

Overview

- ▶ Influence of Inuit and Stakeholder Engagement
- ▶ Existing Environment
- ▶ Project-Environment Interactions
- ▶ Design and Management Based Mitigation
- ▶ Residual Effects and Significance
- ▶ Monitoring Framework
- ▶ Key Outstanding Issues and AREVA's Proposed Issue Resolution



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Influence of Inuit and Stakeholder Engagement

- ▶ Through Inuit Qaujimajatuqangit (IQ) interviews and engagement activities, AREVA has learned about the importance of the marine environment to Kivalliq community members and main concerns include:
 - ◆ Physical presence and movement of marine vessels and effects on the health of marine wildlife (injuries and mortality from collisions with ships) and effects on shoreline habitat (vessel wake)
 - ◆ Underwater noise associated with operation of marine vessels and its effects on marine wildlife
 - ◆ Potential environmental effects of bilge and ballast water, changes in sediment transport, and accidental spills on coastal and marine habitat and marine wildlife
- ▶ Comments and concerns were integrated into the marine study design by:
 - ◆ Identifying mitigation measures and monitoring activities to minimize vessel movement effects on marine wildlife and habitat
 - ◆ Conducting an acoustic modelling study to estimate underwater sound levels emitted by marine vessels along proposed routes
 - ◆ Reviewing regulations, operating protocols, and best practices to prevent discharges of pollutants, sediments, and foreign ballast water from Project vessels



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Project – Environment Interactions

- ▶ The assessment considered the following components of the marine environment

- ◆ Marine mammals
- ◆ Marine fish
- ◆ Marine birds
- ◆ Marine benthic invertebrates
- ◆ Marine vegetation
- ◆ Marine sediment quality
- ◆ Marine water quality
- ◆ Marine species at risk



- ▶ Project activities are expected to have potential interaction with marine mammals and marine fish in the LAA and RAA
- ▶ Substantive interactions with the remaining components of the marine environment are not expected



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Project – Environment Interactions Species at Risk

- ▶ Six species listed under SARA have range that may overlap with the RAA:

- ◆ Northern wolffish
- ◆ Atlantic wolffish
- ◆ Spotted wolffish
- ◆ Polar bear
- ◆ Harlequin duck
- ◆ Peregrine falcon

- ▶ Potential effects on wolffish are similar to those expected for other marine fish
- ▶ Limited spatial overlap with the range and habitat of Harlequin duck and Peregrine falcon; interaction with Project shipping is unlikely
 - ◆ Project vessels will avoid key marine habitat areas for migratory birds, migratory bird sanctuaries, and important bird areas
 - ◆ Vessel lighting will be shielded to minimize the potential for bird-vessel collisions
- ▶ Effects of marine transportation on polar bears are not expected
 - ◆ During open water season, polar bears in the region are generally on land
 - ◆ Project vessels will typically be transiting 30 – 60 km offshore
 - ◆ Encounters with swimming bears will likely be rare; vessels will be navigated to avoid the path of a swimming polar bear



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Existing Marine Environment Marine Mammals

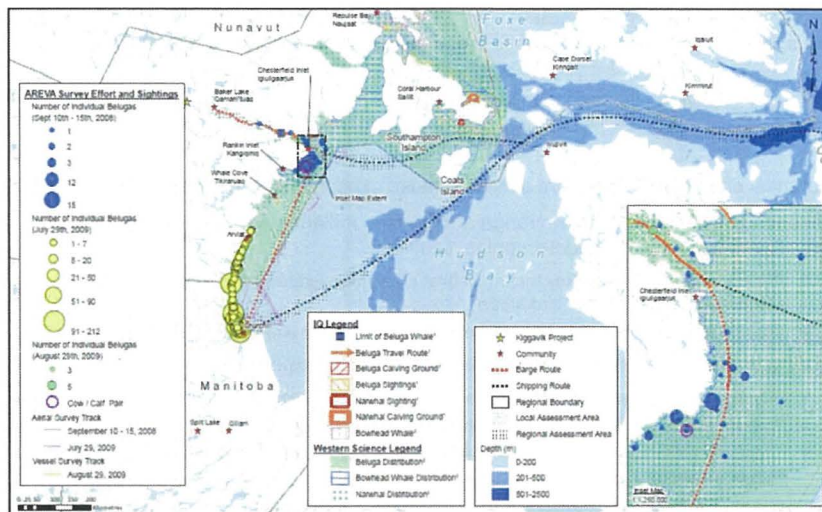
- ▶ Information from IQ, aerial surveys, and scientific literature was used to develop a baseline understanding of distribution and abundance of marine mammals
- ▶ Nine species of marine mammal occur in the Regional Assessment Area (RAA)
 - ◆ Ringed seal
 - ◆ Beluga whale
 - ◆ Narwhal
 - ◆ Bearded seal
 - ◆ Bowhead whale
 - ◆ Killer whale
 - ◆ Harp seal
 - ◆ Walrus
 - ◆ Polar bear
- ▶ Aerial surveys for marine mammals were conducted in 2008 and 2009 and a vessel based survey was conducted in 2009
 - ◆ Beluga whales, seals, and walrus were observed in open water and polar bears were observed on the coast
- ▶ Schedule 1 of the Species at Risk Act (SARA) lists polar bear as Special Concern
- ▶ Beluga whale, bowhead whale, walrus, narwhal, killer whale, and polar bear are designated as Special Concern by COSEWIC



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Example: Whale IQ and Field Surveys



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Project – Environment Interaction Marine Mammals

- ▶ Key issues for marine mammals relate predominantly to marine vessel traffic and its potential to physically harm, disrupt, and/or displace marine mammals from summer habitat in Hudson Bay and Chesterfield Inlet.

Project Activities/Physical Works	Potential Environmental Effects	
	Change in Mortality Risk	Change in Behaviour
Construction	✓	✓
Transport fuel and construction materials (transfers, barging)		
Operations	✓	✓
Marine transportation: loading barges, barging, off-loading (fuel, reagents and supplies), Baker Lake and Churchill/Chesterfield, back-haul		
Final Closure	✓	✓
Marine transportation: fuel and construction materials (transfers, barging)		

- ◆ The assessment of potential effects of marine transportation activities on marine mammals focuses on change in mortality risk due to vessel collisions and change in behaviour due to sensory disturbance and vessel movement.



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Design and Management-Based Mitigation

- ▶ A variety of mitigation measures will be employed to reduce the potential of a Project related vessel-mammal collision from occurring
- ▶ Mitigation by Design:
 - ◆ Marine shipping planned to occur only during open water season
 - ◆ Presence of a local Marine Mammal Observer (MMO) onboard vessels travelling through Chesterfield Inlet to monitor marine activity
- ▶ Mitigation by Management:
 - ◆ Limiting vessel speed in sensitive areas and confined navigation routes
 - Maximum of 10 knots when transiting near Port of Churchill
 - Maximum of 13 knots along established shipping routes in Hudson Bay and Hudson Strait
 - ◆ Vessels will avoid unnecessary acceleration and maintain a constant course
 - ◆ Upon advice of the MMO, the vessel will halt if marine mammals appear to be herded by the approaching vessel

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Residual Effects and Significance Determination

- ▶ Potential residual environmental effects from increased mortality risk to marine mammal populations are expected to be low in magnitude, site specific (along the shipping route), long term, sporadic (restricted to the open-water season when vessels are transiting), and low in frequency
 - ◆ The probability of a lethal or severe vessel collision is considered to be low at speeds of less than 14 knots
 - ◆ The effect of a vessel collision with a marine mammal is potentially fatal, but environmental effects on marine mammal populations are expected to be reversible through natural recruitment
- ▶ The potential environmental effect of an increase in mortality risk of marine mammals due to vessel collision is determined to be not significant



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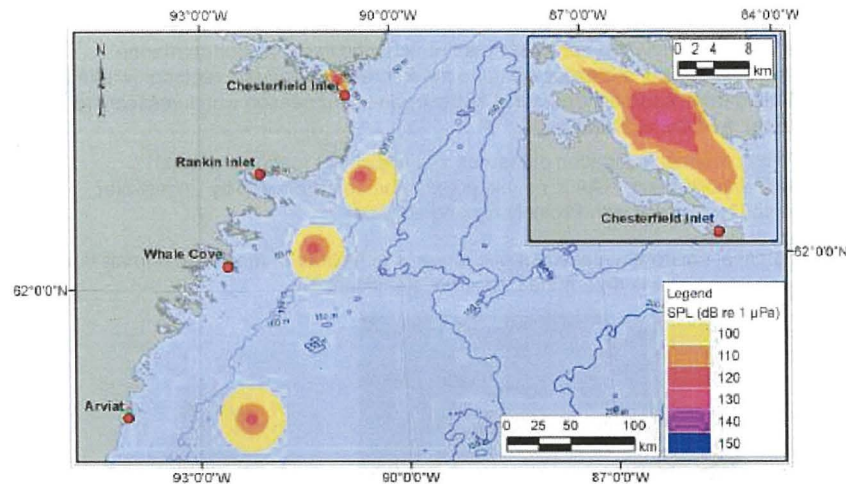
Underwater Acoustic Modelling

- ▶ There is potential for change in behaviour of marine mammals when exposed to underwater noise levels above 120 dB re: 1 μ Pa
- ▶ Acoustic modeling predicts underwater noise levels associated with project vessels at four locations along the shipping route
 - ◆ Underwater noise levels may exceed 120 dB re: 1 μ Pa for up to 4.8 km from the vessel
 - ◆ A stationary animal may be exposed to this level of noise for up to 24 minutes as the vessel is in transit
- ▶ Marine mammal reactions may range from no effect or a small change in respiration rate, to avoidance and change in travel route
- ▶ Animals are expected to recover quickly, and exposure time for each individual animal is expected to be minimal

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Underwater Acoustic Modelling Marine Mammals



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Design and Management-Based Mitigation

- ▶ Mitigation measures will be applied to reduce marine mammal behavioural changes, such as avoidance of underwater noise and changes in migration routes
- ▶ Mitigation by Design:
 - ◆ Minimize propulsion noise – optimize propeller shape for tugs
 - ◆ Imposing vessel speed limits (maximum 13 knots)
 - ◆ Using established routes to limit acoustic inputs to similar and predictable areas
- ▶ Mitigation by Management:
 - ◆ Routine propeller inspections and maintenance to minimize cavitation
 - ◆ Vessels will maintain a constant course and avoid unnecessary acceleration and erratic maneuvers
 - ◆ Upon advice of the MMO, vessels will halt if marine mammals appear to be herded by the approaching vessel



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Residual Effects and Significance Determination

- ▶ Potential residual environmental effects from change in behaviour on marine mammal populations are expected to be moderate in magnitude, regional (within the RAA), long term, sporadic (restricted to the open-water season when vessels are transiting), and low in frequency
 - ◆ With proposed mitigation measures, the viability of marine mammal populations in the RAA is not expected to be compromised by underwater noise associated with Project shipping activities
- ▶ The potential environmental effect of change in behaviour of marine mammals due to underwater noise is determined to be not significant



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Residual Effects and Significance Determination

- ▶ Potential for increased mortality and change in behaviour due to Project-related vessels will exist over the life of the Project
- ▶ Residual environmental effects on marine mammal populations resulting from marine transportation are expected to be not significant due to:
 - ◆ Low frequency of vessel transits in the RAA;
 - ◆ Low intensity of sensory disturbance expected; and
 - ◆ Mitigation measures that will be in place to reduce the incidence of vessel-mammal collisions and minimize underwater noise



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Cumulative Residual Effects and Significance Determinations

- ▶ Project-related marine transportation is expected to contribute to cumulative effects on marine mammals in the region
 - ◆ Marine transportation is limited to the open water season
 - ◆ Increased mortality risk to marine mammals due to Project-related vessel-mammal collisions are considered to be low
 - ◆ Underwater noise exposure of any one animal from a transiting vessel is expected to be limited temporally and spatially
 - ◆ Effects are not expected to affect population viability of marine mammal populations
- ▶ The Project's contribution to the cumulative effect of change in mortality risk and change in behaviour of marine mammals is predicted to be not significant

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Existing Marine Environment Marine Fish

- ▶ Little is known throughout most of the Arctic regarding fish species occurrence and distribution, but at least 49 species of fish occur in the marine ecosystem of Hudson Bay and Chesterfield Inlet
- ▶ Based on collection of IQ and the scientific literature, common species in Chesterfield Inlet and Hudson Bay are known to include:
 - ◆ Arctic char
 - ◆ Arctic sculpin
 - ◆ Arctic cod
 - ◆ Fourhorn sculpin
 - ◆ Banded gunnel
 - ◆ Whitefish
- ▶ Three species of marine fish in the RAA (the Northern, Atlantic, and spotted wolffish) are listed on Schedule 1 of SARA; Hudson Strait is designated as 'probable' range
- ▶ There are no SARA listed fish species or species designated by COSEWIC as species of concern in Chesterfield Inlet, Baker Lake, and surrounding area



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Project – Environment Interaction Marine Fish

- Project-related marine transportation on marine fish relate predominantly to underwater noise and its potential to physically harm, disrupt, and/or displace fish from habitat in Hudson Bay and Chesterfield Inlet.

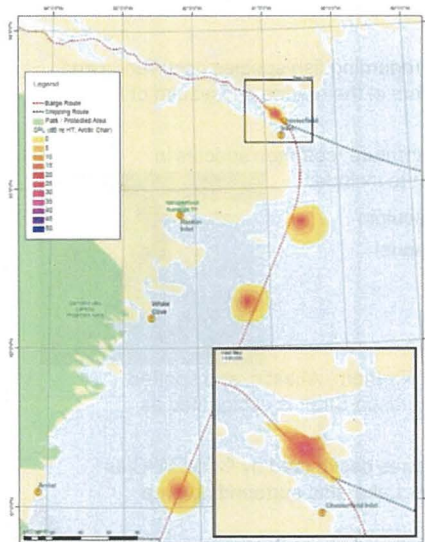
Project Activities/Physical Works	Potential Environmental Effects
	Change in Behaviour
Construction: Transport fuel and construction materials (transfers, barging)	✓
Operations: Marine transportation: loading barges, barging, off-loading (fuel, reagents and supplies), Baker Lake and Churchill/Chesterfield, back-haul	✓
Final Closure: Decommissioning Marine transportation: fuel and construction materials (transfers, barging)	✓

- ◆ It is expected that almost all fish will move away from an approaching vessel in response to the physical presence and noise from the vessel
- ◆ The assessment of environmental effects on marine fish focuses on the potential change in behaviour due to sensory disturbance

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Underwater Acoustic Modelling Marine Fish



- Literature suggests a change in behaviour of marine fish may occur when exposed to underwater noise levels that exceed 30 dB re HT
- Acoustic modeling predicts underwater noise levels above the hearing threshold of Arctic char at four locations along the shipping route
- ◆ Underwater noise levels may exceed 30 dB re HT for up to 500 m from the vessel
- Response to underwater noise may cause
- ◆ startle response
 - ◆ alarm response
 - ◆ lack of response due to auditory masking
 - ◆ change in behaviour or movement patterns

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Design and Management-Based Mitigation

- ▶ Mitigation measures are similar to those implemented for marine mammals and include:
 - ◆ Speed restrictions
 - ◆ Avoidance of unnecessary acceleration and erratic maneuvers
 - ◆ Use of established shipping routes



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Residual Effects and Significance Determination

- ▶ Marine fish are expected to recover quickly and exposure time for each individual animal is expected to be minimal
- ▶ Potential residual environmental effects from change in behaviour on marine fish populations are expected to be low in magnitude, site specific (along the shipping route), short term, and reversible
 - ◆ Any change in behaviour will be brief, spatially limited, and is not expected to have an effect on fish populations in the RAA
- ▶ Given the localized nature and low magnitude of the effect, and the availability of accepted mitigation measures and best practices, environmental effects on marine fish are expected to be not significant

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Cumulative Residual Effects and Significance Determination

- ▶ Marine transportation associated with the Project may contribute to cumulative effects of underwater noise on marine fish in the RAA
- ▶ Cumulative environmental effects of change in behaviour due to marine transportation are not expected to affect the viability of marine fish populations
 - ◆ Based on acoustic modelling, the spatial extent where behavioural effects may occur is small and residual effects on fish are expected to be low
 - ◆ Marine fish are currently exposed to underwater noise disturbance from recreational vessels, supply barges, and commercial vessels



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Summary of Cumulative Effects and Significance Determination

- ▶ Project related environmental effects on the marine environment and marine wildlife populations are expected to be low
- ▶ All vessels operating within the RAA have the potential to result in behavioural change (marine fish and mammals) or mortality risk (marine mammals)
 - ◆ Project vessel traffic may act cumulatively with existing and future vessel traffic in the LAA and RAA
- ▶ Marine populations in the RAA are currently exposed to low levels of disturbance from existing vessel traffic
- ▶ Predicted effects are not expected to affect the population viability of any species given the large geographic ranges of those species likely to be affected, the limited overlap of shipping routes with these ranges, and the short duration that individuals of a population are likely to be affected
- ▶ The Project's contribution to cumulative effects on the marine environment is predicted to be not significant

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Monitoring Framework

- ▶ Marine mammal observers (MMO) will be present onboard tugs and vessels to monitor marine activities when transiting Chesterfield Inlet
 - ◆ MMOs shall record all marine mammal sightings, near misses, and incidents of vessel collisions with marine mammals in the LAA
 - ◆ Sightings and incidents shall be recorded by the maritime crew in the RAA
 - ◆ Ship logs will record course adjustments to avoid sensitive habitat, vessel speed, and speed reductions in important areas
- ▶ AREVA will develop a marine wildlife protection program to further describe:
 - ◆ the distribution and abundance of marine mammals in the LAA and approaches to Chesterfield Inlet
 - ◆ augment the onboard MMO monitoring program
- ▶ The final design of the marine monitoring program will be developed in collaboration with government agencies and local HTO's



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Monitoring Framework

- ▶ Marine transportation associated with the Project is not expected to result in significant residual effects, nor contribute to cumulative environmental effects on marine fish or marine birds
 - ◆ No monitoring programs are proposed for marine fish
 - ◆ Any sightings or incidental catches of SARA listed species of wolffish made during Project associated monitoring programs will be reported in order to improve understanding of their distribution, habitat use, and abundance
 - ◆ Any incidents involving marine bird collisions with Project vessels will be recorded
- ▶ AREVA will consider seeking participation in the Marine Environment Working Group (MEWG) established for the Mary River Project
 - ◆ Opportunity to contribute to understanding the potential cumulative effects of shipping on the regional marine environment
 - ◆ Collaborative effort to identify marine best practices and mitigation and implement adaptive management where appropriate



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Key Outstanding Issues

- ▶ Issues were raised specifying additional baseline information that should be incorporated into relevant marine environment plans
 - ◆ At licensing, plans will be updated with best available information from both western science and IQ knowledge sources regarding:
 - species at risk
 - abundance and distribution
 - critical habitat
 - migration routes
 - potential for interactions with Project vessels
- ▶ AREVA remains committed to working with the GN to include additional information on polar bear distribution into future updates to relevant marine baseline and management plans
 - ◆ Project marine transportation is not expected to result in environmental effects on polar bears since shipping will only occur during the open water season



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Key Outstanding Issues

- ▶ Concerns expressed on the potential effects of a fuel spill from a Project vessel on marine wildlife
 - ◆ The risk of a diesel fuel spill was assessed as low to moderate risk
 - Low frequency of vessel transits
 - Commitment to use a reputable, experienced shipping company
 - Spill contingency and emergency response plans that will be in place
 - ◆ Fuel spill dispersion modelling will be conducted prior to Project shipping
 - Reasonable worst-case spill scenarios along proposed shipping routes will be used to inform emergency response strategies



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THANK YOU



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