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THE **BIG** PICTURE

Contaminated Sites in the NWT



Canada



Introduction

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Development in the NWT has involved many uses of the land over the years. These have included mining, oil and gas and military exercises. As well, over time these activities have fuelled our local economies by providing jobs, attracting new residents and ensuring ongoing investment in our communities. It is all part of our region's rich heritage and will continue to play a valuable role in our future.

However, many development operations in the past have also resulted in contamination that has to be dealt with today, ranging from a few barrels of oil to the 237,000 tonnes of arsenic trioxide at Giant Mine. Currently, there are approximately 660 contaminated sites and waste sites across the NWT.

Many of these sites became the Government of Canada's responsibility after private owners relinquished their properties according to the legislation of the day, or when companies went bankrupt. The property then reverted back to the Crown, and as representative of the Crown, the Department of Indian Affairs and Northern Development (DIAND) became custodian of these properties and related remediation activities.

The federal government recognizes that these contaminated sites must be cleaned up to protect the health and safety of northerners, to safeguard the environment and to restore a precious part of Canada's natural environment.



And that cleanup is underway. To guide its efforts, DIAND created the Contaminated Sites Management Policy in 2002. Today, DIAND's Contaminants and Remediation Directorate (CARD) in Yellowknife is busy overseeing the cleanup of 11 of the most significant sites in the NWT. Solid progress is being made at sites right across the North due in large part to increasing federal funding for the remediation of contaminated sites.

But it is not enough just to clean up yesterday's messes. To ensure that land-use operations today will not result in human health or environmental hazards tomorrow, DIAND also developed new legislation and

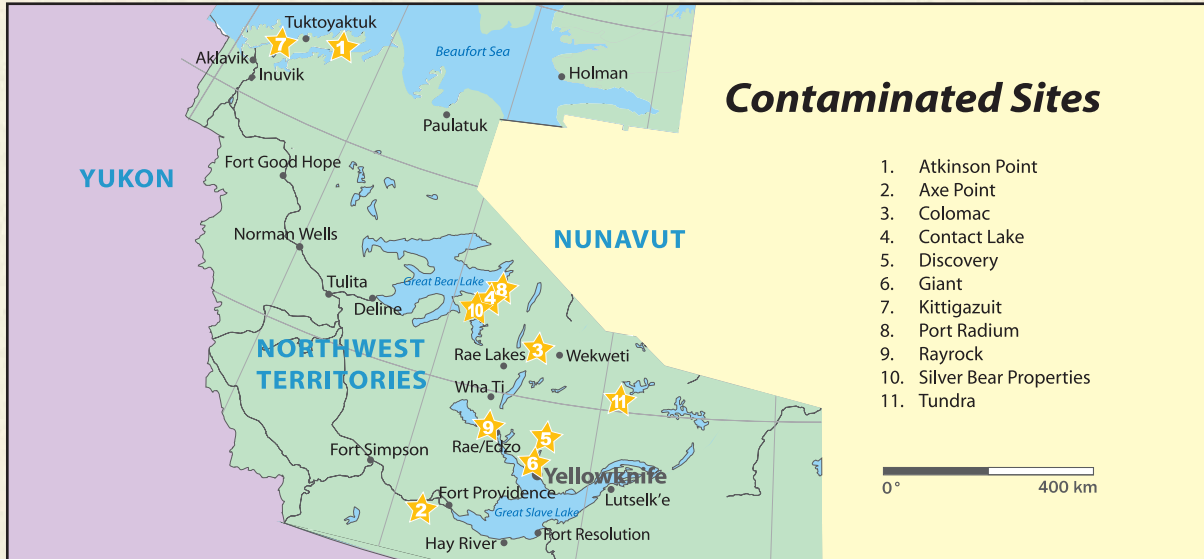
policies. These safeguard the environment and protect Canadian taxpayers from picking up the tab when private operators go bankrupt.

The federal government is committed to protecting Canada's North and the people who live here. That means cleaning up contaminated sites today and making sure they don't happen again tomorrow.

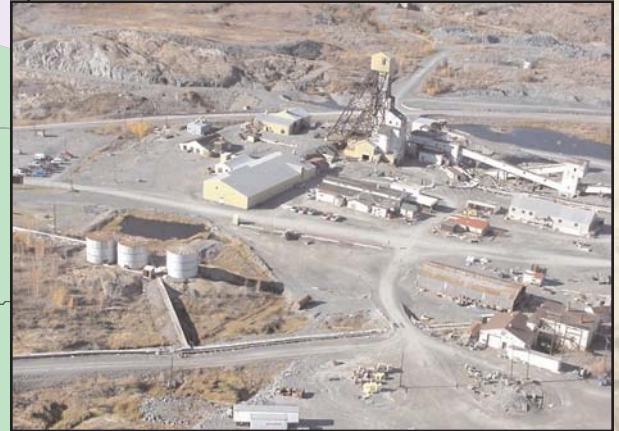




Contaminated Sites in the NWT



Giant Mine



Giant Mine

Yellowknife's Giant Mine began operations in 1948 and quickly became one of Canada's most prolific gold mines. Over its lifespan, Giant Mine produced more than 7 million ounces of gold. This is one of three mines that reverted back to the Crown in 1999 when the mines' owner at the time, Royal Oak Mines Inc., went into receivership.

Why is it a contaminated site?

The main issue at Giant Mine is the 237,000 tonnes of arsenic trioxide dust stored underground at the site. The dust was created during the gold production process. When the mined ore was roasted to release the gold, the arsenic was also released as arsenic trioxide dust.

The highly toxic arsenic trioxide dust continues to be safely stored in the 15 stopes and chambers underground at the site. The amount is equivalent to seven and a half 11-storey office buildings. On site, there are also tailings ponds, old mine structures and other surface features that require remediation.

What's going on at the site?

Giant Mine is currently under care and maintenance. This means the site is secure and is being monitored. Also, all water pumped from the mine is being collected and treated on site before being released into Baker Creek. Numerous on-site studies are also being carried out to gather more

information about the environmental conditions of the site.

Future plans

DIAND's Giant Mine Remediation Project Team is creating a Remediation Plan for the site. This will include a plan to freeze the underground stopes and chambers containing the arsenic trioxide, and the surrounding rock.



Colomac Mine





Colomac Mine

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Colomac Mine was a gold mine in operation from 1989 to 1997, located 222 kilometres northwest of Yellowknife. This is one of three mines that reverted back to the Crown in 1999 when the mines' owner at the time, Royal Oak Mines Inc., went into receivership.

Why is it a contaminated site?

One of the main concerns at Colomac is "tailings water" - contaminated water produced by the processing of the gold ore. The tailings water is contaminated with cyanide, a chemical that was used to get the gold out of the ore, among other substances. Currently, the contaminated water is safely contained in two areas, the Tailings Containment Area (TCA) and a mined-out pit known as Zone 2 Pit. At present, both areas contain approximately 10 million cubic

metres of water. However, rainfall and snowmelt will eventually fill both the TCA and Zone 2 Pit.

What's going on at the site?

After extensive community consultation, DIAND filed a Remediation Plan with the Mackenzie Valley Land and Water Board on March 31, 2004. This plan recommends Enhanced Natural Removal as the best remediation option for tailings water. This involves adding phosphorus to the contaminated water, which promotes the growth of algae. The algae breaks down cyanide and ammonia into non-toxic substances. Measurements over the past three years have shown that this process successfully reduces contaminants, including cyanide and ammonia.

A lot of other remediation work continues to be done at the site, including an eight-kilometre fence installed to prevent caribou and other wildlife from entering the tailings containment area.

DIAND is working in partnership on the Colomac project with the Tlicho people, who live in the area. The site operator is Tli Cho Logistics, a Dogrib company, and the majority of the workforce are Tlicho people.

Future Plans

Once the new water licence and land-use permit are issued, implementation of the large remediation tasks can begin. Remediation of the entire site is expected to be completed by 2010. This will be followed by monitoring for about five years to confirm that the remediation measures are effective.

Tundra Mine





Tundra Mine

Tundra Mine is a former gold mine, located 240 kilometres northeast of Yellowknife. Operations began in 1964. This is one of three mines that reverted back to the Crown in 1999 when the mines' owner at the time, Royal Oak Mines Inc., went into receivership.

Why is this a contaminated site?

During the operation of Tundra and nearby Salmita Mines, processed tailings were deposited in Russell Lake (tailings pond). Elevated metal concentrations have been measured downstream. The water in the tailings pond has elevated levels of aluminium, arsenic, chromium, manganese, copper, iron and lead and is believed to be the source of contamination downstream.

Contamination on site is associated with the tailings pond, metals leaching from the waste rock piles and hydrocarbons (fuels and oils) released during operations at the mine.

The Tundra site includes milling and crushing facilities, a tank farm, assay laboratory, powerhouse, head frame and many other support buildings.

During the operation of nearby Salmita Mine, ore was trucked from the mine along a 10-kilometre road to be processed at the Tundra Mill. Salmita Mine ceased operations and was remediated by Royal Oak in the 1980s.

What's going on at the site?

Since 1999, the site has been in care and maintenance mode. This has included dam repairs, geotechnical inspections, securing buildings and posting signs. Additional work is being done to repair the dams around Russell Lake and more research is being conducted to develop remediation strategies for the site.

Future Plans

When all the environmental studies are completed, a Remediation Plan will be developed and submitted to the Mackenzie Valley Land and Water Board for approval. Once the required licences are received, remediation on the site can proceed.

Rayrock Mine





Rayrock Mine

Rayrock Mine was an underground uranium mine that operated for two years, from 1957 to 1959. It was operated by Rayrock Mines Ltd., which left the site in 1959. It is located 145 kilometres northwest of Yellowknife and 74 kilometres northwest of Rae.

Why is this a contaminated site?

During the operations at Rayrock Mine, an on-site mill facility processed approximately 70,000 tonnes of ore yielding 207 tonnes of uranium concentrate. The site became contaminated with radioactive tailings that were deposited on land and partly flowed into three small lakes. In 1959, two tailings basins contained 70,903 tonnes of radioactive tailings that had the potential to leach metals. Construction of the mine

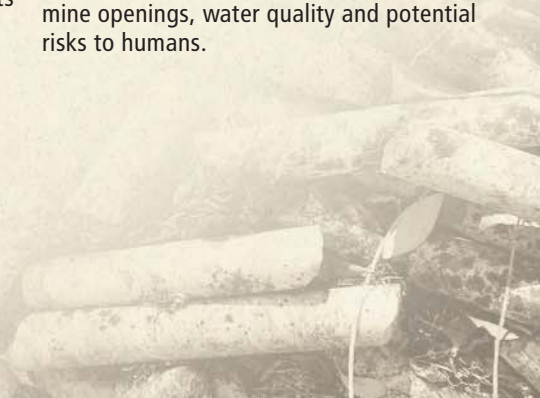
also created a source of potential radioactive contamination through radon gas emissions from the mine openings (adit, vent shafts).

What's going on at the site?

In the early 1980s, buildings were demolished and/or removed from the site. Tailings remediation began in 1996, with the objective being to contain contaminants at the site and limit exposure to persons who visit the area. Remediation activities included sealing mine openings, removing radioactive material from the dump, disposing of this contaminated material on the tailings, and capping the tailings piles with a layer of silty clay, followed by revegetation.

Future plans

Long-term monitoring is ongoing at this site. It is to be conducted annually for 10 years (2000 to 2009), followed by once every 10 years for a further 100 years. This may change if results warrant adjustment, such as some minor care and maintenance work completed in summer 2004. Monitoring assesses the integrity of sealed mine openings, water quality and potential risks to humans.



Discovery Mine



Discovery Mine

Discovery Mine is a former gold mine, located on the west shore of Giauque Lake, approximately 80 kilometres northeast of Yellowknife. It was owned by Discovery Mines Ltd. and was in operation from 1949 to 1969.

Why is this a contaminated site?

At the time of closure, approximately 1.1 million tonnes of mercury-contaminated tailings were spread over 32 hectares of land and 3.7 hectares of lake sediment above the low water level. A tailings beach was created in Giauque Lake. The majority of the tailings were covered in 1999/2000, although there remains some residual exposed tailings on site. There also remains old buildings, mine structures and unsealed

mine openings on site that pose contamination and/or safety risks.

What's going on at the site?

After extensive assessment, remediation started in 1998. The work involved the general clean-up of the site, off-site disposal of some hazardous wastes, and the capping of the tailings using a low permeability clay cover and waste rock. This work was completed in 2000.

In the fall of 2001, the silty clay borrow pit, which was used as the clay source for capping the tailings, became full due to precipitation and runoff. This borrow pit overflowed into Giauque Lake, creating a sediment plume. This water is not contaminated from tailings, but contains

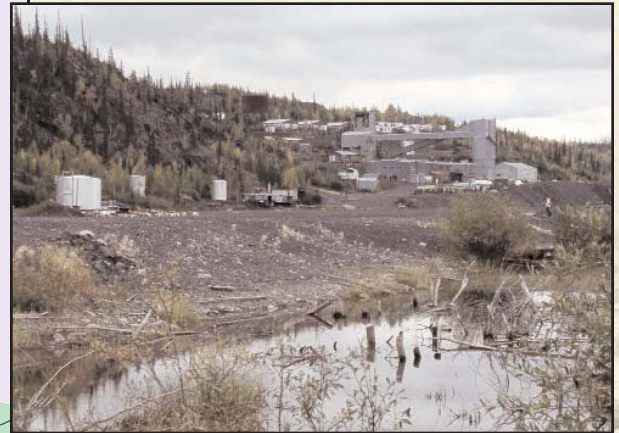
suspended clay from the pit itself. To fix this situation, vegetation was planted on the sides of the pit to stabilize the banks and stop erosion. The water in the pit is also being treated, and once the clay is settled out, the clean water is pumped out into the environment.

Future plans

A long-term Environment Monitoring Program (EMP) was developed and implemented to monitor the effectiveness of the initial remediation work. This includes monitoring the tailings cap, lake water quality, sediments, fish and vegetation. A long-term Remediation Plan is also being developed to address the borrow pit and remaining issues on the site, such as the buildings and structures.



Silver Bear Properties





Silver Bear Properties

The Silver Bear Properties consist of four former mines; Terra, Northrim, Smallwood and Norex. They produced silver, copper and bismuth. Mining began in the area in the 1960s. Terra, Smallwood and Norex mines were owned by Terra Mining Ltd. and Northrim Mine was owned by Northrim Mines Ltd. All mining operations ceased by 1985. The sites are located approximately 300 kilometres northwest of Yellowknife, near the southeast corner of Great Bear Lake.

Why is this a contaminated site?

There are two tailings ponds at the Silver Bear Properties, including HoHum Lake at Terra Mine and Hermandy Lake at Northrim. There is hazardous waste on site, including lab chemicals, ore concentrates and waste fuels. The containers holding these materials

have degraded and pose a risk to the environment. More than 30 buildings on site have not been maintained and pose safety risks.

The first issue that needs to be addressed on site is sealing the more than 20 openings into the underground mines.

What's going on at the site?

Studies have been conducted at the sites since the early 1990s to prepare for remediation. A limited amount of remediation work has been done so far. This includes placing leaking barrels of fuel and antifreeze into new containers at Terra Mine in 1999. In 2001, PCBs and lab chemicals were secured and removed from the site for disposal.

Studies are continuing to develop a remediation plan and offer insight into the condition of the water quality, tailings, waste rock and soils. The contents of 900 barrels at Terra Mine were sampled this year to prepare for incineration.

Future plans

Once studies have been completed, a Remediation Plan will be developed and submitted to the Sahtu Land and Water Board for approval. The Remediation Plan will outline how the tailings ponds will be treated, how the mine openings will be closed and where waste from the site will be placed. In the meantime, water quality monitoring will continue, chemicals will be secured and waste oils will be incinerated.

Contact Lake Mine





Contact Lake Mine

The Contact Lake Mine is located on Contact Lake, approximately 265 km east of Déline and 300 km northwest of Yellowknife. It was originally a silver mine in the 1930s but was mined for uranium from 1949-1950. Mining operations took place intermittently until 1980. The mine was owned by Echo Bay/Ulster Peter Ltd.

Why is this a contaminated site?

During the mine's operation, an estimated 29,100 cubic metres of waste rock and 1,450 cubic metres of processed tailings were deposited downslope of the mine site towards Contact Lake. The tailings are not contained. Surface water runs downslope from the waste rock pile, through the tailings and collects in a settling (tailings)

pond. The tailings and surface mine water have elevated levels of metals including arsenic and uranium. There is the possibility of metals leaching from the waste rock piles and tailings to Contact Lake. There are also old buildings, as well as mine structures and openings, that pose safety hazards.

What's going on at the site?

In 1993, an environmental assessment was conducted. Inventory was taken of the buildings, waste deposits were surveyed, tailings, waste rock and surface water were sampled and lake bottom sediments were collected.

In September 2002 and June 2003, more water and soil sampling was conducted to further quantify and qualify the potential

impacts of the mine site drainage on the surrounding environment.

This year, baseline studies have continued, as well as posting warning signs, installation of groundwater monitoring wells and additional water quality sampling. The groundwater wells were installed to investigate groundwater quality and determine if there is a flow path from the tailings pond to Contact Lake.

Future Plans

Continued water quality monitoring is planned for Contact Lake. The assessment will be used to create a Remediation Plan for the site.



Port Radium Mine



Port Radium Mine

Port Radium abandoned mine site is located on a peninsula along the eastern shore of Great Bear Lake in the Northwest Territories, 440 kilometres north of Yellowknife and 265 kilometres east of the Dene community of Déline. The site was discovered by Gilbert Labine in 1929 and mined for radium and silver until 1940. In 1942, the Crown-owned Eldorado Mining and Refining Company mined for uranium until 1960 before leaving the site. In 1964, Echo Bay Mines took over operations and mined for silver. Echo Bay Mines ceased mining operations at Port Radium in 1982 after covering most tailings and garbage with waste rock, moving all valuable equipment to nearby mining operations and destroying buildings onsite.

Why is this a contaminated site?

Historical and environmental studies done to date determine the following concerns: status of closed mine openings; remaining scrap materials; exposed tailings; elevated gamma radiation levels at the former plant site and spilled tailings areas; elevated metals levels in local surface seeps, some vegetation, lake sediments and water quality; status and environmental issues associated with exposed waste rock; suitability of on-land tailing covers; status of uncapped tailings basin; and if any effects are due to the unknown quantity of tailings deposited into Great Bear Lake.

What's going on at the site?

In 1999, the Canada-Déline Uranium Table (CDUT) was formed. It is comprised of

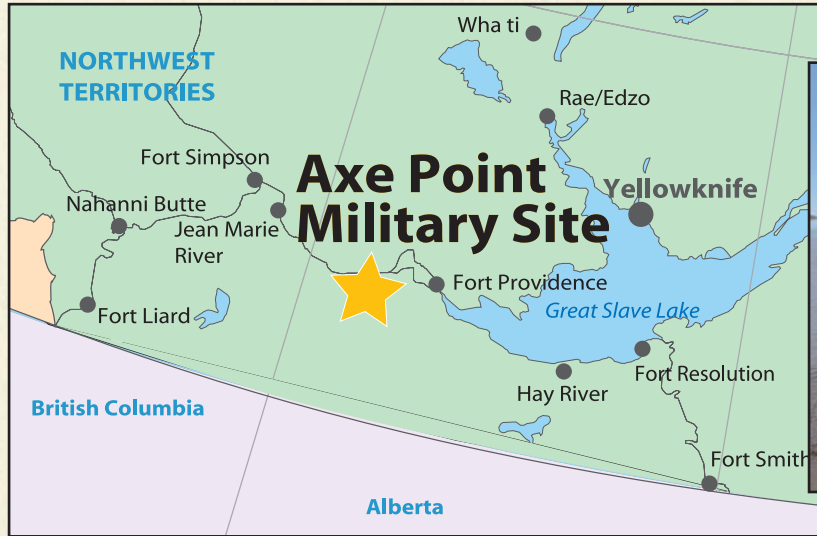
representatives from DIAND and Déline residents. DIAND represents Canada on behalf of Health Canada and Natural Resources Canada. The CDUT created an Action Plan, to describe, scope and recommend studies and activities that, when completed, will provide the information necessary to enable the CDUT to make informed decisions about the long-term management of the Port Radium site and any ongoing community health requirements relating to the mine site.

Future Plans

In March 2005 the CDUT will complete the Action Plan final report, which will include results of the CDUT studies and CDUT recommendations to the Chief and Council and the Minister of Indian Affairs and Northern Development.



Axe Point military site





Axe Point military site

Axe Point was an airstrip, staging area and camp along the winter road to Norman Wells for the American military during World War II. The site supported the construction of the CANOL Project, an oil pipeline between Norman Wells and Whitehorse. It is believed that the site was also used for a couple of years in the early 1940s. Axe Point is 60 kilometres west of Fort Providence, on the shores of the Mackenzie River.

Why is this a contaminated site?

There is very little documented historical information about Axe Point. Most of the available information is from elders in nearby Fort Providence. Remaining on site are seven collapsed buildings, metal debris,

a boiler, several old vehicles and old batteries. The site is overgrown with willow, alder, birch and poplar trees. Investigations have found elevated levels of hydrocarbons and metals in soils and groundwater on site. Geophysical surveys have identified buried materials on site.

What's going on at the site?

In 2001, a general site assessment was done, which included water testing, assessing old buildings, and gathering information about contaminants on site. In 2003, more water quality testing was done, including a detailed study of any impacts on the nearby Mackenzie River. This work was done in cooperation with the Fort Providence Resource Management Board.

Preliminary results indicate no water is moving from site and there is no impact on the Mackenzie River.

Future Plans

Further investigations are required to determine the extent of contamination on site and to determine options for remediating the site. This information will be used to develop a Remediation Plan which will be submitted to the Mackenzie Valley Land and Water Board. Once approvals and licences are obtained remediation can begin at Axe Point.

Kittigazuit military site





Kittigazuit military site

Kittigazuit was used as a long-range navigation site (LORAN) by the military. This was a significant LORAN site in the northern region, built in 1947 and operated from 1948 to 1950. The station was code named "Yellow Beetle". The site is located near Kittigazuit Bay, located between Inuvik and Tuktoyaktuk in the Inuvialuit Settlement Region.

Why is this a contaminated site?

After the LORAN project was shut down, a lot of debris remained at the site, including decaying buildings and equipment. It was then used as a waste metal depot by DIAND. Through site assessment, it was determined that there was also DDT and metal contaminated soils, asbestos waste

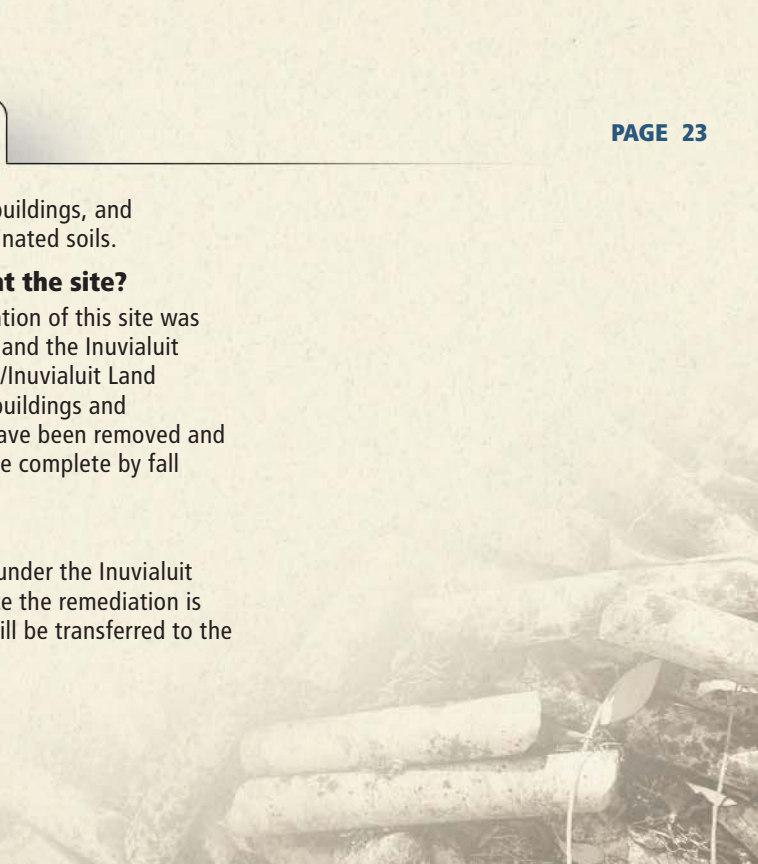
associated with the buildings, and hydrocarbon-contaminated soils.

What's going on at the site?

The scope of remediation of this site was developed by DIAND and the Inuvialuit Regional Corporation/Inuvialuit Land Administration. The buildings and contaminated soils have been removed and remediation should be complete by fall 2004.

Future Plans

As an Annex 'R' site under the Inuvialuit Final Agreement, once the remediation is complete, the land will be transferred to the Inuvialuit.



Atkinson Point military site





Atkinson Point military site

Atkinson Point, otherwise known as BAR-D was an Intermediate DEW Line site located approximately 80 kilometres east of Tuktoyaktuk by McKinley Bay. This military radar site was constructed in 1957 and operated until 1963. The land reverted to DIAND in 1965. DIAND made this site available for scientific use by government and university groups until 1981. During the 1970s, DIAND leased the land to Imperial Oil.

Why is this a contaminated site?

Most of the visible debris at Atkinson Point was collected and stockpiled in 1993. However, there are still several landfills, numerous barrels and several fuel tanks, as well as buildings contaminated with

PCB-amended paint and asbestos. Several soil samples also showed levels of copper, lead, zinc and PCBs above guidelines.

What's going on at the site?

Assessment work is planned for this site after the Kittigazuit Bay military site has been remediated. The area is still in use by reindeer herders, the oil and gas industry, as well as hunters and trappers.

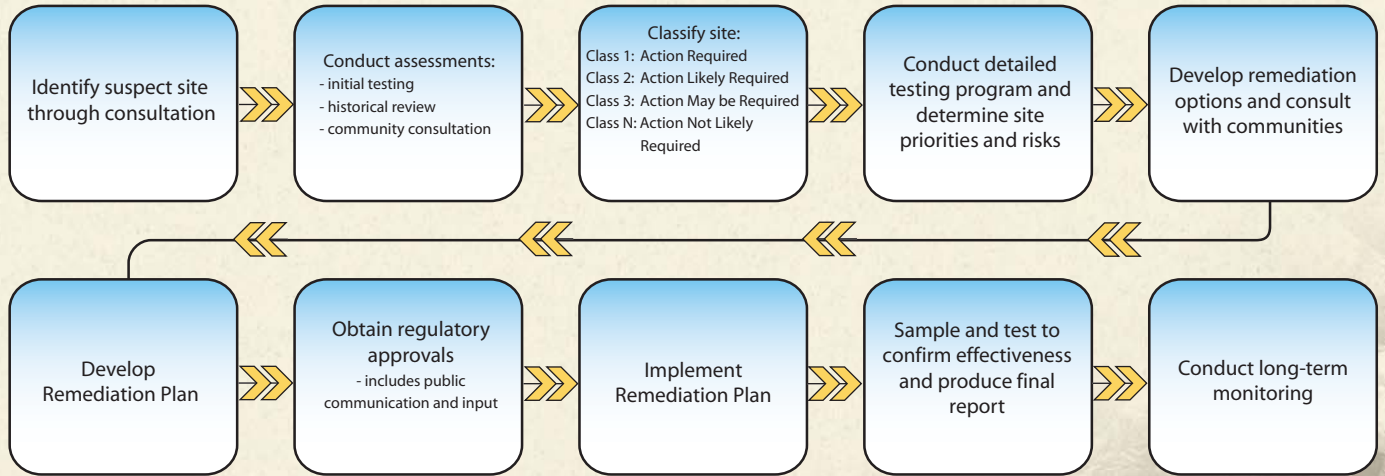
Future Plans

Preliminary assessment work at this site was completed in 2000. However, several new guidelines or standards are now in place, and additional assessment work is required. Once this is completed,

a Remediation Plan will be developed and submitted for approval. Once approved, the site will be remediated and monitored as appropriate.



Taking Action



Taking Action

Once a potential contaminated site is identified, there is a clear path forward for taking action. The site must be assessed, tested and classified. Remediation options are then explored, a Remediation Plan is created, put through regulatory approvals and implemented. Consulting with northerners throughout this entire process is crucial, and their input is carefully considered and included in the decision-making process.

In response to growing public concern over contaminated sites across Canada, the Canadian Council of Ministers of the Environment (CCME) created the National

Contaminated Sites Classification System (NCSCS) in 1995. This is a screening tool that provides scientific and technical assistance for evaluating sites according to their current impacts or potential risks to human health or the environment.

All contaminated sites in DIAND's northern inventory are classified according to the NCSCS and fall into the following classes:

- Class 1:** Action Required;
- Class 2:** Action Likely Required;
- Class 3:** Action May be Required;
- Class N:** Action Not Likely Required; and
- Class I:** Insufficient Information.



What is found at NWT contaminated sites?

A variety of substances and hazards are found at contaminated sites in the NWT. Some substances are naturally occurring but have become a problem due to development, while others were brought into the area for a specific purpose. Below is information about some significant contaminants and hazards found at contaminated sites in the NWT.

Arsenic trioxide: The rock mined in Yellowknife and some other gold deposits in the NWT is rich in arsenopyrite, a mineral that has a high arsenic content. The ore in this area was roasted to release the gold. When it was roasted, arsenic was also

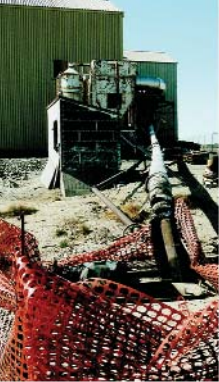
released as a gas. The gas cooled and became arsenic trioxide dust.

Cyanide: This is a chemical added during the floatation process to separate gold from ore. Cyanide is brought to the site as a powder. After it is used in the floatation process, it ends up in tailings and tailings water.

Mercury: This is a chemical added during the floatation process to separate gold from ore. Mercury is brought in as a liquid. Once used, it remains a liquid and can be found in tailings and tailings water.

Hydrocarbons: This refers to all petroleum-based products, such as fuels, oil and grease. It is used at sites for heating, power generation and vehicles. If these products are not handled or stored properly, there can be leaks and spills, which contaminate soil and water.

PCBs: This is an oily like substance that was brought to sites as a coolant used in electrical equipment. PCBs were also mixed with paint to be used as a moisture barrier. If these products are not disposed of properly, they can cause contamination of soils, air and water and cause bioaccumulation in mammals.



Ammonia: This is commonly found at mine sites where cyanide is used. Ammonia occurs when cyanide breaks down (degrading), and is found in tailings and tailings water. Ammonia is also used in explosives.

DDT: This was a commonly used pesticide at sites to help workers deal with mosquitos. It was brought to the site in barrels, and was used liberally.

Lead: This is associated with paint, batteries and hydrocarbon use, such as leaded fuels.

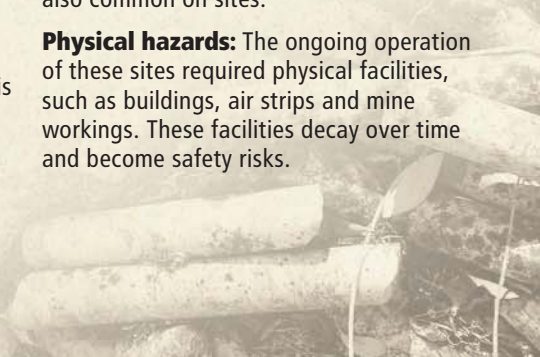
Acid-generating waste rock and tailings: This is also commonly referred to as acid rock drainage. During mining, rock is disturbed and minerals that were contained in the rock are now exposed to oxygen and the environment. If the rocks are naturally acidic, this can lead to the creation of an acidic environment which can be transported by water.

Uranium-related waste: Uranium naturally gives off radiation as part of the ongoing decaying process. When uranium is mined, it is exposed to oxygen and that decaying process is accelerated. Uranium-

related waste is put in tailings containment areas, resulting in a higher concentration and higher than natural radiation levels.

Hazardous waste: There were other substances brought to the sites for ongoing operation. For example, several sites had on-site assay laboratories, which involved lab chemicals. Antifreeze and asbestos were also common on sites.

Physical hazards: The ongoing operation of these sites required physical facilities, such as buildings, air strips and mine workings. These facilities decay over time and become safety risks.



Other Useful Terms

Contaminated Site: A site at which substances occur in amounts above what would be natural and pose, or likely will pose, a hazard to human health or the environment, or exceed levels specified in policies and regulations.

Contaminant: Any physical, chemical, biological or radiological substance in the air, soil or water that has an adverse effect. Any chemical substance with a concentration that exceeds background levels or which is not naturally occurring in the environment.

Remediation: The removal, reduction, or neutralization of substances, wastes or hazardous material from a site so as to prevent or minimize any adverse effects on the environment or public safety.

Reclamation: The process of reconvertng disturbed land to its former or other productive uses.





Protecting the North

DIAND recognizes that not only is it important to clean up federal contaminated sites, it is also necessary to prevent them from happening again.

Today, there is a suite of legislation protecting the North. It includes the NWT Waters Act, the Mackenzie Valley Resource Management Act and the Territorial Lands regulations. Pollution prevention and “polluter pays” are also two key elements underlying the principles of the Contaminated Sites Management Policy.

As well, because of the importance of mining to the NWT, DIAND also instituted the Mine Site Reclamation Policy (MSRP) for the NWT, which reflects the Government of Canada’s commitment to ensure that new mining operations do not leave a legacy of environmental and human health hazards or a financial liability for the Canadian taxpayer.



Mining will never be a zero-impact activity. It is impossible to extract minerals from the earth and process them without affecting the nearby environment. However, with a commitment from all stakeholders to responsible and regulated resource development, it is possible to have healthy communities, a strong economy and a vibrant mining sector.

Technologies associated with mine site remediation are continually improving, as are mining practices. For example, most mining operations now incorporate progressive remediation. This is a "clean up as you go" approach, which has become a

standard operating procedure for mining in the North. This efficient, effective approach is in everyone's best interests. The Mine Site Reclamation Policy reflects this approach.





For More Information

For more details on any of the contaminated sites mentioned in this book or any other related questions, please contact:

Contaminants and Remediation Directorate (CARD) office

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Some helpful websites

DIAND's NWT regional website
<http://nwt-tno.inac-ainc.gc.ca>

Giant Mine Remediation Project
www.giant.gc.ca

DIAND's Mine Site Reclamation Policy for the Northwest Territories
http://www.ainc-inac.gc.ca/ps/nap/recpolnwt/index_e.html

DIAND's Northern Contaminated Sites Program
http://www.ainc-inac.gc.ca/ps/nap/consit/index_e.html

