Red Dog Mine Annual Meeting
Waste Management Permit No. 0132-BA002
Reclamation Plan Approval F20099958
2014
Agenda

- Site Overview
- Production
- Waste Rock Management
- Tailings and Water Management
- Permafrost Monitoring
- Biomonitoring
- Reclamation
- Water Treatment Pilots
- Construction Projects
Aqqaluk Deposit 2010
Aqqaluk Deposit 2012
Aqqaluk and Main Pit 2013
Aqqaluk and Main Pit 2014
Production
2014 Production

**Mine Production**
- Ore Hauled: 4,397,485 tonnes
- Waste Rock Hauled: 8,692,145 tonnes
- Total: 13,089,630 tonnes
- Strip Ratio: 2 : 1

**Mill Production**
- Ore Milled: 4,299,495 tonnes
- Concentrate Production:
  - Zinc: 1,059,621 tonnes
  - Lead: 219,079 tonnes
Waste Rock Management

Waste Rock Hauled 8,692,145 tonnes

Main Waste Stockpile
42,364 tonnes

Main Pit Stockpile
8,272,382 tonnes

In pit use / disposal
1,691 tonnes

Construction use
225,832 tonnes

Most Reactive Waste
1,667,464 tonnes
4.6% Zn
2.8% Pb
5.6% Fe
Red Dog Yearly Precipitation
2014 Bathymetric Survey

- **2014 Survey**
  - Aug-Sep 2014
  - 3,035 Mgal free Water

- **2013 Survey**
  - Sept 19-22, 2013
  - 3,361 Mgal free water
Tailings Pond Trends

[Graph showing trends in dam freeboard and water elevation]

- Free Water Volume (Mgal)
- Tailings Elevation (ft)
- Water Elevation (ft)

Jan-09 to Jan-14
Mine Water Quality

- West Sump
- East Sump
- Tailings Water
- Reclaim Water
- WTP #3 Influent
- WTP #3 Effluent
- Mine Water Collection Sump
- Seepage Pumpback
Water Treatment

- WTP-1
- WTP-2
- WTP-3
- Sand Filters
2014 ARD Collection & Treatment – TDS Reduction

- 2014 Treatment
  - 68.4 Mgal treated
  - 16,820 tonnes TDS removed
  - 8.2 Mgal diverted to MPL
  - 1,930 tonnes TDS diverted

<table>
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<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
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<td>mgal ARD (treated &amp; diverted)</td>
<td>31.6</td>
<td>19.8</td>
<td>20.9</td>
<td>13.6</td>
<td>24.1</td>
<td>74.1</td>
<td>82.2</td>
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<td>Annual Percent Capture</td>
<td>24.2%</td>
<td>15.7%</td>
<td>15.7%</td>
<td>11.4%</td>
<td>19.4%</td>
<td>27.8%</td>
<td>35.6%</td>
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High Density Sludge Treatment of ARD Water (TDS mg/L)

- **Influent TDS**:
  - 13-Jan-14: 52000
  - 20-Feb-14: 52400
  - 10-Mar-14: 66000
  - 10-Apr-14: 72906
  - 8-May-14: 87678
  - 5-Jun-14: 66246
  - 25-Jul-14: 59126
  - 1-Aug-14: 52000
  - 22-Sep-14: 53970
  - 17-Oct-14: 45400
  - 3-Nov-14: 57828
  - 4-Dec-14: 60894

- **Effluent TDS**:
  - 13-Jan-14: 3650
  - 20-Feb-14: 2900
  - 10-Mar-14: 2460
  - 10-Apr-14: 3660
  - 8-May-14: 2862
  - 5-Jun-14: 2630
  - 25-Jul-14: 2978
  - 1-Aug-14: 2812
  - 22-Sep-14: 3758
  - 17-Oct-14: 3670
  - 3-Nov-14: 2604
  - 4-Dec-14: 4672
### TDS Concentration in Tailings Pond (2013 and 2014) (mg/L)

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<td>5100</td>
<td>6260</td>
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<tr>
<td>Feb</td>
<td>5580</td>
<td>6230</td>
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<td>Mar</td>
<td>6140</td>
<td>6390</td>
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<td>Apr</td>
<td>5590</td>
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<td>Jul</td>
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<td>Nov</td>
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High Density Sludge Treatment of ARD Water (Dissolved Se mg/L)
Se in the Tailings Water (2013 and 2014) (mg/L)

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<th>Apr</th>
<th>May</th>
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<th>Jul</th>
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Permafrost Monitoring

Monitoring Program

• Quarterly monitoring of 15 key background and dam area thermistors was conducted to assess currently observed trends in temperature changes in the permafrost;

• Quarterly monitoring of 8 key background and dam area piezometers was conducted to assess currently observed water levels and gradients.

• Annually produce an annual data monitoring report.

• Every five years review and analyze data to determine if changes in permafrost or sub-permafrost groundwater have occurred or can be expected to occur. Next review is in 2017.
Figure 46. North Fork Red Dog Creek fyke net site in early June (left photo 2012, right photo 2013).
Mine Drainage Monitoring Stations

Figure 3

Mine Drainage Biomonitoring Plan
- Stations

0 0.5 1 2 Miles
Bons Creek Monitoring Sites
Aquatic Invertebrates

From Aquatic Biomonitoring at Red Dog Mine, 2014 by Alvin G. Ott and William A. Morris
Dolly Varden

From Aquatic Biomonitoring at Red Dog Mine, 2014 by Alvin G. Ott and William A. Morris
Lead Concentrations in Creeks near Red Dog Mine

From *Aquatic Biomonitoring at Red Dog Mine, 2014* by Alvin G. Ott and William A. Morris
Zinc Concentrations in Creeks near Red Dog Mine

From Aquatic Biomonitoring at Red Dog Mine, 2014 by Alvin G. Ott and William A. Morris
Selenium Concentrations in Creeks near Red Dog Mine

From Aquatic Biomonitoring at Red Dog Mine, 2014 by Alvin G. Ott and William A. Morris
Oxide Pile Cover Study
Five Year Results Oxide Pile Cover Study

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Selenium Piloting – Bio-Reactors

- GE: Advanced Biological Metals Removal Process (ABMet)
- Currently evaluating the results of the pilot test
Saltworks ElectroChem process – ion exchange membrane with electrical currents to attract ions

Currently evaluating the results of the pilot test
Selenium Piloting – Reverse Osmosis Membrane Filtration

- 25 gpm pilot plant onsite
- Currently commissioning
- Piloting scheduled to be completed in 2015
2015 Projects

• Main Tailings Dam Widening
• Tailings Back Dam Raise to 986 ft.
• Lime Slacking Building
Questions

Thank You