



Indian and Northern Affairs Canada
Affaires indiennes et du Nord Canada

Arctic Gold and Silver Tailings Site TA005

Monitoring Report 2010



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Location

The Arctic Gold and Silver mill and tailings impoundment is located approximately 4 km south of the Village of Carcross on the road to both the Arctic Caribou and Big Thing mines on Montana Mountain (60° 08' 00'' N, 134° 43' 20'' W).



Figure 1: Location of Arctic Gold and Silver Tailings



Background

The Arctic Gold and Silver mill was in operation during the late 1960's. It is estimated that about 50,000 tonnes of ore were processed, using a basic flotation method (without cyanide) and leaving nearly 27,000 m³ of tailings.

A phase III environmental assessment was commissioned By DIAND, Waste Management in August, 1997. It was found that the tailings were acid generating and that seepage into a small lake adjacent to the tailings impoundment contained significant concentrations of metals. Several health and safety concerns and environmental risks were identified and it was recommended to clean up the site and assess remedial measures for the tailings (Public Works and Government Services Canada, 1998).

Geotechnical and geochemical testing and delineation of the tailings were initiated in 1998 and options for remediation were presented in a report prepared by Steffen Robertson and Kirsten Inc. (1999).

Clean up of the site and preparations to secure and cap the tailings were carried out in 1999 according to specifications prepared by Public Works and Government Services Canada (1999). The contract for the excavation of previously submerged tailings from the unnamed lake, adjacent to the tailings impoundment, took place during winter 1999/2000. The recovered tailings were expected to dry during the summer 2000 to be placed in the impoundment and covered with clay capping material. Due to a wet and cool summer, the tailings had not dried enough to the satisfaction of the engineer. The final work, including the seeding and fertilizing of the entire capped tailings pond, had therefore be postponed to the summer of 2001. Completion of all components of the remediation effort was achieved in September, 2001 (EBA Engineering Consultants Ltd., 2001).



Monitoring Program

DIAND Waste Management personnel carried out the annual site monitoring for 2010, as it has done since 2002. The integrity of the tailings impoundment and signs of metal leaching into surface waters are the main reasons for the monitoring. The site is listed in the Devolution Transfer Agreement as a Contained Site (Appendix H, Section G). The monitoring program includes:

- Visual inspection of capped tailings impoundment.
- Inspection of tailings dam, drainage channels and diversion ditch.
- Inspection of the spillway and dam of the unnamed lake.
- Sampling of ground water at selected monitoring wells and analysis for dissolved metals.
- Sampling of surface water at Tank Creek and analysis for dissolved metals.

Observations

The site was visited by Waste Management personnel on September 03, 2010. Weather conditions were overcast with light rain at 9°C. The overall state of the impoundment, tailings dam, drainage channel, diversion ditch, spillway and dam of the unnamed lake were satisfactory. The beaver dam near the spillway (**Photo on title page**) is still intact and visibly maintained. The vegetation on the tailings cover is in poor condition and patchy.



Photo 1: Sampling of monitoring well MW-2

Sampling of Monitoring Wells

Groundwater samples were taken from two selected monitoring wells (MW-2 and MW-1D) within the tailings impoundment area (see **Figure 2**). The well volume was established and each well was purged (3 x well volume) prior to sampling. Water quality data as recorded on site is shown in **Table 1**. The samples were filtered (0.45 μm) and sent to an accredited laboratory for dissolved metals analysis.

Surface Water Sampling

Surface water samples were taken from Tank Creek at the inflow (AGS-1) and outflow (AGS-2) of the unnamed lake as well as at the point of seepage from the tailings pile (AGS-0). Water quality data as recorded on site is shown in **Table 1** and sampling locations on **Figure 2**. The samples were filtered (0.45 µm) and sent to an accredited laboratory for dissolved metals analysis.

Sample ID	Time	Temperature (°C)	pH	Conductivity (µS)	Total Dissolved Solids (ppm)
MW-2	16:52	4.7	3.34	>3.999	>2000
MW-1D	15:53	6.0	6.88	307	7.53
AGS-1	17:23	7.8	6.71	104	50
AGS-2	18:30	8.8	7.35	82	41
AGS-0	17:55	10.1	6.90	150	87

Table 1: Water Quality Field Measurements

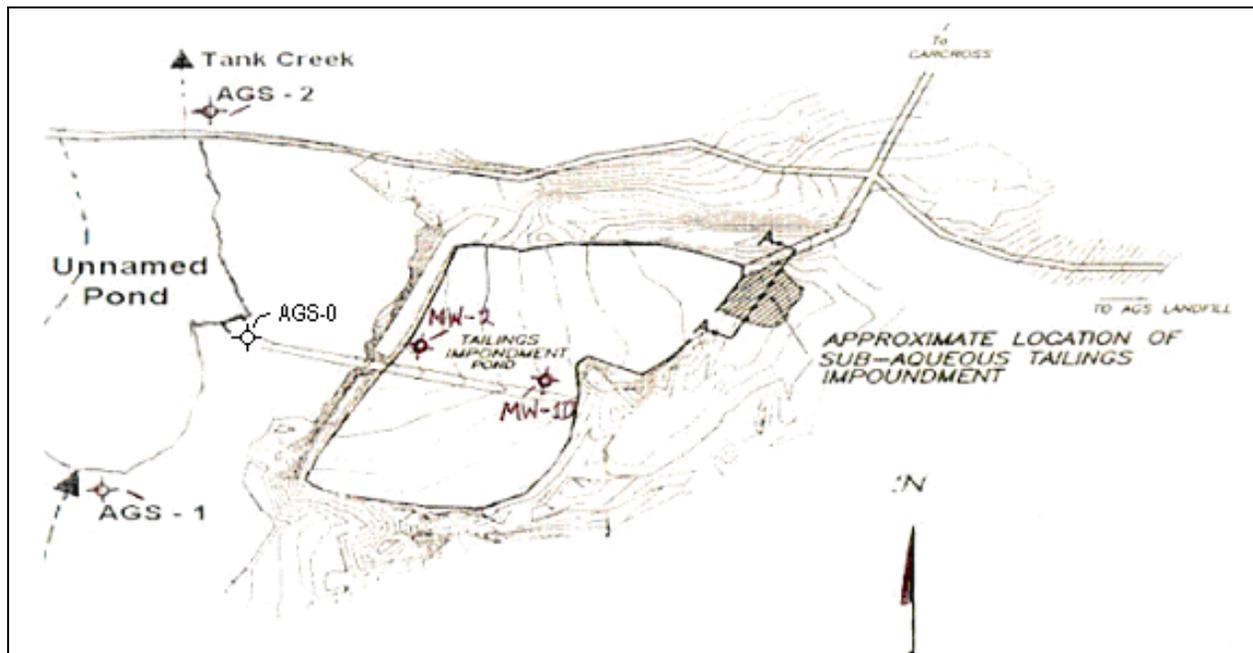


Figure 2: Water Sampling Locations



Analytical Results

The analysis of the groundwater samples for dissolved metals showed elevated levels of several metals in monitoring well MW-2 which is located near the lowest area in the tailings impoundment, next to the drainage channel. The results are generally higher again than the concentrations found in this well last year, after a trend of slightly lower levels in previous years (see **Table 2**). The water quality for this well (low pH and high conductivity – see **Table 1**) suggests that metals would be present in a dissolved state. Since the tailings are covered with a low permeable layer of clay capping material, acid generation should be strongly reduced or not happening at all. Seasonal outflow of water containing high levels of metals from the containment cell into the surface water of the Unnamed Pond via the spillway or by seepage is evident in surface staining of the lower portion of the spillway.

Parameter	MW-2 2005 mg/L	MW-2 2006 mg/L	MW-2 2007 mg/L	MW-2 2008 mg/L	MW-2 2009 mg/L	MW-2 2010 mg/L	CCME ^a Guidelines mg/L Total Metals	YCSR ^b Guidelines mg/L Total Metals
Arsenic	2.41	1.74	1.59	1.80	0.523	0.950	0.005	0.050
Aluminum	62.4	31.3	13.3	45.9	42.5	103	5 - 100	n/a
Zinc	152	90.2	38.2	74.6	55.2	84.4	30	0.075 – 2.4*
Copper	0.33	0.137	0.0520	0.088	0.376	<0.050	0.002 – 0.004	0.02 – 0.09*
Lead	< 0.05	0.017	.0001	0.0006	0.0009	<0.025	0.3	0.04 – 0.16*
Iron	3140	2180	919	2070	2240	3050	0.3	n/a

Table 2: Comparison of Metal Levels (dissolved) in Groundwater at MW-2

^a CCME: Canadian Council of Ministers of the Environment 1999- “Canadian Water Quality Guidelines for the Protection of Aquatic Life



Photo 3: Surface water sampling at the outflow of the unnamed pond.

The analysis of the surface water samples for dissolved metals indicated a slight but insignificant increase in metal content in the outflow sample compared to the inflow (see **Appendix** for analytical report). The concentrations are below the Yukon Contaminated Sites Regulations and CCME guidelines for the protection of aquatic life (YCSR 2002, CCME 2002).

The annual monitoring will be continued.

^b YCSR: Yukon Contaminated Sites Regulations for the Protection of Aquatic Life (*depending on water hardness)



References

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- YCSR. 2002. *Contaminated Sites Regulations: Generic Numerical Water Standards*. Environment Act. Yukon Territorial Government, Whitehorse, Yukon.



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Appendix

(Analytical Report)