July 2, 2010

Chuck Hubert and Paul Mercredi
Environmental Assessment Officers
Mackenzie Valley Environmental Impact Review Board
Box 938 #200 Scotia Centre 5102-50th Avenue
Yellowknife, NT X1A 2N7

File#: NWT-142
File#: EA0809-002

Sent via e-mail: chubert@reviewboard.ca and pmercredi@reviewboard.ca

Subject: Natural Resources Canada's (NRCan) Information Request Regarding the Environmental Assessment of the Prairie Creek Mine EA0809-002

Natural Resources Canada (NRCan) is providing the following information requests for the Mackenzie Valley Environmental Impact Review Board regarding the Prairie Creek Mine Environmental Assessment.

NRCan reviewed the Developer's Assessment Report (DAR) and appendices with respect to the explosives manufacturing and storage, tailings management, seismic hazards, impacts to karst features, baseline climactic information, terrain conditions, geology, impacts to slope stability and permafrost.

Where possible, we have indicated where Information Requests from other federal departments reference similar issues as NRCan. Our view is that these other Information Requests are related to NRCan's, but do not wholly duplicate or conflict with NRCan's.

Should you have any questions regarding NRCan's information requests, please do not hesitate to contact the undersigned.

Sincerely,

Original signed by

John Clarke
Natural Resources Canada
A/Director, Environmental Assessment Coordination
John.Clarke@nrcan.gc.ca

Telephone: 613-943-0773

IR Number: NRCan 1

Source: Natural Resources Canada – Minerals and Metals Sector

To: Canadian Zinc Corporation (CZN)

Subject: The requirement for an explosives factory on-site.

Preamble

NRCan's understanding of the proposal, during the review of the Terms of Reference, was that an explosives factory was not a component of the proposed mine plan. Rather, we understood that CZN planned to rely on packaged explosives to be stored in on-site magazines permitted through the Government of the Northwest Territories Workers Compensation Board. NRCan thus advised the Board that we did not expect to be a "Responsible Minister" under the Mackenzie Valley Resource Management Act (MVRMA).

In reviewing the DAR however, we have noted the following:

- Section 6.3.13 - Explosive Magazine "The economics of an emulsion plant on site verses transporting explosives will be investigated."

- Section 6.8 - Explosives "CZN will consider the viability of an emulsion explosives plant for the production stage."

The manufacture of explosives is regulated by the federal *Explosives Act*, administered by NRCan's Explosives Regulatory Division. An identified future need for a factory licence for the project may change whether NRCan is considered to have 'jurisdiction in relation to the development under federal or territorial law' under the MVRMA.

Requests

(1) CZN has been requested to provide additional information on the whether a factory to manufacture explosives is likely to be required at or near the site.

(2) If CZN has determined that a factory to manufacture explosives is likely to be required, then NRCan typically recommends that the following information be considered in the environmental assessment:

- Explosives to be manufactured.

- Maximum quantity of explosives at each facility.

- Specified location (i.e., detailed site plan), with distances to vulnerable features such as dwellings, roads, camps, railways, bodies of water, etc. Infrastructures

should be identified and include: explosives and detonator magazines, fuel storage, ammonium nitrate storage, maintenance/wash area, process trucks and their parking area, any offices, warehouses, buildings, etc. The proponent needs to demonstrate that safety distances required by the Explosives Regulatory Division of NRCan have been considered and met.

- Fuel and ammonium nitrate storage plans. Storage of ammonium nitrate is to be in conformance with ERD guidelines.
- Liquid effluent disposal plans.
- Evaluation of worst case scenario (i.e. accidental explosion).
- Spill contingency plans.
- Details on any temporary explosive facilities to be used for starting the project must be provided, giving the same information requirements above.

IR Number: NRCan 2

Source: Natural Resources Canada – Minerals and Metals Sector

To: Canadian Zinc Corporation

Subject: The feasibility of using paste backfill for underground tailings disposal for the Prairie Creek Mine.

(NB – The Board is also directed to Parks Canada IRs #27, #28 and #30 requests related to sub-items 3, 7 an 8 below)

(1) *Preamble*

It is proposed that the backfill will be made up of filtered tailings (FPT), float rock from the mill – dense media separation aggregate (DMSA), and cement. DMSA was not available for the laboratory testing performed in 2005 and therefore a dolomite limestone sourced from Manitoulin Island in Ontario was crushed and the fines washed out to simulate the DMSA.

Request

A plan for Unconfined Compressive Strength (UCS) testing incorporating the actual DMSA material should be provided.

(2) *Preamble*

Chemical and mineralogical compositions for the FPT are provided, however those for the DMSA are not.

Request

Chemical and mineralogical compositions for the DMSA should be provided.

(3) *Preamble*

UCS testing of the paste backfill was conducted up to 28 days of curing. Since underground disposal as paste backfill is planned to be a long-term storage method for the tailings, longer term strength as well as consolidation of the material is important to determine.

Request

A plan for long-term UCS testing, up to a minimum of one (1) year should be provided.

(4) *Preamble*

The number of samples tested for UCS and individual variability of the UCS results were not provided.

Request

The detailed results of the UCS testing program to be provided, including individual sample results, calibration reports for equipment used, as well as details of the materials used in the mix recipes to prepare the UCS samples.

(5) *Preamble*

The UCS testing was conducted without the addition of flocculants.

Request

If addition of flocculants is planned, a plan for UCS testing incorporating flocculants should be provided.

(6) *Preamble*

The details of the water used for sample preparation for UCS testing were not provided.

Request

A plan for UCS testing incorporating Prairie Creek Mine process water should be provided.

(7) *Preamble*

The details of the cement used for sample preparation for UCS testing were not provided. It was also stated that a combination of cement, slag, and fly ash may be used as the binder.

Request

Either a plan for UCS testing incorporating the cement available at the Prairie Creek Mine location, or the details of the cement used showing its characteristics are the same as that available at the Mine location, should be provided. It is further requested that a plan be provided which includes the likelihood of using alternative binder materials (such as slag and fly ash) as well as UCS testing plan incorporating those alternative materials.

(8) *Preamble*

Since the UCS testing done to date was for a feasibility study, it was limited in scope.

Request

To conduct a proper optimization of the backfill mix recipe, numerous further tests are required to ensure the proper strength required for the excavations will be achieved. It is requested that a detailed plan of the future UCS testing, with the aim of optimizing the binder content and composition, be provided.

(9) *Preamble*

The particle size distribution of the tailings was conducted on those provided, assuming that the same grind can be expected in a full scale plant.

Request

A plan for particle size analysis of the tailings produced from the full scale plant should be provided. As backfill properties will vary with varying particle size, it is important to use a representative sample of the tailings.

IR Number: NRCan 3

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation (CZN)

Subject: Earthquake hazards

Preamble

It is clear that the proponents are aware of the earthquake history of the region, the current National Building Code of Canada (NBCC) seismic provisions, and current seismic databases. There are numerous references to the 1985 Nahanni earthquakes (M 6.6 and 6.9) that occurred about 80 km from the mine site. The proponents note that "mine site did not appear to suffer any significant consequences" during those earthquakes. This is important and valid information. However, stronger shaking (a larger or closer earthquake) cannot be ruled out in the future, and hence a thorough seismic hazard assessment should be performed at this site. Underground storage of all tailings from the mill is noted – this certainly minimizes any risk from future earthquakes in the long-term. In this proposal, seismic hazard during the operation phase of the Prairie Creek Mine and the stability of the "Water Storage Pond" will likely dominate the seismic risk assessment. For example, if the flood protection berm failed, and if water flooded the mine site, are there life-safety issues? Will the water retention system utilize the provisions in the 2005 Dam Safety Guidelines? Also, any site infrastructure the falls under the building code provisions should be designed to the current standards (2005NBCC or equivalent). Details on all aspects of the seismic hazard assessment and proposed mitigation measures need to be provided.

Requests

(1) DAR – Main Volume "Site Infrastructure" (p. 20) "The existing buildings will be upgraded and modernized. New facilities will include a kitchen/accommodation block, concentrate shed, power generation units, and an incinerator."
Question: Are any of the existing buildings engineered structures? Will any of the new facilities be engineered structures? If so, what building code standards have been used / or will be used?

(2) DAR – Main Volume Section 4.12.1 "Seismic History" (p. 136) "The Prairie Creek Mine site was constructed in 1980-1982 and did not appear to suffer any significant

consequences of the 1985 seismic events." (the M 6.6 and 6.9 earthquakes 80 km to the northeast of the mine site).
Question - What were the ground shaking levels estimated at the mine site during the 1985 events? Is there any evidence for active faulting near the site? A deterministic hazard assessment (in addition to the standard probabilistic hazard assessment) should be considered.

(3) DAR – Main Volume (p. 280) "Earthquakes: Earthquakes have occurred in the area previously (refer to Appendix 25), and since the Mine was originally built. No earthquake damage is evident in the berms and dykes. The structures have been inspected annually for 4 years and found to be stable. Recent geotechnical studies (see Appendices 12 and 18) by Golder Associates have confirmed the suitability of the structures for their intended purpose during normal conditions and during seismic events."
Question – what level of seismic design was used for the berms and dykes?

(4) DAR – Main Volume Section 8.8.3 WSP at Full Capacity (p. 280) "In addition to considering the potential for dyke and berm failures, it is also appropriate to consider the consequence of failures. If the flood protection berm failed, water from Prairie Creek could potentially flood the Mine site. There would undoubtedly be some damage to the accommodation block and other buildings, but there would be very limited impact in terms of contamination."
Question –Are there life-safety issues here? Will the Canadian Dam Association Guidelines (2005) be utilized?

(5) DAR – Main Volume (p. 318) "Future performance of the subject slopes during earthquake events cannot be determined with certainty, but the current evidence indicates that the likelihood of large rock slope failures occurring due to seismic activity is very remote."
Question – what was the estimated level of shaking in these areas during the 1985 Nahanni earthquakes and how does this compare to expected/possible levels of shaking during future earthquakes?

(6) DAR – Addendum (p. 15) "Geotechnical designs for mine site structures account for potential seismic events, and stability should not be significantly comprised should such events occur…."
Please provide details. What level of seismic hazard was utilized in the geotechnical design?

(7) <u>(Refer also to IR NRCan 5 for a related request)</u> Appendix 11 - Preliminary Design – Waste Rock Pile (p. 4). "During the 1985 earthquakes, significant vertical ground accelerations were measured (Wetmiller et al. 1988). A thorough review of the available seismic data should be undertaken to identify if additional considerations are warranted for final design and analysis."
Agreed. Question – will other potential seismic sources be considered? Is there any evidence for active faults closer to the mine site?

(8) Appendix 11 - Preliminary Design – Waste Rock Pile (p. 4). "For design options, the pseudo-static seismic analyses were completed using a ratio of horizontal pseudo-static acceleration to gravity (kh) of 0.125. This value represents roughly one half of the peak ground acceleration (PGA) determined for firm ground (NBCC 2005)."
Question - Why was a value that is one-half the PGA in code provisions used? This should be explained.

(9) Appendix 12 - Preliminary Design – Water Storage Pond (p. 7). "During the 1985 earthquakes, significant vertical ground accelerations were measured. A review of the available seismic data should be undertaken to identify if additional remedial considerations are warranted during the detailed design."
Agreed. Question – will other potential seismic sources be considered? Is there any evidence for active faults closer to the mine site?

(10) Appendix 12 - Preliminary Design – Water Storage Pond (p. 7). "For remediation and design options, the pseudo-static seismic analyses were completed using a ratio of horizontal pseudo-static acceleration to gravity (kh) of 0.125. This value represents roughly one half of the PGA determined for firm ground (NBCC 2005)."
Question – Why was a value that is one-half the PGA in code provisions used? (As noted above, this should be explained.) Is it appropriate to use the same coefficient for the "Water Storage Pond" as for the "Waste Rock Pile"? Is the material strength comparable?

IR Number: NRCan 4

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject of request: Deposit geology/mineralogy/structural geology

Preamble

A feasibility study usually precedes environmental applications and permitting. Such a study increases the understanding of the geology baseline as part of the description of the existing environment. Canadian Zinc Corporation mentions in the project description report of May 2008 (p.20) that Kilborn Engineering (B.C.) Ltd. completed a feasibility study in 1980 for mining the "Main Zone" area. Completion of the NI 43-101 report was done in 2007 (p.23).

Request

Provide information on more recent feasibility study done since the NI43-101 (2007) report, or any plans to update the NI43-101 (2007) report.

IR Number: NRCan 5

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject of request: Deposit geology/mineralogy/structural geology

Preamble

Canadian Zinc Corporation describes in the Prairie Creek Mine Developer's Assessment Report Section 4.11 Geology on pages 127 and 134 that the Prairie Creek area is folded and dissected by numerous faults and fracture zones. A good understanding of the regional and mine fault and fracture systems are critical for the mine development and seismicity evaluation.

Request

Provide any more information (if available) on the roles of the regional- and property-scale faults on the mineralization.

IR Number: NRCan 6

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject of request: Deposit geology/mineralogy/structural geology

Preamble

Canadian Zinc Corporation describes on page 36 of the Project Description Report and page 128 of the Prairie Creek Mine Developer's Assessment Report Section 4.11 Geology

the vein system that carries the mineral resource. Veins by their geological nature have a tendency to vary in width, thickness and length. More detailed information on the vein stock work might help delineate more ore underground and identify other similar vein system in the region.

Request

Provide, if known, any more information on the true width of the vein system at Prairie Creek. Provide more information, if available on the continuity of the vein system known underground and on the surface i.e., in terms of its width, thickness, and length, including any information on changes towards the north and south, and with depth.

IR Number: NRCan 7

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject of request: Deposit geology/mineralogy/structural geology

Preamble

Canadian Zinc Corporation describes on page 38 of the Project Description Report and page 128 of the Prairie Creek Mine Developer's Assessment Report Section 4.11 Geology, the strata bound mineralization, including apparent thicknesses. It would be helpful to have a better definition of the sulphide ore potential towards the north at depth and towards the south, i.e., between 50,100mN and 49,800mN, where exploration drilling is presently limited (see Figure 2-3, p. 36 of the Project Description Report).

Request

Provide any additional information (if available) on the strata bound zone, including the true thickness, its attitude and the structural relationship to regional faults, such as the HC and PC faults and other structures.

IR Number: NRCan 8

Source: Natural Resources Canada – Earth Sciences Sector

To: Canadian Zinc Corporation

Subject of request: Deposit geology/mineralogy/structural geology

Preamble

Canadian Zinc Corporation provides information on the chemical composition of the host rock on page 130 of Prairie Creek Mine Developer's Assessment Report Section 4.11 Geology. A brief summary of the chemical composition of the host rocks is provided, however, there is not enough information provided in this report on the chemistry of the sulphide ore and host rocks to have a clear understanding of the chemistry of the host rocks and ores. A summary table with the range of values may be useful.

Requests

(1) Provide a summary table with host rock and mineralization geochemistry and the range of values.

(2) Provide any information on the background Cu, Pb, Zn, Sb, Cd, Ag, As and W concentration values in the Road River Formation.

(3) Describe the results of the sulphide oxidation and redistribution from nearby ore into adjacent host rock in terms of Ag, Cd, Hg, Pb, Sb, As and Zn. Provide information on the mobility of As, Cd, Pb and Hg, including information on co-precipitation with secondary zinc minerals and if some of these elements stay behind.

(4) Provide the depth of the Pb/Zn oxidation level. Describe if this level is constant at the scale of the property.

(5) Provide a Table with the range of values characteristic of the Prairie Creek ores. Describe which minerals are responsible for anomalous chromium values.

IR Number: NRCan 9

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Operation of access road and potential impacts to Karst

(NB – The Board is also directed to consider Parks Canada IRs #7, #8 and #9 for related requests)

Preamble

According to CZC the risks to the proposed access route from the potential for renewed subsidence associated with the karst features appear to be small. No evidence of subsidence at any location along the road was noted. However CZC notes that the zone of intense karst terrain that exists in the vicinity of Km 56 be avoided by re-routing the access route to the north of the karst valley (Polje by-pass route). All karst features within 200 m of the access road should be identified and monitored. It is unclear how, when and at what frequency this identification and monitoring will be done.

Requests

(1) Provide a map of karst features along the proposed new route

(2) Provide an analysis of the size and orientation of the karst sinkholes

(3) Comment on the features that control sinkhole distribution (lithology and stratigraphy, faulting and fracturing?) and their bearing on road location

(4) Provide details of the geotechnical investigation that will examine these and other factors related to road stability (ice-rich permafrost; weak soils)

(5) Provide a monitoring plan, including the methods that will be used to monitor karst-related subsidence

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IR Number: NRCan 10

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Baseline climatic conditions

Preamble

Terms of Reference section 3.2.4 requires that baseline climatic conditions, including temperature and precipitation be provided. Information on temperature and precipitation is essential to determine the water balance and also for determining terrain stability and effects of the environment on the stability and performance of project components such as the water storage pond, waste rock pile and water retention structures. In addition, an assessment of the variability in climatic conditions, especially precipitation (including determination of extreme events), is also required to determine the long-term terrain stability (including erosion potential, slope stability) as well as stability of project

components. The DAR and supporting documents indicate that some onsite data for the Prairie Creek site were collected but this is only available for a short period of time (2005-07, with additional data from the Cadillac site for 1980) and the Proponent must therefore rely on data collected from surrounding Environment Canada Stations (e.g. Fort Simpson). Since conditions for the project site may be different than those at Fort Simpson, the proponent may through analyses of data available develop a site climatology or alternatively, deal with uncertainty in climate conditions through sensitivity analysis for example. In addition, only information on summer precipitation is available for the site and the lack of snow data could lead to uncertainties in hydrological modeling, water balance calculations and terrain stability analysis. There are also inconsistencies in the source of climate data utilized for the various analyses presented by the Proponent. For example, for the air quality assessment, data from Fort Simpson are utilized, while data from Ft. Liard and Ft. Simpson along with the limited site data appear to have been used for the waste rock pile modeling. Only 1980 values appear to have been used for other water balance calculations. It is not clear why these inconsistencies exist. To adequately assess the impact assessment provided by the Proponent, a clear statement of the source of the climate data and the rational for selecting the data are required. Further information is also required on how the Proponent incorporated extreme events into their analysis and how uncertainties, particularly with onsite precipitation (including the lack of local winter precipitation and snow data), are dealt with in project component design and impact assessment.

Request

Please provide the following with respect to the climate data utilized:

(1) A clear statement of the source of the climate data utilized for water balance calculations, design (and stability assessments) for project components such as the waste rock pile, water storage pond and water retention structures and the rationale for the data source.

(2) A description of the analysis performed to develop site climatology from the limited onsite data and Environment Canada data from nearby stations. This should also include a discussion of how uncertainties (including the lack of onsite winter precipitation data) are dealt with in design of project components and impact assessment.

(3) A description of how climate variability and extreme events (in particular those associated with precipitation) were included in the design of project components (e.g. water storage pond, waste rock pile, water retention structures), assessments of terrain stability surrounding these structures (e.g. erosion potential and slope stability) and the impact analysis.

IR Number: NRCan 11

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Terrain Conditions along the Access Road

Preamble

Terms of Reference sections 3.24, 3.3.7 and 3.3.3 require the Proponent to provide information on soil and terrain conditions and to also address the impacts that the project may have on the terrain or that the terrain may have on the project. The access road may traverse areas of permafrost and removal of vegetation and surface disturbance due to grading along realignments may result in changes to the ground thermal regime which may result in terrain instability including thaw settlement and slope instability. Changes to surface water (e.g. ponding of water) or erosion associated with these instabilities may also result in impacts to terrestrial and aquatic ecosystems (TOR 3.3.3). From the documentation provided it appears that there have been no subsurface investigations to characterize sediments including thermal and ground ice conditions along the access route. The terrain analysis report (App. 16) indicates that ice-rich material may be present along the route and instabilities (e.g. mudflows) may have resulted from thawing permafrost. Additional investigations have been recommended to the Proponent by Golder (authors of the terrain analysis report). The Proponent states that where possible, organic layers will be maintained in a viable and uncompacted state in order to maintain the ground thermal state. Observations of the ground thermal regime by the Geological Survey of Canada in the Fort Simpson area indicate that permafrost where present is at temperatures close to 0°C and clearance of vegetation and disturbance of the organic layer may lead to permafrost thaw and ground instability (e.g. Smith et al. 2004, 2008, 2010). It is not clear if the Proponent has additional information on the ground thermal conditions along the access road that would indicate that the ground thermal state could be maintained during any construction and operation activities. It is unclear how the Proponent will maintain the ground thermal conditions after clearing of vegetation (even if the organic layer is largely undisturbed) which will reduce shading of the soil and may also result in increased snow cover. Removal of vegetation could also lead to a loss of surface protection during extreme precipitation events leading to increased erosion but is not clear whether there are mitigation plans to deal with this possibility.

Preparation of the access road and its period of operation will be highly dependent on climate and warmer conditions could result in later onset of freezing and less frost penetration and earlier thaws. Low snow conditions could also reduce the protection for the ground surface. It is not clear what monitoring procedures will be in place to ensure that ground conditions are adequate and the activities associated with the road will not result in any damage to the ground surface.

Request

(NB – The Board is also directed to consider Parks Canada IRs #8, #10 and #12 for related requests)

Please provide the following:

(1) Any additional information the Proponent may have consulted or any other observations regarding the properties of the surficial materials along the road alignment including thermal conditions (permafrost existence and ground temperatures) and ground ice conditions where permafrost exists.

(2) A description of plans for further geotechnical investigations to further characterize ground conditions (including ground ice conditions).

(3) A description of monitoring plans to (i) ensure that ground conditions are adequate for activities associated with the road to occur; (ii) to determine if there are any changes to ground stability, increased erosion or other impacts associated with the preparation or operation of the access road.

(4) A description of mitigation plans to ensure that impacts to the ground surface (including the organic layer) and subsequent impacts (ground instability, erosion etc) that may result from changes to the ground surface, ground thermal regime etc. are minimized.

IR Number: NRCan 12

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Stability of the Water Storage Pond (WSP)

Preamble

The Water Storage Pond (WSP) is an essential component of the project water management strategy and any instability that could result in impacts on its integrity could have impacts on water quality, a key line of inquiry (TOR 3.3.2). Adequate information is therefore required on the factors that may affect the terrain stability in the area near the WSP, in particular the north slope of the pond. From the documentation provided, it appears that there has been much work done to characterize subsurface conditions of the North Slope. These investigations include recent investigations conducted by Golder (results provided in App. 12) and earlier studies conducted by BGC in 1994. Although a description of the results from the earlier investigations has been provided, the detailed

information from the BGC reports has not been provided. Thawing of ice-rich permafrost has been proposed as one of the factors exacerbating previous instability of the North Slope and BGC collected data indicating that permafrost was likely originally present. Recent, ground temperature measurements from one site (provided in App. 12), which is located near a stream, indicate that permafrost is not present. More detailed information from the earlier BGC studies however, may be useful in determining whether permafrost may be present beneath the North Slope and whether its continued thawing may result in further instability. The Proponent indicates that the effect of degrading permafrost appears to have abated. However, slope inclinometers have been installed recently and although there has only been one set of measurements, there appears to be movements of several mm per year. It is not clear whether this ongoing creep may be related to additional thawing of permafrost. Slope inclinometers were also installed previously by BGC but these data have not been provided and it is difficult to compare present movements to those in the past.

The Proponent provides documentation of the design options and stability analysis in App. 12. It is not clear however, whether the occurrence of extreme events such as excessive snowmelt or intense rainfall events which might result in elevated pore water pressures or erosion was considered in the stability analysis.

Request

Please provide the following:

(1) Any additional data and information collected during previous investigations utilized to characterize subsurface conditions at the WSP and surrounding area including the North Slope.

(2) Information associated with previous measurements of slope movements on the North Slope in order to compare with the more recent measurements.

(3) Further information related to how extreme events (high rainfall, excessive snow melt) have been incorporated in stability analysis and designs of the WSP, in particular the stability of the North Slope. Please provide any additional information regarding measures that may be utilized to ensure stability of the WSP should these extreme events occur.

IR Number: NRCan 13

Source: Natural Resources Canada - Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Stability of the Waste Rock Pile

Preamble

Stability of the waste rock pile (WRP) and the surrounding terrain is an essential component of the project water management strategy and impacts on the integrity of the WRP could result in impacts on water quality, a key line of inquiry (TOR 3.3.2). The proponent has provided information regarding the design of the WRP (App. 11) and modeling associated with the cover system design (App. 22). It is not clear however whether extreme precipitation events have been incorporated into the design of the cover system to ensure that there will be no excessive erosion of the cover, and therefore maintaining the integrity of the cover and limiting percolation. Runoff from surrounding terrain will be diverted around the pile and it is unclear whether there has been consideration of the impact that extreme rainfall events (which will also result in runoff from the pile to the surrounding terrain) may have with respect to stability of the terrain surrounding the pile (where runoff is diverted) and erosion that may occur which may have impacts on downstream water quality.

Request

NRCan requests that the Proponent provide further information describing how extreme precipitation events have been incorporated into the design of the WRP including its cover system and the associated stability analysis, including that for the surrounding terrain. Please also describe any measures to be implemented to reduce terrain instability or erosion associated with extreme precipitation events.

IR Number: NRCan 14

Source: Natural Resources Canada – Earth Sciences Sector

To: Canadian Zinc Corporation

Subject: Surficial geology, slope stability at Prairie Creek Mine.

Preamble

The surficial geology of Prairie Creek Mine property boundary and access road indicates that they are located in a glaciated (70 %) and unglaciated (30%) terrain. The surficial glacial materials arrived to the sites in question are from the east (Laurentide Ice Sheet) and local cirques in Funeral and Manetoe ranges. Scattered Shield erratics are found at the top of the ranges east of the mine site indicating that the Laurentide glacier overtopped the lowest parts of it. The surficial materials for the mine property are mostly colluvium of different thickness and bedrock surfaces wide spread in location. A minimum amount of sediments derive from glaciofluvial, lacustrine and till deposits

while most are derived from the north part of the Prairie Creek basin. All the terrains are affected by a great variety of slope processes in particular within the mine property: rock fall, debris flows, mudflows, snow avalanches and a minimum of bedrock rotational slides are found in the west part of the property.

The access road presents different percentages of surficial materials. As soon as the road reaches CAT Camp these deposits are in its majority glacial in origin (80%). The maximum thickness of glacial deposits is found on the intermontane basins that served as a sediment trap. These are filled with outwash and lacustrine deposits and less till deposits. Colluvial deposits here have glacial provenance. Lacustrine deposits are commonly affected by permafrost and therefore by retrogressive thaw-flow slides, debris flows and rotational slumping. Plateau areas have carbonate rocks and karst development is common. Recommendations have been proposed for road re-alignment along stretches where the terrain is susceptible to slope instability. These major proposed changes to the winter road have been presented in Appendix 16. Multiple recommendations are given on the subject of instability along the access road i.e. "…appropriate planning and design decisions can minimize the impact", "it is recommended that this issue be assessed in detail…". However, the report does not specify where and what measure will be taken. Tables with information on the stability are provided, however, no detail mapping of the features are presented. The scale of work is much too small.

Request

The report indicates that aerial photographs have been used in the identification of slope processes as well as fieldwork. Please provide the following:

(1) Surficial geology mapping at the scale of the aerial photograph (approximately 1:50 000 scale or less).

(2) Aerial photographs with the interpretation of landslide processes: karst, rock fall, debris flow, mudflow, snow avalanches, rotational slides, retrogressive thawflow slides etc.