulfill these commitments, NexGen has developed an Integrated Management System (IMS) for the Project that provides a common, transparent, risk-informed process framework for both Project activities and achieving excellence in employee safety, radiation safety, and environmental protection. Environmental and human health monitoring requirements for the Project, including monitoring required for the Project camp, will be described within the IMS.

NexGen's health, safety, environmental, and quality policies include several monitoring programs that would apply to the Project camp. These include:

- **Air Quality Monitoring:** The Project would include atmospheric monitoring to verify that human health is protected. Monitoring would occur through the Project Effluent and Emissions Plan, which forms part of the Environmental Protection Program.
- **Worker Health Monitoring:** The Project would include human health monitoring to verify that worker and public health is protected. Ionizing radiation exposures (i.e., exposures to gamma radiation, long-lived radioactive dust, radon progeny, and radon gas) would be routinely monitored for nuclear energy workers using personal dosimetry equipment. This is part of the Radiation Protection Program. Chemical, physical, and biological hazards would be monitored to quantify exposure and risk, in accordance with established sample collection and analysis methods, allowing for effective controls. This is outlined in the Health and Safety Program.
- **Environmental Protection Monitoring:** NexGen would implement the Environmental Protection Program, which would describe the processes required to monitor and characterize emissions from Project facilities and activities, to monitor and characterize the quality of the environment to assess the effectiveness of mitigations, and to continually improve environmental protection performance throughout all Project phases. Where relevant, adaptive management measures may also be proposed to address the uncertainties associated with the effects predictions and mitigation measures. The process for determining when, how, and where to use adaptive management will be described within NexGen's IMS.

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1 Introduction

NexGen Energy Ltd. (NexGen) is proposing to develop a new uranium mining and milling operation in northwestern Saskatchewan, called the Rook I Project (Project). The proposed Project is subject to both provincial and federal Environmental Assessment (EA) processes, would be licensed as a nuclear facility by the Canadian Nuclear Safety Commission (CNSC), and would be subject to various provincial and federal permits and approvals.

On 8 November 2023, the Saskatchewan Minister of Environment issued a Notice of Ministerial Decision Pursuant to Section 15 of *The Environmental Assessment Act* (Notice of Decision) approving NexGen to proceed with the development of the Project subject to certain terms and conditions. As part of the conditions of the Notice of Decision, NexGen is required to submit an alternative camp location for the Project.

To fulfill conditions of the Notice of Decision related to an alternative camp location for the Project (i.e., conditions 8, 9, and 10), this document represents an application under Section 16 of *The Environmental Assessment Act* of Saskatchewan and includes an assessment of potential effects for the proposed alternative camp location.

1.1 Project Overview

The Project would be located approximately 40 kilometres (km) east of the Saskatchewan-Alberta border, 130 km north of the Northern Village of La Loche, and 640 km northwest of the city of Saskatoon (Figure 1-1). The Project would reside within Treaty 8 territory and the Métis Homeland. At a regional scale, the Project would be situated within the southern Athabasca Basin adjacent to Patterson Lake, along the upper Clearwater River system. Patterson Lake is at the interface of the Boreal Shield and Boreal Plain ecozones. Access to the Project would be from an existing road off Highway 955 (Figure 1-2), with on-site worker accommodations serviced by fly-in/fly-out access.

The Project, which is 100% owned by NexGen, would include facilities to support the extraction and processing of uranium ore from the Arrow deposit, a land-based, basement-hosted, high-grade uranium deposit. The anticipated lifespan of the Project would be 43 years and include Construction, Operations, and Decommissioning and Reclamation (i.e., Closure) phases.

The proposed Project represents a substantial and consistent potential source of uranium for meeting the expected growing global demand for electricity. The Project could meaningfully contribute to the Government of Canada's ability to meet its environmental obligations and commitments with respect to climate change (Prime Minister of Canada 2021) by displacing high-greenhouse gas (GHG) emitting fossil fuel (e.g., coal, natural gas) electricity generation in favour of low-GHG emitting, green energy. Providing a potential source of uranium would also support Saskatchewan's objective of developing lower carbon emission electricity generation over the next decade (Government of Saskatchewan 2019).

The Project would span a 43-year period from the beginning of Construction, through Operations, to the end of Closure. Construction is expected to occur over approximately four years and include activities such as site preparation and infrastructure development. Operations is expected to last for 24 years and include mining and processing and the associated tailings, waste, and water management. Closure would follow, with an expected duration of 15 years. Further detail on Project phases is provided in Environmental Impact Statement (EIS) Section 5.1.4, Project Phases, and activities during Project phases are summarized in EIS Section 5.5, Project Activities.

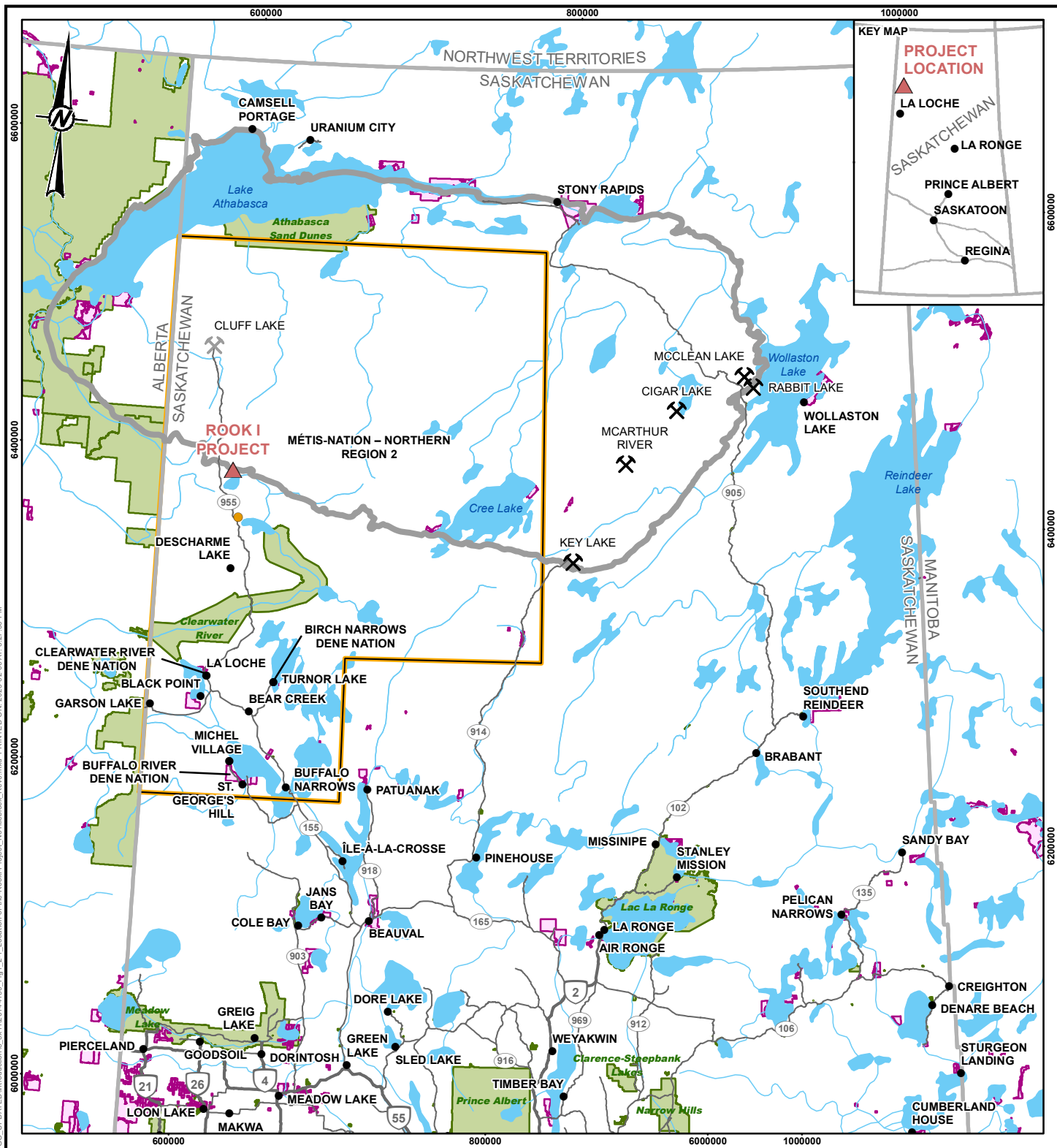
The Project would include the following key facilities (Figure 1-3; EIS Figure 5.1-3):

- underground mine development;
- process plant buildings, including uranium concentrate packaging facilities;
- paste tailings distribution system;
- underground tailings management facility (UGTMF);
- potentially acid generating (PAG) waste rock storage area (WRSA);
- non-potentially acid generating (NPAG) WRSA;
- special waste rock¹ and ore storage stockpiles;
- surface and underground water management infrastructure, including water management ponds, effluent treatment plant (ETP), and sewage treatment plant (STP);
- conventional waste management facilities and fuel storage facilities;
- ancillary infrastructure, including maintenance shop, warehouse, administration building, and camp²;
- airstrip and associated infrastructure; and
- access road to the Project and site roads.

The Project would be designed, constructed, operated, decommissioned, and closed in accordance with applicable regulatory requirements and industry best management practices, which would provide for the safety of the public and workers and the long-term protection of the environment. NexGen would develop and operate all Project infrastructure, facilities, and systems in accordance with design standards developed for the Project. Informed by a robust understanding of environmental considerations (e.g., climate; geotechnical, hydrological, and geochemical conditions), NexGen is committed to advancing the proposed Project with innovative approaches to mine design, management, and operations to deliver enhanced environmental, social, and economic performance.

¹ Special waste rock is mine rock that is mineralized with insufficient grade to be considered ore (i.e., greater than 0.03% of triuranium octoxide [U_3O_8] and less than 0.26% U_3O_8). All special waste would be temporarily stored in the special waste rock stockpile.

² The camp location shown in Figure 1-3 is the location identified in the Project EIS; the new camp location proposed as part of this Application is identified as Option #3 in Figure 2-1.



LEGEND

- POPULATED PLACE
- ⌘ URANIUM MINING FACILITY (ACTIVE)
- ⌘ URANIUM MINING FACILITY (DECOMMISSIONED)
- PRIMARY HIGHWAY
- SECONDARY HIGHWAY
- WATERCOURSE
- ▭ ATHABASCA BASIN BOUNDARY
- ▭ INDIAN RESERVE
- ▭ PROVINCIAL PARKS
- ▭ WATERBODY
- ▲ PROJECT LOCATION
- PRESTON LAKE WILDLIFE REFUGE
- ▭ MÉTIS NATION-SASKATCHEWAN NORTHERN REGION 2

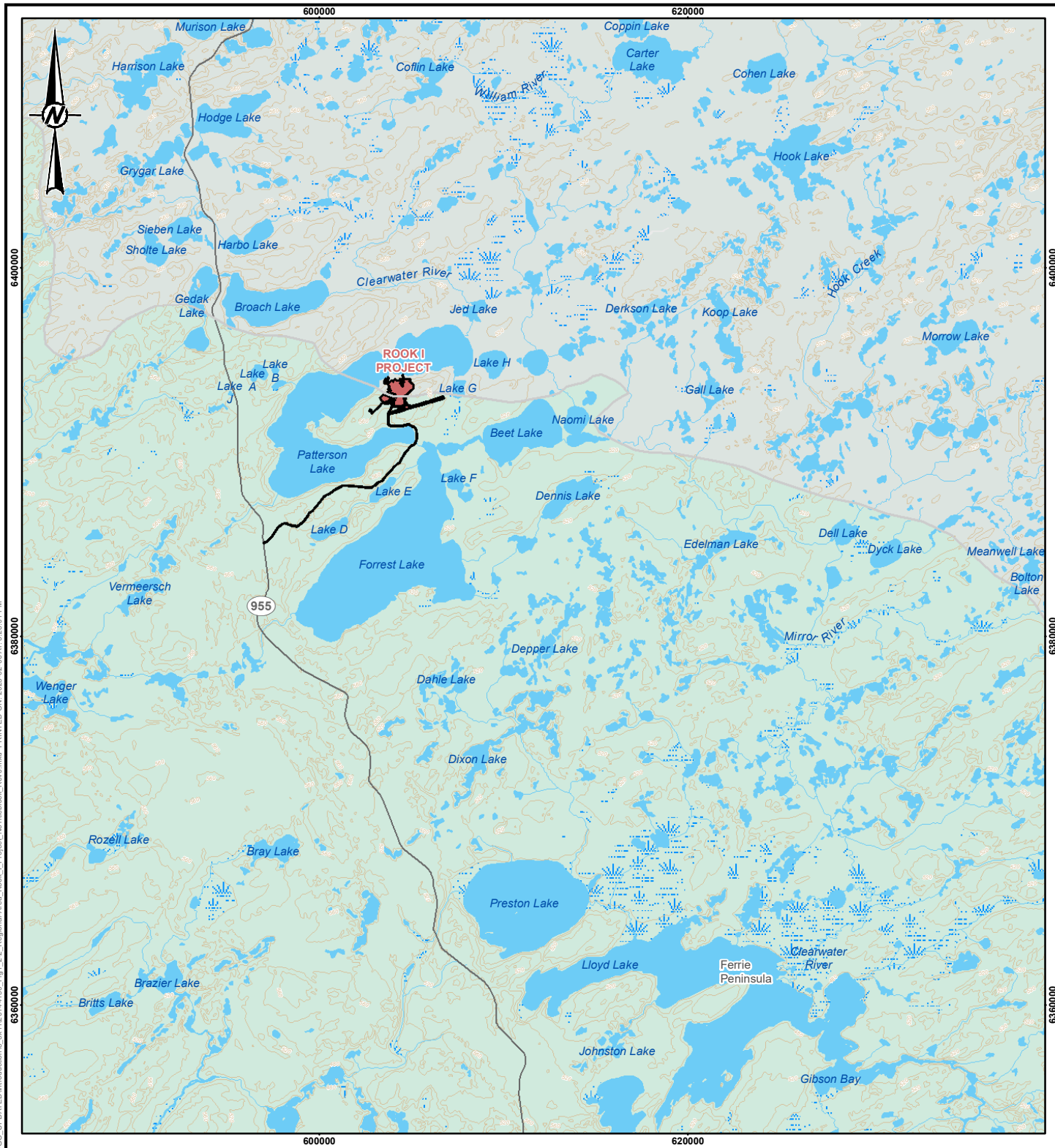
REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
 2. PARKS OBTAINED FROM IHS MARKIT CANADA ULC.
- PROJECTION: UTM ZONE 12 DATUM: NAD 83

ROOK I PROJECT	
LOCATION OF THE ROOK I PROJECT	
CONSULTANT 	PROJECT 20144150 SCALE AS SHOWN REV. 0
FIGURE 1-1	

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- LEGEND**
- ELEVATION CONTOUR (20 m INTERVAL)
 - SECONDARY HIGHWAY
 - WATERCOURSE
 - ATHABASCA BASIN
 - WATERBODY
 - WETLAND
 - WOODED AREA
 - PROPOSED PROJECT FOOTPRINT

REFERENCE(S)
 1. PROJECT FEATURES OBTAINED FROM NEXGEN, APRIL 6, 2021.
 2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
 PROJECTION: UTM ZONE 12 DATUM: NAD 83



PROJECT		ROOK I PROJECT	
TITLE			
REGIONAL AREA OF THE ROOK I PROJECT			
CONSULTANT		PROJECT	
		20144150 SCALE AS SHOWN REV. 0	
FIGURE 1-2			

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1.2 Requirement for a Project On-Site Camp

The proposed Project would require a workforce of approximately 350 workers during Construction and 260 workers during Operations. The Project site is located in a remote area of northern Saskatchewan; the Northern Village of La Loche is the closest population centre, located approximately 2.5 hours away by road, while the larger cities of Prince Albert and Saskatoon are approximately 1 and 2 hours away by air, respectively. With the workforce typically expected to work 12-hour shifts (i.e., 24-hour coverage by 2 shifts) on a rotational basis, daily commute to and from the Project site would be impractical due to the travel times at both ends of the shift and the large number of bus trips and/or flights that would be required. Therefore, a permanent local camp would be necessary to service the Project during the Construction, Operations, and Closure phases.

As a permanent local camp would be required for the Project, a preliminary alternatives assessment of local off-site vs. on-site camp accommodation options was conducted early in the Project design stage (EIS Section 4, Project Alternatives). With respect to local off-site options, one option exists near Grygar Lake; this camp would be located an approximately 30-minute drive north of the proposed Project site and could accommodate approximately half of the workforce. Therefore, additional housing would be required to accommodate the full staffing requirement for the Project. Given the need for additional housing, construction of a new on-site camp was the selected alternative for the Project as this option would provide sufficient accommodation for the entire workforce in one location, and daily off-site transport would not be required.

Based on the preliminary alternatives assessment, the Project has been designed as on-site camp-based operation, similar to other mining operations in northern Saskatchewan.

1.3 Environmental Impact Statement Camp Location Evaluation and Selection

As noted in EIS Section 4, Project Alternatives, submitted to the Saskatchewan Ministry of Environment (ENV), a screening-level alternatives assessment was employed to identify a preferred camp location alternative. The following on-site camp locations were considered for the Project (Figure 1-4):

- south location;
- west location; and
- east location.

Figure 1-4: Final Environmental Impact Statement Camp Location Alternatives



For the **south location**, a camp at the south end of the Project site was considered in approximately the same area that the existing exploration camp is located. This option would allow camp accommodations to be located in an area that was already partially disturbed along the southern lakeshore of Patterson Lake, and away from active mining and processing areas. Additional infrastructure would be required to support a larger camp at this location, including an intake for fresh water supply (or an extension of the fresh water supply from the mine terrace) as well as power, lighting, and communications infrastructure. Workers would be bussed to and from their work locations at the mine terrace.

For the **west location**, a camp would be located west of, and adjacent to, mine buildings for the Project, and would be integrated into the general mine and mill terrace areas. This option would result in a reduced overall Project footprint compared to the other alternatives (i.e., integration within the main mine development area and less additional on-site road development to connect the camp and main working areas) and would allow direct access for arrivals from and departures along the on-site road. In addition, some workers could walk from camp to the administration building (i.e., no bussing required) and possibly to other areas, such as the process plant and supporting infrastructure. Bussing would be required for workers to access areas such as the underground mine and mine dry complex.

For the **east location**, the land to east of the mine terrace and WRSAs would be used for the camp location. This option would require a site road to this location, which would possibly be routed through the mine and mill terraces. While this option is relatively close to the main working areas, services would need to be extended to this location and bussing of the workers to and from their work locations would be required.

After evaluation of the relative advantages and disadvantages of the range of feasible alternatives, the selected camp location alternative in the Project EIS was the **west location**. Consolidating the site footprint to reduce the overall Project disturbance area was a key consideration in the selection of this alternative. While the west location is situated relatively closer to mining activities, the camp would be designed to minimize worker exposure to potential noise and air quality emissions.

1.4 Project Provincial Environmental Assessment Process Summary and Camp Conditions

The EA for the Project has been advanced under a cooperative federal and provincial review, subject to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and *The Environmental Assessment Act* of Saskatchewan, respectively.

A Draft EIS for the Project was submitted to the ENV's Environmental Assessment and Stewardship Branch (EASB) and the CNSC on 13 June 2022. Upon receipt by the Province, the Project EIS underwent a provincial technical review, and technical review comments were provided to NexGen by the ENV EASB. Between November 2022 and June 2023, NexGen and the ENV EASB underwent an iterative approach to achieve resolution of the technical review comments, and in August 2023, NexGen submitted a Final EIS (NexGen 2023) for the Project to the ENV EASB for public review and a subsequent Ministerial Decision.

On 8 November 2023, the ENV issued a Notice of Decision for the Project EA. The Notice of Decision advised NexGen that the Minister of Environment was satisfied that all conditions of *The Environmental Assessment Act* had been met and that the Project should be approved, subject to terms and conditions. The Notice of Decision included a list of 15 approval conditions and 3 of these conditions (i.e., conditions 8, 9, and 10) were associated with the Project camp location. These conditions are as follows:

Condition 8: This approval excludes an environmental approval with respect to the currently proposed location of the camp (referenced as the west location in the alternatives assessment within the statement).

Condition 9: The proponent shall submit proposed changes to the project, including a suitable alternative camp location, for subsequent review and approval under section 16 of the Act [*The Environmental Assessment Act*].

Condition 10: As part of a change request as outlined in condition 9, the proponent shall complete an assessment of the selected alternative camp location and submit a final report to the Ministry of Environment, Environmental Assessment and Stewardship Branch for approval prior to receiving an approval to construct a pollutant control facility. The scope of the alternative camp assessment shall be specific to the selected camp location and consider impacts to human health and safety and mitigation measures to be implemented including:

- a. Noise and light effects from both traffic in proximity to the camp and from processing facilities.
- b. Air and dust emission impacts on the selected camp location. Including potential impacts from the accident and malfunction bounding scenarios provided in section 21 of the statement that would result in the release of air or dust emissions.
- c. Proposed monitoring and mitigation measures to limit impacts to human health and safety.
- d. Identify upset conditions, including but not limited to: fire; facility/equipment failure; radiological events; and spill events, and provide the measures to be taken to protect human health and safety should these upset conditions occur.

- e. The AERMOD [American Meteorological Society / Environmental Protection Agency Regulatory Model] electronic package used for the assessment.

1.5 Purpose and Scope of Document

In accordance with the Notice of Decision, this document represents an application for approval (Application) of the new Project camp location under Section 16 of *The Environmental Assessment Act*. The primary purpose of this Application is to meet the requirements of conditions 8, 9, and 10 of the Notice of Decision.

Following receipt of the Notice of Decision, NexGen and the ENV met to discuss the conditions outlined in the Notice of Decision. At that time, members of the ENV also requested that NexGen include information in the Application confirming that residual effects classifications for valued components (VCs) and intermediate components as described in the Project EIS would not be affected as a result of relocating the camp. This additional information is also provided within the Application.

The scope of the alternative camp location assessment is to identify a suitable alternative camp location (i.e., new camp location); consider the potential effects to human health, worker and public safety, and the environment from this new camp location (including possible effects from potential accidents and malfunctions); and determine if additional mitigation measures are required beyond measures committed to within the Project EIS. This Application is structured as follows:

- Section 2 presents the alternatives considered for the new camp location, methods used in the alternatives screening assessment, alternatives assessment results, and the selected alternative (i.e., selected new camp location).
- Section 3 discusses the camp design features, including any features that are different from the camp location proposed in the Project EIS.
- Section 4 provides the camp evaluations or assessments, which were both requested by the ENV and required by the Notice of Decision:
 - Section 4.1 includes the evaluation of potential changes to residual effects classifications for VCs and intermediate components described in the Project EIS as a result of relocating the camp.
 - Section 4.2 includes the assessment of potential effects to workers at the selected new camp location under standard operating conditions and an evaluation of potential accident and malfunction risks, which includes potential effects to workers where predicted effects may be different than effects described in the Project EIS.
- Section 5 discusses mitigation measures and monitoring programs and plans that are applicable to the camp.
- Section 6 provides key findings from the Application.

2 Assessment of Alternatives for the New Camp Location

This section speaks to the process undertaken to assess alternatives to determine the preferred location for the Project camp.

2.1 Alternatives Identification

As part of the updated new camp location alternative assessment, four alternative options were identified based on technical and economic feasibility that would allow the Project to be carried out (CEA Agency 2015). In addition, the EIS camp location was also included in the alternatives assessment for comparative purposes. For the four alternative locations considered, the two non-selected alternatives from the Project EIS (i.e., east location and south location) were re-evaluated with slight optimizations made to their locations, and two new locations were identified for consideration. Location options were intended to provide a reasonable cross-section of locations across the proposed Project site while still being generally accessible by the currently proposed road network to minimize the Project footprint. The five alternatives assessment options considered for the on-site camp location, including the EIS camp located included (Figure 2-1):

- EIS camp location (i.e., west location);
- Option #1 (central location);
- Option #2 (revised south location);
- Option #3 (southwest location); and
- Option #4 (revised east location).

For the **EIS camp location**, a camp would be located west of, and adjacent to, mine buildings for the Project, and would be integrated into the general mine and mill terrace areas. This option would result in a reduced overall Project footprint compared to the other alternatives (i.e., integration within the main mine development area and less additional on-site road development to connect the camp and main working areas) and would allow direct access for arrivals from and departures along the on-site road. In addition, some workers could walk from camp to the administration building (i.e., no bussing required) and possibly to other areas such as the process plant and supporting infrastructure. Bussing would be required for workers to access areas such as the underground mine and mine terrace (approximately 0.59 km).

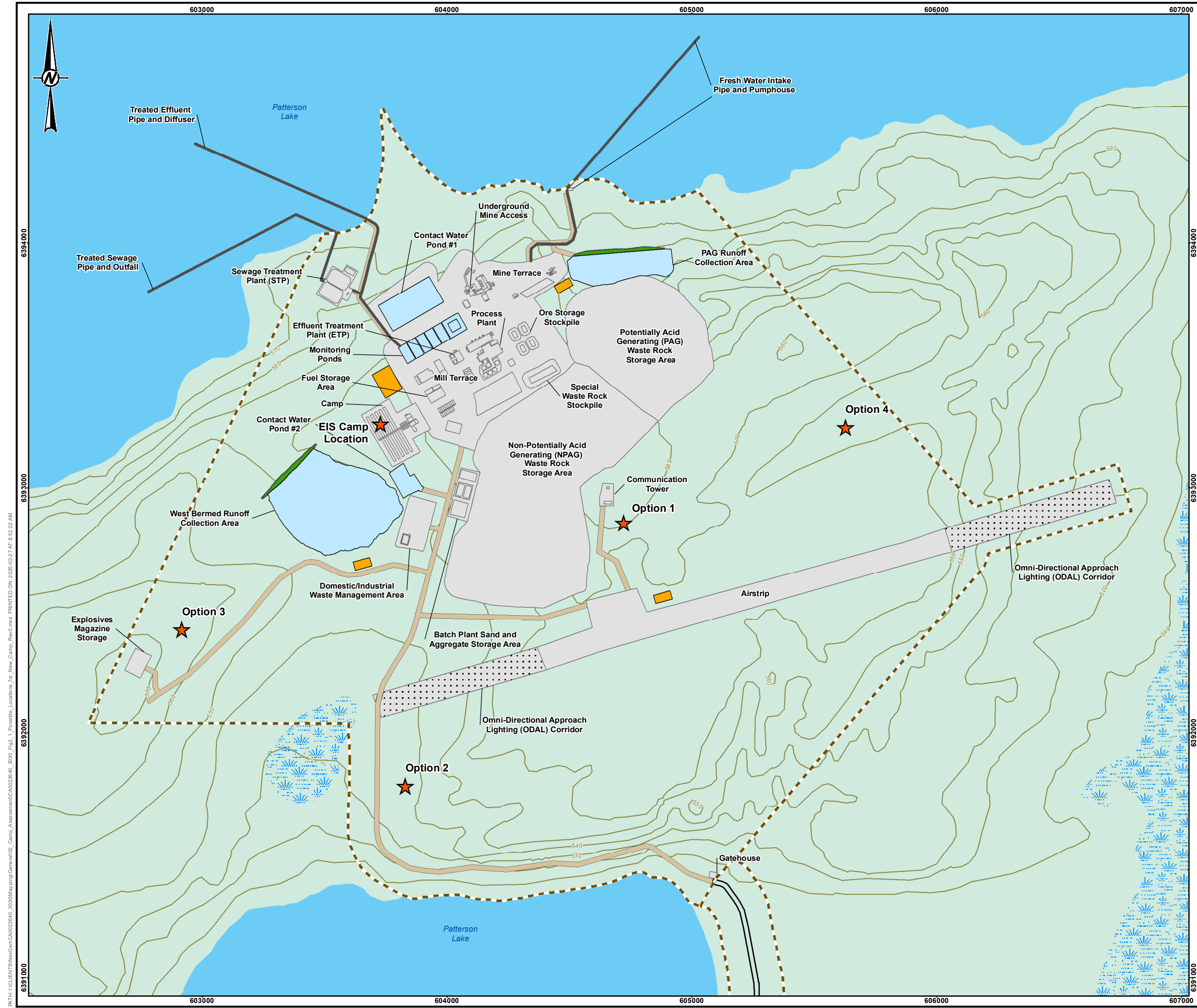
For **Option #1 (central location)**, a camp south of the WRSAs was considered that would be adjacent to the airstrip access road and approximately 0.78 km from the mine terrace. Additional surface area disturbance compared to the footprint shown in the Project EIS would be required to implement the infrastructure required for this camp location. Workers would be bussed to and from their work locations at the mine terrace, requiring additional fuel consumption and road maintenance. Due to the proximity to WRSAs, the mobility of maintenance crews around the camp's perimeter would be restricted and could limit future potential WRSA design optimizations.

For **Option #2 (revised south location)**, a camp located adjacent to the site access road near the entrance to Project site was considered. This option would be located away from active mining and processing areas, approximately 2.0 km from the mine terrace, which would allow for better separation from Project effects and activities than the EIS camp location. Additional surface area disturbance compared to the footprint shown in the Project EIS would be required to implement the infrastructure required for this location. Workers would be

bussed to and from their work locations at the mine terrace, requiring additional fuel consumption and road maintenance.

For **Option #3 (southwest location)**, a camp located to the southwest of the mine terrace and WRSAs was considered. This option would be located away from active mining and processing areas, approximately 1.8 km from the mine terrace, which would allow for better separation from Project effects and activities than the EIS camp location. Additional surface area disturbance compared to the footprint shown in the Project EIS would be required to implement the infrastructure required for this camp location. Workers would be bussed to and from their work locations at the mine terrace, requiring additional fuel consumption and road maintenance. The camp would be near the previously designated explosives and detonator storage facility area, which would require relocation of these explosives facilities.

For **Option #4 (revised east location)**, the land to the east of the mine terrace and WRSAs would be used for the camp location, approximately 1.5 km from the mine terrace, which would allow for better separation from Project effects and activities than the EIS camp location. Additional surface area disturbance compared to the footprint shown in the Project EIS would be required to implement the infrastructure required for this camp location. Workers would be bussed to and from their work locations at the mine terrace, requiring additional fuel consumption and road maintenance. This option would require a site road to this camp location, which would possibly be routed through the mine and mill terraces.



LEGEND

- POSSIBLE CAMP LOCATION
- ELEVATION CONTOUR (10 m INTERVAL)
- WATERBODY
- WETLAND
- WOODED AREA
- INTAKE OR DISCHARGE PIPE
- ACCESS ROAD
- CONTACT WATER CONTAINMENT BERM
- OMNI-DIRECTIONAL APPROACH LIGHTING (ODAL) CORRIDOR
- PROJECT INFRASTRUCTURE
- SITE ROAD
- TOPSOIL STORAGE AREA
- WATER MANAGEMENT POND
- MAXIMUM DISTURBANCE AREA

REFERENCE(S)

1. PROJECT FEATURES OBTAINED FROM NEXGEN, APRIL 6, 2021 AND UPDATED JUNE 8, 2021 .
2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.

PROJECTION: UTM ZONE 12 DATUM: NAD 83

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<p>PROJECT</p>	<p>ROOK I PROJECT</p>
<p>POSSIBLE LOCATIONS FOR THE NEW CAMP</p>	
<p>CONS</p>	<p>PROJECT CA0022640.3030 SCALE AS SHOWN REV. 0</p> <p>FIGURE 2-1</p>

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2.2 Alternatives Assessment Methods

The updated alternatives assessment for the camp location involved the comparison of the relative advantages and disadvantages for the feasible alternatives identified in Section 2.1. The assessment was used to facilitate the selection of an alternative that, on balance, best met a combined set of decision criteria that considered environmental, technical, economic, and social aspects. This evaluation process aligned with the purpose of assessing alternative means, as described in applicable guidelines from the CEA Agency and Government of Saskatchewan (CEA Agency 2015; Government of Saskatchewan 2021).

The updated alternatives assessment for the new camp location employed a screening-level approach to select the most suitable camp location. The screening-level alternatives assessment was based on four main assessment categories: Environmental, Technical, Economic, and Social. Within the assessment categories, assessment sub-categories were considered. The key assessment categories and associated sub-categories are shown in Table 2-1.

For each assessment sub-category, alternative-specific criteria were defined with the intent of describing the material differences (i.e., differentiating aspects) between each alternative (Table 2-2). For the screening-level assessment, criteria were applied quantitatively (where possible) or qualitatively (where required). Following this step, relative preferences were assigned, as shown by the shading in Table 2-2, with darker blue being more preferred; the preferences reflect the relative degree to which an alternative addressed a particular criterion compared to other options (Table 2-2).

Table 2-1: Assessment Categories and Key Considerations for the Camp Alternatives Assessment

Assessment Categories	Key Considerations	Assessment Sub-categories ^(a)
Environmental	<ul style="list-style-type: none"> How do the potential effects on the receiving environments compare? Can the alternative be constructed, operated, and decommissioned in a manner that provides long-term protection of ecological health? 	<ul style="list-style-type: none"> Surface area disturbance Air quality and emissions
Technical	<ul style="list-style-type: none"> Does the alternative meet the Project design principles? Is the alternative an approach or technology that has been successfully implemented elsewhere? Does the alternative require any tools, equipment, or technologies that cannot be easily adapted to the current application (e.g., climate, location)? Is the alternative an example of best available technology? Does the design incorporate sufficient design robustness to protect the environment, communities, and workers? What is the complexity of design or monitoring? 	<ul style="list-style-type: none"> Design and reliability Construction risk and complexity Maintainability Operational risk and complexity
Economic	<ul style="list-style-type: none"> How does the total cost of each alternative over the Project lifespan compare to the other(s)? Are the costs of the alternative supportable within the current funding framework? Are the costs of the alternative well defined and sustainable through the Project lifespan? 	<ul style="list-style-type: none"> Capital cost Operating cost
Social	<ul style="list-style-type: none"> Can the alternative be constructed and operated in a manner that provides protection of public and worker health and safety (including consideration of mental health), and how does the protection of health and safety compare? Is the distance from the mining and milling area desirable to allow for separation from Project effects and activities? 	<ul style="list-style-type: none"> Worker safety and human health

a) Sub-categories selected for assessment are based on the most applicable aspects for consideration based on both the current stage of Project development and applicability to the conditions prescribed in the ENV Notice of Decision.

ENV = Saskatchewan Ministry of Environment.

2.2.1 Input from Indigenous Groups and the Public

NexGen values and respects the culture, interests, and aspirations of the communities where it operates and firmly believes in the establishment and maintenance of trusting relationships that facilitate open discussion and meaningful collaboration.

Engagement with Indigenous Groups and local communities, residents, businesses, organizations, land users, and the various regulatory authorities is foundational to NexGen, and an integral part of the responsible development of the Project. NexGen recognizes the importance of community input and continually strives to acknowledge and incorporate key feedback in the design and development of the Project. A variety of engagement methods have and will continue to be implemented in support of Project engagement that is early, often, and long lasting.

The knowledge of community values, commitment to high standards, and understanding of lessons learned from other mining operations led to key early design decisions being incorporated into the Project. Indigenous and Local Knowledge and feedback received during these engagement activities was considered during relevant Project camp planning and design stages. Specifically, in alignment with comments received to minimize environmental disturbance, all options identified for potential camp locations were situated to avoid wetlands and remain within the Project maximum disturbance area. In addition, NexGen is proposing to include a dedicated space for Elders to be available on site to support Indigenous employees.

Following the receipt of the Notice of Decision, NexGen further discussed the proposed Project camp location with Indigenous Groups and the public to explain the requirements of conditions 8, 9, and 10 of the Notice of Decision and outline NexGen's approach to determining a new camp location. In general, other than questions inquiring about why the EIS camp location needed to be amended, minimal information that would inform the alternative location of the Project camp was received. There was acknowledgement by one individual that moving the camp farther away from the main site activities could help provide a mental break from the daily work routine.

2.3 Alternatives Assessment Outcome

The results of the alternatives assessment are presented in Table 2-2. Colour coding is used in the table summary to reflect these relative preferences, with dark blue representing more preferred alternatives, light blue representing alternatives that are neutral, and white representing less preferred alternatives.

Table 2-2: New Camp Location Alternatives Assessment

Assessment Categories	Sub-category or Criteria	Alternative Camp Location Options				
		EIS Camp Location	Option #1 – Central Location	Option #2 – Revised South Location	Option #3 – Southwest Location	Option #4 – Revised East Location
Environmental	Surface area disturbance	▪ Camp adjacent to mine terrace; least surface area disturbance due to shortest infrastructure pipelines	▪ Minimal surface area disturbance due to shorter infrastructure pipelines	▪ Larger surface area disturbance due to longer infrastructure pipelines	▪ Moderate surface area disturbance due to infrastructure pipelines	▪ Largest surface area disturbance due to longer infrastructure pipelines and new road requirement
	Air quality and emissions	▪ Minimal additional emissions from limited on-site transportation to move workforce back and forth between camp and work locations (e.g., mine terrace)	▪ Minor additional emissions associated with bussing workforce back and forth between camp and mine terrace	▪ Low additional emissions associated with bussing workforce back and forth between camp and mine terrace	▪ Low additional emissions associated with bussing workforce back and forth between camp and mine terrace	▪ Highest additional emissions associated with bussing workforce back and forth between camp and mine terrace
Technical	Design and reliability	▪ Camp adjacent to mine terrace; no extension of infrastructure required ▪ Minimal complexity	▪ Moderate design complexity	▪ Moderate design complexity	▪ Most complex design factors due to the relocation of the explosives and detonator storage facility area	▪ Second most complex design factors due to the longest infrastructure line and additional road to access the camp location
	Construction risk and complexity	▪ Minimal complexity	▪ Moderate complexity	▪ Moderate complexity	▪ Moderate complexity	▪ Substantial complexity due to the new road construction
	Maintainability	▪ Least complex due to shortest infrastructure pipelines	▪ Most complex due to proximity to the PAG WRSA, which would restrict the mobility of the maintenance crew around the camp's perimeter	▪ Moderate complexity	▪ Moderate complexity	▪ Second most complex due to longest infrastructure pipelines and new road maintenance
	Operational risk and complexity	▪ Access to camp direct from on-site road ▪ Portion of the workforce can walk from camp to work areas; minimal bus transport distances to and from other locations	▪ Highest risk due to proximity to the PAG WRSA	▪ Access to camp direct from on-site road ▪ Requires regular bussing to transport workforce back and forth between camp and mine terrace	▪ Requires regular bussing to transport workforce back and forth between camp and mine terrace	▪ Requires longer and regular bussing to transport workforce back and forth between camp and mine terrace
Economic	Capital cost	▪ Lowest cost	▪ Second lowest cost	▪ Second highest cost	▪ Moderate cost	▪ Highest cost
	Operating cost	▪ Lowest fuel consumption, access road maintenance, and operating costs	▪ Second lowest fuel consumption, access road maintenance, and operating costs	▪ Third highest fuel consumption, access road maintenance, and operating costs.	▪ Second highest fuel consumption, access road maintenance, and operating costs	▪ Highest fuel consumption, access road maintenance, and operating costs
Social	Worker safety and human health	▪ Subject to noise and air quality emissions associated with adjacent mine buildings and activities ▪ Distance from work area ~590 m	▪ Subject to noise and air quality emissions associated with WRSAs and airstrip proximity ▪ Distance from work area ~780 m	▪ Located farthest away from main noise and air quality emission sources ▪ Distance from work area ~2,050 m	▪ Located farther away from main noise and air quality emission sources ▪ Distance from work area ~1,770 m	▪ Subject to noise and air quality emissions associated with WRSAs and airstrip ▪ Distance from work area ~1,530 m
Overall		N/A	Neutral	More Preferred	Neutral	Leas Preferred

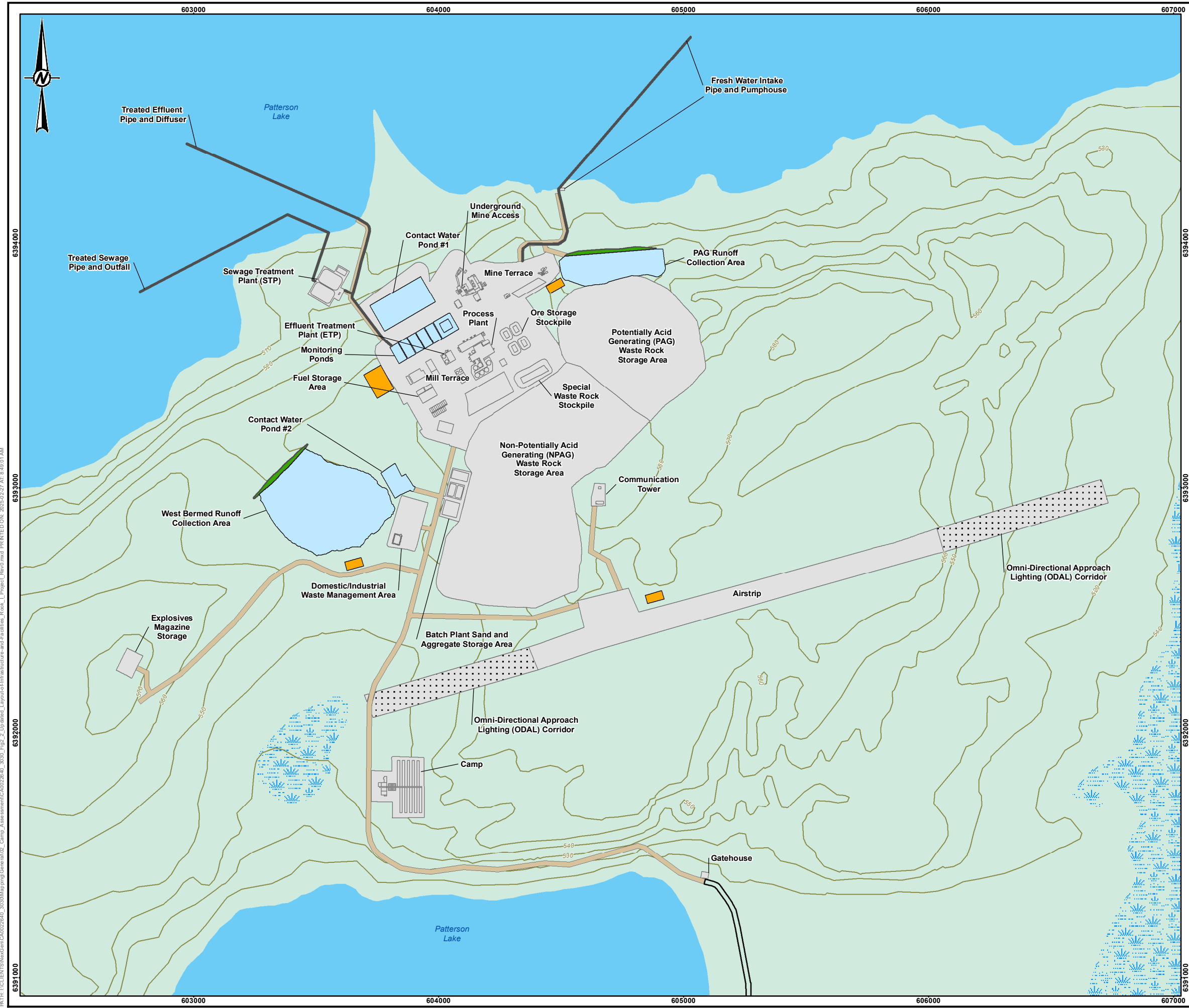
Legend: more preferred neutral less preferred

Note: EIS camp location is shaded in grey because sub-category or criteria were not scored as this location does not represent a formal option under consideration. Option 1 through Option 4 were ranked relative to each other and were not compared against the EIS camp location. ~ = approximately; EIS = Environmental Impact Statement; m = metre; NPAG = non-potentially acid generating PAG = potentially acid generating; WRSA = waste rock storage area; N/A = not applicable.

After evaluation of the relative advantages and disadvantages of the range of feasible alternatives, the selected alternative for camp location for the Project was the **Option #2 (revised south location)**. Overall, this alternative rated highest in the screening assessment and is located farthest away from the main mining and milling areas, giving workers an opportunity to be better separated from active work areas while not on shift. In addition, the following key disadvantages were identified for the other alternatives considered:

- **Option #1 (central location):** This option is not as desirable as it places the camp close to the PAG WRSA and the airstrip, which would result in greater potential exposure to Project air and noise emissions.
- **Option #3 (southwest location):** This alternative would require relocating the explosives and detonator storage facility to the other side of the Project site, which is not recommended due to the complexities involved in delivering explosives to the new explosives location.
- **Option #4 (revised east location):** This option is not as desirable as it neglected to score as a more preferred alternative for any assessment category or sub-category.

The updated Project footprint including the new camp location is presented in Figure 2-2. NexGen notes that the Figure 2-2 shows the proposed general location of the new Project camp and that slight adjustments to this location may occur should a more detailed field survey show that minor alterations would result in better environmental or technical performance.



LEGEND

- ELEVATION CONTOUR (10 m INTERVAL)
- WATERBODY
- WETLAND
- WOODED AREA
- INTAKE OR DISCHARGE PIPE
- ACCESS ROAD
- CONTACT WATER CONTAINMENT BERM
- OMNI-DIRECTIONAL APPROACH LIGHTING (ODAL) CORRIDOR
- PROJECT INFRASTRUCTURE
- SITE ROAD
- TOPSOIL STORAGE AREA
- WATER MANAGEMENT POND



REFERENCE(S)
 1. PROJECT FEATURES OBTAINED FROM NEXGEN, APRIL 6, 2021 AND UPDATED JUNE 8, 2021 .
 2. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
 PROJECTION: UTM ZONE 12 DATUM: NAD 83

PROJECT 	ROOK I PROJECT				
TITLE UPDATED LAYOUT OF INFRASTRUCTURE AND FACILITIES FOR THE ROOK I PROJECT					
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PROJECT	CA0022640.3030	SCALE AS SHOWN	REV. 0		
FIGURE 2-2					

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3 New Camp Design Features

The design of the new camp for the proposed Project is not anticipated to change from the design presented in the Project EIS, aside from modifications necessary to accommodate the new location. The new camp would be a modular, single-story facility that would provide accommodation for all workers (e.g., employees, consultants, contractors) and other personnel staying at the Project site. The new camp would adhere to necessary design codes and worker health and safety requirements, such as the National Building Code of Canada and The Occupational Health and Safety Regulations (2020).

The new camp would be designed for a maximum capacity of approximately 350 individuals to accommodate workers during Construction. As the construction workforce completes commissioning activities and operations workers begin shift rotations, the on-site population would reduce to approximately 260 individuals during Operations. Residential wings of the camp would be added or removed as the total worker requirements change through the Project lifespan.

The new camp would provide semi-private spaces, such as individual rooms for workers that would be shared on a rotating basis (i.e., shared with each worker's cross-shift partner) as well as amenity spaces for different activities, including dining and recreation. The camp would be connected by arctic corridors to allow workers to move between areas while remaining indoors and would include the following key facilities (EIS Section 5.4.7.1, Camp Facilities and Utilities):

- dining hall, which would be used as a large meeting space, when required;
- full kitchen and buffet-style service area, including washing facilities and dry and cold storage;
- medical and emergency services area, including first aid and observation rooms, offices, and a fire truck and ambulance garage;
- two recreation rooms, including exercise and meeting facilities and dedicated space for Elders;
- multiple bedrooms;
- multiple washrooms and shower rooms;
- concession area, boot room, and registration area;
- general loading and storage areas;
- laundry, janitorial, and mechanical/electrical rooms; and
- main information technology (IT) room.

On-site systems would provide utilities for the camp, including potable water; electricity; heating, ventilation, and air conditioning (HVAC); and sanitary services. Potable water would be provided to the camp from the fresh water supply through a network of buried pipes (EIS Section 5.4.5.1, Water Supply). Electricity would be provided by the on-site liquified natural gas (LNG) power plant to the camp by an overhead power line (EIS Section 5.4.7.5, Power Supply and Distribution). Heating, ventilation, and air conditioning systems, including domestic hot water systems, would include both electrical and natural gas systems. The sanitary system would serve the washrooms, showers, housekeeping, kitchen, and laundry facilities (EIS Section 5.4.5.5, Sanitary Sewage Collection and Treatment). Kitchen waste would pass through a grease interceptor prior to entering the sanitary system. Floor drains would be located in mechanical rooms,

showers, and other areas, where required. The camp sanitary sewage would flow to the STP via a buried pipeline for treatment.

The following changes to components and activities are required for the new camp location in comparison to the Project components and activities proposed for the camp location in the Project EIS:

- Modifications to/additional clearing, grubbing, and stripping at the location of the new camp and for the overhead transmission line corridor that would service the camp.
- Modifications to/additional water management structures, including water collection, pumping, and pipeline infrastructure.
- Transporting of workers to and from the mine terrace by bus to support Project Construction, Operations, and Closure activities. It is assumed that 7 return trips, twice per day (i.e., 14 trips per 24-hour period) would be required to transport staff to and from the camp location.

4 New Camp Location Assessment

The scope of the new camp location assessment has been structured to fulfil two requirements:

1. A request made by the ENV to complete an evaluation to confirm that residual effects classifications for VCs and intermediate components would not be affected as a result of relocating the camp.
2. Condition 10 of the Notice of Decision (Section 1.4).

As presented in Section 2 and Section 3, the new camp location will result in changes to certain Project activities, and infrastructure would require modifications as a result of situating the new camp in a different location than what was proposed within the Project EIS. The new camp location would result in a modification of the Project footprint; however, the new camp location and any supporting infrastructure would be located within the maximum disturbance area that was assumed within the Project EIS. Additionally, while the relocation of the camp requires additional surface water management and transmission line infrastructure, there are no anticipated changes to the water volumes withdrawn and diverted, or to the quality of any effluent discharges by the Project. However, as the new camp location would be farther away from the primary mining activities, bussing of staff to and from the camp and work areas would be required. Therefore, there could be potential changes to air emissions, which would represent the only camp-related Project interaction that would have the potential of producing outcomes different than the outcomes predicted in the Project EIS.

Section 4.1 provides an evaluation of whether the new camp location could potentially change the VC or intermediate component residual effects classifications beyond what was presented in the Project EIS. To address Condition 10 of the Notice of Decision, Section 4.2.1 presents findings with respect to noise, light, air quality, and potential dust effects at the new camp location, and Section 4.2.2 presents findings with respect to accidents and malfunctions, including upset conditions.

4.1 Valued Component and Intermediate Component Evaluation

The first step in the VC and intermediate component evaluation was to conduct a screening analysis to determine if Project effects could change the residual effects classifications for any VCs or intermediate components as a result of the new Project camp location (Table 4-1). The screening analysis evaluated whether Project activities associated with the new camp location could have the potential to affect measurement indicators for each VC and intermediate component.

Based on this screening analysis, modified air emissions due to the new camp location represents the only Project interaction with the potential to change predicted effects to VCs and intermediate components. On this basis, VCs and intermediate components that had linkages to air emissions were evaluated for potential change to measurement indicators as a result of changes to air emissions, as shown in Table 4-1. Where potential changes to measurement indicator(s) and the associated VC or intermediate component were noted as possible, these potential changes were identified for further evaluation; a summary of these evaluations is presented in Sections 4.1.1 to Section 4.1.7. At the conclusion of each evaluation, potential changes were assessed to determine if they were significant enough (i.e., the residual effects classification would differ from the EA predictions) to warrant additional mitigation measures.

In summary, the change in camp location has the potential to result in changes to the residual effects classification for the following VCs and intermediate components:

- **Valued components:** climate change, fish and fish habitat, human health, Indigenous land and resource use, and other land and resource use.
- **Intermediate components:** air quality and surface water quality.

Section 4.1.1 through Section 4.1.7 provides an assessment of potential changes to VCs and intermediate components. Section 4.1.8 provides a summary of the VC and intermediate component evaluation.

Table 4-1: Valued Component and Intermediate Component Screening Analysis

Valued Component or Intermediate Component	Measurement Indicator	Potential for Changes to Measurement Indicator beyond EA Predictions	Basis for Screening and Results
Air Quality	Nitrogen dioxide	Yes	<ul style="list-style-type: none"> The new camp location would require the transportation of staff by bus to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions. Potential changes to air quality measurement indicators are further discussed in Section 4.1.1.
	Sulphur dioxide	Yes	
	Sulphuric acid	Yes	
	Carbon monoxide	Yes	
	Particulate matter with a nominal diameter of 2.5 µm or less	Yes	
	Particulate matter with a nominal diameter of 10 µm or less	Yes	
	Total suspended particulate	Yes	
Noise	Energy equivalent sound level for the daytime period	No	<ul style="list-style-type: none"> With the new proposed camp location, staff would require the transportation by bus to and from the active working areas during all Project phases. However, this minor modification is not expected to result in measurable changes to the EA noise predictions at sensitive receptors outside of the maximum disturbance area. Therefore, there would be no changes to the predictions for noise, and no further assessment for noise is required.
	Energy equivalent sound level for the nighttime period	No	
	Combined day-night sound level	No	
	Maximum sound level	No	
Climate Change	GHG emissions of carbon dioxide	Yes	<ul style="list-style-type: none"> The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which would generate additional GHG emissions. Potential changes to climate change measurement indicators are further discussed in Section 4.1.2.
	GHG emissions of methane	Yes	
	GHG emissions of nitrous oxide	Yes	
Hydrogeology	Groundwater elevations	No	<ul style="list-style-type: none"> The camp relocation would not require changes to the use of groundwater or changes to potential discharges to the ground. Infiltration would be minimally affected at the location of the new camp resulting from localized changes to the routing of precipitation to the ground. Therefore, there would be no changes to the predictions for hydrogeology, and no further assessment for hydrogeology is required.
	Groundwater flow directions and rates	No	
	Groundwater quality	No	
Hydrology	Waterbody water surface elevations	No	<ul style="list-style-type: none"> The camp relocation would not require changes to the Project surface water intake or environmental discharge locations or volumes, nor to surface water diversions. Therefore, there would be no changes to the predictions for hydrology, and no further assessment for hydrology is required.
	Watercourse flow rates	No	
	Stream channel parameters	No	
	Fluvial sediment transport	No	
Surface Water Quality	Water quality constituent concentrations	Yes	<ul style="list-style-type: none"> The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions on waterbodies. Based on conclusions presented in EIS Section 10.5.1.2.5, Atmospheric Deposition, changes to the EA predictions for surface water quality would only occur if changes to air quality emissions were substantial. Potential changes to surface water quality measurement indicators are further discussed in Section 4.1.3.
	Drinking water quality constituent concentrations	Yes	
	Productivity status constituent concentrations	Yes	
Sediment Quality	Sediment quality constituent concentrations	No	<ul style="list-style-type: none"> The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions on waterbodies. Changes to water quality could affect sediment quality. However, as no primary pathways to sediment quality exist (EIS Section 10.5, Residual Effects Analysis), no further assessment for sediment quality is required.
Fish and Fish Habitat	Habitat availability	No	<ul style="list-style-type: none"> The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions on waterbodies. Changes to water quality could affect fish survival and reproduction. However, changes to the EA predictions for fish survival and reproduction would only occur if changes to water quality are substantial (EIS Section 11.4, Project Interactions and Mitigations). Potential changes to fish survival and reproduction are further discussed in Section 4.1.4.
	Habitat distribution	No	
	Survival and reproduction	Yes	
Terrain and Soils	Quantity and distribution of terrain units	No	<ul style="list-style-type: none"> The EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted effects to the quantity and distribution of terrain or soil map units. The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions. However, changes to soil quality from Project emissions were designated as secondary pathways that did not require further assessment in the Project EIS (EIS Section 12.4.2, Secondary Pathways). The minor additional traffic volumes relative to the traffic volumes assumed in the Application Case would not change these designations. Therefore, no further assessment for terrain and soils is required.
	Quantity and distribution of soil map units	No	
	Soil quality	No	
Vegetation	Ecosystem or habitat availability	No	<ul style="list-style-type: none"> The Project EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted effects to ecosystem/habitat availability or distribution. The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions. However, changes to ecosystem condition from Project emissions and fugitive dust were designated as secondary pathways that did not require further assessment in the Project EIS (EIS Section 13.4.2, Secondary Pathways). The minor additional traffic volumes relative to the traffic volumes assumed in the Application Case would not change these designations. Therefore, no further assessment for vegetation is required.
	Ecosystem or habitat distribution	No	
	Ecosystem condition	No	

Table 4-1: Valued Component and Intermediate Component Screening Analysis

Valued Component or Intermediate Component	Measurement Indicator	Potential for Changes to Measurement Indicator beyond EA Predictions	Basis for Screening and Results
Wildlife and Wildlife Habitat	Habitat availability	No	<ul style="list-style-type: none"> The Project EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted effects to habitat availability or distribution. The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions. However, potential effects to wildlife health from Project emissions was designated as a secondary pathway (EIS Section 14.4.2, Secondary Pathways) and Project emission effects on wildlife habitat was designated as no pathway (EIS Section 14.4.1, No Pathways); neither of these pathways required further assessment in the Project EIS. The minor additional traffic volumes relative to the traffic volumes assumed in the Application Case would not change these designations. Therefore, no further assessment for wildlife and wildlife habitat is required.
	Habitat distribution	No	
	Survival and reproduction	No	
Human Health	Hazard quotient	Yes	<ul style="list-style-type: none"> The new camp location would require the transportation of staff to and from the active working areas during the Project lifespan, resulting in additional traffic on site roads, which could generate additional CAC emissions within and outside of the maximum disturbance area. These emissions have the potential to affect human health. However, as noted in Section 4.3.4 of EIS TSD XXI, Environmental Risk Assessment, no atmospheric constituents of potential concern were required to be quantitatively evaluated as the atmospheric pathway was not predicted to result in greater-than-negligible effects to human health (note: uranium-238 radionuclides were quantitatively assessed in the EIS as they represent a public interest; however, changing the camp location would not result in changes to radiological emissions generated by the Project). Therefore, changes to the EA predictions for human health would only occur if changes to air quality emissions were substantial. Potential changes to human health hazard quotients and incremental lifetime cancer risks are further discussed in Section 4.1.5.
	Incremental lifetime cancer risk	Yes	
	Radiation dose	No	
Cultural and Heritage Resources	Changes to the number, quality, and significance of archaeology and heritage sites in the heritage study area	No	<ul style="list-style-type: none"> The Project EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted effects to the number, quality, and significance of archaeology and heritage sites in the heritage study area, and no further assessment to cultural and heritage resources is required.
Indigenous Land and Resource Use	Changes to access to and area available for Indigenous land and resource use	No	<ul style="list-style-type: none"> The Project EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted access to and area available for Indigenous land and resource use. In addition, changes to air quality affecting the availability and quality of fish, plants, and wildlife for harvesting was designated as no pathway (EIS Section 16.4.1, No Pathways), and the minor additional traffic volumes relative to the traffic volumes assumed in the Application Case would not change this designation. Therefore, no further assessment for Indigenous land use and resource use is required in this regard. However, should changes to air quality be substantial as a result of additional site traffic, changes to the quality of the Indigenous land use experience could occur. Potential changes to the quality of the Indigenous land use experience are further assessed in Section 4.1.6.
	Changes to the availability and quality of fish, plants, and wildlife for harvesting	No	
	Changes to the quality of the Indigenous land use experience	Yes	
Other Land and Resource Use	Access to, and area available for, land and resource use	No	<ul style="list-style-type: none"> The Project EIS conservatively assumed that the area of the new camp location, which is located within the maximum disturbance area, would be disturbed. Therefore, there would be no changes to predicted access to and area available for land and resource use. In addition, changes to air quality affecting the availability of fish and wildlife for harvesting was designated as no pathway (EIS Section 17.4.1, No Pathways), and the minor additional traffic volumes relative to the traffic volumes assumed in the Application Case would not change this designation. Therefore, no further assessment to other land and resource use is required in this regard. However, should changes to air quality be substantial as a result of additional site traffic, changes to the quality of resources and the quality of resource use experience could occur. Potential changes to the quality of the resources and the quality of resource use experience are further assessed in Section 4.1.7.
	Availability of fish and wildlife for harvesting	No	
	Quality of the resources and the quality of resource use experience	Yes	
Economy	Local population levels	No	<ul style="list-style-type: none"> None of the potential changes to environmental effects associated with the change of the camp location would have links to the economy measurement indicators. Therefore, no further assessment for economy is required.
	Project-related employment	No	
	Indigenous community participation and employment in the traditional economy	No	
	Income (including both wage income and traditional economy income)	No	
	Training and educational opportunities	No	
	Project-related contracting opportunities for businesses in local communities	No	
	Project-related procurement expenditures	No	
	Business counts	No	
Federal and provincial government revenues	No		
Community Well-Being	Societal and cultural well-being	No	<ul style="list-style-type: none"> None of the potential changes to environmental effects associated with the change of the camp location would have links to the community well-being measurement indicators. Therefore, no further assessment for community well-being is required.
	Health well-being	No	
	Neighbourhood and physical environment well-being	No	
	Educational well-being	No	
	Economic well-being	No	

Shading indicates measurement indicators and associated VCs or intermediate components with the potential for predicted effects to be greater than the effects presented in the Rook I Project EIS.

CAC = criteria air contaminant; EA = Environmental Assessment; EIS = Environmental Impact Statement; GHG = greenhouse gas; VC = valued component.

4.1.1 Air Quality

As noted in Section 4, the additional bussing and transportation requirements for the new camp location could result in additional criteria air contaminants (CACs) being emitted from the Project. Residual effect pathways related to air quality were evaluated through a comparison of model predicted maximum concentrations of air quality measurement indicators (i.e., CACs) outside of the maximum disturbance area to determine if the new camp location and associated activities would result in a material change to predicted air quality concentrations presented in the Project EIS. The modelling was conducted for the Project Construction and Operations phases. Modelling was also completed to assess cumulative effects of the Project with the inclusion of potential effects from the Fission Patterson Lake South Property, which is included within the reasonably foreseeable development (RFD) case. The model applied the same American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) settings, source emissions, and meteorological datasets that were used in the Project EIS modelling with the addition of emissions resulting from the bussing and transportation requirements for the new camp location.

The following CACs were modelled:

- nitrogen dioxide (NO₂);
- sulphur dioxide (SO₂);
- carbon monoxide (CO);
- sulphuric acid (H₂SO₄);
- total suspended particulates (TSP);
- particulate matter with a nominal diameter of 10 microns (µm) or less (PM₁₀); and
- particulate matter with a nominal diameter of 2.5 µm or less (PM_{2.5}).

Table 4-2 presents the results of the predicted maximum concentrations of these CACs outside of the Project maximum disturbance area, comparing the EIS camp location to the new camp location. The AERMOD electronic package, including the model inputs and outputs, has been submitted along with the Application.

As shown in Table 4-2, the change in camp location results in either no or negligible (i.e., less than 3%, with most being less than 1%) increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case.

Based on these results, it can be concluded that the increased Project air emissions as a result of the change in camp location would not change the air quality residual effects classification completed for the Project EA. Therefore, no additional mitigation measures for air quality are proposed or required.

Table 4-2: Predicted Project Maximum Air Concentrations Outside of the Maximum Disturbance Area for the EIS Camp Location and New Camp Location

Criteria Air Contaminant	Averaging Period	Project with EIS Camp Location			Project with New Camp Location		
		Construction	Operations	RFD	Construction	Operations	RFD
CO	1 hr	1,654.7	1,255.9	1,255.9	1,658.1	1,255.9	1,255.9
	8 hr	831.4	792.5	793.3	831.9	792.5	793.3
NO ₂	1 hr	276.9	167.0	167.0	280.2	167.6	167.6
	24 hr	79.9	61.9	61.9	80.0	61.9	61.9
	Annual	9.7	6.7	6.7	9.7	6.7	6.8
	1 hr CAAQS	230.0	153.3	153.3	234.1	157.2	157.3
SO ₂	1 h	4.5	9.4	9.4	4.5	9.4	9.4
	24 hr	0.7	1.8	1.8	0.7	1.8	1.8
	Annual	0.0	0.1	0.1	0.0	0.1	0.1
	1 hr CAAQS	5.1	10.4	10.7	5.2	10.4	10.7
H ₂ SO ₄	1 hr	N/A	1.2	1.6	N/A	1.2	1.6
	24 hr	N/A	0.2	0.3	N/A	0.2	0.3
TSP	24 hr	185.3	109.2	109.8	185.3	109.4	110.0
	Annual	13.2	11.2	11.3	13.2	11.3	11.3
PM _{2.5}	24 hr	16.6	10.5	10.6	16.7	10.5	10.6
	Annual	4.1	3.7	3.7	4.1	3.7	3.7
PM ₁₀	24 hr	147.0	65.4	65.6	147.3	65.4	65.7

Shading indicates an increase in predicted concentrations at the new camp location versus the EIS camp location.

EIS = Environmental Impact Statement; CO = carbon monoxide; NO₂ = nitrogen dioxide; SO₂ = sulphur dioxide; H₂SO₄ = sulphuric acid; PM_{2.5} = particulate matter with a nominal diameter 2.5 µm or less; PM₁₀ = particulate matter with a nominal diameter 10 µm or less; TSP = total suspended particulate matter; hr = hour; RFD = reasonably foreseeable development; CAAQS = Canadian Ambient Air Quality Standards; N/A = not applicable.

4.1.2 Climate Change

The Project EIS estimated direct GHG emissions of the Project from the multiple emissions sources. For each emission source, Scope 1 emissions were estimated for the measurement indicators of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), when relevant, as well as the total carbon dioxide equivalent (CO₂e) emissions. The direct GHG emissions sources considered in the Project EIS included:

- **Electricity generation:** includes the natural gas and diesel combustion from the generators used to produce electricity on site.
- **On-site mobile equipment:** includes the diesel combustion from surface and underground mobile equipment that would be used for construction activities, mining operations, road maintenance, material movement, and movement of personnel around site.
- **Heating:** includes the natural gas combustion from the mine heaters and building heaters for underground and surface operations.
- **Land use change emissions:** includes the carbon sink lost annually due to removed vegetation and the one-time total carbon losses in biomass due to disturbances. There are no CH₄ or N₂O emissions associated with land use change.
- **Stationary combustion:** includes the natural gas and diesel combustion from the burner that would heat the calciner (i.e., industrial furnace) in the process plant to remove impurities from the processed ore and from operating incinerators.
- **Waste incineration:** includes the emissions released from domestic and low-level radiological waste as the fraction of fossil carbon.
- **Industrial processes:** includes the H₂SO₄ production plant and the acidification of ore material. Industrial process emissions would begin in the final year of the Construction (i.e., Year -1) and would not produce quantifiable CH₄ or N₂O emissions.
- **Explosive emissions:** includes the emissions from explosives used for blasting.

The emission sources that have the potential to change as a result of the new camp location and associated activities are on-site mobile equipment through the transportation of staff to and from the new camp location, and land use change from the additional clearing associated with the new transmission line corridor along the access road to the new camp location. When calculating GHG emissions from land use change in the Project EIS, it was conservatively assumed that the entire maximum disturbance area would be cleared. Therefore, the changes to the Project footprint from the new transmission line corridor or new camp location would not result in additional GHG emissions from the GHG emissions presented in the Project EIS; only on-site mobile equipment GHG emissions from the transportation of staff to and from the camp to work areas are anticipated to change.

Table 4-3 presents a comparison of estimated on-site mobile equipment GHG emissions of the Project EIS and the Project with the new camp location.

As shown in Table 4-3, the change in camp location would have minimal effect on the GHG emissions associated with the Project, resulting in an increase of total Scope 1 emissions of less than 1%, which is within the margin of error for the GHG emission estimates. Based on these results, it can be concluded that the increased Project GHG emissions as a result of the change in camp location would not change the climate change residual effects

classification completed for the Project EA. Therefore, no additional mitigation measures for climate change are proposed or required.

Table 4-3: Comparison of Project Direct (Scope 1) Greenhouse Gas Emissions by Compound from On-Site Mobile Equipment between EIS and the Project Considering the New Camp Location

Phase	Year	EIS Emission Estimate				Emission Estimate of Project with New Camp Location ^(a)			
		CO ₂	CH ₄	N ₂ O	CO ₂ e	CO ₂	CH ₄	N ₂ O	CO ₂ e
Construction	Year -4	4,600	0.1	<0.1	4,600	4,600	0.1	<0.1	4,600
	Year -3	15,500	0.4	0.1	15,500	15,500	0.4	0.1	15,500
	Year -2	8,300	0.2	0.1	8,300	8,300	0.2	0.1	8,300
	Year -1	7,900	0.2	0.1	7,900	7,900	0.2	0.1	7,900
Operations	Year 1	11,200	0.3	0.1	11,200	11,300	0.3	0.1	11,300
	Year 2	11,800	0.3	0.1	11,800	11,800	0.3	0.1	11,900
	Year 3	11,800	0.3	0.1	11,800	11,800	0.3	0.1	11,900
	Year 4	11,600	0.3	0.1	11,700	11,700	0.3	0.1	11,700
	Year 5	10,500	0.3	0.1	10,500	10,500	0.3	0.1	10,600
	Year 6	10,500	0.3	0.1	10,500	10,500	0.3	0.1	10,600
	Year 7	11,000	0.3	0.1	11,100	11,100	0.3	0.1	11,200
	Year 8	11,000	0.3	0.1	11,100	11,100	0.3	0.1	11,200
	Year 9	11,000	0.3	0.1	11,000	11,100	0.3	0.1	11,100
	Year 10	10,500	0.3	0.1	10,500	10,600	0.3	0.1	10,600
Closure	Years 11-24 (per yr) ^(b)	10,500	0.3	0.1	10,500	10,600	0.3	0.1	10,600
	Years 25-29 (per yr) ^(c)	15,500	0.4	0.1	15,500	15,500	0.4	0.1	15,500
	Years 30-39 (per yr) ^(d)	200	<0.1	<0.1	200	200	<0.1	<0.1	200
Total Scope 1 Emissions by Source (t CO₂e)		373,700	10.1	3.2	374,000	375,700	10.1	3.2	376,300

a) Shading indicates increase in emissions based on new camp location.

b) It is expected that the emissions from Year 10 are reflective of annual emissions for Year 11 to Year 24.

c) It is expected that the highest annual emissions from the Construction Phase conservatively represents the annual emissions during the Active Closure Stage (Year 25 to Year 29) of the Closure Phase.

d) The emissions sources during the Transitional Monitoring Stage (Year 30 to Year 39) of the Closure Phase include fuel combustion from pickup trucks and land use change.

CO₂ = carbon dioxide; CH₄ = methane; N₂O = nitrous oxide; CO₂e = carbon dioxide equivalent; n/a = not applicable, < = less than; t CO₂e = tonnes of carbon dioxide equivalent.

4.1.3 Surface Water Quality

As shown in Table 4-2, the change in camp location air quality results in either no or negligible (i.e., less than 3%, with most being less than 1%) increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case. As noted in Table 4-1, changes to the EA predictions for surface water quality would only occur if changes to air quality emissions were substantial. Based on the air quality results, it can be concluded that the change in camp location would not meaningfully change surface water quality. Therefore, there would be no changes to the surface water quality residual effects classification completed for the Project EA, and no additional mitigation measures for surface water quality are proposed or required.

4.1.4 Fish and Fish Habitat

As noted in Table 4-1, changes to the EA predictions for fish and fish habitat would only occur if changes to surface water quality were substantial. As there would be no change to the residual effects classification for the surface water quality assessment completed for the Project EA, there would also be no changes to the residual effects classification for the fish and fish habitat assessment, and no additional mitigation measures for fish and fish habitat are proposed or required.

4.1.5 Human Health

As shown in Table 4-2, the change in camp location air quality results in either no or negligible (i.e., less than 3%, with most being less than 1%) increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case. As noted in Table 4-1, changes to the EA predictions for human health would only occur if changes to air quality emissions were substantial. Based on the air quality results, it can be concluded that the change in camp location would not meaningfully change human health. Therefore, there would be no changes to the human health residual effects classification completed for the Project EA, and no additional mitigation measures for human health are proposed or required.

4.1.6 Indigenous Land and Resource Use

As shown in Table 4-2, the change in camp location air quality results in either no or negligible (i.e., less than 3%, with most being less than 1%) increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case. As noted in Table 4-1, changes to the EA predictions for Indigenous land and resource use would only occur if changes to air quality emissions were substantial. Based on the air quality results, it can be concluded that the change in camp location would not meaningfully change Indigenous land and resource use. Therefore, there would be no changes to the Indigenous land and resource use residual effects classification completed for the Project EA, and no additional mitigation measures for Indigenous land and resource use are proposed or required.

4.1.7 Other Land and Resource Use

As shown in Table 4-2, the change in camp location air quality results in either no or negligible (i.e., less than 3%, with most being less than 1%) increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case. As noted in Table 4-1, changes to the EA predictions for other land and resource use would only occur if changes to air quality emissions were substantial. Based on the air quality results, it can be concluded that the change in camp location would not meaningfully change other land and resource use. Therefore, there would be no changes to the other land and resource use residual effects classification completed for the Project EA, and no additional mitigation measures for other land and resource use are proposed or required.

4.1.8 Conclusions

The only Project interactions that have the potential to affect EA predictions as a result of the change in camp location are modified air emissions (i.e., CACs and GHGs) associated with additional on-site bussing requirements. As shown in Table 4-2 of Section 4.1.1, the change in camp location results in either no or negligible increases to the predicted concentrations of CACs during the Construction and Operation phases and in the RFD case. Also, as shown in Table 4-3 of Section 4.1.2, the change in camp location would have minimal

effect on the GHG emissions associated with the Project, resulting in an increase of total Scope 1 emissions of less than 1%.

As changes to Project atmospheric emissions would be minimal, no changes are predicted to the residual effects classifications for Project EIS VCs or intermediate components. For this reason, no additional mitigation measures are proposed or required to further protect people or the environment beyond the mitigation measures identified in the Project EIS.

4.2 Notice of Ministerial Decision Camp Assessment Requirements

The following section provides the required evaluations described in Condition 10 of the Notice of Decision. The evaluation focuses on effects to workers at the new camp location. Section 4.2.1 presents information on standard operations, and Section 4.2.2 presents information on accidents and malfunctions, which includes upset conditions.

4.2.1 Potential Project Effects to Camp Workers during Standard Operations

Section 4.2.1.1 through Section 4.2.1.3 presents the evaluation of the Project air quality, noise, and light effects to workers at the new camp location under typical conditions; conclusions of this evaluation are presented in Section 4.2.1.4.

4.2.1.1 Air Quality

To evaluate the potential effects to workers at the new camp location as a result of changes to air quality, including dust (i.e., large particulate matter, represented herein as TSP), updated air quality model predictions (i.e., model outputs that considered amended Project effects resulting from the change in camp location) at the new camp location were compared against the same ambient air quality criteria from the human health risk assessment completed for the Project EA (EIS Technical Support Document [TSD] XXI, Environmental Risk Assessment, Section 4.3.3.1). Maximum predicted air concentrations of constituents in air including NO₂, SO₂, CO, H₂SO₄, PM_{2.5}, PM₁₀, TSP, and radon, were screened against ambient air quality criteria and follow-up analysis was completed, if required. Ambient air quality criteria were selected based on the following order for selection:

- Saskatchewan Ambient Air Quality Standards (SAAQS) are maximum concentrations in ambient air from all sources as stipulated in The Clean Air Regulations (Government of Saskatchewan 2015).
- Alberta Ambient Air Quality Objectives (AAAQO) are based on an evaluation of scientific, social, technical, and economic factors (Government of Alberta 2021).
- Ontario Ambient Air Quality Criteria (OAAQC) are concentrations of a contaminant in air that are protective against adverse effects on health and/or the environment (MECP 2020).
- Texas effects screening levels are air concentrations at or below which adverse health effect in the general public, including sensitive subgroups such as children, the elderly, pregnant women, and people with pre-existing health conditions, are not likely to occur (TCEQ 2016).

A screening value for radon gas was not available from the sources identified. Therefore, Health Canada's annual average corrective action trigger value of 200 becquerels per cubic metre (Bq/m³) for indoor air (Health Canada 2009) was used for the screening. As Project activities would result in the release of radon gas into the atmosphere, radon was evaluated further in terms of radiation dose to the camp worker at the new camp location. The atmospheric model for the Project used AERMOD to estimate radon concentrations at various locations based on radon source emissions (EIS Appendix 7A, Air Quality Modelling Report). The underground mine vent is the dominant source of radon emissions for the Project, representing approximately 98.6% of the total modelled radon emissions.

The selected ambient air quality screening values for different averaging periods, criteria sources, and rationale in terms of potential effects are summarized in Table 4-4. The rationale provided in Table 4-4 for each of the selected ambient air quality screening values describes the sensitive effect that is the basis for the value cited by the relevant source.

Table 4-4: Screening Values for the Air Quality Criteria Air Contaminants at the New Camp Location

Constituent	Averaging Period	Selected Screening Value ^(a)	Source	Rationale
NO ₂	1 hr	300	SAAQS	Respiratory effects
	24 hr	200	SAAQS	Human health
	Annual	45	SAAQS	Vegetation
SO ₂	1 hr	450	SAAQS	Pulmonary effects
	24 hr	125	SAAQS	Human health
	Annual	20	SAAQS	Ecosystem health
CO	1 hr	15,000	SAAQS	Oxygen carrying capacity of blood
	8 hr	6,000	SAAQS	Oxygen carrying capacity of blood
	Annual	n/v	n/a	n/a
H ₂ SO ₄	1 hr	10	AAAQO	Not stated
	24 hr	5	OAAQC	Human health
	Annual	n/v	n/a	n/a
TSP	24 hr	100	SAAQS	Human health. Pulmonary effects
	Annual	60	SAAQS	Visibility
PM _{2.5}	24 hr	27	OAAQC	Human health
	Annual	8.8	OAAQC	Human health
PM ₁₀	24 hr	50	SAAQS	Human health
	Annual	n/v	n/a	n/a
Radon	Annual	200 Bq/m ³	Health Canada ^(b)	Addressed in terms of radiation dose in the ERA

a) Units are µg/m³ unless otherwise specified.

b) Source: Health Canada 2009.

AAAQO = Alberta Ambient Air Quality Objectives (Government of Alberta 2021); OAAQC = Ontario Ambient Air Quality Criteria (MECP 2020); SAAQS = Saskatchewan Ambient Air Quality Standards (Government of Saskatchewan 2015); CO = carbon monoxide; NO₂ = nitrogen dioxide; SO₂ = sulphur dioxide; H₂SO₄ = sulphur acid; hr = hour; RFD = reasonably foreseeable development; Bq/m³ = becquerels per cubic metre; µg/m³ = micrograms per cubic metre; TSP = total suspended particulates; ERA = environmental risk assessment; PM₁₀ = particulate matter with a diameter of 10 microns or less; PM_{2.5} = particulate matter with a diameter of 2.5 microns or less; n/a = not applicable; n/v = no value.

To allow for a comparison of expected air quality at the new camp location to the ambient air quality screening values provided in Table 4-4, the predicted air concentrations at the new camp location for Construction, Operations, and the RFD Case are presented in Table 4-5.

Table 4-5: Comparison of Predicted Air Concentrations at New Camp Location Against Air Quality Criteria

Criteria Air Contaminant	Averaging Period	Air Quality Value ^(a)	Source	Construction	Operations	RFD
CO	1 hr	15,000	SAAQS	977.1	738.7	738.8
	8 hr	6,000	SAAQS	664.4	617.0	617.0
NO ₂	1 hr	300	SAAQS	191.4	142.5	142.5
	24 hr	200	SAAQS	42.0	25.0	25.0
	Annual	45	SAAQS	5.3	4.6	4.6
SO ₂	1 h	450	SAAQS	2.2	4.2	4.2
	24 hr	125	SAAQS	0.3	0.5	0.5
	Annual	20	SAAQS	0.008	0.030	0.032
H ₂ SO ₄	1 hr	10	AAAQO	N/A	0.5	0.5
	24 hr	5	OAAQC	N/A	0.1	0.1
TSP	24 hr	100	SAAQS	49.9	33.7	33.9
	Annual	60	SAAQS	9.0	8.2	8.3
PM _{2.5}	24 hr	27	OAAQC	9.9	7.7	7.7
	Annual	8.8	OAAQC	3.6	3.3	3.3
PM ₁₀	24 hr	50	SAAQS	44.5	26.8	26.8
Radon	Annual	200 Bq/m ³	Health Canada ^(b)	n/a	12.2	16.6

a) Units are µg/m³ unless otherwise specified.

b) Source: Health Canada 2009.

OAAQC = Ontario Ambient Air Quality Criteria (MECP 2020); SAAQS = Saskatchewan Ambient Air Quality Standards (Government of Saskatchewan 2015); CO = carbon monoxide; NO₂ = nitrogen dioxide; SO₂ = sulphur dioxide; H₂SO₄ = sulphur acid; PM_{2.5} = particulate matter with a nominal diameter 2.5 µm or less; PM₁₀ = particulate matter with a nominal diameter 10 µm or less; TSP = total suspended particulate matter; hr = hour; Bq/m³ = Becquerels per cubic metre; µg/m³ = micrograms per cubic metre; RFD = reasonably foreseeable development; N/A = not applicable.

As shown in Table 4-5, all CACs are predicted to be below the air quality screening values (Table 4-4), including the SAAQS, indicating that no health effects are anticipated to workers at the new camp location. The incremental radon dose to a camp worker at the new camp location (i.e., a person who spends all of their work rotation, including sleep, at the camp) during Operations (i.e., Application Case) and the RFD Case is expected to be 0.12 millisieverts per year (mSv/yr) and 0.18 mSv/yr, respectively. These incremental radon doses to a camp worker at the new camp location is both lower than the predicted dose at the EIS camp location (i.e., 0.51 mSv/yr and 0.57 mSv/yr, respectively, for the Application Case and the RFD Case [EIS TSD XXI, Section 5.4.1]) and below the dose limit for a non-nuclear energy worker of 1 mSv/yr; therefore, health effects from radon to a camp worker at the new camp location are not expected.

As all CACs were predicted to be below the air quality screening values and health effects from radon to a camp worker at the new camp location, neither further analysis to the health of workers at the new camp location, nor implementation of additional air quality mitigation measures were required.

To provide context as to how the air quality would differ between the EIS camp location and the new camp location, the modelled maximum concentrations at the EIS camp location and new camp location for Construction, Operations, and the RFD Case are summarized in Table 4-6.

Table 4-6: Predicted Maximum Air Concentrations at the New Camp Location and the EIS Camp Location

Criteria Air Contaminant	Averaging Period	EIS Camp Location			New Camp Location		
		Construction	Operations	RFD	Construction	Operations	RFD
CO	1 hr	864.8	1,060	1,060.00	977.1	738.7	738.8
	8 hr	724.6	774.9	775	664.4	617	617
NO ₂	1 hr	254.5	157.7	157.7	191.4	142.5	142.5
	24 hr	105.6	91.6	91.6	42	25	25
	Annual	14.7	8.5	8.6	5.3	4.6	4.6
SO ₂	1 h	4.6	17.6	17.6	2.2	4.2	4.2
	24 hr	1	3.8	3.8	0.3	0.5	0.5
	Annual	0.1	0.2	0.2	0.008	0.03	0.032
H ₂ SO ₄	1 hr	N/A	2.2	2.2	N/A	0.5	0.5
	24 hr	N/A	0.5	0.5	N/A	0.1	0.1
TSP	24 hr	142.5	92.8	92.9	49.9	33.7	33.9
	Annual	15.3	10.2	10.3	9	8.2	8.3
PM _{2.5}	24 hr	19.5	10.8	10.8	9.9	7.7	7.7
	Annual	5.3	3.8	3.9	3.6	3.3	3.3
PM ₁₀	24 hr	97.5	60.2	60.3	44.5	26.8	26.8
Radon (Bq/m ³)	Annual	N/A	44.5	49.3	N/A	12.2	16.6

Note: Units are µg/m³ unless otherwise specified.

EIS = Environmental Impact Statement; CO = carbon monoxide; NO₂ = nitrogen dioxide; SO₂ = sulphur dioxide; H₂SO₄ = sulphur acid; hr = hour; n/a = not applicable; PM_{2.5} = particulate matter with a nominal aerodynamic diameter of 2.5 µm or less; PM₁₀ = particulate matter with a nominal aerodynamic diameter of 10 µm or less; TSP = total suspended particulates; Bq/m³ = Becquerels per cubic metre; µg/m³ = micrograms per cubic metre; RFD = reasonably foreseeable development.

As shown in Table 4-6, the predicted maximum air quality CAC concentrations at the new camp location are lower than CAC concentrations at the EIS camp location, with the exception of 1-hour carbon monoxide concentration during the Construction Phase. Since the new camp location is located farther from the main mine facility area, lower Project air quality effects are expected.

4.2.1.2 Noise

The noise assessment presented in the Project EIS focused on potential effects to human receptors in the environment surrounding the Project. Consistent with guidance from Health Canada and other Canadian regulators of environmental noise, the Project EA did not consider potential noise effects to the on-site worker camp (i.e., the EIS camp was not a receptor in the Project EA) since these effects are addressed in the context of occupational health and safety (OHS) requirements. However, in response to Condition 10 of the Notice of Decision, NexGen has compared the predicted noise effects at the Project EIS and new camp locations.

The assessment of potential noise effects to workers at the two camp locations considered both the measured baseline data gathered and the computer models developed for the Project EA, including the models representing:

- Construction and Operations phases of the Project;
- construction and operation of Fission Patterson Lake South Property, an RFD located southwest of the Project; and
- aircraft arrivals and departures at the Project and Fission Patterson Lake South Property airstrips.

Consistent with the Project EA, potential noise effects from sources that generally operate continuously were assessed separately from potential noise effects from the Project and Fission Patterson Lake South Property

airstrips, which would emit noise periodically when aircraft are arriving or departing but would be effectively nonexistent at other times.

Table 4-7 presents baseline noise levels, predicted noise levels from Project Construction and Operations phases, and predicted noise levels from Fission Patterson Lake South Property construction and operation phases for both the EIS camp location and the new camp location. Table 4-8 presents the Application Case cumulative noise levels and RFD Case cumulative noise levels for both the EIS camp location and the new camp location. Table 4-7 and Table 4-8 present noise levels outdoors (i.e., along the façade of the camp buildings).

Table 4-7: Predicted Noise Levels at the New Camp Location and the EIS Camp Location – Outdoors

Camp Location	Baseline Noise Level [dBA]		Project Noise Level ^(a) [dBA]		Fission Noise Level ^(a) [dBA]	
	Daytime	Nighttime	Construction	Operations	Construction	Operations
EIS camp location	30	21	64.4	65.5	31.0	31.2
New camp location	30	21	47.7	45.7	30.6	30.7

a) Activities at the Project and Fission Patterson Lake South Property are assumed to be continuous (i.e., 24 hours per day). As such, separate predictions are not required for the daytime period and nighttime period.

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

Table 4-8: Predicted Cumulative Noise Levels at the New Camp Location and the EIS Camp Location – Outdoors

Camp Location	Application Case Cumulative Noise Level: Baseline + Project [dBA]				RFD Case Cumulative Noise Level: Baseline + Project + Fission [dBA]			
	Construction		Operations		Construction		Operations	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
EIS camp location	64.4	64.4	65.5	65.5	64.4	64.4	65.5	65.5
New camp location	47.8	47.7	45.8	45.7	47.9	47.8	45.9	45.8

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

The results presented in Table 4-8 show that cumulative outdoor noise levels at the new camp location are predicted to be at least 15 A-weighted decibel (dBA) less than outdoor noise levels at the EIS camp location. In other words, noise levels at the new camp location are expected to be substantially quieter than noise levels at the EIS camp location.

To assess potential noise effects to workers residing at the on-site camp during non-working hours or a camp worker, outdoor noise levels from Table 4-8 were converted into corresponding indoor noise levels. Rooms in the new camp location would be equipped with either an HVAC unit or larger HVAC system, which would allow workers to keep windows closed year-round while maintaining comfortable temperatures. Health Canada (2023) guidance indicates that fully closed windows can be assumed to reduce outdoor noise levels by 27 dBA. Therefore, outdoor noise levels from Table 4-8 were converted to indoor noise levels by subtracting 27 dBA. Table 4-9 presents indoor Application Case and RFD Case cumulative noise levels.

Table 4-9: Predicted Cumulative Noise Levels at the New Camp Location and the EIS Camp Location – Indoors

Camp Location	Application Case Cumulative Noise Level: Baseline + Project [dBA]				RFD Case Cumulative Noise Level: Baseline + Project + Fission [dBA]			
	Construction		Operations		Construction		Operations	
	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime
EIS camp location	37.4	37.4	38.5	38.5	37.4	37.4	38.5	38.5
New camp location	20.8	20.7	18.8	18.7	20.9	20.8	18.9	18.8

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

The results presented in Table 4-9 show that indoor noise levels are predicted to be less than 30 dBA at the new camp location. To protect against sleep disturbance, Health Canada (2023) indicates that continuous/steady-state indoor noise levels should not exceed 30 dBA during the sleeping period. Workers at the camp may be sleeping at any time of day (e.g., workers on nightshift may sleep during the daytime period), so the 30 dBA sleep disturbance threshold (Health Canada 2023) was interpreted as applying to both daytime and nighttime noise levels. As indoor noise levels would be below 30 dBA, no sleep disturbance effect is predicted at the new camp location and no additional mitigation measures are currently required.

Consistent with the Project EA, noise modelling for the Project and Fission Patterson Lake South Property airstrips considered maximum noise levels experienced during aircraft arrival and departures activities, along with the number of arrival/departure activities during periods when workers may be sleeping. To protect against sleep disturbance from transient/intermittent activities, Health Canada (2023) indicates that maximum indoor noise levels should not exceed 45 dBA more than 10 to 15 times per sleeping period. Because workers may be sleeping at the camp at any time of day, the analysis that follows assumes that sleep disturbance may result if maximum indoor noise levels exceed 45 dBA more than 10 to 15 times per 24-hour period.

Table 4-10 presents maximum outdoor noise levels (i.e., along the façade of the camp buildings) at each camp location during an average 24-hour period of arrival and departure activities at the Project and Fission Patterson Lake South Property airstrips. Similarly, Table 4-11 presents maximum indoor noise levels during an average 24-hour period of arrival and departure activities at the Project and Fission Patterson Lake South Property airstrips. Consistent with Health Canada (2023), the indoor noise levels in Table 4-11 were calculated by subtracting 27 dBA from the outdoor noise levels presented in Table 4-10 under the assumption that camp windows would be closed year-round.

Table 4-10: Predicted Airstrip Noise Levels – Outdoors

Camp Location	Maximum Airstrip Noise Level – Outdoors [dBA]			
	Project Construction	Project Operations	Fission Construction	Fission Operations
EIS camp location	56	56	<40	<40
New camp location	66	66	<40	<40

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement; < = less than.

Table 4-11: Predicted Airstrip Noise Levels – Indoors

Camp Location	Maximum Airstrip Noise Level – Indoors [dBA]			
	Project Construction	Project Operations	Fission Construction	Fission Operations
EIS camp location	29	29	<13	<13
New camp location	39	39	<13	<13

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement; < = less than.

The results in Table 4-11 show that the maximum indoor noise level at the EIS camp location is predicted to be 29 dBA, and the maximum indoor noise level at the new camp location is predicted to be 39 dBA.

Table 4-12 shows the average number of times per 24-hour period that maximum indoor noise levels are expected to exceed 45 dBA. As noted in Table 4-12, there are not expected to be any exceedances of the 45 dBA noise threshold indoors during an average 24-hour period at both the EIS camp location and the new camp location. Therefore, no sleep disturbance effect is predicted from airstrip activities at either camp location.

Table 4-12: Predicted Number of Threshold Exceedances for Airstrip Noise Levels - Indoors

Camp Location	Average Number of Times Maximum Indoor Noise Levels Exceed 45 dBA Threshold Per 24-Hour Period					
	Project Airstrip		Fission Airstrip		Total: Project + Fission	
	Construction	Operations	Construction	Operations	Construction	Operations
EIS camp location	0	0	0	0	0	0
New camp location	0	0	0	0	0	0

dBA = A-weighted decibel; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

In summary, noise levels at the new camp location are expected to be acceptable with respect to outdoor noise, indoor noise, and prevention of unacceptable levels of sleep disturbance. However, if monitoring were to show that unacceptable levels of noise were present at the camp, the Project would implement any necessary additional mitigation measures to meet the requirements of Section 8-2 of The Occupational Health and Safety Regulations (2020).

4.2.1.3 Light

The light assessment included with the Project EIS focused on potential effects to human receptors in the environment surrounding the Project. The Project EA did not consider potential light effects to the on-site worker camp (i.e., the EIS camp was not a receptor in the Project EA) since these effects are addressed in the context of OHS requirements. However, in response to Condition 10 of the Notice of Decision, NexGen has compared the EIS camp location and new camp location with respect to potential light effects.

Consistent with the Project EIS, potential light effects were assessed in terms of light trespass and sky glow. Light trespass refers to illumination from luminaires (i.e., outdoor light fixtures) shining directly onto a receptor. Sky glow refers to stray light scattering in the atmosphere, brightening the night sky, and conditions that make it harder to see stars. Both light trespass and sky glow are nighttime phenomena. During the daytime period, the presence of the sun in the sky dominates any potential effects from anthropogenic light sources. Therefore, all the results presented are for nighttime conditions, even though workers may be sleeping at any time of day.

4.2.1.3.1 Light Trespass

When assessing light trespass, NexGen applied an illumination target of 10,000 millilux (mlux) for general areas adjacent to buildings (EIS TSD XI, Light Effects Analysis Report, Section 2.5.1) and this target applies to areas

immediately adjacent to the camp. The luminaires required to achieve this illumination target are the most important source of light trespass at both camp locations.

The assessment of potential light effects to the two camp locations considered both the measured baseline data gathered and the computer models developed for the Project EA, including models representing Project Construction and Operations phases and Fission Patterson Lake South Property construction and operations phases.

Table 4-13 presents baseline light trespass levels, predicted light trespass levels from the Project, and predicted light trespass levels from Fission Patterson Lake South Property. Table 4-14 presents Application Case light trespass levels and RFD Case light trespass levels.

Table 4-13: Baseline, Project, and Fission Patterson Lake South Property Light Trespass Levels

Camp Location	Baseline Light Trespass [mlux]	Project Light Trespass [mlux]			Fission Light Trespass	
		Camp Luminaires	Other Construction Luminaires	Other Operations Luminaires	Construction	Operations
EIS camp location	4	10,000	0	0	0	0
New camp location	4	10,000	0	0	0	0

mlux = millilux, 0.001 lumens per square metre; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

Table 4-14: Cumulative Light Trespass Levels

Camp Location	Application Case Cumulative Light Trespass Level: Baseline + Project [mlux]		RFD Case Cumulative Light Trespass Level: Baseline + Project + Fission [mlux]	
	Construction	Operations	Construction	Operations
EIS camp location	10,004	10,004	10,004	10,004
New camp location	10,004	10,004	10,004	10,004

mlux = millilux, 0.001 lumens per square metre; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

Results presented in Table 4-13 and Table 4-14 show that the EIS camp location and the new camp location have identical light trespass levels. Windows in camp bedrooms would be equipped with blackout curtains to block light from outdoor sources. Use of blackout curtains would be sufficient to mitigate any light trespass effects at either camp location; therefore, no additional mitigation measures are proposed at this time. However, if monitoring were to show that unacceptable levels of light were present in new camp location bedrooms or other areas where light sensitivity should be considered, the Project would implement any necessary additional mitigation measures to meet the requirements of Section 6-6 of The Occupational Health and Safety Regulations (2020).

4.2.1.3.2 Sky Glow

Sky glow is characterized in terms of sky quality, which represents the quality of the sky for stargazing. Sky quality is expressed in units of magnitude per square second of arc (mag/arcsec²). The larger the sky quality value, the less sky glow, and the better conditions are for observing stars. For example, a sky quality value of 20.9 mag/arcsec² means much less sky glow than a sky quality value of 17.5 mag/arcsec². For context, the Institution of Light Professionals (ILP 2020) recommends a sky glow threshold of 15 mag/arcsec² for “sparsely

inhabited rural areas”; the ILP does not provide thresholds for “well inhabited rural or urban settlements” or for “town and city centres and other commercial areas”, since these types of environments are inherently unsuitable for stargazing.

Baseline sky glow levels represent conditions that would exist without the influence of industrial development. The assessment of potential sky glow effects at the two camp locations also considered the computer models developed for the Project EIS, including models representing Project Construction and Operations phases and Fission Patterson Lake South Property construction and operations phases.

Table 4-15 presents baseline sky glow levels, predicted sky glow levels from the Project, and predicted sky glow levels from Fission Patterson Lake South Property. Table 4-16 presents Application Case sky glow levels and RFD Case sky glow levels.

Table 4-15: Predicted Sky Glow Levels

Camp Location	Baseline Sky Glow [mag/arcsec ²]	Project Sky Glow [mag/arcsec ²]		Fission Sky Glow [mag/arcsec ²]	
		Construction	Operations	Construction	Operations
EIS camp location	20.1	17.5	17.5	20.3	20.3
New camp location	20.1	18.0	17.9	20.3	20.3

mag/arcsec² = magnitude per square second of arc; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

Table 4-16: Cumulative Sky Glow Levels

Camp Location	Application Case Cumulative Sky Glow Level: Baseline + Project [mag/arcsec ²]		RFD Case Cumulative Sky Glow Level: Baseline + Project + Fission [mag/arcsec ²]	
	Construction	Operations	Construction	Operations
EIS camp location	17.4	17.4	17.3	17.3
New camp location	17.8	17.8	17.7	17.7

mag/arcsec² = magnitude per square second of arc; Fission = Fission Patterson Lake South Property; EIS = Environmental Impact Statement.

The results presented in Table 4-16 show that sky glow levels are predicted to be lower at the new camp location than at the EIS camp location, with sky quality values at the new camp location being 0.4 mag/arcsec² greater than sky quality values at the EIS camp location. Both the EIS camp location and new camp location would be representative of a sparsely inhabited rural area.

4.2.1.4 Conclusions

In alignment with the requirements outlined in Condition 10 of the Notice of Decision, potential effects to workers at the Project camp were evaluated for air quality (including dust), noise, and light.

All predicted concentrations of Project CACs at the new camp location are predicted to be below the air quality screening values (Section 4.2.1.1), indicating that no health effects are anticipated to workers at the new camp location.

Outdoor noise levels at the new camp location are generally expected to be substantially quieter than the EIS camp location. In addition, the continuous/steady-state and periodic indoor noise levels at the new camp location are expected to be below the 30 dBA and 45 dBA sleep disturbance thresholds (Health Canada 2023),

respectively, for these types of noise; therefore, no sleep disturbance effects are predicted at the new camp location from the Project or from airstrip activities.

The EIS camp location and the new camp location are identical in results with respect to light trespass. Windows in camp bedrooms would be equipped with blackout curtains to block light from outdoor sources. Use of blackout curtains would be sufficient to mitigate any light trespass effects at both camp locations. In addition, sky glow levels are predicted to be lower at the new camp location than at the EIS camp location.

4.2.2 Accidents and Malfunctions

Within the Project EIS, an assessment of accidents and malfunctions was undertaken that identified the potential Project-associated hazards that fall outside the range of typical day-to-day events. The objective of this assessment was to evaluate the potential effects on people and the environment resulting from accidents and malfunctions and identify proposed preventative and mitigative measures.

To consider the effects of potential accidents and malfunctions at the new camp location, the scope of the accidents and malfunctions assessment included the reconsideration of the accident and malfunctions assessment completed for the Project EA. This updated accidents and malfunctions assessment is intended to address Condition 10 of the Notice of Decision, where NexGen is required to evaluate potential effects to workers at the camp from accidents and malfunctions, including the identification of upset conditions (e.g., fire, facility/equipment failure, radiological events, spill events), and provide measures to be taken to protect human health and safety in the unlikely event of these upset conditions occurring. Two key steps were undertaken to complete the updated accidents and malfunctions assessment:

1. The original screening assessment completed as part of the hazard identification process (EIS TSD VIII, Accidents and Malfunctions Report, Appendix A) was reconsidered to confirm the results and the identified bounding scenarios that were carried forward for further assessment in the Project EIS.
2. The detailed assessment of designated bounding scenarios was reconsidered to assess whether overall risks to human health and the biophysical environment are different than the risks described in the Project EIS.

A summary of the accidents and malfunctions assessment presented in the Project EIS is included in Section 4.2.2.1 to provide context for the new camp location assessment, which is presented in Section 4.2.2.2. The risk prevention and mitigation measures that would be implemented through NexGen's health, safety, environmental, and quality policies, practices, and procedures are presented in Section 4.2.2.3.

4.2.2.1 *Summary of the Environmental Impact Statement Accidents and Malfunctions Assessment*

Environmental Impact Statement Section 21 assessed the accidents and malfunctions for potential Project-related accidents and malfunctions that could occur during any phase of the Project as well as transportation-related accidents along the Project access road to Highway 955. The accidents and malfunctions assessment provided a framework for quantifying the risks associated with identified hazards. The five basic steps in the process of risk assessment for the accidents and malfunctions assessment included (EIS TSD VIII):

1. **Hazard identification:** The identification of physical situations with the potential for harming human health or the biophysical environment. Hazard scenarios were identified using a systematic approach with consideration of the existence of sources of hazards and initiating events for each Project component and

activity. Scenarios were identified for several potential events, such as releases of chemical and radiological constituents, fires, and explosions.

2. **Bounding scenarios:** The identified hazard scenarios were then screened qualitatively for the perceived effects and probability of occurrence as well as the potential risk using a risk matrix approach. Project information, experience from similar projects, particularly projects located in Northern Saskatchewan, and professional judgment were used for this initial screening. Among the high or moderate-risk scenarios, bounding scenarios were selected. The bounding scenarios encompass the effects of other scenarios screened for each Project component and activity. The subsequent analysis focused on these bounding scenarios.
3. **Probability analysis:** The estimation of the probability of occurrence of the selected bounding scenario occurring within a specific time period, or in specified circumstances.
4. **Effects analysis:** Quantitative evaluation of the potential effects of a selected bounding scenario to the human health or biophysical environment.
5. **Risk estimation and ranking:** The estimation of the effect of a scenario and the probability with which it is likely to occur; that is, risk is the product of effect and probability (i.e., risk = consequence × probability of occurrence).

The methods for completing each of these five steps are summarized in Section 4.2.2.1.1 through Section 4.2.2.1.5.

4.2.2.1.1 Hazard Identification

The hazard identification process is a systematic approach to identify possible hazards associated with all physical system components and activities in a work process. A hazard can be defined as a physical event or condition that has the potential for causing damage to people, property, or the environment (e.g., fire, explosion, release of chemicals, radioactivity).

The hazard identification evaluation identified a comprehensive list of potential Project-related accident and malfunction scenarios. These scenarios were initially screened as to the potential risks based on the likelihood of the events and the potential consequence of the events. Based on the initial screening results, a number of high- or moderate-risk scenarios were selected as bounding scenarios (Section 4.2.2.1.2). These bounding scenarios were carried forward for more detailed risk assessment.

On a scale of increasing likelihood, scenarios were categorized as highly unlikely, unlikely, likely, very likely, and almost certain as shown in Table 4-17.

Table 4-17: Likelihood Index

Rating	Likelihood	Description
1	Highly unlikely	<1 occurrence in 1,000 years
2	Unlikely	≤1 occurrence in 100 years and >1 occurrence in 1,000 years
3	Likely	≤1 occurrence in 10 years and >1 occurrence in 100 years
4	Very likely	≤1 occurrence in 1 year and >1 occurrence in 10 years
5	Almost certain	>1 occurrence in 1 year

< = less than; ≤ = less than or equal to; > = greater than.

On a scale of increasing consequence, scenarios were categorized as negligible, minor, moderate, major, and catastrophic as shown in Table 4-18.

Table 4-18: Consequence Index

Rating	Consequence	Description
1	Negligible	No measurable biophysical environmental effects, or medical treatment not required
2	Minor	Short-term (i.e., less than one month in duration) minor effect on small area, or minor first aid injuries with no lost time
3	Moderate	Reversible or repairable (i.e., less than one year in duration) effect off site, or reversible injuries with lost time
4	Major	Extended-range, long-term (i.e., between 1 and 10 years in duration) effect off site, or severe injuries with long-lasting effects and/or disability
5	Catastrophic	Long-lasting (i.e., more than 10 years) or irreversible environmental effects, fatalities, or multiple disabilities

A total of 93 hazard scenarios were identified and evaluated via a screening process that considered both likelihood and consequence to characterize the overall risk (i.e., low, moderate, or high) of each individual scenario according to the matrix shown in Table 4-19.

Table 4-19: Hazard Analysis Risk Matrix

Likelihood		Consequence				
		1	2	3	4	5
		Negligible	Minor	Moderate	Major	Catastrophic
5	Almost certain	Low	Moderate	Moderate	High	High
4	Very likely	Low	Low	Moderate	High	High
3	Likely	Low	Low	Moderate	Moderate	High
2	Unlikely	Low	Low	Low	Moderate	High
1	Highly unlikely	Low	Low	Low	Moderate	Moderate

For the purposes of the accidents and malfunctions assessment, risks were identified as being low where the screening evaluation considered the risk as generally being acceptable, as the likelihood of these scenarios could be effectively managed through application of planned controls and/or the consequence of the effect would not be significant. Low-risk scenarios have a likelihood ranging from highly unlikely to almost certain and a consequence ranging from negligible to moderate.

Risks were identified as being moderate where the screening evaluation considered the risk as generally being tolerable. In some cases, a moderate-risk scenario can encompass the risk of several screened scenarios for each effect category (e.g., toxic release, fire). In these cases, a moderate-risk scenario can be carried forward as a bounding scenario for more detailed analysis. Moderate-risk scenarios have a likelihood ranging from highly unlikely to almost certain and a consequence ranging from minor to catastrophic. In many cases, risk-reduction activities would reduce the risk associated with these scenarios to as low as reasonably practicable (ALARP); under this condition, the risk may be characterized as tolerable.

Risks were identified as being high where the screening evaluation considered the risk as generally being unacceptable. High-risk scenarios have a likelihood ranging from unlikely to almost certain and a consequence ranging from major to catastrophic. As the evaluation of the risk at this hazard identification stage was qualitative

and subject to some uncertainty, the hazard scenarios identified as high risk were advanced for further detailed assessment so that a more detailed evaluation of risk and potential management activities could be considered.

Of the 93 hazard scenarios identified and evaluated, 55 were characterized as low-risk scenarios, 33 were characterized as moderate-risk scenarios, and 5 were characterized as high-risk scenarios. Of the original 93 scenarios, a total of 6 scenarios were carried forward as bounding scenarios for further detailed assessment.

4.2.2.1.2 Bounding Scenarios

Following the hazard identification screening process, six hazard scenarios were selected as bounding scenarios for more detailed risk analysis (Table 4-20). A bounding scenario is used to represent an event in which its potential effects are considered to represent effects associated with other accident and malfunction scenarios; or, alternatively, the potential effects of scenarios that are bounded by another scenario are expected to fit within the envelope of the effects associated with the bounding scenario. Utilizing the bounding scenario approach avoids duplication in the evaluation process while confirming the evaluation is completed in a conservative manner.

Table 4-20: Bounding Scenarios Identified for Further Assessment by the Hazard Identification Process

No.	Accident or Malfunction Scenario	Location	Effect Pathway	Interactions with the Environment
1	Traffic accident (uranium concentrate)	Access road at bridge crossing	Aquatic release of uranium concentrate	Affects the water quality, sediment quality, terrestrial and aquatic biota, and members of the public
2	Traffic accident (chemical)	Access road at bridge crossing	Aquatic release of fuel, hazardous chemicals	Affects the water quality, sediment quality, terrestrial and aquatic biota, and members of the public
3	Solvent extraction fire or explosion	Solvent extraction building	Atmospheric release of uranium concentrate (chemical toxicity)	Affects the air quality and members of the public
4	Tailings transfer pipe or pump failure	Tailings release to surface within secondary containment	Terrestrial release of radioactivity	Affects the soil and potentially groundwater and terrestrial biota
5	Untreated effluent transfer pipe failure	Effluent treatment system	Terrestrial release of radioactivity	Affects the soil and potentially groundwater and terrestrial biota
6	Acid plant tail gas scrubber failure	Acid plant	Atmospheric release of sulphur dioxide	Affects air quality and members of the public

Notes: **high risk**; **moderate risk**.

Effect Pathway describes nature of the event and exposure media, and therefore the nature of the assessment of effects.

4.2.2.1.3 Probability Analysis

The detailed assessment of the bounding scenarios required the quantification of the probability of the effects. The estimation of the probability requires the identification of the probability of the initiating events leading to the hazard scenario and the conditional probability of any of the associated events within the casual event chain.

Commonly, the probability estimation relies on the statistics collected by various government and non-government agencies for similar processes. These include:

- Transportation-related scenario probabilities estimated based on the transportation accident statistics available by various government agencies.

- Equipment and structural failures and incidents based on the industry experience and failure rates available from various organizations.

In some cases, there is not enough historical information to support a statistically meaningful evaluation of the probability. Under these circumstances, the probabilities were reported as less than a specific value. For example, the probability of the mechanical failure of a structure is reported as less than 0.01 if the life span of the structure is 100 years and no historical information is available for mechanical failure of similar structures. In many cases, an assessor’s experience and professional judgment are used in the probability evaluation.

The quantification of probabilities considered the prevention measures that would be implemented through NexGen’s health, safety, environmental, and quality policies, practices, and procedures (Section 4.2.2.3).

4.2.2.1.4 Effects Analysis

The detailed accidents and malfunctions assessment in EIS TSD VIII included the quantification of the potential effects of each of the bounding scenarios on human health and the biophysical environment. The quantification of effects included the assessment of the fate and transport of a chemical or radiological release and associated exposures related to the scenario. The quantification of effects also included the characterization of the airborne source terms where potential exists for the release of radioactivity or hazardous materials to the environment.

The quantification of potential effects also considered the risk prevention and mitigation measures that would be implemented through NexGen’s health, safety, environmental, and quality policies, practices, and procedures (Section 4.2.2.3). This approach provided a more in-depth, quantitative, and representative characterization of the scenario risks beyond the estimation of the risk in the hazard identification process, which was preliminary and completed at the screening level using primarily qualitative methods.

4.2.2.1.5 Risk Estimation and Ranking

The risk estimation for the bounding scenarios was performed by ranking the results of the assessment for likelihood (Table 4-18) and consequence (Table 4-19) on the risk matrix presented in Table 4-20. The analysis considered both probability and potential effects to determine the overall level of risk. The risk assessment results of this more detailed ranking review indicate that the risks of the six selected bounding scenarios were low to moderate (Table 4-21); these results represent a tolerable level of risk in consideration of proposed safeguards and design features that reduce the risk level to ALARP (EIS Section 21.6, Assessment of Accidents and Malfunctions).

Table 4-21: Risk Level Determination for Bounding Scenarios Considered in the Assessment of Accidents and Malfunctions

Bounding Scenario		Likelihood	Consequence	Risk Level	
1	Traffic accident (uranium concentrate and radioactivity)	Highly unlikely	Moderate	Low	
2	Traffic accident (chemical)	Highly unlikely	Moderate	Low	
3	Solvent extraction fire or explosion	Unlikely	Minor to moderate	Low	
4	Tailings transfer pipe or pump failure	Likely	Minor	Low	
5	Untreated effluent transfer pipe failure	Likely	Minor	Low	
6	Acid plant tail gas scrubber failure	Likely	Minor to moderate	Low	Moderate

4.2.2.2 ***Consideration of the New Camp Location***

For the assessment of accidents and malfunctions in relation to the new camp location, NexGen reconsidered the 93 hazard scenarios identified in Appendix A of EIS TSD VIII to determine if these hazard scenarios and the 6 bounding scenarios assessed (Table 4-20; Table 4-21) represented the appropriate scenarios that should be considered in relation to workers at the new camp location. The re-evaluation confirmed that the 93 hazard scenarios and 6 bounding scenarios remained the most applicable potential accidents and malfunctions as most of the identified hazard scenarios are associated with mining and processing activities and would not change as a result of the camp relocation (i.e., the risks associated with these hazard scenarios are unrelated to the camp location). Therefore, the 6 bounding scenarios selected in the Project EIS were determined to suitably represent the identified hazard scenarios in consideration of the new camp location.

Following confirmation that the appropriate bounding scenarios had been identified, a screening analysis was completed that considered their applicability to workers at the new camp location to determine if the new location could result in potential changes to the risk characterization. Where potential changes could exist, the bounding scenario was reassessed. Where it was determined that the risk would not change, no additional analysis was completed. A summary of the bounding scenario screening process in consideration of workers at the new camp location is presented in Table 4-22. Based on the screening analysis, two of six bounding scenarios were reassessed for the new camp location (i.e., Bounding Scenario 3 and Bounding Scenario 6); these two scenarios are discussed in Section 4.2.2.2.1 and Section 4.2.2.2.2, respectively. A summary of the new camp location accidents and malfunctions assessment and conclusions is provided in Section 4.2.2.3.

Table 4-22: Summary of EIS Accident and Malfunction Bounding Scenario Assessment in Consideration of the New Camp Location

Environmental Assessment Results							Consideration of the New Camp Location
No.	Accident or Malfunction Bounding Scenario	Scenario Description	Location	Probability	Estimated Effects Consequence	Overall Risk Level	
1	Traffic accident (uranium concentrate)	Bounding Scenario 1 comprised the release of uranium concentrate into the Clearwater River under the bridge along the Project access road. This scenario was envisioned to occur due to a traffic accident, collision, or rollover at that location. It was postulated that approximately 25% of a shipment (5,625 kg) would be released, most of which (95%) is believed to be recoverable through emergency response.	Access road at bridge crossing	Highly unlikely	Moderate	Low	<ul style="list-style-type: none"> The assessment of Bounding Scenario 1 is unaffected by the proposed new camp location as the likelihood of the event is unrelated to the location of the camp. Similarly, consequence is unrelated to the location of the camp as the event is expected to occur downstream of the camp and any workers at the camp are not considered relevant receptors from a human health perspective. The new camp location would not result in change to the overall risk ranking for this scenario; therefore, no further assessment was required.
2	Traffic accident (chemical)	Bounding Scenario 2 comprised the release of fuel / hazardous chemicals (i.e., diesel, gasoline, organic solvents, liquefied natural gas, hydrogen peroxide, or molten sulphur) into the Clearwater River under the bridge along the Project access road. This scenario was envisioned to occur due to a traffic accident, collision, or rollover at that location. For reference purposes, a release of diesel was characterized to represent this scenario as diesel was regarded to have the greatest likelihood and severity in terms of potential adverse effects on aquatic and semi-aquatic biota. It was postulated that approximately 30 m ³ of diesel would be released. Exposure to human and ecological receptors was evaluated.	Access road at bridge crossing	Highly unlikely	Moderate	Low	<ul style="list-style-type: none"> The assessment of Bounding Scenario 2 is unaffected by the proposed new camp location as the likelihood of the event is unrelated to the location of the camp. Similarly, consequence is unrelated to the location of the camp as the event is expected to occur downstream of the camp and any camp workers are not considered relevant receptors from a human health perspective. The new camp location would not result in change to the overall risk ranking for this scenario; therefore, no further assessment was required.
3	Solvent extraction fire or explosion	Bounding Scenario 3 involved a fire / explosion in the processing plant and release of uranium concentrate to the environment. It was postulated that such an event could occur due to damage to the equipment or vessels containing uranium-bearing solutions due to human error or equipment failure. Both an indoor fire in the solvent extraction building and an unconfined fire were assessed. To estimate the consequence of the potential effects associated with Bounding Scenario 3, the ALOHA model was used. Modeled concentrations of uranium in air were compared to Emergency Response Planning Guidelines that are used as a planning tool to help predict adverse human health effects caused by chemical exposure.	Solvent extraction building	Unlikely	Minor to Moderate	Low	<ul style="list-style-type: none"> This scenario is relevant to the new camp location. The consequence of the scenario was originally assessed from a human health perspective in consideration of exposure resulting from the air release with the fire / explosion. The level of exposure to the uranium released by the event for a given receptor is a function of the distance to the release source. Since the new camp location is at a greater distance from the release source, the exposure (i.e., consequence of the event) can be reconsidered to assess the predicted effects to workers at the new camp location. This assessment is presented in Section 4.2.2.2.1.
4	Tailings transfer pipe or pump failure	Bounding Scenario 4 comprised the release of tailings from pump and pipes at the surface. This scenario was envisioned to occur within the processing plant, within the mine underground workings, or at surface near but not within the process plant. The latter scenario was evaluated since it has the potential to result in the greatest environmental consequence. It was postulated that a major release from the piping system would occur over a 15-minute period, after which the leak area would be isolated, thereby ending the release. The potential effects on soil, groundwater, and surface water were considered.	Tailings release to surface within secondary containment	Likely	Minor to Moderate	Low / Moderate	<ul style="list-style-type: none"> The assessment of Bounding Scenario 4 is unaffected by the proposed new camp location as the likelihood of the event is unrelated to the location of the camp. Similarly, consequence is unrelated to the location of the camp as the event is expected to occur such that there would be no direct exposure of the release to workers within the camp. The new camp location would not result in change to the overall risk ranking for this scenario; therefore, no further assessment was required.
5	Untreated effluent transfer pipe failure	Bounding Scenario 5 comprised the release of untreated effluent from the piping system connecting the first stage reactor tanks, first stage clarifier, second stage reactor tanks, and the effluent treatment system. The catastrophic failure of the transfer pipe at the surface was evaluated since it represents a release outside of the containment provided by a building. It was postulated that a major release from the piping system would occur over a 15-minute period, after which the leak area would be isolated, thereby ending the release. The potential effects on soil, groundwater, and surface water were considered.	Effluent treatment system	Likely	Minor	Low	<ul style="list-style-type: none"> The assessment of Bounding Scenario 5 is unaffected by the proposed new camp location as the likelihood of the event is unrelated to the location of the camp. Similarly, consequence is unrelated to the location of the camp as the event is expected to occur such that there would be no direct exposure of the release to workers within the camp. The new camp location would not result in change to the overall risk ranking for this scenario; therefore, no further assessment was required.
6	Acid plant tail gas scrubber failure	Bounding Scenario 6 involved a failure of the tail gas scrubber in the acid plant and release of tail gas containing sulphur dioxide to the atmosphere before scrubbing. To estimate the consequence of the potential effects associated with Bounding Scenario 6, the ALOHA model was used. Modeled concentrations of sulphur dioxide in air were compared to Emergency Response Planning Guidelines that are used as a planning tool to help anticipate adverse human health effects caused by chemical exposure.	Acid plant	Likely	Minor to Moderate	Low / Moderate	<ul style="list-style-type: none"> This scenario is relevant to the new camp location. The consequence of the scenario was originally assessed in consideration of exposure of a camp inhabitant resulting from the air release with the failure of the tail gas scrubber. The level of exposure to the sulphur dioxide released by the event for a camp worker is a function of the distance to the release source. Since the new location is at a greater distance from the release source, the exposure (i.e., consequence of the event) can be reconsidered to assess the predicted effects to workers at the new camp location. This assessment is presented in Section 4.2.2.2.2.

ALOHA = Areal Locations of Hazardous Atmospheres.

4.2.2.2.1 Reassessment of Bounding Scenario 3 – Solvent Extraction Fire or Explosion

The following subsections provide a reassessment of Bounding Scenario 3 (solvent extraction fire or explosion) in consideration of the new camp location.

4.2.2.2.1.1 Updated Scenario Description

This bounding scenario is unchanged from the Project EIS and is associated with damage to equipment or vessels containing uranium-bearing solutions in the solvent extraction building, resulting in a fire that could release a large amount of uranium to the atmosphere. A fire could occur following a spill and exposure of spilled solvent to an ignition source, which could then spread to other process plant areas if not extinguished rapidly. The accumulated organic vapour could also form an explosive vapour cloud.

This scenario could occur under two separate situations: an indoor fire in the solvent extraction building, and an unconfined fire.

4.2.2.2.1.2 Release Characterization

The release characterization is unchanged relative to the release characterization presented in the Project EIS. This information is summarized below for completeness.

The quantification of solvent release followed the widely accepted methods proposed by the United States Department of Energy (USDOE) to estimate airborne source terms (USDOE 1994). According to the USDOE, the airborne source term is typically estimated by the following five-component linear equation:

$$\text{airborne source term (kg/lb or kg/lb/s)} = \text{MAR (kg/lb or kg/lb/s)} \times \text{DR} \times \text{ARF} \times \text{RF} \times \text{LPF}$$

where:

MAR = Material at risk is the amount of chemical or radionuclide available to be acted on by a given physical stress. For facilities, processes, and activities, the MAR is a value representing some maximum quantity of chemical present or reasonably anticipated for the process or structure being analyzed.

DR = Damage ratio is the fraction of the MAR affected by the initiating event(s) (i.e., accident-generated conditions). The DR is estimated based on engineering analysis of the response of structural materials and materials of construction for containment to the type and level of stress or force generated by the event. These estimates often include a degree of conservatism due to simplification of phenomena to obtain a useable model.

ARF = Airborne release fraction, or airborne release rate for continuous release, is the coefficient used to estimate the amount of a chemical released or suspended in air as an aerosol or gas and thus available for transport due to physical stresses from a specific accident.

RF = Respirable fraction is the fraction of airborne chemical particles that can be transported through air and inhaled into the human respiratory system. The RF is commonly assumed to include particles of 10 microns (μm) aerodynamic equivalent diameter or less. Other definitions of “respirable particles” have been presented by various groups at different times, but for the present purposes, 10 μm and smaller particles were considered respirable. For gaseous chemicals, the RF is 1.

LPF = Leak path factor is the fraction of the chemical or radionuclide transported through some confinement deposition or filtration mechanism. There can be many LPFs for some accident conditions

(e.g., fraction transported from the package, such as a shipping container, to the enclosure; fraction leaked from the enclosure to the operating area around the enclosure or room; fraction leaked from the room to the building–atmosphere interface).

Background information on airborne source term parameters for the solvent fire scenario is summarized in Table 4-23, and estimates for each parameter are developed below, as well as the estimated airborne source term value.

Material at Risk (MAR):

The total volume of the uranium-rich solvent which could burn during a fire is 100 m³. The fire is assumed to be unmitigated (i.e., not extinguished). The United States Nuclear Regulatory Commission Fire Dynamics Tools (USNRC 2004) were used to calculate the Fire Duration (T_{FD}) for a liquid pool fire:

$$T_{FD} = 4V/\pi D^2v$$

where:

V = volume of solvent available for burning (i.e., 100,000 L)

D = solvent spill or exposure area diameter; in the worst-case scenario, the entire ground floor area could be involved in a fire (i.e., 20 m by 20 m)

v = regression rate (i.e., liquid pool burning rate) based on solvent properties (USNRC 2004) of 0.05 L/m²/s for the solvent

The theoretical burning rate is $400 \times 0.05 = 20$ L/s and the fire duration was calculated as 83 minutes. The maximum uranium concentration in the loaded solvent is 8 g/L (8 kg/m³) and the density of this solution is approximately 1,500 kg/m³. Therefore, MAR will be calculated as:

$$MAR = 20 \text{ L} \times 8 \text{ g/L} = 160 \text{ g/L} = 0.16 \text{ kg/s}$$

Damage Ratio (DR):

A constant burn rate was assumed with no credit for initial fire build-up time. In practice, the fire duration may be less because the fire would be extinguished as part of the fire response. If it is assumed that the fire would last 1 hour, the DR would be 0.45. Conservatively, the fire duration limit of 1 hour was not considered and the DR was assumed to be 1. Also, the effects of oxygen availability on the burning rate were not considered, which is a conservative assumption because oxygen limitation is often a factor that governs compartment fire behaviour. If oxygen starvation becomes a limiting factor in burning rate (e.g., fire in enclosed or congested areas), the burning rate could be less.

Airbourne Release Fraction (ARF):

The ARF is assumed to be 0.1 based on the ARF data published by USDOE (USDOE 1994).

Respirable Fraction (RF):

It was assumed that all the aerosols produced in the fire are respirable; therefore, the RF = 1 (Table 4-23).

Leak Path Factor (LPF) for confined fire in the building:

During a confined fire in a building, natural or mechanical ventilation would be enhanced by the chimney effect of the fire. The building ventilation rate during a fire can be estimated based on the volume of air drawn into the building to support the fire. The volume of air required to support a burning rate of 20 L/s kerosene is approximately 220 m³/s. Assuming 14 air changes per hour, which is typical of a closed building during fire, maximum air flow through the building is approximately 27 m³/s. This volume of air can only support a burning rate of 2.5 L/s of solvent. The limiting factor in the rate of fire is the availability of oxygen. Thus, the LPF would be 2.5/20 = 0.125.

The airborne source term is calculated as:

$$0.16 \text{ kg/s} \times 1 \times 0.1 \times 1 \times 0.125 = 0.002 \text{ kg/s uranium} = 0.0024 \text{ kg/s (0.005 lb/s) U}_3\text{O}_8$$

Leak Path Factor (LPF) for unconfined fire:

If the building envelope is breached, then the calculations for the previous scenario are still valid; however, the LPF would be 1. Therefore, the source term for this scenario would be 0.016 kg/s uranium or 0.0189 kg/s U₃O₈.

Since the atmospheric benchmarks (i.e., Protective Action Criteria) are defined for 1-hour exposure and the fire can potentially burn for more than an hour, it was conservatively assumed for the airborne source term that the above amount is released in 1 hour.

Table 4-23: Airborne Release Fraction and Respirable Fraction Values for Various Fire Scenarios (Liquid Fire Parameter Values – Summary Values)

Type of Stress	Material	Conditions	Median ARF	Bounding ARF	Median RF	Bounding RF	Comments
Fire	Organic combustible liquids	<ul style="list-style-type: none"> ▪ Quiescent burning ▪ Small surface area or small solvent layer over large pool that burns to self-extinguishment 	6×10^{-03}	1×10^{-02}	1	1	n/a
Fire	Organic combustible liquids	<ul style="list-style-type: none"> ▪ Vigorous boil-off ▪ Large surface area or pool or solvent layer burning over limited aqueous layer with sufficient turbulence to disrupt the bulk of the aqueous layer ▪ Does not burn to complete dryness 	n/a	3×10^{-02}	n/a	1	n/a
Fire	Organic combustible liquids	<ul style="list-style-type: none"> ▪ Vigorous boil-off ▪ Large surface area ▪ Burns to complete dryness or burning solvent over aqueous phase burning to complete dryness for both phases 	1×10^{-02}	1×10^{-01}	1	1	Typically, an external outside heat source
Fire	Organic combustible liquids	<ul style="list-style-type: none"> ▪ Aqueous solution or air-dried salts ▪ Porous absorbing surface (e.g., cracks, pits, soil, sand) 	n/a	5×10^{-03}	n/a	0.4	Based on gasoline fire
Fire	Organic combustible liquids	<ul style="list-style-type: none"> ▪ Aqueous Solution or air-dried salts ▪ Heat conducting surface (e.g., metal) 	n/a	2×10^{-01}	n/a	0.3	Based on gasoline fire

Source: USDOE 1994.

Note: Quiescent burning = relatively undisturbed liquid surface (opposite of vigorous boil-off), while vigorous boil-off = strongly disturbed liquid surface (opposite of quiescent burning).

ARF = airborne release fraction; RF = respirable fraction; n/a = data not provided in original source material.

4.2.2.2.1.3 Assessment of Probability

The probability assessment is unchanged relative to the probability assessment presented in the Project EIS. This information is summarized below for completeness.

The following mitigation measures would be in place to reduce the probability of a release and potential for fire:

- concrete mixer-settler to facilitate visual leak inspection;
- emergency organic dump tanks and fast-acting valves to transfer solvent extraction mixer-settlers in case of fire;
- fire detection systems;
- fire safety plan and firefighting systems;
- regular and preventive inspections, testing, and maintenance programs;
- emergency response plan;
- full containment of process plant building or mixer-settler area; and
- ambient air monitoring.

Uranium-bearing solution would be stored or processed in mixer-settler or storage tanks and transported through piping systems. A spill of these solutions could occur as a result of the following events:

- overflow of storage or process vessels;
- leaks or rupture in storage tanks and process vessels;
- failure of valves or other piping system components;
- failure of the pumps; and
- failure of other process components such as screens and filters.

Average probabilities of failures for different components in the solvent extraction building were based on the information provided by the Center for Chemical Process Safety of the American Institute of Chemical Engineers (AIChE-CCPS 1989) and are shown in Table 4-24.

Table 4-24: Average Failure Probability for Solvent Extraction Process Equipment

Equipment with Potential for a Major Spill or Fire	Failure Rate (All Modes; Per Year)
Vessels (i.e., atmospheric and metallic; assuming 2 major vessels containing uranium reach solvents)	10 ⁻³
Piping (i.e., metal; straight section and connection; assuming 100 sections)	10 ⁻⁴ per item
Pumps (e.g., motor driver and pressure-centrifugal; assuming 5 pumps)	10 ⁻²

Source: Center for Chemical Process Safety of the American Institute of Chemical Engineers (AIChE-CCPS 1989).

If it is assumed that the process plant is in service 350 days per year for 8 hours per day (i.e., 2,800 hours per year), this would result in a failure frequency of 6×10^{-02} per year under this scenario.

$$10^{-3} \times 2 + 10^{-4} \times 100 + 10^{-2} \times 5 = 6 \times 10^{-02} \text{ per year}$$

Less than 10% of the releases would result in a fire (AIChE-CCPS 1989); therefore, the probability of fire would be $6 \times 10^{-02} \times 0.1 = 6 \times 10^{-03}$ per year.

The USNRC reported that the frequency of a major solvent extraction fire occurring at a uranium process plant was in the range of 4×10^{-04} to 1×10^{-02} per year (USNRC 1980). The above calculated value is within the range provided by the USNRC.

According to the likelihood index (Table 4-17), the likelihood (i.e., probability) that this scenario would occur is unlikely.

4.2.2.2.1.4 Assessment of Potential Effects

The modelling that supports the assessment of Bounding Scenario 3 as presented in the Project EIS is unchanged as the original modelling was not orientation-specific; therefore, the original modelling results can be re-interpreted for the new camp location.

To estimate the consequence of the potential effects associated with Bounding Scenario 3, the ALOHA model was used. The ALOHA model is a standalone software application developed and supported by the Emergency Response Division, a division within the National Oceanic and Atmospheric Administration (NOAA) in collaboration with the Office of Emergency Management of the Environmental Protection Agency. The primary purpose of the ALOHA model is to provide estimates of the spatial extent of some common hazards associated with chemical spills or releases to emergency response personnel (NOAA 2013).

A fire that originates in the solvent extraction building and involves loaded solvent could release uranium to the atmosphere. This fire event was assessed through two separate scenarios:

1. a contained, indoor fire in the solvent extraction building; and
2. an unconfined fire.

Although uranium is a radioactive substance, for natural and depleted uranium, the risks from intake of uranium are related to its chemical toxicity, and the potential for such effects is the basis of the assessment for this scenario.

To put the releases into a human health effects context, Emergency Response Planning Guideline (ERPG) values developed by the American Industrial Hygiene Association were used. The ERPGs are intended to be a planning tool to help anticipate human adverse effects on the general public caused by toxic chemical exposure. Three ERPG levels are described:

- **ERPG-1:** The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing effects other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour.
- **ERPG-2:** The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.
- **ERPG-3:** The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

The most commonly used benchmark for emergency release scenarios is ERPG-2. The ERPG-2 and ERPG-3 values for uranium oxide and U_3O_8 are presented in Table 4-25 (USDOE 2016).

Table 4-25: Emergency Response Planning Guidelines for Uranium Oxide and Uranium Concentrate

Chemical	ERPG-2	ERPG-3
Uranium oxide	10 mg/m ³	30 mg/m ³
U ₃ O ₈	10 mg/m ³	50 mg/m ³

Source: USDOE 2016.

ERPG = Emergency Response Planning Guideline; U₃O₈ = uranium concentrate; mg/m³ = milligrams per cubic metre.

Confined Indoor Fire

This scenario assumes that the fire is confined inside the building and that the building envelope remains intact. The fire could involve the loaded solvent directly, such as a fire in the loaded solvent vessels, or from spilled loaded solvent.

The design of the process and the operational procedures minimize the probability of ignition leading to a fire. For example, all switches and motor controls would be explosion proof and designed not to create a source of ignition, and welding would not be permitted in the area except under extremely controlled conditions, including the use of a fire watch during and after the job in accordance with the required work permit. To the extent that the building envelope remains intact after the unlikely initiating event, the building envelope may act as containment for the release scenario.

The airborne source term calculated in Section 4.2.2.2.1.2 was 0.0024 kg/s (2.4 g/s) uranium concentrate, which converts to 2.05 g/s uranium. The air concentration versus distance was calculated and compared with appropriate exposure benchmarks for the following two weather conditions:

- **W1 (worst-case weather conditions):** 95th percentile wind speed and Pasquill stability class F. Stability class F is a stable atmospheric condition that occurs during nighttime, overcast conditions, with a wind speed of less than 2 m/s, typically 1.5 m/s. Thus, a wind speed of 1.5 m/s and stability class F were selected as the worst-case condition for dispersion of released materials (NOAA 2019).
- **W2 (typical weather conditions):** average wind speed and Pasquill stability class D. Stability class D is a neutral atmospheric condition that occurs during slight to moderate daytime solar intensity and thin nighttime overcast conditions, with a wind speed of around 5.0 m/s or slightly higher. This represents the average condition for dispersion of released materials (NOAA 2019). The wind rose in the area of the Project indicates that the most frequent wind speed is approximately 5.0 m/s. Thus, 5.0 m/s was selected as the typical wind speed.

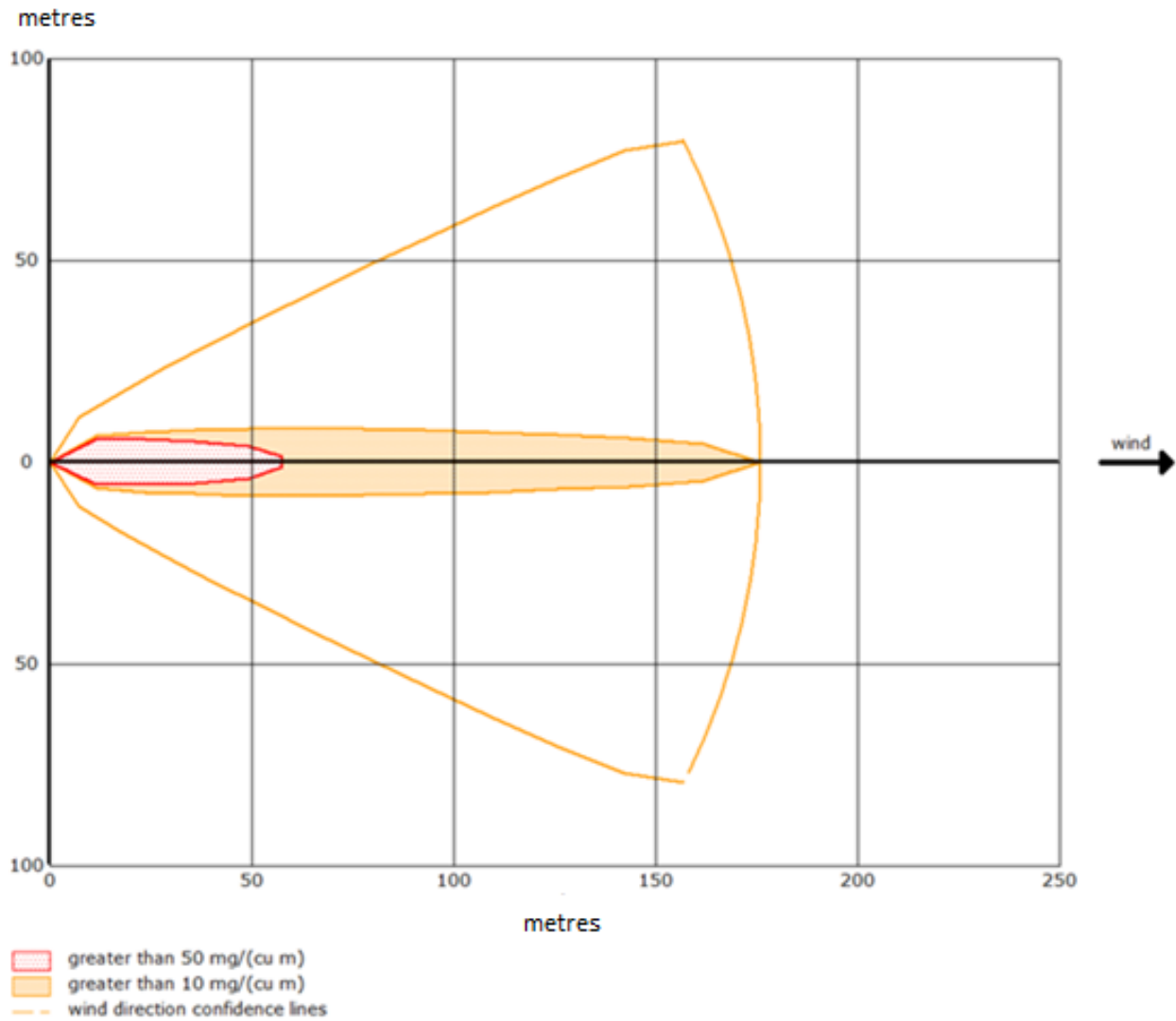
The probability of W1 weather condition is less than 5% of the probability of W2 weather condition. The results of the modelling of uranium concentration in air downwind of the fire are summarized in Table 4-26. Figure 4-1 presents the results for W1 weather condition, and Figure 4-2 presents the results for W2 weather condition.

Table 4-26: Results of Uranium Fire Release Modelling for the Contained, Indoor Fire

Weather Condition	Distance to ERPG-3 [m]	Distance to ERPG-2 [m]
W1	58	176
W2	30	68

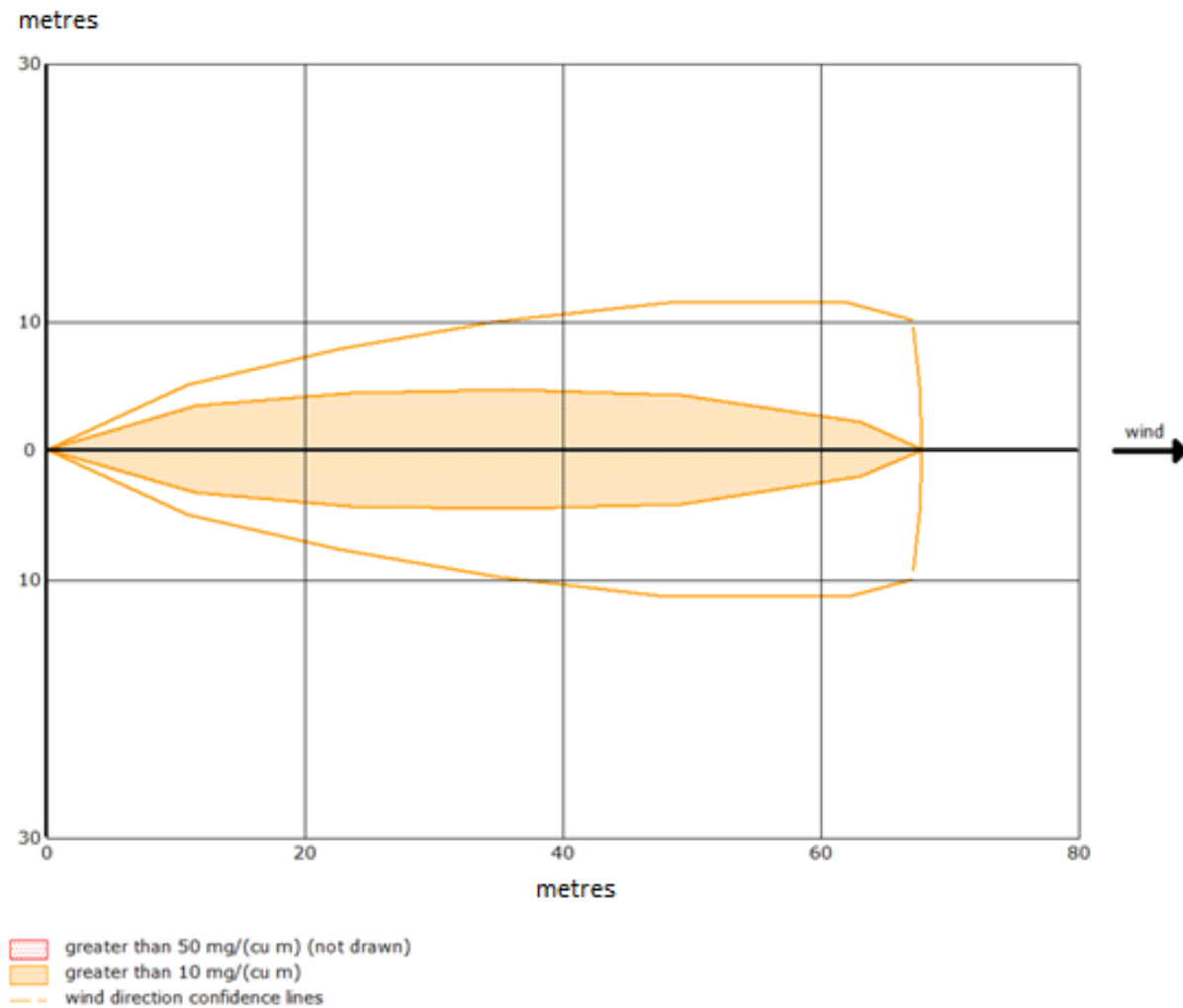
ERPG = Emergency Response Planning Guideline; W1 = worst-case weather conditions; W2 = typical weather conditions; m = metres.

Figure 4-1: Concentration of Uranium in Air for a Confined Indoor Fire for Worst-Case Weather Conditions



Note: The ERPG-2 for uranium concentrate is 10 mg/m³; ERPG-3 for uranium concentrate is 50 mg/m³.
mg/cu m = milligrams per cubic metre; ERPG = Emergency Response Planning Guideline.

Figure 4-2: Concentration of Uranium in Air for a Confined Indoor Fire for Typical Weather Conditions



Note: The ERPG-2 for uranium concentrate is 10 mg/m³; ERPG-3 for uranium concentrate is 50 mg/m³.
 mg/cu m = milligrams per cubic metre; ERPG = Emergency Response Planning Guideline.

The results indicate that the ERPG-2 benchmark of 10 mg/m³ would be reached (i.e., the uranium levels would be below the threshold beyond this distance) at 176 m from the assumed source of the release (i.e., the solvent extraction building) for W1 weather condition, and at 68 m for W2 weather condition, representing the more likely weather condition.

For the assessment completed in EIS Section 21, the consequence of the potential effects of this scenario was rated minor to moderate, with the effect limited to a relatively short distance from the release. This rating was in reference to general exposure levels for people on the mine site. Based on the distance from the event to the new camp location, it is predicted that, due to the greater distance from the source, the worker at the new camp location would be unaffected by the event. Therefore, the consequence rating (Table 4-18) for the confined fire scenario would be negligible.

Unconfined Fire

For an unconfined fire, where it is assumed that the building envelope has been breached, the calculations described for the contained indoor fire remain valid; however, the LPF would be 1 and the release rate would be 18.9 g/s uranium concentrate, which converts to 16 g/s uranium. The air concentrations versus distance were modelled using these release rates for the W1 and W2 weather conditions (Table 4-27) and compared with the benchmarks provided.

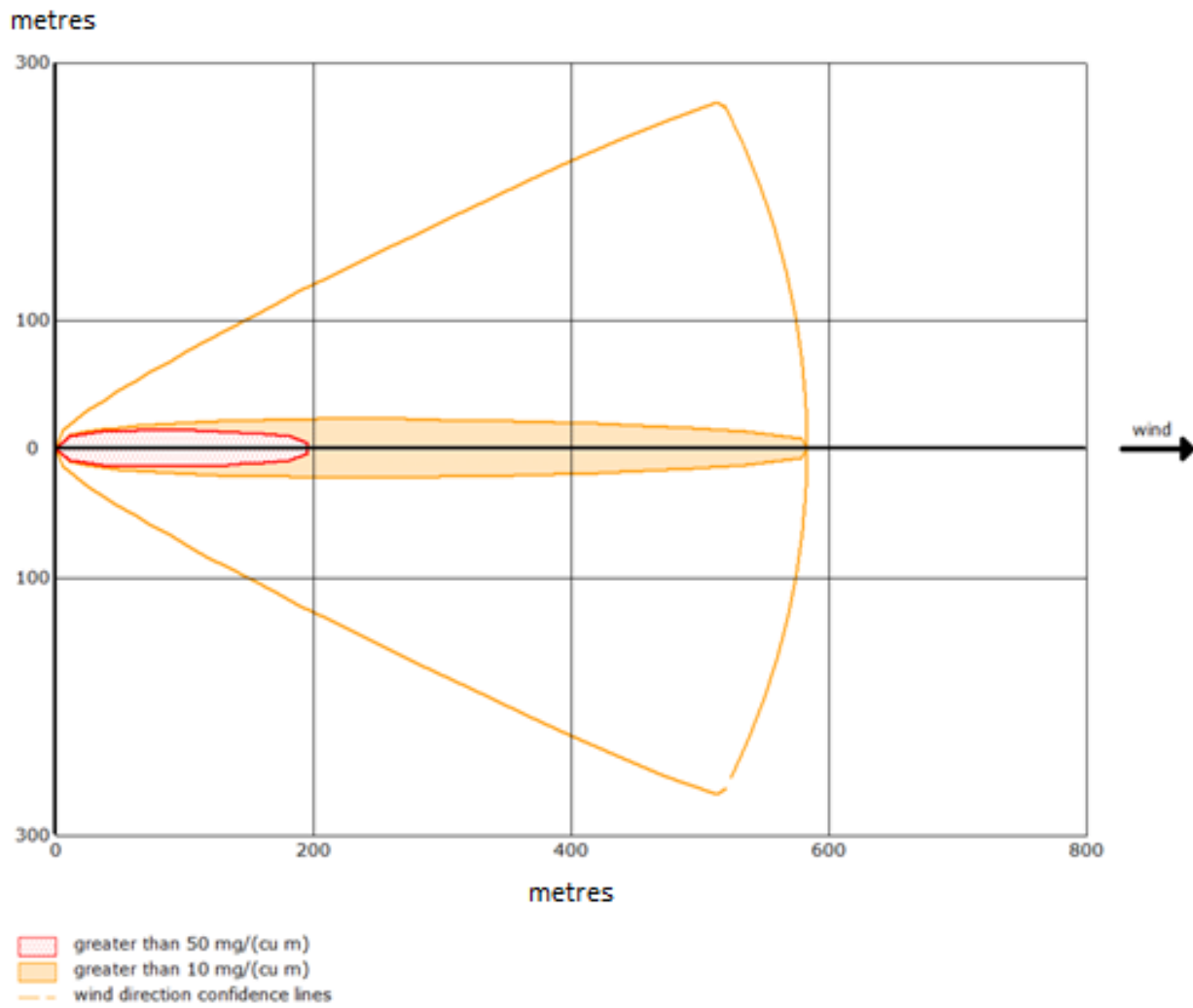
The results of the modelling of uranium concentration in air downwind of the fire are summarized in Table 4-27. Figure 4-3 shows the results for W1 weather condition, and Figure 4-4 shows the results for W2 weather condition.

Table 4-27: Results of Uranium Fire Release Modelling for Unconfined Fire

Weather Condition	Distance to ERPG-3 [m]	Distance to ERPG-2 [m]
W1	196	584
W2	91	214

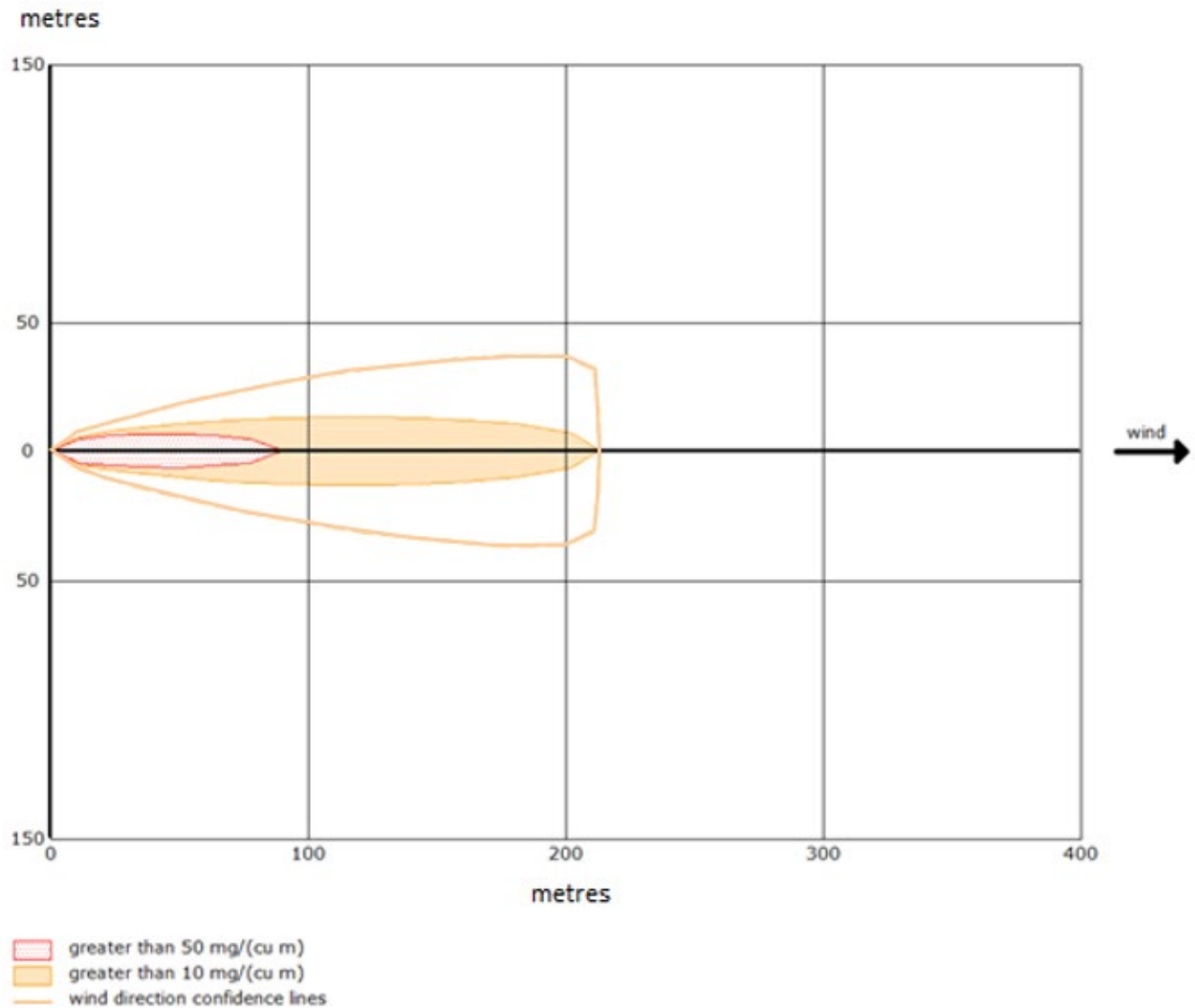
ERPG = Emergency Response Planning Guideline; W1 = worst-case weather conditions; W2 = typical weather conditions; m = metres.

Figure 4-3: Concentration of Uranium in Air for Unconfined Fire for Worst-Case Weather Conditions



Note: The ERPG-2 for uranium concentrate is 10 mg/m³; ERPG-3 for uranium concentrate is 50 mg/m³.
mg/cu m = milligrams per cubic metre; ERPG = Emergency Response Planning Guideline.

Figure 4-4: Concentration of Uranium in Air for Unconfined Fire for Typical Weather Conditions



Note: The ERPG-2 for uranium concentrate is 10 mg/m³; ERPG-3 for uranium concentrate is 50 mg/m³.
 mg/cu m = milligrams per cubic metre; ERPG = Emergency Response Planning Guideline.

As noted above, the most frequently used benchmark for emergency release scenarios is ERPG-2. The results indicate that the ERPG-2 benchmark of 10 mg/m³ would be reached (i.e., the uranium levels would be below the threshold beyond this distance) at 584 m from the source of the release (i.e., the solvent extraction building) for weather condition W1, and at 214 m for weather condition W2, representing the more likely weather condition.

For the assessment completed in EIS Section 21, the consequence of the potential effects of this scenario was rated minor to moderate, with the effect limited to a relatively short distance from the release. This rating was in reference to general exposure levels for people on the mine site. Based on the distance from the event to the new camp location, it is predicted that, due to the greater distance from the source, the worker at the new camp location would be unaffected by the event. Therefore, the consequence rating (Table 4-18) for the unconfined fire scenario would be negligible.

4.2.2.2.1.5 *Characterization of Overall Risk*

Overall, the risk for Bounding Scenario 3 is low with respect to a worker at the new camp location. This rating has not changed from the risk rating predicted in the Project EIS, though it is acknowledged that the consequence at the new camp location would be lower than the consequence at the EIS camp location. A risk comparison between the EIS camp location and new camp location is presented in Table 4-28.

Table 4-28: Solvent Extraction Fire or Explosion Risk Characterization for the EIS Camp Location and New Camp Location

Camp Location	Likelihood	Consequence	Overall Risk Rating
EIS camp location	Unlikely	Minor to moderate	Low
New camp location	Unlikely	Negligible	Low

EIS = Environmental Impact Statement.

4.2.2.2.2 *Reassessment of Bounding Scenario 6 – Acid Plant Tail Gas Scrubber Failure*

The following subsections provide a reassessment of Bounding Scenario 6 (acid plant tail gas scrubber failure) in consideration of the new camp location.

4.2.2.2.2.1 *Updated Scenario Description*

The bounding scenario is unchanged from the Project EIS and is associated with a failure of the tail gas scrubber in the acid plant and release of tail gas containing SO₂ to the atmosphere before scrubbing. Molten sulphur would be fed to the acid plant, where it would be burned in the presence of dry air to produce an SO₂ gas stream. Any process upset, or failure of equipment, instrumentation, or piping in the burner and converter, absorber, or tail gas scrubbers could potentially result in the release of SO₂. If the vessels, exchangers, and/or piping system handling SO₂ fail, then a release of SO₂ into the atmosphere could result.

4.2.2.2.2.2 *Release Characterization*

The release characterization is unchanged relative to the release characterization presented in the Project EIS. This information is summarized below for completeness.

The throughput of SO₂ in the acid plant is 180 tonnes per day (t/d), or 7.5 tonnes per hour (t/h) or 2,880 cubic metres per hour (m³/h). The total volume of the pipes and vessels containing SO₂ upstream of the tail pipe scrubber is estimated at approximately 200 m³ or 0.5 tonnes (t).

The SO₂ content of the tail gas in a typical acid plant is approximately 15 kg/t of acid produced. This SO₂ content would equate to 15 kg/t × 300 t/d = 4,500 kg/d. Under this scenario, the total amount released during a 15-minute event would be 47 kg, or approximately 0.05 t. This released amount is 10% of the entire capacity upstream of the tail gas scrubber.

4.2.2.2.2.3 *Assessment of Probability*

The probability assessment is unchanged relative to the probability assessment presented in the Project EIS. This information is summarized below for completeness.

The following mitigation measures would be in place to reduce the probability of a release and potential for tail gas release:

- SO₂ monitoring;
- routine and preventive inspection, testing, and maintenance program; and
- ambient air monitoring.

A release of SO₂ could occur as a result of the following events:

- failure of the sulphur furnace, heat exchanger, economizer, waste heat boilers, absorption tower, and/or tail gas scrubber.
- failure of valves or other piping system components.

As described above, the failure of the tail gas scrubber is the most likely cause of the SO₂ release. According to the Center for Chemical Process Safety of the American Institute of Chemical Engineers (AIChE-CCPS 1989), the probability of a failure of a wet scrubber is less than 3×10^{-02} per year.

According to the likelihood index (Table 4-17), the likelihood (i.e., probability) that this scenario would occur is likely.

4.2.2.2.4 *Assessment of Potential Effects*

The modelling that supports the assessment of Bounding Scenario 6 as presented in the Project EIS is unchanged as the original modelling was not orientation-specific; therefore, the original modelling results can be re-interpreted for the new camp location.

The airborne source term calculated for the release of SO₂ from the acid plant in the Project EIS was 47 kg of SO₂ based on a 15-minute response time, or 52 g/s of SO₂ (EIS TSD VIII, Section 11.2). The air concentration versus distance was calculated using the ALOHA model and compared with the Acute Exposure Guideline Level (AEGL) benchmarks for the W1 and W2 weather conditions (Table 4-29). Similar to the ERPG guidelines, the AEGL guidelines are intended to be a planning tool to help anticipate human adverse effects on the general public caused by toxic chemical exposure and are described as follows (USDOE 2016):

- **AEGL-1:** The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible on cessation of exposure.
- **AEGL-2:** The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
- **AEGL-3:** The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

The most commonly used benchmark for emergency release scenarios is AEGL-2. As indicated in Section 4.2.2.2.1.4, the probability of the W1 weather condition is less than 5% of the probability of W2 weather condition.

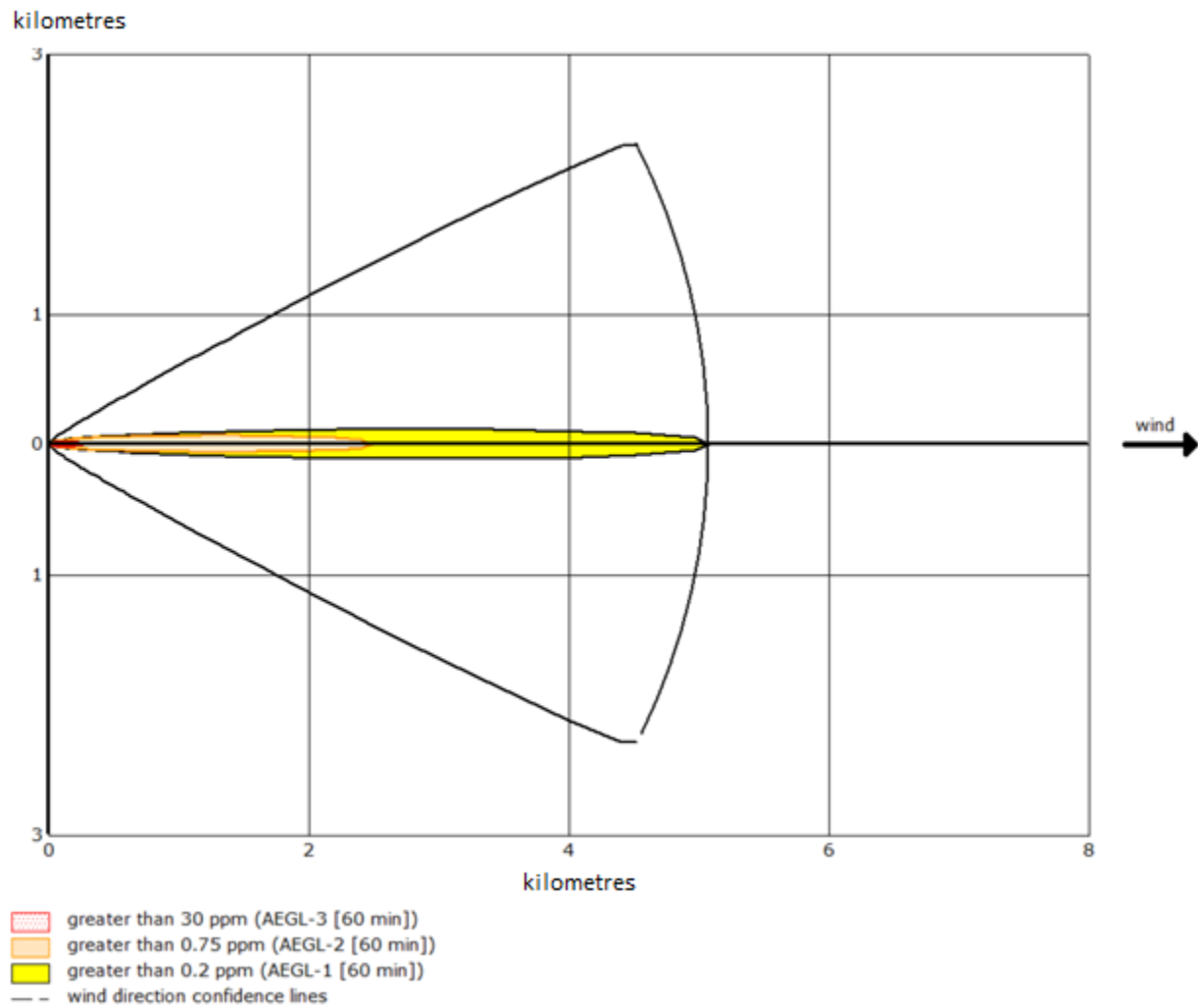
The results of the modelling are summarized in Table 4-29. Figure 4-5 shows the results for the W1 weather condition and Figure 4-6 shows the results for the W2 weather condition.

Table 4-29: Results of Sulphur Dioxide Release Modelling

Weather Condition	Distance to AEGL-3 [m]	Distance to AEGL-2 [m]	Distance to AEGL-1 [m]
W1	261	2,500	5,100
W2	122	849	1,700

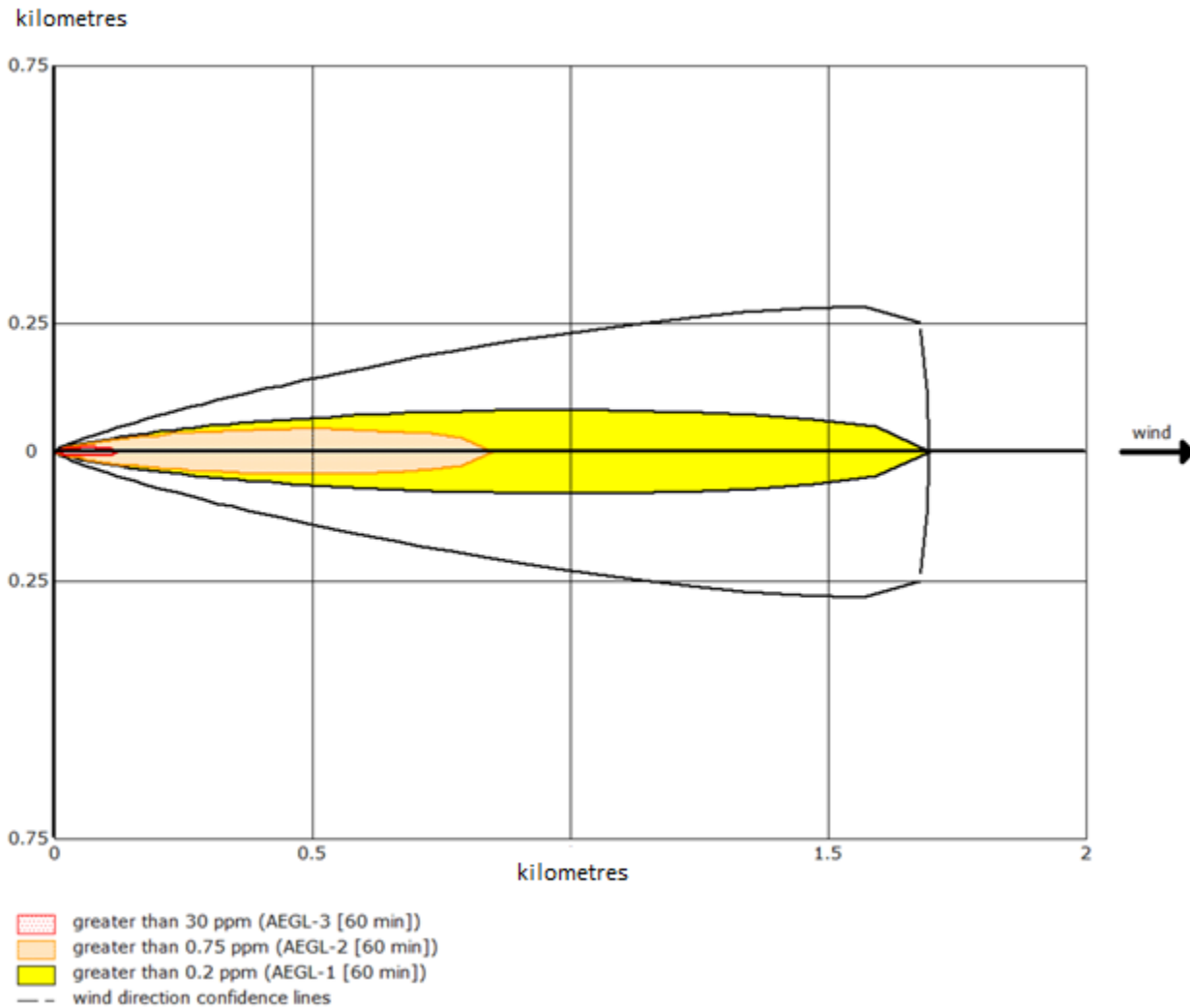
AEGL = Acute Exposure Guideline Level; W1 = worst-case weather conditions; W2 = typical weather conditions; m = metre.

Figure 4-5: Sulphur Dioxide Dispersion for Worst-Case Weather Conditions



Note: Concentration of sulphur dioxide in air is shown.
 AEGL = Acute Exposure Guideline Level; ppm = parts per million; min = minute.

Figure 4-6: Sulphur Dioxide Dispersion for Typical Weather Conditions



Note: Concentration of sulphur dioxide in air is shown.
 AEGL = Acute Exposure Guideline Level; ppm = parts per million.

The results indicate that the AEGL-2 benchmark would be reached (i.e., SO₂ levels would be below the threshold beyond this distance) at 2,500 m from the source of the release (i.e., the acid plant) for W1 weather condition, and at 849 m for W2 weather condition, representing the more likely weather condition.

For the assessment completed in EIS Section 21, the consequence of the potential effects of this scenario was rated minor to moderate, with the effect limited to a relatively short distance from the release. This rating was in reference to general exposure levels for people on the mine site. Based on the distance from the event to the new camp location, it is predicted that, due to the greater distance from the source, the worker at the new camp location would largely be unaffected (i.e., AEGL-1 or lesser effects) by the event under the W2 (i.e., most likely) weather condition. For the W1 weather condition, the worker at the alternative camp location would be within the AEGL-2 exposure envelope.

The concentrations depicted in the assessment described above correspond to outside concentrations; therefore, the level of exposure predicted is for a human receptor (i.e., worker) outside a building. The exposure scenario can also be viewed in consideration of implementation of emergency response planning. In the event an accident or malfunction occurs, including one associated with an acid plant tail gas scrubber failure, emergency response planning would be implemented to minimize potential consequence to workers on site, including a potential worker staying at the camp. Such an event would trigger a shelter-in-place response; therefore, the realistic pathway is related to indoor SO₂ exposure rather than outdoor SO₂ exposure. Given the low rates of air exchange that would occur between outside and inside with tight-construction and closed doors and windows, indoor air concentrations are not expected to be affected significantly. Within this specific context, if the scenario consequence was re-interpreted, the consequence rating (Table 4-18) for the scenario would be considered negligible.

4.2.2.2.5 Characterization of Overall Risk

Overall, the risk for Bounding Scenario 6 is low with respect to a worker at the new camp location. This rating is similar to the risk rating predicted in the Project EIS, where the risk was rated as low to moderate based typical versus worst-case weather conditions, respectively. It is acknowledged that the consequence at the new camp location would be lower than the consequence at the EIS camp location under typical weather conditions, and the consequence would be further reduced for workers at the Project camp during a shelter-in-place response associated with this type of accident or malfunction. A risk comparison between the EIS camp location and new camp location is presented in Table 4-30.

Table 4-30: Acid Plant Tail Gas Scrubber Failure Risk Characterization for the EIS Camp Location and New Camp Location

Camp Location	Likelihood	Consequence	Overall Risk Rating	
EIS camp location	Likely	Minor to moderate	Low	Moderate
New camp location	Likely	Negligible	Low	

EIS = Environmental Impact Statement.

4.2.2.2.3 New Camp Location Accident and Malfunction Summary and Conclusions

The accident and malfunction scenarios originally evaluated as part of the Project EIS were re-evaluated to consider potential effects to workers at the new camp location. This re-evaluation included verification of the potential hazards and bounding scenarios identified for the Project as well as an assessment of bounding scenario risks.

The review of original hazard identification / screening process did not identify any further relevant scenarios that warranted assessment and confirmed that the bounding scenarios selected for assessment were appropriate. With respect to the bounding scenarios, the re-evaluation determined that the risk characterization for four of the six bounding scenarios would not change as a result of a relocated camp; these four bounding scenarios were not further assessed. The other two bounding scenarios (i.e., Bounding Scenario 3 and Bounding Scenario 6) were re-assessed quantitatively in consideration of the new proposed camp location. The results of these assessments are as follows:

- **Bounding Scenario 3:** The overall risk ranking (i.e., low) and probability of occurrence (i.e., unlikely) for this scenario is unchanged relative to the Project EIS for a camp worker who is situated at the new camp location; however, the consequence rating is reduced from 'minor to moderate' to 'negligible'.

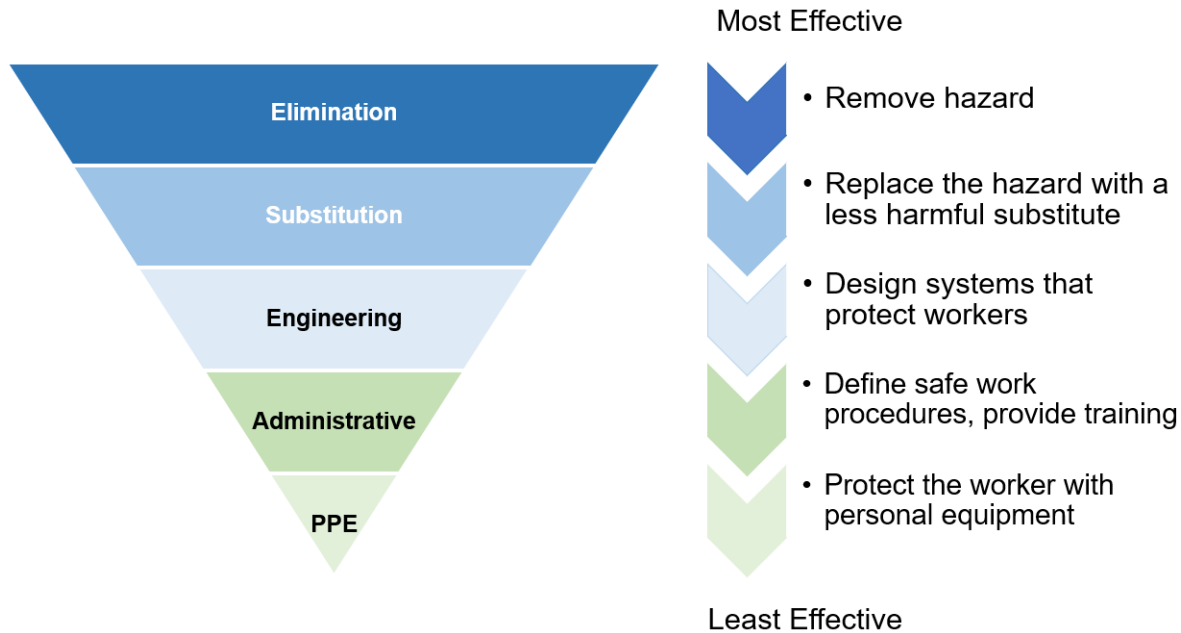
- **Bounding Scenario 6:** The overall risk ranking (i.e., low) for a worker at the new camp location is slightly different relative to the Project EIS risk ranking (i.e., low to moderate), as the consequence rating is reduced from 'minor to moderate' to 'negligible'. The probability of occurrence (i.e., likely) for this scenario is unchanged relative to the Project EIS.

4.2.2.3 *Health, Safety, Environmental, Quality Policies, Practices, and Procedures*

Over the past four decades of global commercial nuclear facility operation, the frequency and severity of accidents has been markedly lower than frequency and severity of accidents in related industrial operations (OECD 2010). This reduction can be attributed to the rigorous regulatory framework and well-developed plans and procedures for the safe operation of nuclear facilities, including uranium mining and milling operations, particularly in Northern Saskatchewan. The experience gained from the accidents that have occurred has resulted in improved engineered safety features and operating procedures. Therefore, assessing the probability that similar accidents might occur in the future based on historical data is conservative.

It is the intention of NexGen to develop and operate the Project in a manner that mitigates potential adverse effects on the human health and biophysical environment to the extent possible. NexGen would verify that all work to be completed during the Project would meet or exceed the regulatory requirements stipulated by the province of Saskatchewan, the CNSC, and other regulatory authorities. NexGen is focused on achieving high standards in all facets of the business and across the Project lifespan through complying with all regulations and standards; engaging with Indigenous Groups, local communities, workers and other stakeholders; and embracing the application of technology and best practices. This focus on high standards which would serve to mitigate potential Project-related effects, including the potential effects that may be associated with postulated accident and malfunction scenarios. As part of this commitment, NexGen has adopted a hierarchy of controls (Figure 4-7) as part of the Integrated Management System (IMS) to prevent, eliminate, and reduce hazards and mitigate the risks associated with activities throughout the Project lifespan.

Figure 4-7: Hierarchy of Controls



PPE = personal protective equipment.

In practice, the hierarchy of controls shown in Figure 4-7 would be implemented and their effectiveness monitored via management system processes defined in topic-specific programs which would include, but may not be limited to, the following:

- Integrated Management System Manual;
- Health and Safety Program;
- Radiation Protection Program;
- Environmental Protection Program;
- Waste Management Program;
- Transportation Program;
- Emergency Preparedness and Response Program;
- Fire Protection Program;
- Security Program;
- Training Program;
- Contractor Management Program;
- Indigenous and Public Engagement Program;
- Construction Management Program;
- Mine Operations Program;
- Mill Operations Program;

- Commissioning Management Program; and
- Asset Management Program.

The processes outlined in the IMS Manual and these programs would be described in more detailed topic-specific plans, procedures, and work instructions developed for the Project. This information includes processes related to:

- process and operational controls;
- mine development and control;
- workplace inspections;
- training;
- radiation exposure monitoring and protection;
- spill response;
- security;
- environmental monitoring;
- emergency response; and
- transportation emergency response.

These plans, procedures, and work instructions would be implemented throughout the lifespan of the Project, and together, would help to mitigate the likelihood of occurrence and consequence of accident and malfunction scenarios.

5 Mitigation and Monitoring

This section provides context regarding Project mitigation measures and monitoring. More detailed information is provided in EIS Section 23, Summary of Mitigation, Monitoring, and Follow-up Programs. In addition to the mitigation measures and monitoring presented in this section, the Project would also implement any additional mitigation and monitoring measures to verify that the conditions at the new Project camp meet all applicable regulatory requirements, such as The Occupational Health and Safety Regulations (2020), National Building Code of Canada, and National Fire Code of Canada.

5.1 Mitigation Measures

As noted in Section 3, the camp design would not change as a result of the camp relocation. Potential effects to VCs and intermediate components as a result of relocating the camp farther south at the Project site would not change EA predictions, including the human health predictions associated with the camp worker receptor. This no change in EA predictions is due to:

- the EA assumed the area of the new camp location would be disturbed as part of the maximum disturbance area, and appropriate mitigation measures were applied accordingly;
- there would be no changes to water use or water quality; and
- changes to Project atmospheric emissions would be negligible (Section 4.1).

With respect to accidents and malfunctions, potential effects to workers at the new camp location are expected to be less than the effects that may have been realized at the EIS camp location due to the increased distance from the accident and malfunction sources.

For these reasons, no new mitigation measures are required or proposed as the existing mitigation measures stated within the Project EIS would remain protective of people (including workers at the camp) and the environment. However, as the Project would follow a Plan-Do-Check-Act continual improvement cycle for the management of potential effects, monitoring would be conducted to verify compliance, and should Project effects be worse than predicted, additional mitigation measures would be planned and implemented to achieve the environmental and human protection goals (EIS Section 5.7, Integrated Management System).

The following presents a summary of key mitigation measures that would be implemented that apply to the Project camp location:

- Minimize areas of vegetation clearing and soil disturbance.
- Use existing roads, where feasible.
- Install fire breaks at the Project site that would both align with fire break requirement assessments that would be completed for the Project and consider any input provided by the Saskatchewan Public Safety Agency.
- Install a gate at the site entrance (i.e., gatehouse) to control public access.
- Limit idling of vehicles and equipment to the extent practicable.
- Limit vehicle speeds on unpaved site roads to reduce fugitive dust during Construction and Operations.

Continue to evaluate monitoring and mitigation measures during the Project lifespan to track and minimize air pollution and, where practicable, implement any newly identified mitigation measures that are technically and economically feasible.

- Implement procedures to reduce noise, dust, and light levels, such as:
 - Enclose or dampen equipment in process plant buildings where the total sound power level is expected to be more than approximately 80 dBA, where feasible.
 - Use noise suppression (e.g., mufflers) on vehicles and inspect regularly to verify they are functioning properly.
 - Limit light pollution to the extent practicable for constructed infrastructure.
- Apply water and/or suppressants to site roads, access road, and airstrip, as necessary. Use dust suppressants that minimize environmental risk and are government-approved for use.
- Use erosion control measures, as required.
- Design slopes for long-term stability.
- Design and install appropriate site drainage and water management structures on site.
- Perform maintenance of water management structures (i.e., roadside ditches and culverts) to limit the risk of road wash-out or sediment release to the environment.
- Implement best management practices and mitigation, such as spill prevention.
- Do not allow hunting by employees in areas within the Project footprint.
- To avoid and limit attraction of wildlife to the Project site, collect domestic (e.g., food) and industrial (e.g., used oil and lubricants) waste and temporarily store in wildlife-proof containers, incinerate on site, transport off site for recycling, or dispose at a licensed disposal facility, as appropriate.
- Skirt buildings and stairs to the ground to limit opportunities for use as shelter by wildlife to the extent practicable.
- Provide dedicated space for Elders to be available to support employees to assist with employee retention.

5.2 Monitoring Programs and Plans

NexGen is responsible for and committed to providing for the health and safety of workers and the public and the protection of the environment. To fulfill these commitments and as noted in Section 4.2.2.3, NexGen has developed an IMS for the Project that provides a common, transparent, risk-informed process framework for both Project activities and achieving excellence in employee safety, radiation safety, and environmental protection. The IMS contains the Project environmental monitoring programs, plans, procedures, and work instructions as well as health and safety programs, procedures, and work instructions designed to protect the environment, and worker and public health and safety. NexGen's IMS approach follows a Plan-Do-Check-Act continual improvement cycle that is intended to verify that the programs and plans contained within the IMS are meeting their objectives, and where additional measures may be required to improve conditions for people and the environment, these measures are planned and implemented.

Environmental and human health monitoring requirements for the Project, including monitoring required for the Project camp, will be described within the IMS. Key IMS components include the Environmental Protection Program, Health and Safety Program, and Radiation Protection Program. To protect workers at the Project

camp, the most relevant monitoring activities that would occur would be associated with air quality and human health.

Air Quality

The Project would include atmospheric monitoring to verify that human health is protected.

There are no predicted exceedances of annual screening values for any constituents, indicating that unacceptable chronic effects from direct exposure to air are not expected. However, short-term exceedances, based on maximum predicted concentrations for the 24-hour averaging time for nitrogen dioxide and particulate matter, including uranium in TSP and PM₁₀, may occur within the Project footprint and at the associated boundary. Unacceptable levels of risk are not expected from infrequent, direct, short-term exposures to these constituents; however, these constituents would be monitored as part of the Project Effluent and Emissions Plan, which forms part of the Environmental Protection Program.

Worker Health Monitoring

The Project would include human health monitoring to verify that worker and public health is protected.

To keep exposures to ionizing radiation hazards ALARP during all phases of the Project, exposures to gamma radiation, long-lived radioactive dust, radon progeny, and radon gas would be routinely monitored for workers designated as nuclear energy workers. Personal dosimetry equipment would be provided for all nuclear energy workers, and dose records would be maintained for each nuclear energy worker at the Project site. Effective (i.e., whole body) and equivalent (i.e., organ-specific) doses would be measured and recorded, as applicable. Doses would be routinely tracked and compared to internal and external limits. The processes for classifying nuclear energy workers and for managing worker dosimetry will be included in the NexGen's Radiation Protection Program.

Chemical, physical, or biological health and safety hazards encountered by workers during all phases of the Project would be monitored in accordance with established sample collection and analysis methods to quantify exposure and risk to workers, and to confirm the effectiveness of applicable controls. Results from personal occupational exposure and workplace monitoring would be collected, maintained, stored, communicated, and used to identify improvement opportunities, as required. The process for identifying health and safety hazards and monitoring occupational exposures will be outlined in the NexGen's Health and Safety Program.

Environmental Protection Monitoring

In addition to the measures outlined above, NexGen would implement the Environmental Protection Program, which would describe the processes required to monitor and characterize emissions from Project facilities and activities, to monitor and characterize the quality of the environment to assess the effectiveness of mitigations, and to continually improve environmental protection performance throughout all Project phases. Where relevant, adaptive management measures may also be proposed to address the uncertainties associated with the effects predictions and mitigation measures. The process for determining when, how, and where to use adaptive management will be described within NexGen's Integrated Management System Manual.

6 Conclusions

A Draft Environmental Impact Statement (EIS) for the Rook I Project was submitted to the Saskatchewan Ministry of Environment Environmental Assessment and Stewardship Branch (ENV EASB) and Canadian Nuclear Safety Commission (CNSC) on 13 June 2022. Following submission, the Draft Project EIS underwent a thorough provincial technical review, and NexGen provided any necessary clarifications and amendments to the Project EIS based on the provincial feedback. In August 2023, NexGen submitted a Final EIS for the Project, and on 8 November 2023, the Saskatchewan Minister of Environment issued a Notice of Ministerial Decision Pursuant to Section 15 of *The Environmental Assessment Act* of Saskatchewan (Notice of Decision). The Environmental Assessment (EA) conditions formed part of this Notice of Decision, three of which were specific to the proposed Project camp location. Specifically, the Notice of Decision required NexGen to propose and submit an application for approval under Section 16 of *The Environmental Assessment Act* for an alternative camp location. As part of this application for approval, NexGen was required to complete an assessment of effects relative to workers at the camp location that considered air quality, noise, and human health effects, including effects associated with potential accidents and malfunctions. In discussions with representatives of the ENV following the Notice of Decision, NexGen was also requested to provide information regarding potential changes to valued components (VCs) and intermediate components as a result of an amended camp location. This document has been created to meet the requirements of the Notice of Decision and the additional ENV requests.

An alternatives screening assessment was conducted to determine the preferred alternative camp location. The assessment identified the camp location to the south of the primary Project mining and processing areas as the selected alternative. This camp location is preferred as it was determined to represent the best combination of environmental, technical, economic, and social (i.e., worker safety and human health) aspects.

The camp design would not change as a result of moving the camp to a new location. In addition, the camp would not require additional access as it would be situated along the main access to the Project. The amended camp location would not result in changes to water use or discharge water quality. Some additional air emissions would be produced as a result of bussing workers between the new camp location and active working areas.

The assessment of VCs and intermediate components demonstrated that no changes to EA predictions would occur. The new camp footprint was already considered to be disturbed in the Project EIS, there would be no changes to water use or water quality, and changes to air quality would be too minor to change assessment conclusions.

As per the requirements of the Notice of Decision, effects to workers, including worker health, with respect to air quality, noise, and light, were evaluated. These evaluations demonstrated:

- All air quality criteria air contaminants (CACs), including dust deposition associated with total suspended particulate (TSP) matter emissions, are predicted to be below the air quality screening values, which included the Saskatchewan Ambient Air Quality Standards (SAAQS).
- Cumulative outdoor noise levels are predicted to be less at the new camp location than noise levels would be at the camp location identified in the Project EIS. In addition, indoor noise levels from both steady-state sources and intermittent sources (i.e., airstrip) would be below the recommended levels to avoid sleep disturbance.

- Light effects would generally not change at the new camp location as these effects would be dominated by sunlight during the day and local (i.e., camp-specific) lighting at night. Mitigation measures such as blackout curtains would be installed within camp bedrooms to prevent unacceptable sleep disturbance to workers.

Potential effects to workers at the new camp location as a result of potential accidents and malfunctions were also evaluated as part of the Notice of Decision requirements. This evaluation included a review of the hazard scenarios identified for the Project to determine if both the hazard scenarios and the bounding scenarios assessed in the Project EIS were appropriate, followed by an assessment of updated bounding scenarios. The evaluation concluded:

- The hazard scenarios and bounding scenarios selected for assessment in the Project EIS were appropriate.
- Of the six bounding scenarios assessed in the Project EIS, only the assessment results for two bounding scenarios have the potential to change as a result of the new camp location; namely: solvent extraction fire or explosion, and acid plant tail gas scrubber failure.
- Due to the increased distance between the active mining and milling areas to the new camp location relative to the camp location identified in the Project EIS, the consequence of accidents and malfunctions is predicted to be reduced, and all bounding scenario risks would be low.

NexGen has developed an Integrated Management System (IMS) for the Project that contains the Project environmental monitoring and health and safety programs and plans designed to protect the environment as well as worker and public health and safety. The assessment of the new camp location validated that existing mitigation measures stated within the Project EIS would remain protective of people (including workers at the camp) and the environment. While no specific additional mitigation measures are proposed or required as a result of the assessment, the programs and plans within NexGen's IMS would verify that human and environmental health are being protected, and where additional measures may be required to improve Project performance, these measures would be planned and implemented.

7 References

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