



Aboriginal Affairs and Northern Development Canada (AANDC) Public Hearing Presentation

Canadian Zinc Corporation Prairie Creek Mine Project

MVEIRB EA0809-002

**Fort Simpson, NWT
June 23 – 24, 2011**



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Technical Review Summary

Three main areas of concern:

1. Water Quality
2. Water Management and Storage
3. Tailings Management and Storage

Technical Review Summary

Other concerns:

- Post Closure
- Access Road



Water Quality

- Water Quality Objectives or Site Specific Water Quality Objectives (SSWQOs)
 - Effluent Quality and Effluent Quality Criteria (EQC)
- Effluent Discharge
 - Exfiltration Trench and Mixing Analysis
- Aquatic Effects Monitoring Program (AEMP) and Adaptive Management



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Site Specific Water Quality Objectives (SSWQOs)



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SSWQOs - Derivation

- Site Specific Water Quality Objectives (SSWQOs) is the “standard” for water at an assessment boundary. It defines the level of protection afforded a waterbody downstream of a development.
- Defensible and acceptable SSQWOs are required for the Prairie Creek Mine. This requires input from all parties.

SSWQOs - Derivation

- **Recommendation:**
 - AANDC recommends that the Developer be required to establish and present SSWQOs for the Prairie Creek Mine using the Reference Condition Approach.
 - A committee consisting of the Developer and interested parties to the Environmental Assessment will evaluate the appropriateness and practicality of these generated SSWQOs. The committee will report back to the Review Board with a recommendation on appropriate SSWQOs for Prairie Creek, prior to the Review Board's closure of the public registry for EA0809-002.

SSWQOs – Assessment Boundary

- Estimates of in-stream water quality affected by mine related activities show very little decrease between the edge of a proposed mixing zone 100 m downstream of the site and the Nahanni National Park Reserve (NNPR) boundary 7 km downstream of the site.

SSWQOs – Assessment Boundary

- **Recommendation:**
 - AANDC recommends that in-stream water quality must meet SSWQOs, derived using the Reference Condition Approach, at the edge of a predefined assessment boundary (e.g. vertical mixing zone, horizontal mixing zone, NNPR boundary). The location of the assessment boundary for the Prairie Creek Mine would have to be determined in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.

SSWQOs - Mercury Concentrations

- Mercury will be present in the effluent from the mine.
- Existing mercury concentrations in Prairie Creek water and sediment in the vicinity of the mine site have not been established.
- Studies conducted to date have documented an increase in fish tissue mercury concentrations downstream of the mine site.
- An aboriginal subsistence fishery exists at the mouth of Prairie Creek.
- CZN has completed only a qualitative assessment of the potential for mercury to bio-accumulate in Prairie Creek.

SSWQOs - Mercury Concentrations

- **Recommendation:**
 - ANNDC recommends that CZN collect and analyze additional samples (seasonally representative) using a sufficiently low detection limit to permit development of a SSWQO for mercury in Prairie Creek using the Reference Condition Approach. This work would have to be completed in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.

SSWQOs - Mercury Concentrations

- **Recommendation:**
 - AANDC recommends that CZN identify whether increases in mercury concentrations resulting from their discharge can meet this Reference Condition Approach objective, and quantify the level of impact in Prairie Creek resulting from increased concentrations of mercury. This evaluation should consider both the operational and post-closure period. This work would have to be completed in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.

SSWQOs – Effluent Quality Criteria

- Effluent Quality Criteria will be determined from SSWQOs.

SSWQOs – Effluent Quality Criteria

- **Recommendation:**
 - AANDC recommends that Effluent Quality Criteria (i.e. Maximum Grab Concentrations) must be back calculated from SSWQOs based on the Best Estimate inflow prediction.

SSWQOs – Effluent Quality Criteria

- **Recommendation:**
 - ANNDC recommends that CZN must not discharge effluent that has concentrations above the stipulated Maximum Grab Concentrations in the Water Licence.

SSWQOs – Effluent Quality Criteria

- **Recommendation:**
 - AANDC recommends that any discharge from the end-of-pipe must meet the Maximum Average Concentrations as stipulated by the Surveillance Network Program (SNP) in the Water Licence. Detailed instructions on the method and timing for sampling, deriving and reporting regulated average concentrations should be specifically outlined within the SNP.



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Effluent Discharge



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Effluent Discharge

- Exfiltration trenches are not commonly used for discharge into a waterbody.
- Potential concerns:
 - Incomplete mixing in the trench resulting in effluent jets entering the receiving water and mixing downstream.
 - Plugging of the pipe due to debris entering the pipe.
 - Pipe break due to differential movement of sections of the pipe.

Effluent Discharge

- Successful operation of the Exfiltration Trench will be key to meeting in-stream Water Quality Objectives.

Effluent Discharge

- **Recommendation:**
 - AANDC recommends that the final design of the trench and twinned pipe configuration should account for potential failure mechanisms.

Effluent Discharge

- **Recommendation:**
 - AANDC recommends that Canadian Zinc evaluate the requirement for a screen or equivalent structure on the upstream end of the discharge pipe to minimize the potential for debris entering the exfiltration pipe and causing a blockage.

Effluent Discharge

- **Recommendation:**
 - AANDC recommends that the performance of the exfiltration trench be monitored as part of the SNP, to confirm that adequate performance is achieved.

Effluent Discharge

- **Recommendation:**
 - AANDC recommends that no effluent be discharged via the culvert into Harrison Creek unless an emergency situation has been declared for the site by the MVLWB.
 - Any discharges to Prairie Creek via Harrison Creek must be short term in duration to avoid potentially increased effects to the environment from the mine site.
 - During this scenario a specific Emergency Plan, approved by the MVLWB, must be followed by CZN. This Emergency Plan should include a complete shut down of mining and milling operations.



Aquatic Effects Monitoring Program (AEMP) and Adaptive Management



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AEMP and Adaptive Management

- The Developer is responsible for monitoring and assessing the impacts of their project on the aquatic environment, and adapting their project to minimize impacts.
 - AANDC has developed the Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories (2009).
- CZN's proposed AEMP concept includes reference to AANDC's guidelines but is missing key components.
- Identification of low, medium and high action levels must be identified as a part of this plan.

AEMP and Adaptive Management

- **Recommendation:**
 - AANDC recommends that CZN follow the “Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, June 2009” in the development of its AEMP, action levels, and related management response framework for the Prairie Creek Mine.
 - This work should commence in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.



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Water Management and Storage



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Water Management and Storage

- Water Storage Pond (WSP) Capacity:
 - Holding water is the primary contingency identified for addressing issues related to meeting Water Quality Objectives or EQCs.
 - Slope stability concerns impose limitations on the operation of the existing WSP ~ 3m working depth.

Water Management and Storage

- Water Storage Pond (WSP) Capacity:
 - CZN proposes to maximize discharge during the summer (higher average flows) and discharge less over the winter (lower average flows).
 - Depending upon timing, process upsets could require storing a volume of water exceeding the available storage space.

Water Management and Storage

- **Recommendation:**
 - AANDC recommends that the WSP must be operated such that the water level does not impinge on the 1 m freeboard level. The freeboard must be reserved for short-term emergency situations.



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Tailings Management and Storage



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Tailings Management and Storage

- CZN proposes to backfill 100% of the float tailings produced during operations.
- Approximately 50,000m³ of float tailings will be stored in the WSP during operations.
 - Required to give time for mining of ore to create voids for placing paste backfill.

Tailings Management and Storage

- AANDC's analysis indicates that the backfill calculations are not conservative.
- Additional tailings may require storage on surface during operations and potentially post closure.
- Additional tailings stored in the WSP will impact available storage volume and water quality.

Tailings Management and Storage

- **Recommendation:**
 - AANDC recommends that the Developer provide the following information regarding tailings and water management prior to closure of the public record for EA0809-002:
 - A detailed mining and paste backfill schedule be produced by CZN to demonstrate that float tailings will not accrue in Cell A of the WSP.
 - A detailed description of all operational contingencies that may be implemented to maintain the working capacity of the WSP for the life of the mine, if or when required.
 - This work would have to be completed in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.

Tailings Management and Storage

- **Recommendation:**
 - AANDC recommends that any temporary float tailings stored on the surface be stored in predesigned and approved lined containment areas that have specified capacity limits that must not be exceeded.

Tailings Management and Storage

- **Recommendation:**
 - AANDC recommends that any Dense Media Separation (DMS) tailings that do not proceed to the Paste Backfill Plant must be transported and stored within the Waste Rock Pile (WRP) as per CZN's operating plan. Any temporary DMS facilities must be predesigned, lined and approved to contain DMS and leachate; their maximum specified storage capacity must not be exceeded.



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Post Closure Conditions



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Post Closure Conditions

- CZN has provided minimal assessment of post closure impacts:
 - Mine water quality and quantity.
 - Paste backfill leachate quality.
 - Groundwater monitoring is proposed, but response to poor quality groundwater is not clear.
 - Seepage from waste rock pile is not likely acid generating, but potentially metal leaching.
 - Hydrocarbon impacted soil to be landfarmed – no discussion of leachate impacts to water.
 - Potential for tailings storage on surface.

Post Closure Conditions

- **Recommendation:**
 - AANDC recommends that post closure water quality must meet SSWQOs derived using a Reference Condition Approach. This would be determined in conjunction with the establishment and evaluation of SSWQOs for Prairie Creek.

Post Closure Conditions

- **Recommendation:**
 - AANDC recommends that CZN develop a Preliminary Closure and Reclamation Plan, during the regulatory phase prior to Water Licence issuance.
 - The plan must be developed in consultation with regulators, stakeholders and other interested parties.
 - The plan should developed in accordance with AANDC's Mine Site Reclamation Guidelines (January 2007) or subsequent version.



Access Road

- Land Disturbance
- Permafrost Degradation
- Sediment Inputs
- Post Closure
- Spills



Access Road – Land Disturbance

- CZN will be relying upon frozen ground for their winter road to prevent disturbance to the underlying surface.
- Calendar dates are proposed to determine the start and end of the winter road season.
- Calendar dates may not accurately predict the presence of frozen ground in every year.
- Local ground temperature measurements will provide a more accurate indication of when the ground is frozen.

Access Road – Land Disturbance

- **Recommendation:**
 - AANDC recommends that local ground temperature measurements define the commencement of road construction activities using equipment other than low pressure ground vehicles, in areas where road construction relies on frozen ground.

Access Road – Land Disturbance

- **Recommendation:**
 - AANDC recommends that local ground temperature measurements define the duration of the road operating season, in areas where road operation relies on frozen ground.

Access Road – Permafrost Degradation

- Areas of permafrost will be encountered along the access road.
- Side slopes containing ice rich ground may be particularly susceptible to impacts.
- Road construction and operation may lead to permafrost degradation.
- A permafrost assessment has not been conducted along the access road route.

Access Road – Permafrost Degradation

- **Recommendation:**
 - AANDC recommends a permafrost assessment be conducted along the access route to identify areas requiring implementation of measures to ensure the integrity of the underlying permafrost. Road construction/operation methods to maintain the organic layer in permafrost areas should be defined in advance of initial road construction.

Access Road – Permafrost Degradation

- **Recommendation:**
 - AANDC recommends that construction of access through side slopes containing permafrost, specifically ice rich ground, should be avoided where possible. Where unavoidable, site-specific stabilization measures should be developed and approved by regulators prior to implementation.

Access Road – Permafrost Degradation

- **Recommendation:**
 - AANDC recommends that ground temperature monitoring data should be collected along the access road itself and in adjacent undisturbed terrain where permafrost is present to evaluate the success of operational measures to prevent the degradation of underlying permafrost.

Access Road – Sediment Inputs

- Access road construction and operation could facilitate sediment inputs to water courses.
- Construction on side slopes with ice rich soil should be avoided where possible.

Access Road – Sediment Inputs

- **Recommendation:**
 - AANDC recommends that a Sediment and Erosion Control Plan be developed in advance of mine operations. This Plan should include an assessment of the erosion sensitivity of the mine site, as well as proposed watercourse crossings along the access route.
 - Site-specific mitigation measures to prevent erosion should be defined.

Access Road – Sediment Inputs

- **Recommendation:**
 - AANDC recommends that erosion control measures identified within the Sediment and Erosion Control Plan be implemented in advance of operations.

Access Road – Sediment Inputs

- **Recommendation:**
 - AANDC recommends that routine monitoring of erosion susceptibility at watercourse crossings along the access road should be conducted. If issues are identified, maintenance/mitigation measures should be implemented in as timely a manner as possible.

Access Road – Sediment Inputs

- **Recommendation:**
 - AANDC recommends that local ground temperature measurements define the commencement of road construction activities using equipment other than low pressure ground vehicles, in areas where road construction relies on frozen ground.

Access Road – Sediment Inputs

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Access Road – Sediment Inputs

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 - AANDC recommends that ground temperature monitoring should be collected along the access road itself and in adjacent undisturbed terrain where permafrost is present, to evaluate the success of operational measures to prevent the degradation of underlying permafrost.

Access Road – Post Closure

- There is a lack of clarity regarding ultimate closure and reclamation of the access road.
- The entire length of the access road should be included within the Prairie Creek Mine Closure Plan.

Access Road – Post Closure

- **Recommendation:**
 - AANDC recommends that the Closure and Reclamation Plan include the entire length of the access road.

Access Road – Spills

- Terrestrial and Aquatic Impacts from Spills Along the Access Road:
 - A variety of materials will be transported on the access road and the access road crosses a variety of terrain types.
 - The assessment of risk and consequence should consider the differences in effects and response depending upon the product spilled and the location.

Access Road – Spills

- **Recommendation:**
 - AANDC recommends that an assessment of the risk and consequence of spills along the access road be conducted by product type. This evaluation should dictate operational procedures, implementation of preventative/mitigative measures, and response measures for potential spills.



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Closing Remarks



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Concluding Remarks

- The Prairie Creek Mine will discharge effluent into Prairie Creek.
- The effluent discharge location is 7 km upstream of the boundary with NNPR.
 - National Park
 - UNESCO World Heritage Site
 - Canadian Heritage River
- An aboriginal subsistence fishery exists at the mouth of Prairie Creek.
- The level of protection required for Prairie Creek must consider conditions within Prairie Creek as well as the downstream environment.

Concluding Remarks

- As proposed, the Prairie Creek Mine development poses a high level of risk for significant adverse impacts to water.
- AANDC is committed to working with interested parties towards the resolution of outstanding issues identified during the process.



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Thank you



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