Nanisivik Mine

NiyF4 s/C48ix6F4

Environmental Site Assessment (ESA)

&

Human Health and Ecological Risk Assessment (HHERA)

x?tz kNz euD/siz (ESA)

x7ml

wkw5 tuq8k5 x7ml x?tz i5g5 smJw5 x5b3N3gu7mzb euD/siz (HHERA)

Background
c k w o s3y m i z

- October 1st, 2002 – NWB approved a water licence for the closure and reclamation of Nanisivik Mine, however certain conditions must be met
- January 30th, 2003 – CanZinco Limited submits its Phase II ESA, HHERA reports to the NWB
- March 29th, 2003 – Technical meeting held in Iqaluit to discuss these submissions
- End of May, 2003 – NWB to review and approve the documents

- sgWE)!, @))@ _ kNK5u wuoEi3j5 vtmpq5 xq3y9lt4 wu3j5 xgDmiq5 WJ8Nstzi4 mg/sizk5 x7ml nlm3n3bsizk5 NiyF4 s/C4ix3F4 ryxi xgd/sJi4 sc3ymics3Li.
- /kxE #), @))# _ v8pf4f5– CanZinco Limited giy9lt4 xg3bsix3gu4 @ x?tzb euD/sizi4, tuj9l x5b3N3gumzb euDi3u4 X3Nstzi4 giy9lt4 kNK5u wuoEi3j5 vtmpq8k5
- mp @(, @))# _ wloq8i4 ckwozizi4 vtmstc3Lt4 wcl4i gi/symJ5 WJbs9lt4.
- Mw kazi @))# _ kNK5u wuoEi3j5 vtmpq5 euDlt4 x7ml xq3ylt4 X3NstsJi4.

Part I
wM z !

Phase II Environmental Site Assessment (ESA)

xg3bsJmJ6 @ x?t z kN z euD/s i z (ESA)

What is the Phase II ESA and what does it have to do with the Nanisivik Mine?

rh? xg3bsJmJ6 @ x?t z i4 euDi6 x7ml ck3 xgtc3m5 NiyF4j5 V

- Study to understand the contamination at the mine site
  - What contaminants are there?
  - Where are they located?
  - How much contamination is there?
- Based on a detailed site visit, which included soil sampling, as well as historical information
- It follows standards and guidelines supported by the Federal government (Canadian Council of Ministers of the Environment - CCME)

- cspn3lt4 gryNh4lt4 hD3N3gi4 s/C4ix3Fzi
  - ckw5g?5 hD3N3g5V
  - Nu2X5 hD3N3g5 V
  - cktQ hD3N3g3bc3tQ? V
- euD/sizb ckwozi z mo4lA, WcystlA miCzi4 gxX4u4 cspn3Lt4, x7ml cspn3bsc5b3ymJ5
- moZ3i4 xgxZi4l Z?mgc4fi z3gi4 xg3y9lt4

What different pieces of information make up the ESA?

c k w5g i 4 gnZ4nsJ i 4
w l o c3X x? t o E i 6 V

1985 Soil metal survey
!(*%u miC3u5g5 nF4nc3i z cspn3bs9l i

- Soil samples from all around the mine site were taken
- Occurred before the disposal of tailings above-ground; provides “background” values
- Soil metal concentrations of zinc, lead and copper were elevated in the town and mine area
- May be the result of natural rock formations

- miC6 gxX4l W/w=Fs9l i s/C4ix3FsJ5 ciQ/omz cspnZ4n3b3Fs9l i
- WbcMs3g5 fFyc5b1q t9lQ5 miCgw8N3j5; cspmJt5tx?sJ6 ckwc5b3ymi z k5 gryQxDtQlA
- miC3uz3g6 nF4nsi q5 hD3N3g5 zinc, lead x7ml copper d=?y4i6nsMs3g5 kNozi x7ml s/C4b3FsJ5 ciQ/z l
- s/C4 bwmwo zw8N3i z k9l8i5 wo6dy6h6Li

Marine sediment studies
w}n i 5g5 c spn3bs i q 5

- Several studies were taken before and during mining (1974-2000)
- There were elevated levels of metals near the mouth of the creek before mining operations started
- These levels have increased over time

- s k X l 4g5 c spn3bsMs3g5 s/C4 i xMs q 8 t 9 l Q5 x7m l s/C4 i x3ymo3 t 9 l Q5 G!(&$u5@)))j5H
- nF4nc3 i z d?y4 i 6nsMsg5 f z b fQx3 i z b c i Q/ z i s/C4 i xMs q t 9 l Q5
- b4fx d?y4 i q5 x q4oQx3ymo3g5 W?9ox9 l i

Air and water quality studies SJiz x7ml wus5 ckw5giq5 cspn3bs9lt4

- From 1997, CanZinco has monitored air quality at the mine site
- Extensive water quality studies have taken place
  - Mine activities have increased metals concentrations into Twin Lakes and Strathcona sound
  - Dominant source of metals is West Adit area
  - Water quality compliance from tailings area has been good

- !((&u, v8pf4f5 CanZinco cspnc5b3ymJ5 WJiz yMsu5g6 s/C4is3FsJu
- cspn5tx6ymJi4 xgc5b3ymJ5 wus5 ckw5giz i4
  - s/C4ys3iq8k5 nF4nc3iz xq4oQx3ymJ6 by3j5 x7ml bEsj5 vq3L4j5
  - nF4nc3FsMaJ6 xqMu4 s/C4b3FsJ6 West Adit
  - wus5 ckw5giz i4 moZ3i4 wmw5g/Exc3iz i4 mo4ym5tx3g5

2002 Soil Survey
2002 miCz gxX4 csn3bsiz

- A large number of soil samples were taken by CanZinco's consultants from around the:
  - Town site
  - Industrial Complex
  - Dock site
  - Tailings Disposal Facility
  - Solid Waste Facility
  - STOL Air Strip
  - Mine Workings

- sk3gv9<w5 cspn3FsMs3g5 v8pf4f8i5 CanZinco wcNw/3tbsJi5 cspn3tj4 sfiz csn3Lt4:
  - kNoz wkc3FsJ6
  - w3cNw/3F5 Wdt3JxoEF5
  - gM4b3F4
  - fF4b3F4 Wdtq9l
  - x4b3F4 Wdt3Jxk5
  - u5b3FFi6
  - s/C4b3FsymJ5

So what were the main contaminants of concern?
rh9o whm l 4Nm a Ms3X5 hD3N3g i q 5 V

- Two main groups of contaminants
  - Petroleum Hydrocarbons
    - Residues of diesel, gasoline and greases
  - Metals
    - Cadmium, copper, zinc, and lead

- m3D4 xF4ym9 l t4 hD3N3gJ4 s f x a J4
  - s3h x l 4u z 3g5 hD3N3g5 Petroleum Hydrocarbons
    - s? z 3ym i fw5 wZys t u5, Zyu5 x7m l r i 3g i 5
  - nF4ns i q 5
    - s/Cw5 W/s c5b3g5 x t q 5 Cadmium, copper, zinc, and lead

What were the findings for metal contamination

c k9o c spMs3X5 nF4ns i q 8 i 4 hD3N3g c3 i q 8 i 4 s f x

- Oceanview
- K-Baseline
- East Adit Area
- East Adit Treatment Facility
- Area14
- Area14 Road
- Tailings Pipeline/Dump Ponds
- West Adit Area
- Twin Lakes Creek
- Wind Dispersed Tailings
- Town
- Industrial Complex Area
- Concentrate Haul Road
- Dock Area

- s/C4b3F4 SMb3F4 Oceanview
- s/C4b3F4 K-Baseline
- s/C4b3F4 East Adit Area
- s/C4b3Fs5 wM z n l m3nwF4 East Adit Treatment Facility
- s/C4b3F4 Area14
- s/C4b3F o x z J6 x3d t Area14 Road
- f F3b3F s J6 h9 l o q 9 l by3j5
- s/C4b3F4 SMb3F4 West Adit Area
- by3u z 3g6
- x k E j5 t4bsC3X9oxym i z f F/s c5b3g6
- k No z wk c3F s J6
- w3c Nw/3F s J5
- nF4nu4 syv3b3g k5 x3d t
- gM4b3F4

What were the findings for hydrocarbons (fuel and grease) contamination?

c k3o c spMs3X5 hD3N3g c3 i z i 4

c k tQ Gs3hx l 4u z 3gu4H hD3N3g i 4

- **Oceanview**
- **K-Baseline**
- **East Adit Area**
- **17N Refuge Station**
- **Area14**
- **West Adit Area**
- **Town**
- **Carpenter Shop**
- **Land Farm**
- **STOL Airstrip**
- **Industrial Complex Area**
- **Dock Area**

- s/C4b3F4 **Oceanview**
- s/C4b3F4 **K-Baseline**
- s/C4b3F4 **East Adit Area**
- s/C4ysgk5 wiQ/sJ6 **17N Refuge Station**
- s/C4b3F4 **Area14**
- s/C4b3F4 **West Adit Area**
- kNo z wkc3FsJ6
- eJoEF4
- gxX4b6F4 **Land Farm**
- u5b3Ffi 6
- w3cNw/3F4
- gM4b6F4

Review of the Phase II ESA, HHERA and ERP

Concerns of Interested Parties

- The documents were reviewed by:
  - DIAND and GN
  - NTI
  - Environment Canada
  - Acres International and Dillon Consulting (for NWB)

Phase II ESA – Main Concerns

DIAND and GN

- That the1985 soil survey may have underestimated the contribution of mining activities to high metal concentrations found at Nanisivik

Environmental Canada

- Requested information about soil sampling and analysis; water sampling; PCB detection; solid waste facility sampling
- Requested CanZinco to use an approved incinerator instead of open-burning of its wastes

Z?mgc4f5 x7m kNK5u Z?m4f5

- !(*%u cspn3bsymJ5 gzs5tlx3ym4mb nF4nco3iz s/C4ix3iq8k5 NiyF4u

x?toEp4f5 vNbu

- WJmymJ5 miCzi4 cspnsti4; wuzi4 cspnsti4, hD3N3g5 cspn3ymJ5; x4b3Fzi4 cspn3ymJ5
- WJmymJ5 NiyF4f5 xq3bsymJu4 wr5tFczl3t4 bmigw8N3 wr5tc5bq9lt4 ni3i4

Phase II ESA – Main Concerns

NTI

- Believed areas of contamination were underestimated as “limited or localized”
- Expressed doubt about using the 1985 soil metal survey as a background soil-metal concentration

Acres International and Dillon Consulting

- Requested more about soil sampling procedures
- Noted a lack of discussion about areas of concern and the next step in addressing these areas
- Environmental concerns about marine sediments
- Surface water sampling and air monitoring concerns

kNK5 gz F4f5

- s4WDh4g5 hD3N3gc3iq5 gzsbsym4mb kNo8Nzi8iC3bs9lt4 ciQ/w8Nzi8iC3bs9lt4
- s4WDhq5g5 !(*%u cspn3bsJFi4 nF4nc3iq5 WQx3FsJ8N3mzb cktQ Wbc3tQMs3izi4.

cspn3t5 to/symJ5 wuoEp4f8i5

- WJmymJ5 ck3 cspn3i3mzb miCzi4
- whmltQ/sJ5 ck3gDbsqlx3iq8i4 x7ml ckwos3lt4 vmQ/sJ8N3mzb
- x?t5t8k5 whmltq5 wm3u5gi4
- Wus5 x7ml xi3tE/5b SJw5 cspn3bsiq5

So what does this information mean to the health of humans and animals at the Nanisivik site?

c k w o z ? b4f x c s p n3b s y m J5 w k w5 t u q 8 k5 x7m l sm J3 k5 N i y F4u V

To be addressed in Part II

s c s y s i x3g6 wM z i @

Part II
wM z @

Human Health and Ecological Risk Assessment (HHERA)

wkw5 tuq8k5 x7ml x?t5t8k5 x5b3NC/3g5 euD/siz (HHERA)

What is the purpose of this HHERA for the Nanisivik Mine site?

b8N tuj5 x?tj9l cspn3isJ6 W0Jtc3X NiyF4u V

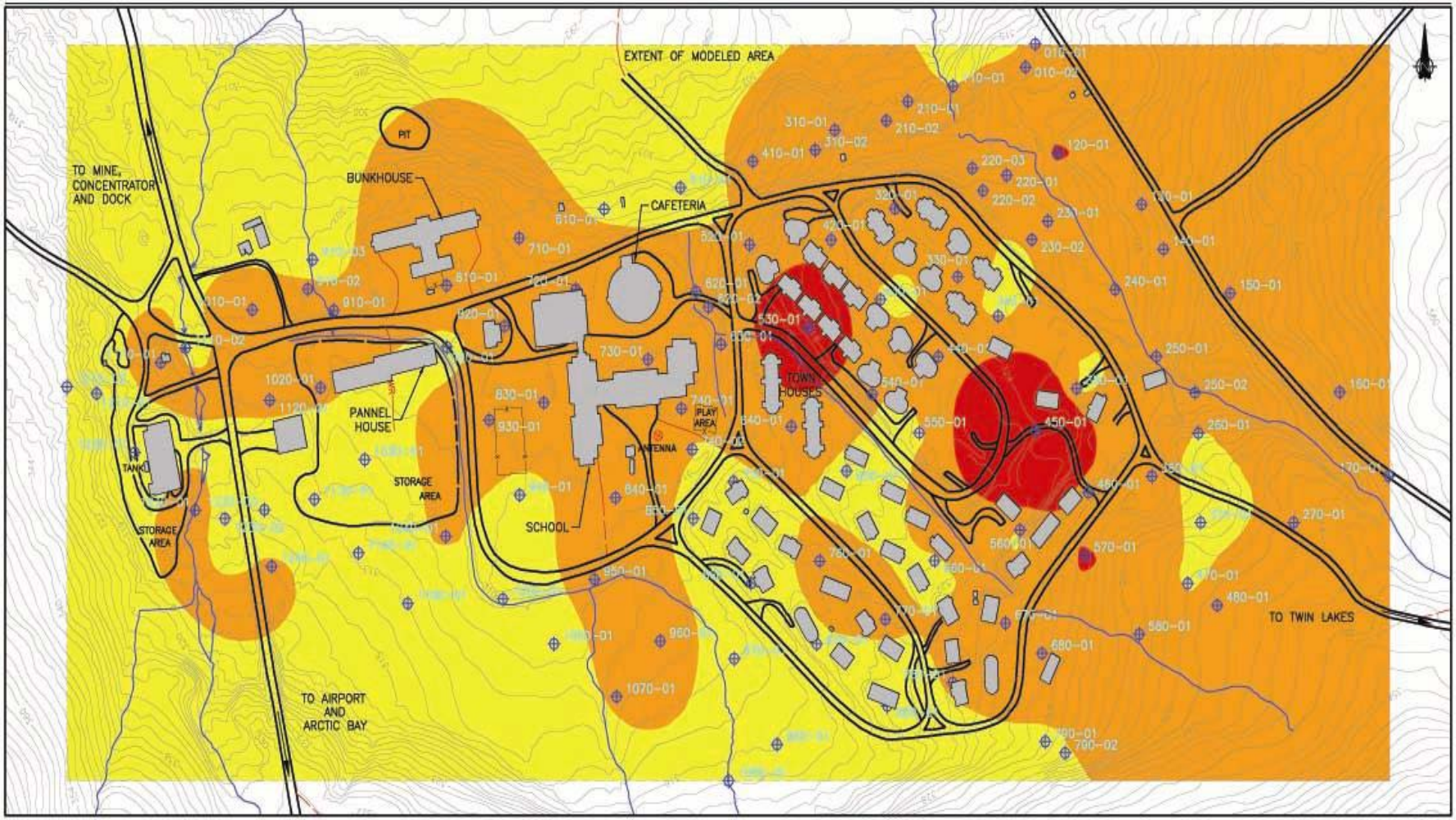
- The goal of risk assessment is to guide regulators to make good decisions, which avoid unacceptable harm to humans or the environment
- Helps to answer concerns about the effects of metals on both humans and animals at the mine site
- Tells us how much soil clean-up might be necessary to protect human health as well as local animal populations

- WNh4bsJ6 euD/siz wvJbsix3m5 moZos3tsJk5 xe4yNh4t9lQ5, x5b3N3gudNQ5 wkw5 s=?l8i5 x?tK5
- wvJbsix3g6 gry0Jbsli ckwo8N3mzb nF4nw5 wkw5 tuq8k5 x7ml smJk5 s/C4ys3FsJu
- gry=FQ9ltA miC3uz3g5 gxXw5 nlm3n3bs/Exc3iq8i4 wkw5 smJw9l nDt/symlt4

Addressing previous information
scsysiz NlNw3bscsJ5

- We must first re-examine the generic guidelines provided by the CCME
- Previous information shown in the community did not tell the whole story
- These guidelines are a “benchmark” and can be modified according to a specific situation

- bfN4v8iExc3gA5 moZsji4 xgxZsJi4l vNbu CCME
- scsysMs3g5 kNo4i siv3ymMs q7mb wlw5gN3Li
- b4fx xgxZsJ5 WQx3Dt5tx?s4mb x7ml xeQx3bsJ8N3Lt4 xgi ckwozi q5 mo4lQ5



0 125
metres
Scale = 1:2,500

LEGEND:

Pb (PPM)

- 600 (CCME - PE&HH INDUSTRIAL)
- 140 (CCME - PE&HH RESIDENTIAL)
- 11.5 (BACKGROUND)
- 0

NOTES:

1. BACKGROUND LEVELS DERIVED FROM THE AVERAGE ANALYTICAL VALUES OF SAMPLES OBTAINED FROM CONTROL SAMPLE STATIONS CON1P AND CON2P

Figure 7B
Nanisivik Town Site
Lead Concentration

Areas of study
cspn3FsJ5 Numzb

- The Study divided the mine site into three areas with three different future uses
  - Town site (29 ha) – to continue with residential use
  - Dock area (24 ha)– to continue with light industrial use
  - General mine area (4,400 ha) – to be used as hunting / recreational land

- cspn3FsJ3 xF4g3ym9li Wzhoczli Wzhi4l yKi4nj5 xgtQZ/ax3bq5
  - kNoz xqic3g6 (29 ha) xg8wN3bs9li wkc3Fsli
  - gM4b3F4 xqiz (24 ha) xgw8N3bs9li wcNw/3Fsli
  - s/C4b3Fsc5b3ymJ6 xqic3g6 (4,400 ha) xg3bsli xaNh4Fsli wex8aw/l4Fsliil kNz

The study
c spn3 i sJ6

- Is based upon the CCME guidelines
- Uses information from GN/DIAND town site study, Phase II ESA soil study, and 1985 soil survey
- Water quality information from monitoring program was also used (1996 – 2001)
- The animals within the marine environment were not included
- Effects of hydrocarbon (fuel and grease) contaminated soils was not included

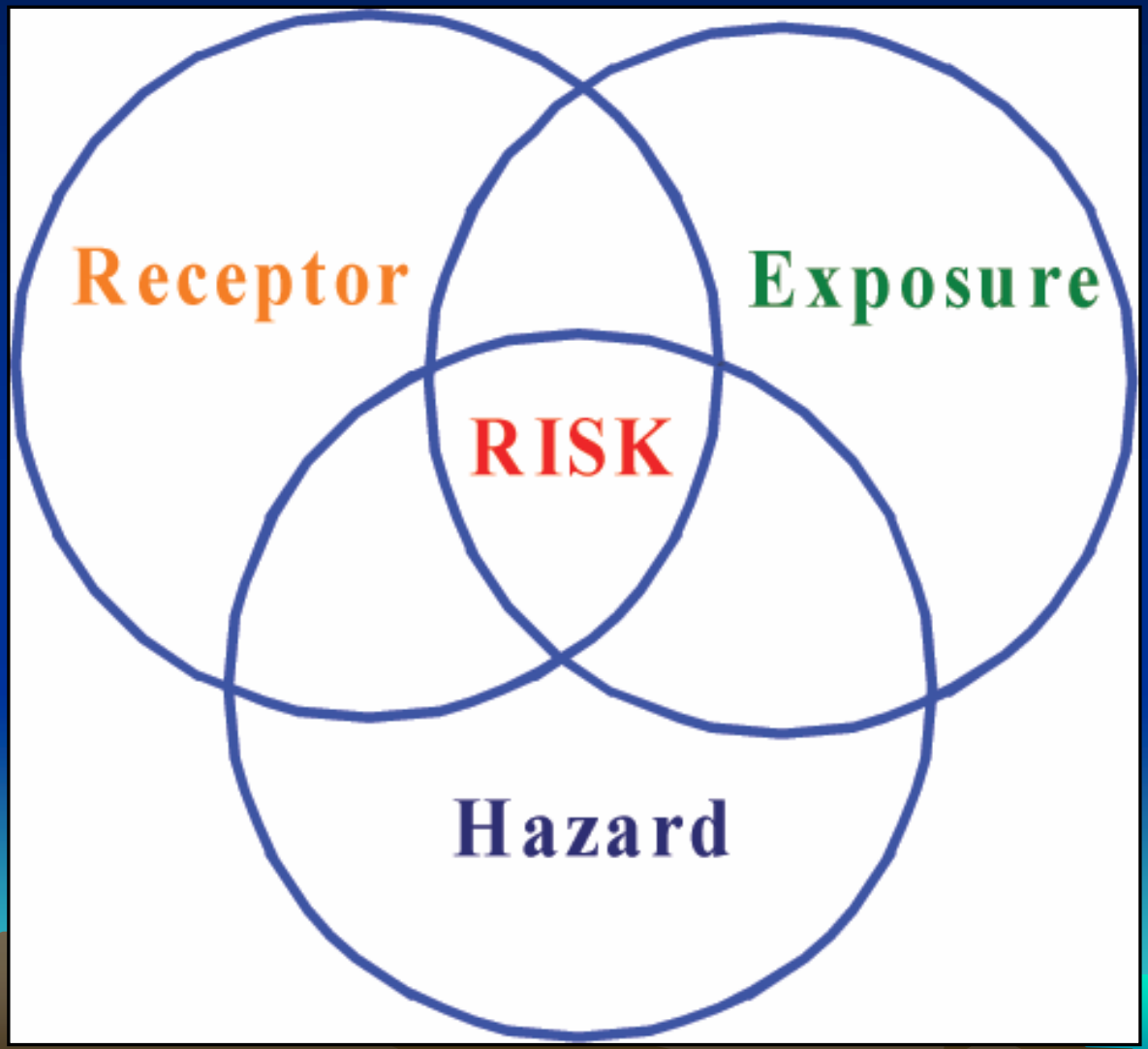
- mo4y9l i vNbu moZsJi4
- t tC3bsymJi4 vt3hw9l t4 Z?m4f8i5 kNK5u x7ml Z?mgc4f8i5 cspn3bsJFi3i4 kNo z i4, xg3bs i x3g6 @ gxX z i4 cspn3i6, x7ml !(*%u gxX z i4 cspn3i6
- wus5 ckw5g i z i4 cspn3i6 xg3bsMs3uJ6 (1996 – 2001)
- smJw5 wm i 5g5 cspn3bsMs q 5g5
- ckwJbsZ/3m z 5 hD3N3g6 Gs3hx l4u z 3g6H m i C3u5g6 gxX4u5g6 cspn3bsMs q 5g6

The study
c spn3 i 6

- Incorporated local knowledge about the Nanisivik site when a JWEL consultant, along with Mishak Allurut, conducted a survey that asked questions about hunting practices, land use and the animals found at the mine site

- Wcys/symJ5 kNo4i cspmiq5 NiyFs5 kNzi4 trymJc3t9lA xE3h3ti4 Wcbs9li unr xlD5, xW3hc5bMs3g5 xaNh4FsJi4 xaNh4Fsc5b3iq5, smJq8i4l NiyFs5 ciQ/i5g5

Risk Assessment
x5b3N3 i z i 4 c spn3 i 6



What are the steps in this risk assessment process?
c k w o s3X9 o x l t4 o c s p n3 i x3X5 x5b3N3 i z i4 V

- Step 1 – See if the levels of metal in soil are below the CCME recommended levels
- Step 2 – Compare current levels of metal in soil to historic “background” levels (1985 soil survey)
- Step 3 – Assess the risk for each study area
- Step 4 – Establish levels for metals in soil that will protect environmental and human health
- Step 5 – Determine the requirement for clean-up of metal-affected soil

- Step 1 – c s p Q x3b s l i nF4n c3 i z g x X4u5g6 g z i4v l x3m z5 vNbu m o Z q 8 i s c3y m J5
- Step 2 – c k w o ?9 o3y m4m z b nF4n c3 i q5 b w m z5 WQx3Ms q t9 l A s/C4 i x3F4
- Step 3 – e u D/s l t4 c s p n3b s l t4 x5b3N3 i E/ q5 x g i c s p n3F s J5
- Step 4 – x e4y l t4 r4o Q i x3b z i4 c k t Q3 l i nF4n c3 t Q l i m i c3u g x X4u x5b3NC/ q7m z5 w k4k5 x? t5t8k9 l
- Step 5 – c s p Q x3b s l i x e4b s l i i l c k t Q n l 7m3n w t Q/E x c3 i x3m z b nF4n D J i q5 m i C3u5g5

Human Health Risk Assessment

wkw5 tuq8k5

x5b3N3i q8k5 cspn3i6

Choice of receptors
cspn3bsJ5 rN4fZ/3m z b

- For human health study two receptors were chosen:
  - Toddler (6 months to 4 –years)
  - Person who spends a 70 year lifespan at mine site

- Wkw5 tuq8k5 cspn3i6 mD4i4 cspnDmMs3g5 :
  - kbCw5 bec3g5 G^u5 xCAo4k5 $j5H
  - xCAi4l &)i4 kNc3gFisax3li s/C4ix3F4u

Identifying the hazard (contaminants)
N l Nw3bs i q 5 x5b3N3g5 GhD3N3g5H

- 10 different metals were initially examined
- 3 metals were of concern:
  - Zinc
  - Lead
  - Cadmium

- !) a J5 xpQ q 5g5 nFC/w5 c spn3bsQxMs3ymJ5
- W z h5 whm l 4N3g9 l t4 s f x a J5:
  - nF4n6 e3 i 3b6 Zinc
  - fy6yx4n6 Lead
  - hD3N3g6 Cadmium

Information on these metals
cspm/sJ5 wmw5g i q 5 nF4nw5

- Lead, Zinc & Cadmium (through ingestion or skin-contact) can threaten human health in different ways when exposure exceeds the body's ability to deal with these chemicals
- Cadmium, when inhaled, is known to contribute to cancer

- W z h5 hD3N3g5 b4f x Lead, Zinc & Cadmium G t u j x D8N3g5 w/sA i s=? l 8 i 5 sF i 4j5 x4g t A i H tuj5 x5b3Ngw8NE x o4 xpQ q 5g4f5 s z b k xDpZ z 5 t u5b W?9o x J8N3b z b b4f x hD3N3g5 t u5t 8 i 2X9o x i q 5
- hD3N3g6 Cadmium, x i 3n3bsZ z 5 cspm/s9 l i WJ8 i D8Nw9o J8N3g6

Exposure Scenarios
c k w o z a x C / 3 i z wh m Q / s 9 l i

1. Toddler ingests and/or comes into direct contact with contaminated soil at mine site
2. Toddler eats country food that was hunted in the mine area. The game may have ingested or come into direct contact with contaminated soil at the mine site
3. A persons lives 70 years at the Nanisivik site and is exposed to cadmium as a result of inhaling dust

- k b C 6 i E A i s = ? l 8 i 5 x 4 g 3 y A i g x X 4 u 4 m i C 3 u 4
- k b C 6 i E A i w k w 5 i e q 8 i 4 x 8 a b s J F i 3 u 4 s / C 4 i x 3 F s 5 c i Q / i 5. x a N h 4 b s J 3 l 8 i 5 i E y m 8 i 3 D i s = ? l 8 i 5 m i C 3 j 4 g x X 4 u 9 l 8 i 5 W 8 i D i
- r N g w 8 N 6 k N c 3 l i x C A i 4 &) i 4 x 7 m l x i 3 n 3 g c 5 b 3 l i h D 3 N 3 g i 4 S J 3 l 4 i 4 l

What affects the intensity of the exposure to metals?

ckt Qo nF4nu4 WymtQoDi ckwJtQZ/3X

- There are several factors, including:
  - Amount of time spent at the mine site:
    - Hunting and Residential
  - Body weight
  - Rate of ingestion of soil
    - Hunting and Residential
  - Soil exposure to skin
  - Dust inhalation rate
  - Amount of country food eaten

- cyZMsJ5 WJbsZ/3g5, sfxAQ9lt4:
  - ckt Q xfistQJ6 s/C4ix3F4umz3W5
    - xaNh4li wexaw/l4liil8i5
  - tuF5 seq8iz
  - xktQ h4vtQJu4 w?9ox4mz3Ws4
    - xaNh4li wexaw/l4li9l8i5
  - gxX4 miC3l8i5 sFi4j5 x4gtymAi
  - SJ3u4 is3yymAi ckt Q W?9oxtQli
  - CktQl iEc5b3tQiz wkw5 ieq8i4

Background exposure to metals
ckwoz?9oxiz nF4nu4 Wbc3gu9li

- People are exposed to metals on a day to day basis in ways that cannot be avoided
- The Estimated Daily Intake (EDI) of each metal of concern was calculated for a toddler living in the town site and general mine area. The EDI includes the contribution of metals from:
  - Air
  - Supermarket foods
  - Drinking water
  - Background soil (1985 Study)
  - Background dust (1985 Study)

- rN4fgw8Nw5 nF4nu4 Wbcw8Ns/3g5 W?9oxq8Ns/3g5 csbm5 W5bwom/4nsq5g4f5
- s9l3j5 WJ8N3bz tu5b5 (EDI) xgi nF4nsiq5 cspn3bsymJ5 s4gtQ/s9li kbC6 kNozi9li x7ml bmigw8N6l. s9lJ5 WJ8N3bK5 tu5tkxD8N3g5 nF4nw5 s/zD8N3uJ5 :
  - xi3tE/5t8i5
  - isF3F4u5g5 ie5
  - wuc5b3bK5 wu6
  - ckwoziEMsbzi4 WQxFsJ6 !(*%u cspn3bsJFi6
  - SJDJ4 cspn3bsiz !(*%u

Additional metal contributors xy q5bs6 nF4nc oDbsJ8N3g5

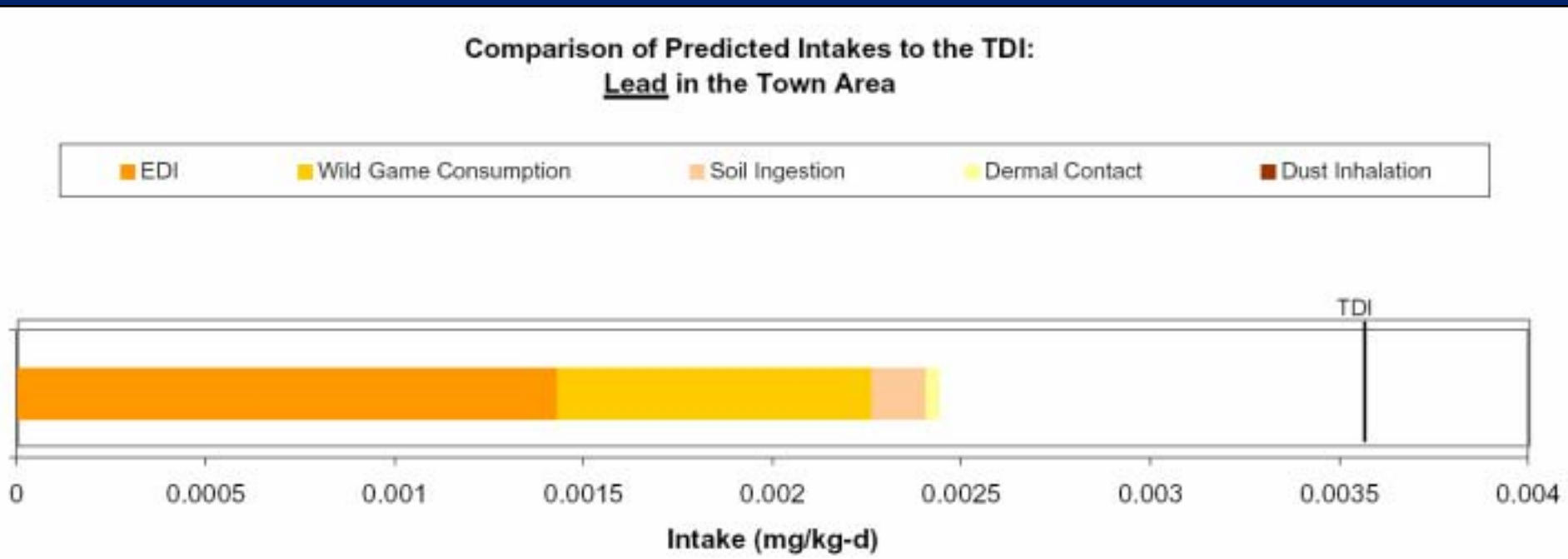
- In addition to the metals included in the EDI, there is a contribution of metals from:
  - Consumption of country food
  - Direct ingestion of soil
  - Direct contact with soil
- NF4nu4 tu5t8kxcwJ8N3uJA5 sfNz5 :
  - iDA5b wkw5 iezi4
  - wyA5b miC3uz3gu4
  - x4gxA5tA miC6

Knowing your limits
cspmlA r4oQ/w5

- The Tolerable Daily Intake (TDI) is the amount of metal that a person can ingest without being harmed
  - The amounts have been developed through extensive scientific research
  - The limit at which someone or something is harmed is called the “threshold”

- s9l3j5 WJ8N3bz wlxkx3c3izb r4oz grc3g6 rNgw8N3 wlxkxD8N3b tuzb ckwoJtQMsq9lis4
  - cktQ3iq5 Nnst4f5 xe4ymJ5 cspn3bsymJ5
  - r4oz rNgw8N6 ckwoFQZ/3bz bw/wJ9li r4oz i8iz i4

The example of lead
s4g t fy3yx4n6 nF4n6



The risk of breathing cadmium
x5b3N3 i z x i 3n3g6 l A hD3N3g6 cadmium

- The risk is considered unacceptable when more than one in a million persons gets cancer as a result of inhaling cadmium at the Nanisivik mine site
- Calculations reveal that the chance of someone getting cancer from the mine site is much lower than this

- x5b3N3 i C3bsJ6 s z b i 8 i C3bsJ6 xbsys q 4v z 5 wkw5 !uo x a J5 WJ8 i D8N q 5g6bD t4 x i 3n3g3 l t4 N i yF4u
- c spn3bsymJ5 N l Nw3yymJ5 rNgw8N6 WJ8 i D8N q 5g3bC/3 i z b r4o z b g z i 5g6

Results
N l Nw3g5

- The predicted daily intake for all metals are below the tolerable limits
- The chance of someone developing cancer as a result of breathing cadmium at Nanisivik is extremely remote
- Results suggest that the metals examined should not affect human health at the mine site

- c spn3bsymJ5 s9 l 3j5 WJ8N3b z b r4o z g z i5g6 nF4n c3 i EJ8N3b z b
- rNgw8N6 WJ8 i D8N q 5g3bC/3 i z x i 3n3g3 l i hD3N3gu4 n i yf4u ur5g9Mf l 4
- N l ND8 i 3g6 nF4nw5 c spn3bsJ5 t uj5 c kwo?9oDbsZ/ q 8 i q 8 i 4

Ecological Risk Assessment (ERA)

x ? t z x5b3N3g i z

c spn3bs i z (ERA)

Purpose of ERA
W0Jt z x?t z i4 cspn3i6

- Examines the impacts of metal contamination at the mine site on populations of selected animals; those chosen were:
  - Collard lemming
  - Arctic fox
  - Willow ptarmigan
  - Gyrfalcon
- euDl i nF4nw5 hD3N3g i q5 s/C4i x3F4u5g5 ckw2X9oDbsZ/3m z b smJk5; cspn3bsJmMs3g5 sfx:
  - xF8 z w5
  - tEZ i x5
  - xeQ5
  - rZFx3Jw5

Identifying the hazard (contaminants)
N l Nw3bs i q5 x5b3N3g i q5 GhD3N3g5H

- 10 different metals were initially examined
- 5 metals were of concern:
  - Zinc
  - Lead
  - Cadmium
  - Copper
  - Silver

- d o i4 c spnMs3g5
- b9omw5 whm l 4N3 i cMs3g5 sfx a J5:
  - nF4n6 e3 i 3b6 Zinc
  - fy6yx4n6 Lead
  - hD3N3g6 Cadmium
  - vJ6 nF4n6 Copper
  - e9o3b6 nF4n6 Silver

What affects the intensity of exposure to metals?

ck3 xq tQJu4 nF4nu ckwJbsZ/3X V

- There are several factors, including:
  - Body weight
  - Feeding rate and food selection
  - Water intake
  - Length of time spent in study area
  - Home range size
- Information on the species were obtained from scientific literature; some assumptions were made

- xpQq5g5 WJbsZ/3g5, sfxa9lt4l wMq5:
  - tusa5 seq8iz
  - cktQ iEc5b3iz rhu4l
  - cktQ wuc5b3tQiz
  - cktQ xfistQiz b?i5bw8N3Li
  - wiQ8N3bz xqiz kNz
- cspQx3FsymJ5 ttC3ymJ5 xg3bsJFi5 cspn3ti5 ttC3bsymJ5 wMq9l whmQ/sgw8N3ym9lt4.

How are animals exposed to metals?

c k3o smJw5 nF4n3c oD8N3X5 V

1. Animals ingest soil or dust directly (includes preening)
2. Animals drink surface waters on site
3. Animals consume plants or prey that contain metals

- smJw5 i DA t4 m i C3u z 3gu4
- smJw5 wuD t4 wu3u4
- smJw5 i EA t4 WD3g i4 i3J t i4 l8 i5

How is the risk to animal health assessed?
c k3o x5b3N3 i z cspn3bsym? V

- The animals' estimated exposure to metals was compared to scientific reports on metal toxicity
- The lowest levels at which animals are affected by long-term exposure to metals was chosen selected
- Certain animals were adopted in place of others ex. rat for lemming, chicken instead of ptarmigan

- smJw5 nF4nc3gu8 i q5 c k tQ l c kwoJ tQZ/3m z A t tC3ymJ5 cspn3t i5 mo4bs9 l t4
- urM z smJw5 r4oQZ/3b z nF4nc3 i EJ8N3b z i Dx3bs9 l i
- wM q5 smJw5 r a Fs t tbsc5b3L t4 h3 l xF z xpX l x k5 Xuso4k5 xy q9 l

Results
N l Nw3g5

- Results indicated that metal in soils at the mine site should not impact animals
- Contribution of surface water to any negative effect is minimal
- Lemming and Ptarmigan residing in the dock area would have the highest exposure to metals
- Metal exposure to fox and gyrfalcon would be much less

- N l Nw3g5 gryN3g5 nF4nw5 m i C3u5g5 N i yF4u c kwJbsZ/ q 5g5 smJk5
- wus5 c z i 5gu4 wuC l xD t4 c kwJbsZ/ q 5g6
- xF z w5 x eQ9 l gM4b3F4u5g5 nF4n c3 i 3nu4v/3g5
- nF4n c3 i 3uZ/ q 5g5 t EZ i x5 x7m l rZF x3Jw5

Conclusions of the Study
r a o3Xu4 s c s y4nw5

- In general, for all three study areas, the metals present in the soil do not pose a future risk for humans and animals at the mine site
- The level of metals in soil where humans and animals would be negatively affected is higher than the general level of metals in soil at Nanisivik Mine

- bm3 i om6 bf a x3 l A b4f x W z H5 c spn3bsymJ5 nF4n c3 i z i4 m i C z i5gu4 x5b3N q 5g5 wk4k5 smJ k9 l
- x q i3nsJ5 r4oQZ/3b z nF4n c3 i EZ/3b z t tC3ymJ6

Conclusions of the Study
r a o3Xu s c sy4nw5

- There are however “hot spots” of zinc and lead at the town site, and in the general mine area, which should be addressed
- CanZinco has indicated a willingness to address these areas of concern
- Environmental consultants hired from NTI, DIAND, GN and the NWB to review these reports are generally supportive

- W l x3 i c s3m5 nF4n3b c3 i q5 kNo z i x7m l s/C4 i x3F s c5b3ymJ i c kwo/s/E x o4 i 4
- v8p f4f5 x q 3ymJ5 whm l tQ/sJ5 WQx3Dm9 l t4
- x?t oE i 3j5 c spn3t sJ5 t o/symJ5 kNK5 g z F4f8 i 5, Z?mg c4f8 i 5, Z?m4f8 i 5 kNK5u x7m l wuoEp4f8 i 5 euD i x3uJ5 s i v3bsymJ i 4 Nm4n3 i 3nsym9 l t4 l

Review of the Phase II ESA, HHERA and ERP

Concerns of Interested Parties

- The documents were reviewed by:
  - DIAND and GN
  - NTI
  - Environment Canada
  - Acres International and Dillon Consulting (for NWB)

HHERA – Main Concerns

DIAND and GN

- That using 1985 data may underestimate the risk to human and animal health
- Lead as a carcinogen (cancer-causing chemical)
- That SQROs for the Polaris Mine are stricter than those proposed for Nanisivik
  - EBA Associates to review this issue and to present a report by May 30th, 2003
- That DIAND and GN have an opportunity to comment on any response from CanZinco regarding the HHERA or the SQROs
- GN has contracted the service of Drs. Rodgers and Zelt to examine health issues related to lead

Z?mgc4f5 x7ml kNK5u Z?m4f5

- !(*%u cspnstFi5 xg3bs9lt4 gzs5tymlx3mb x5b3N3gi4 wk4k5 smJk9l
- Fy3yx4n6 ci7m4N3g3bDbsJ8N3izi4
- S/C4ix3F4j5 x3F4u xe4ymJ5 xe5tx3ymi3ns4mb NiyF4u5gi5 cspn3tsJ5 euDix3g5 bmguz x7ml sivos3ix3uJ5 mw #). @))# gzi.
- Z?mgc4f5 x7ml kNK5u Z?m4f5 rsFcD8N3tbsJm9lt4 NiyF4f5 rsJtq8k5 sivoxEym/q8k5
- kNK5u Z?m4f5 toyym4J5 cspn3tsJi4 wkw5 tuq8k5 ckwJbsZ/3mz5 fy6yx4n6

HHERA – Main Concerns

NTI

- Why the SQROs for Polaris were set lower than those for Nanisivik?

Acres International and Dillon Consulting

- Why were certain animals not examined in the Ecological Risk Assessment (“ERA”)?
- The use of southern information for filling in gaps in the ERA
- The need to revise some assumptions made by CanZinco’s consultants

kNK5 g z F4f5

- Ckw7m5 Nns t4f5 x e4ymJ5 x4Xy4 i 3ns4m z b x3F4 s/C4 i x3F4j5

c spn3t5 t o/symJ5 wuoEp4f8k5

- Ckw7m5 wM q 5 smJw5 c spn3bsMs q 7m z b x?t z i4 c spn3t 9 l Q5
- Xg3bs i q 5 c9 l N i z 3g5 t tC3ymJ5 wo/sym i q 5 c spn3t 9 l Q5
- x eQx3bs4v8 i Ex c3g5 N i y=4f5 c spn3t q 8 i 4 t tC3bsymJ5

HHERA – Main Issues

Community of Arctic Bay

- That some of the assumptions were based on southern environments and southern cultures which may under-predict risk in the north
- That the harsh arctic climate may increase risk in a way that was not taken into account by the consultants
- How the animal receptors chosen for the ERA may have been underestimated in their ability to become exposed to contaminants
  - Example: Arctic foxes go everywhere at the mine site, including the tailings pond or rock dumps

w4Wx3J4us5

- t tC3bsJ5 mo4ym4mb c9lN5 kNz i xg3bsJFi5 mo4bs9l t4 srs3b3gj5 mo4ym q7mb
- srs3b3gu kNz xpQq8i z k5 x5b3N3i3nsgw8NExc3m5 cspn3t i5 whmQ/sym q7m5 srs3b3gj5 ckwJbsZ/3m z5
- smJw5 cspn3bsJ5 g z s5tym4mb hD3N3gw5 tuq8kxC/3i q8i4 _ s4gtQ9lA tEZix5 Njgw8ND8N3mb fF3b3F4j9l xyq8k9l

CanZinco's Response

Filed May 19th, 2003

Revision of SQROs

- The most significant change brought forward during CanZinco's review was the revision of the Soil Quality Remediation Objectives (SQROs)

- xyo3bs l x3ymJ6 N i yF4f8 i 5 euD t 9 l Q5 m i c3u z 3g6 gxX4 n l m3n3bs i z b gCZE / z

Modified SQROs

Town Site	Metal		
	Cadmium	Lead	Zinc
Human Health SSTL	120	600	10,700
Ecological SSTL	2,800	4,600	44,000
Final SQRO	120	600	10,700

General Mine Area	Metal		
	Cadmium	Lead	Zinc
Human Health SSTL	205	850	22,000
Ecological SSTL	2,800	4,600	44,000
Final SQRO	205	850	22,000

SSTL = site specific threshold level or "safe concentration in soil"

Response to Main Issues

Comment #1

- Does the 1985 soil geochemistry data accurately reflect natural background conditions and is it appropriate for use in the risk assessment?

scsy4n6 !

- !(*%u gxXz cspn3bsiz hoJu4 NlNw3ym? Raiz5t8i ckwozi EMs3bzk 5 x7ml xg3bsJ8N3X x5b3N3izk5 cspnsbsliV

Comment #1 - Discussion

- The 1985 report noted that the townsite and dock were elevated in metals
- Mine areas away from places of mining activity can provide an accurate background concentration
- CanZinco agreed with DIAND to used General Mine Area as the background for soil metal concentration

- !(*%u sivoxaymJ6 sc3ym4m kNoz x7ml gM4b3F4 nF4nc3lx3iC3bsym9li
- s/C4b3FsJ5 ciQ/z s/C4b3Fsymq5g6 hoi3nsZ/3g6 WQx3FszDi cktQ Wbc3tQ8i3mzb
- NiyF4f5 xq3ymJ5 Z?mgc4f8k5 s/C4b3FsJ5 ciQ/z WQx3FsJm9li cktQ Wbc3tQym4mzb cspnsbsli

Response to Main Issues

Comment #2

- Should potential carcinogenic (cancer causing) risks from lead be included in the risk assessment?

scsy4n6 @

- x5b3N3i q5 ci7m4bDbsJ8N3i z GWJ8iD8N q5g3bD8N3 i zH fy6yx4n6 Wcys/s/Exc3X cspn3t9lA 5 x5b3N3i z i4V

Comment #2 - Discussion

- Lead causes cancer in animals
- Cancers have been observed in industrial workers
- Lack of research on lead causing cancer in humans; limited evidence
- Many animals studies have used high doses
- Neither Health Canada nor US EPA consider cancer from lead
- Lead exposure at Nanisivik will be under the Tolerable Daily Intake (TDI); this will protect persons from cancer or other health problems

- Fy6yx4n6 WJ8iD8Nq5g3bDbsJ8N3g6 smJk5
- WJ8iD8Nq5g3b3ymJ5 csp/symJ5 wcNw/3t5
- Cspn3bsym5txql x3iz fy6yx4ns5 WJ8iD8NwoJbsJ8N3iz wk4k5
- Sk3i3nw5 smJw5 cspn3bsymJ5 xqJu4 tuq8i5gc3t9lA
- x8ixc3Nq5goEp4f5 vNbu x7ml xuxov4f8i cspn3ymq7mb fy6yx4nu4
- Fy3yx4nc3iz Niys5 gzi4v/3gZlx6 tus5 WJ8N3bzb r4ozi5

Response to Main Issues

Comment #3

- Why are the recommendations for Nanisivik Mine and the recommendations for Polaris Mine different?

scsy4n6 #

- ckw7m5 xgd/sJ5 xpQqM5 x3F4u s/C4ix3Fzk5 x7ml NiyFs5 s/C4ix3iz k5V

Comment #3 - Discussion

- The Polaris HHRA was based on short term exposure, Nanisivik's was long term
- Soil ingestion factor for Polaris was based on short term exposure
- Acceptable levels of lead in the body differed between sites
- Nanisivik HHRA took into account other sources of metal besides soil (country food, water)

- x3F4u s/C4i x3F4u eM7usJu4 Wbc3ym4m NiyF4u xfisJu4 Wbc3ym9li
- gxXz i5g6 x3F4u s/C4i x3F4u eM7usJ4f5 tuq8iMsv4li cspn3bsym4m5
- tu5t8iiz fy6yx6 xpQq5g5 kNi cktQ3iq5
- NiyF4u cspn3bsym4mb xyqtA5 tu5t8kxC/3iz miC3ugw8Nsq5g6 Gwu3u9l ieu9lH

Comment #3

- The Polaris and Nanisivik ESAs were based upon similar guidelines
- Polaris ESA was limited to land mammals
- Nanisivik ESA used drinking water as source of potential exposure
- SQROs were not calculated for animal receptors

- x3F4u NiyF4ul x?t q5 cspn3bs9l t4 xpQXlMs3g4 xgxZq5
- x3F4u cspn3bsiq5 kNu5gk5 smJk5 cspnMs3g5
- NiyF4u x?tz cspn3iz wu3 cspn3bscys/sMs3g6
- gxX4u z3g6 cspn3bsMsq5g6 smJk5 ckwJbsZ/3mz5

Other Comments

xy q5 sc sy4nw5

Other Comments

- HHERA included conservative assumptions
- Climatic conditions were considered
- JWEL adjusted its calculations to meet the suggestions of peer reviewers

- x5b3N3i z i4 cspns t5 x q l x q 5gu4 mo4ymJ5
- yMs5 i4Mh4i z whmQ/symJ6
- cspn3t sJ5 xeQx3yMs3g5 cspn3b q5 whmQ/symJ i4 mo4ym9l t4

Emergency Response Plan

Emergency Response Plan

- Is an action plan for employees to follow in case of incidents that may affect:
  - The safety of human life
  - Property
  - The environment

Emergency Response Plan

- Defines responsibilities of key personnel and outlines procedures for responding to emergencies to minimize health and safety hazards, environmental damage and cleanup costs
- Designed to provide access to all information required in dealing with a spill
- Is a revision of an existing document

Emergency Response Plan

- Contains information on:
  - Reporting Procedures
  - Site Information
  - System Failure Prevention and Emergency Supplies
  - Action Plans
  - Tailings and Fuel Spills

Emergency Response Plan

- PCB Incidents
- Spill Response Assumptions
- Health and Safety
- Marine Spills
- Fuel Storage Tank Decommissioning
- Aircraft Disaster
- Fire Procedures
- Care and Maintenance Procedures

Review of the Phase II ESA, HHERA and ERP

Concerns of Interested Parties

- The documents were reviewed by:
  - DIAND and GN
  - NTI
  - Environment Canada
  - Acres International and Dillon Consulting (for NWB)

ERP – Main Concerns

GN

- The GN stated, while generally pleased with the Emergency Response Plan, it will require some modification to for it to become compliant with Government of Nunavut Environmental Protection