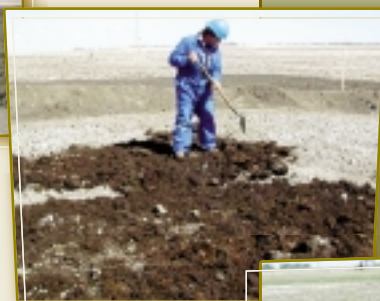


# Taking action on federal contaminated sites: An environmental and economic priority



**July 2005**





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## Introduction

Activities over the last century have left an environmental legacy that includes toxic waste sites, abandoned mines, contaminated military installations, leaking fuel storage depots, and other hazards to human health and the environment. The practices and activities of past years were consistent with the standards of the time and were carried out without full consideration of the environmental and health protection consequences they created.

With the awakening of environmental consciousness over the last quarter century, Canadians have become aware of the threats posed by contaminated sites, and the Government of Canada has started cleaning up many of the worst federal contaminated sites. The cleanup is a lengthy and complex process that is both costly and time consuming, but it is the right thing to do, and the federal government has committed significant resources to the task.



United Keno Hill Mine, Yukon

Until recently, federal departments were on their own to manage or remediate sites for which they were responsible. Without a central fund or dedicated resources, progress was slow. In 2003, the government committed \$175 million over two years to accelerate action on federal contaminated sites. This was in addition to about \$100 million per year already being spent by individual departments to manage federal contaminated sites. The new funding has had the desired effect, spawning an increase in activities to manage risk at federal contaminated sites, the engagement of communities and the environmental industry. With a further announcement of \$3.5 billion in long-term funding in the 2004 budget, the federal contaminated sites program is now on a solid footing.

The government commitment to action on remediating contaminated sites for which it is responsible will also deliver economic opportunities to Canadians through the use of environmental technologies here and abroad. The contaminated sites remediation program clearly demonstrates the 2004 Speech from the Throne commitment that the government will work with its partners to build sustainable development systematically into decision making.

This booklet provides an overview of progress to date on initiatives to remediate federal contaminated sites and is the first in a series of updates the Government of Canada will provide to Canadians as this environmental legacy becomes an environmental and economic opportunity.



## **A success in the heart of a major city**

Between 1910 and 1981, the Harvey Barracks in Calgary was a busy training facility for the Canadian Forces. Part of the former Canadian Forces Base (CFB) Calgary, the Barracks was used by many illustrious military units, including Princess Patricia's Canadian Light Infantry and Lord Strathcona's Horse. Troops that served in World War II, the Korean War, and dozens of peacekeeping missions around the world trained and lived on the 380-hectare site tucked away in the southwest corner of Calgary.

Canadian soldiers conducted a variety of military training activities at the Harvey Barracks. The site included an artillery range, small arms ranges, an obstacle course, housing, a mess, a fire hall, and a hospital. When CFB Calgary was closed in the 1990s, the Harvey Barracks bore the scars of years of training and other military activities. The site was contaminated with residue from unexploded explosive ordnance (UXOs), the artillery range was littered with UXOs, part of the base was contaminated with lead, and two other areas contained waste materials, including paints, solvents, harmful chemicals, and metals.

Since 1994, the Department of National Defence (DND) has spent more than \$66 million cleaning up the Harvey Barracks. In 2003, the Government of Canada identified the area as a candidate for priority action. Today, thanks to the increased pace of the work, the site is almost restored, and it will soon be available for residential use.

The Harvey Barracks is just one of about 4,000 contaminated sites identified in Canada that fall under federal responsibility. Many of these sites pose significant risks to human health and the environment. They include major sites with significant environmental liabilities, such as abandoned mines in the North, military sites, harbours and lighthouse stations, and sites used to store fuel. There are also many smaller sites with lower levels of contamination, such as airports, government laboratories, landfills, and reserve lands. The financial liability of all federal contaminated sites is estimated at \$3.5 billion.



Harvey Barracks, Calgary





## Federal responsibility for contaminated sites

The federal government supports the “polluter pays” principle, which places responsibility for restoration with whoever caused the contamination. This principle guides federal action on addressing federal contaminated sites.

In some cases, the federal government is directly responsible because of military operations or other government activities that caused the contamination. In other cases, the government is directly responsible when activities such as mining or exploration occurred on federally owned land or on land that the federal government has since acquired.

### Inventory of federal contaminated sites

The Treasury Board Secretariat of Canada maintains the Federal Contaminated Sites Inventory. The inventory includes all known contaminated sites for which federal departments and agencies are accountable. There are about 4,000 such sites in the inventory. More than a quarter of these are currently being remediated or under risk management. Close to 2,000 sites are still being assessed, and about 1,000 are considered remediated. The inventory is accessible on the Treasury Board Secretariat Web site at [www.tbs-sct.gc.ca/dfrp-rbif/cs-scl](http://www.tbs-sct.gc.ca/dfrp-rbif/cs-scl)

The Department of National Defence and Indian Northern Affairs Canada (INAC) have responsibility for many of the most contaminated sites. These include military installations and other sites related to national defence activities on Federal Crown lands dating back over half a century, long before the environmental impacts of such activities were adequately understood or managed. Over the last quarter century, INAC has also “inherited” responsibility for many former mines in the North after they were abandoned or through bankruptcy proceedings and Court decisions.

## The biggest challenges: Time, money and logistics

Many sites are contaminated due to decades of improper handling and storage of various kinds of waste products. It will take many years to restore some of them. Determining the nature of the contamination and its current environmental

and health impacts can be very time consuming. In many cases, adequate historical records do not exist, and scientists must discover the nature and extent of the contamination and its present impact through extensive monitoring and analysis.

Many federal contaminated sites are located in remote regions with harsh climates. It is impossible to work at some of these locations year-round, lengthening the time required to remediate the sites.

Some remote sites can be accessed only by air or ship, resulting in high transportation costs. Poor weather can restrict access by air, causing expensive delays. Some access roads are not passable all year round. In addition, the equipment required for work at many sites is large, extensive, and costly to move.

## Accelerating action on federal contaminated sites

In 2003, the Government of Canada announced a plan to address federal contaminated sites by identifying and prioritizing higher-risk contaminated federal sites and providing funds to ensure effective assessment, risk management, and/or remediation of the highest-risk sites. Remediation activities focus on protecting human health and the environment and reducing the financial liabilities associated with them.

Individual government departments retain responsibility for specific contaminated sites under their administration, but they now have access to expert support from Environment Canada, Health Canada, and Fisheries and Oceans Canada and additional funding as a result of the 2003 and 2004 announcements.



Wing Air Force Base, Happy Valley-Goose Bay



Since the program was created, much has been achieved. While initial efforts were devoted to establishing the administrative procedures and structures required to manage such a program, a number of notable objectives have been attained in just over two years. They include:

- developing a scientifically defensible human health and ecological risk ranking system;
- funding about 400 assessment projects to determine the status of federal contaminated sites across Canada; and
- funding care and maintenance and remediation / risk management activities at 57 federal sites that pose the greatest risks.

## Assessing risk and ranking sites

One of the first priorities was to establish a scientifically defensible risk ranking system to ensure that the sites that pose the greatest environmental and human health risks would be selected for priority action.

The ranking and selection process, developed with help from consultants, engineers, and scientists, is based on nationally consistent methods of assessing health and environmental risks. The level of risk depends on a variety of factors, including the nature and degree of contamination, the sensitivity of the surrounding area, and the presence of certain substances in the environment.

A list of the priority sites was developed in 2003, based primarily on risks to human health and the environment. The top 50 sites were then reassessed and, using non-scientific factors, and sites were selected for priority action.

## How do you clean up a contaminated site?

Clean up activities are based on the *Ten Step Process for Addressing a Contaminated Site* (see box), which incorporates a risk-based approach to the management of contaminated sites. The *Ten Step Process* outlines the three primary phases in

managing risk at a contaminated site: assessment, care and maintenance, and remediation and risk management.

The proper management of a contaminated site does not necessarily involve complete remediation or clean up of a site. The best approach for each site is determined based on a cost-benefit analysis, which considers the level of risk to human health and the environment and other factors, such as site conditions and the existence of appropriate technology. This way, resources are allocated where they will have the most impact.

### Ten Step Process for Addressing a Contaminated Site

- Step 1: Identify suspect sites* – Identifies potentially contaminated sites based on activities (past or current) on or near the site.
- Step 2: Historical review* – Assembles and reviews all historical information pertaining to the site.
- Step 3: Initial testing program* – Provides a preliminary characterization of contamination and site conditions.
- Step 4: Classify contaminated site using the Canadian Council of Ministers of the Environment (CCME) National Classification System* – Prioritizes the site for future investigations and/or remediation / risk management actions.
- Step 5: Detailed testing program* – Focuses on specific areas of concern identified in Step 3 and provides further in-depth investigations and analysis.
- Step 6: Reclassify the site using CCME National Classification System* – Updates the ranking based on the results of the detailed investigations.
- Step 7: Develop remediation / risk management strategy* – Develops a site-specific plan to address contamination issues.
- Step 8: Implement remediation / risk management strategy* – Implements the site-specific plan that addresses contamination issues.
- Step 9: Confirmatory sampling and final reporting* – Verifies and documents the success of the remediation / risk management strategy.
- Step 10: Long-term monitoring* – If required, ensures that remediation and long-term risk management goals are achieved.

Source: A Federal Approach to Contaminated Sites, 1999, Contaminated Sites Management Working Group



Risk management and remediation projects for federal contaminated sites may be subject to environmental assessment under the provisions of the *Canadian Environmental Assessment Act*.

### **Assessment projects**

Funding assessment work is an important part of the federal contaminated sites program. Assessment projects involve detailed analysis to identify the nature and extent of the contamination. This helps determine the risks to human health and the environment.

A full-scale assessment of the severity of contamination for a specific site is a lengthy and complex process (see steps 1 to 5 in the *Ten Step Process*).

By assessing contaminated sites, the federal government is able to develop a more accurate estimate of the level of the financial liability it faces.

To date, about 400 site assessments have been done.

### **Care and maintenance projects**

Care and maintenance projects are initiated in exceptional circumstances to prevent severe environmental damage from occurring before a site assessment is completed. They are undertaken because immediate action is required to avoid an imminent environmental disaster that would harm human and wildlife populations. They are typically undertaken at abandoned or idled mines or other properties where there is extensive contamination. Because of the imminent danger at these sites, short-term care and maintenance measures are used to stop the spread of contamination while remediation options can be fully developed and studied. (See steps 1 to 4 in the *Ten Step Process*).

These projects involve managing health and environmental concerns and maintaining necessary infrastructure such as retaining structures and other risk management measures used to collect and treat contaminated water. Various methods and approaches can be used, depending on the circumstances. They include monitoring the site, posting warnings, restricting access to the site, changing land use

patterns at or around the site, isolating contaminants or pollutants by stabilizing them, erecting barrier walls, capping the site, and partial remediation. The approach to each site differs, depending on the nature of the risks that are present.

Examples of sites that have received funding for care and maintenance projects include Giant Mine in the Northwest Territories and Faro Mine in the Yukon. In most cases, significant consultation with the surrounding community occurs before projects are initiated.

### **Remediation / risk management projects**

After a site assessment is completed, a remediation / risk management action plan is developed for priority sites. The plan describes the various alternatives under consideration and identifies the preferred option to reduce the risk to human health and the environment.

The chosen remediation method is designed to address the unique conditions at the site where it will be implemented. The responsible federal government department oversees the development of the remediation plan and works closely with the consultants, contractors, and tradespeople hired to design and implement it. Common remediation activities involve reducing exposure to dangerous contaminants by removing, destroying, or containing them.

Public consultation and community involvement are important elements of the remediation process, and information is shared with surrounding communities through public information sessions, workshops, and other communication activities.

A “remediated” site has moved through Step 9 in the *Ten Step Process*, and long-term monitoring is in place, where necessary.

The Distant Early Warning (DEW) Line sites in the North and the Harvey Barracks in Calgary are some examples of federal contaminated sites that have received funding for remediation / risk management projects.

**Funding for Assessment, Care and Maintenance, and Remediation/Risk Management projects, 2003–2005**

Type of project	Number of sites	Funding allocated
<b>Assessment</b>		
2003-04	218	\$3 400 000
2004-05	175 <sup>1</sup>	\$4 480 000
<b>Care and maintenance<sup>2</sup></b>		
2003-04	6	\$29 344 000
2004–05	9	\$10 245 900
<b>Remediation / risk management<sup>2</sup></b>		
2003–04	12	\$35 356 000
2004–05	46	\$74 874 100
<b>Total sites<sup>2</sup> (care and maintenance and remediation / risk management only)</b>	<b>57</b>	<b>\$157 700 000</b>

<sup>1</sup> Approximation; final numbers are not yet available.

<sup>2</sup> A total of 57 sites received funding for care and maintenance and remediation/risk management projects in 2003–2005. Numbers do not add up because some sites received funding in both years.

## Goals of federal contaminated sites remediation

Federal contaminated sites receive funds through the Federal Contaminated Sites Action Plan for the purpose of reducing risks to human health and the environment. At the same time, it generates economic activity for the communities and the industry.

## Who benefits?

The program offers many benefits. For example, it has already helped create new jobs in the environmental industry, and it is providing economic opportunities for affected communities, particularly in the North. In some cases, previously contaminated sites may have potential for redevelopment.

The program is also committed to stimulating local economies around contaminated sites. Training initiatives are incorporated wherever possible to develop the skills of people who live and work in the areas around contaminated sites.

In some cases, projects have included Aboriginal training and employment opportunities. Aboriginal peoples are already involved in the remediation of a number of federal contaminated sites. For example, the Tsuu T'ina Nation has acquired a great deal of technical expertise and knowledge about environmental remediation as a result of its work with DND on the restoration of the Harvey Barracks.

The program is also helping Canada's environmental industry develop new technologies for environmental remediation.

The Canadian scientific community is benefiting by developing expertise in remediation and risk management of contaminated sites.

Finally, Canadian taxpayers are also benefiting from the program. The estimated financial liability from federal contaminated sites is approximately \$3.5 billion, which will be reduced as a result of remediation activities. More importantly, the warning signs will come down in many of these remediated sites and housing, business and recreational users will move in.





## Progress on specific federal contaminated sites

In just over two years, 57 priority federal contaminated sites have been identified for accelerated action. Below is a brief description of each of the sites and the work that is being done to restore them.

### Northern Territories

There are 16 federal contaminated sites in the North that have received funding to date. Ten of the sites are mines, and six are military installations or abandoned DEW Line radar sites.

#### Distribution of 57 funded sites<sup>1</sup>

Federal contaminated sites in all regions of Canada have received funding for care and maintenance and remediation / risk management projects since 2003.

Location	Number of sites
North (Yukon, Nunavut, Northwest Territories)	16
British Columbia	23
Prairie Provinces	6
Ontario	4
Quebec	1
Atlantic Provinces	7

<sup>1</sup> Work on one site in the Atlantic Provinces was deferred, and it has not been included in the project descriptions.

### Giant Mine

*(Indian Northern Affairs Canada)*

Giant Mine is a former gold mining operation located within the limits of the City of Yellowknife. Since the first gold brick was poured in 1948, the mine has played a significant role as a major employer and economic engine for Canada's North. Now, more than 50 years later, following the receivership of the mine's former owner in 1999, the mine is entering its final chapter. A plan is being written to close the site in a responsible and effective manner, offering the best protection possible to local residents and the environment.

Approximately 237,000 tonnes of highly toxic arsenic trioxide are stored underground at the site. In addition, arsenic-contaminated buildings, soils, and tailings

on the site represent hazards to human health. There is also potential for the release of arsenic dust from contaminated sources on the surface.

The arsenic trioxide was created during the production of more than seven million ounces of gold between 1948 and 1999. The rock mined at Giant is rich in gold and arsenopyrite, a mineral that has a high arsenic content. When the rock was roasted to release the gold, the arsenic was also released in the form of arsenic trioxide. The arsenic trioxide dust is a toxic, grey powder, and ingesting even a small amount can cause illness or death.

Almost all of the arsenic trioxide at Giant Mine is stored in 15 underground chambers surrounded by rock. Each of the chambers is cut into solid rock and sealed with a cement bulkhead. Initially, this storage method relied on the area's permafrost, which worked naturally as a frozen barrier. However, the permafrost has thawed because of ongoing mining activity, causing water seepage in and out of some of the storage areas. All contaminated water from the mine is currently being collected and pumped to an aboveground water treatment facility on site.

After consulting extensively with the community and taking into account the recommendations of the project's technical advisor and a panel of independent experts, the Giant Mine Remediation Project team began work on a plan to freeze the toxic material and surrounding rock underground. The solid, impenetrable frozen blocks will contain the arsenic trioxide and isolate it from the environment. After investigating a long list of alternatives, the team selected this method as the best choice to protect Northerners and the environment.

Work on care and maintenance of the site is continuing while additional site assessments and engineering studies are undertaken. Wells have been installed to monitor groundwater conditions and natural flow patterns to provide baseline data.

A formal remediation plan for the site that describes both underground and surface remediation plans is in the final stages of development. The plan will



include full-scale demolition of buildings, a clean up of contaminated material, placement of tailings covers, and details on the implementation of the underground arsenic trioxide management plan. Remediation of the site will take several years.

### **Colomac Mine**

*(Indian Northern Affairs Canada)*

Colomac Mine, located 222 kilometres northwest of Yellowknife, was a gold mine in operation from 1989 to 1997. 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.

Since the mine shut down in 1997, the tailings containment area, which was designed not to discharge to the environment, has been filling up with natural runoff and precipitation. To date, activities have focused on avoiding an overflow of tailings water contaminated with cyanide, ammonia, and metals and treating the water. Other issues at the site include hydrocarbon contamination, contamination from tailings and other spills, and the presence of many hazardous chemicals.

The release of cyanide and metals to the environment has an impact on the food chain, as caribou, moose, and other wildlife are directly exposed to tailings within the tailings containment area. Human health is affected as a result of the widespread consumption of these "country foods," particularly by Aboriginal people who depend on a traditional diet. Workers and visitors at the site are also affected.

Discharge of contaminated water would also affect fish and water downstream and cause additional exposure to wildlife in the area. There are also concerns about hydrocarbon contamination near a tank farm on the site.

Restoration of the Colomac Mine site will involve care and maintenance and remediation activities over six years, to 2010. Progressive remediation will occur throughout the six years, with the major activities scheduled for 2006–2008. The remediation plan includes water treatment and soil remediation activities, containment, treatment or removal of hazardous and non-hazardous waste, covering the tailings ponds, and activities to ensure that the infrastructure (airstrip, roads, power, fuel, accommodation) is adequate to support other site activities. Towards the end of the remediation, these facilities and site buildings will be removed.

### **Silver Bear Mine**

*(Indian Northern Affairs Canada)*

Silver Bear Mine includes five properties in the Camsell River area, located 280 kilometres northwest of Yellowknife. These mines produced silver, copper, and bismuth between 1960 and the early 1980s. The Silver Bear properties include Terra Mine, Northrim Mine, Norex Mine, Graham Vein, and Smallwood Mine.

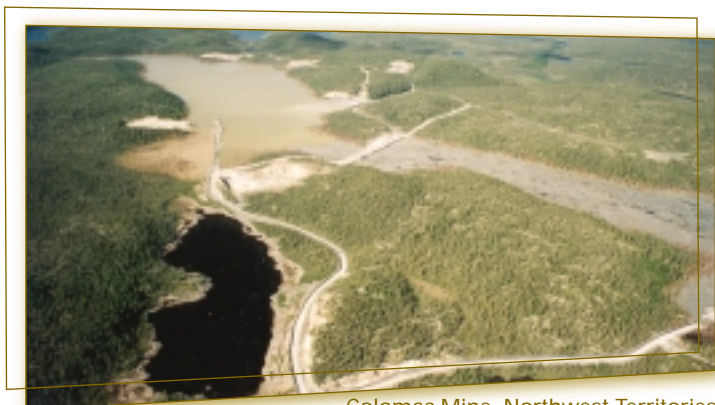
The sites are contaminated with arsenic and other heavy metals. Additional studies will be done in 2005, including further water quality assessment, treatment studies, and further acid rock drainage assessment.

Clean up activities during the 2005 summer program include incineration of waste oils and fuels. Chemicals stored at these sites will be containerized and secured for future removal. Warning signs will also be posted, and buildings at the site will be secured to address health and safety concerns.

### **Discovery Mine**

*(Indian Northern Affairs Canada)*

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.



Colomac Mine, Northwest Territories



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 and 2000, although some residual exposed tailings remain on site. There are also old buildings, mine structures, and unsealed mine openings on the site that pose contamination and/or safety risks.

A remediation plan has been developed and accepted. The necessary land use permits and licences to begin the remediation activities have also been received. The major demolition and remediation work is expected to take place during the summer of 2005.

### **Port Radium Mine**

*(Indian Northern Affairs Canada)*

The Port Radium 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 mined for silver and radium between 1929 and 1940; uranium mining was conducted between 1942 and 1960; and silver mining occurred between 1964 and 1982, when the site was closed.

Approximately 1.7 million tonnes of uranium and silver tailings remain on the site (contained) and in Great Bear Lake (uncontained). Risks include radiological hazards and metal toxicity.

A remediation plan will be submitted to the regulatory board this year, and remediation work is expected to start next year. Health studies and some site monitoring are ongoing.

### **Tundra-Taurcanis Mine**

*(Indian Northern Affairs Canada)*

Tundra-Taurcanis 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.

Elevated metal concentrations have been measured downstream from the mine. The water in the tailings pond contains elevated levels of aluminum, arsenic, chromium, manganese, copper, iron, and lead and is believed to be the source of contamination downstream. Contamination at the 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.

Since 1999, the site has been in care and maintenance mode. This work will continue in 2005, and options for a closure plan will be developed. Last year, major repairs on the tailings dam were completed to protect the receiving environment. Additional assessment work will be conducted on water quality and on contaminated soils, tailings, and waste rock. Once all of the environmental studies are completed, a remediation plan will be developed and submitted to the Mackenzie Valley Land and Water Board this year.

### **Faro Mine**

*(Indian Northern Affairs Canada)*

In its heyday, Faro Mine was Canada's largest zinc and lead mining operation. It opened in 1969 and operated until 1998. Today, the site consists of waste rock dumps, ore processing facilities, water treatment plants, tailings disposal facilities, and offices, shops, and other buildings. There are also three large open pits that hold water containing high levels of metals.

A large tailings impoundment holds an estimated 57 million tonnes of metal-bearing tailings. There are concerns about the chemical stability of the tailings solids. Tailings surface water is contaminated and



Faro Mine, Yukon



requires treatment prior to release to the environment. Groundwater studies are ongoing to assess potential contamination below the tailings impoundment.

Care and maintenance activities will continue, focusing on water treatment operations, maintaining the diversion channels, inspecting and maintaining all water-retaining structures, and maintaining infrastructure.

A comprehensive abandonment plan will be finalized by 2006. This plan will then require environmental assessment and permitting prior to implementing closure. Ross River Dena Council and Selkirk First Nation are involved in closure plan development. Site investigations, assessments, and monitoring are ongoing.

### **Clinton Creek Mine**

*(Indian Northern Affairs Canada)*

The Clinton Creek asbestos mine operated from 1967 to 1978. The mine is located 86 kilometres northwest of Dawson City, Yukon, and consists of three open pits located on the south side of Clinton Creek. During operations, 940,000 tonnes of chrysotile asbestos fibre, 60 million tonnes of waste rock, and 10 million tonnes of tailings were produced.

Tailings were placed on an upper bench in the Wolverine Creek valley. During operations, the tailings pile failed and moved down the slopes into the Wolverine Creek channel. Wolverine Creek continues to erode the toe of the tailings pile, and a small amount of water has been impounded.

In 1974, the waste dump fell into the Clinton Creek valley, resulting in the damming of the creek and impoundment of water. The slide formed a lake approximately 114 hectares in size and moved the creek up against the valley wall on the north side. A failure of the lake outlet was a real possibility, which could release 12 million cubic metres of water, causing flooding, potential loss of life, loss of property, and loss of fish habitat. Clinton Creek drains into the Forty Mile River, which is a tributary of the Yukon River, 55 kilometres upstream of the U.S. border.

The possible release of asbestos fibres to the atmosphere has been a concern, although for normal site activities there is a nil to very low risk of health effects due to airborne asbestos.

A mid-term solution to the Clinton Creek stabilization problem was completed in 2004. This has eliminated the immediate risk of flooding due to failure of the lake outlet. Also in 2004, the demolition of a number of buildings, tanks, and other physical hazards on site was undertaken. Care and maintenance of creek stabilization structures, further revegetation, salvage of demolition debris, and continued air, water, and slope movement monitoring will continue in 2005.

### **United Keno Hill Mine**

*(Indian Northern Affairs Canada)*

Silver and lead deposits were first discovered in 1903 at the site of the United Keno Hill Mine, about 350 kilometres north of Whitehorse, Yukon. The mine operated until 1989, when it closed due to low silver prices and high operating costs. A number of underground workings discharge water that is high in zinc and other metals. These waters must be treated before it is released to the environment. Conventional lime treatment is currently carried out on a year-round basis.



United Keno Hill Mine, Yukon

A large tailings impoundment containing approximately five million tonnes of zinc-bearing tailings occupies the McQuesten River valley. Three dams that hold back the tailings and water are built on melting permafrost. They are physically unstable and require constant maintenance. The site is under active care and maintenance, and a caretaker is on site





at all times. All polychlorinated biphenyls (PCBs) and hazardous chemicals will be removed from the site in 2005 and disposed of at appropriate facilities.

The site was placed in receivership in April 2004 with the view of selling the property by the fall of 2005. This process is ongoing.

### **Mount Nansen Mine**

*(Indian Northern Affairs Canada)*

Placer gold was originally discovered in Nansen Creek in 1899. The Mount Nansen Mine site is located 60 kilometres west of the village of Carmacks, Yukon, and covers an area of 53 square kilometres.

Exploration for lode gold began in the 1940s. Prior to the 1990s, two attempts at mining the Mount Nansen deposit were unsuccessful. The latest attempt at mining began in 1996 and proceeded sporadically until 1999, when the operator, BYG Natural Resources Inc., shut down, placed itself in receivership, and subsequently abandoned the property.

At the time of abandonment, high levels of cyanide were present in the pond, and the dam seepage was discharging to Dome Creek. The dam is not stable and is susceptible to failure. During the summers of 1999–2004, accumulated contaminated water was withdrawn from the tailings pond, treated, and discharged to the environment, to make room for the following winter's snowmelt and summer runoff. Seepage water continues to be captured by a smaller downstream dam and pumped back into the main impoundment.



Mount Nansen Mine, Yukon

Cyanide and metal levels have been reduced to the point where biological in situ treatment may be adequate to meet discharge standards and may be tried in 2005.

The Brown McDade pit contains water that cannot be discharged directly because of the high levels of zinc that it contains. Pit water is pumped and treated as required to prevent discharge through underground workings in the pit.

Ongoing care and maintenance of the site continue while a final closure plan is being developed in consultation with First Nations and stakeholders in 2005. Once the plan goes through environmental assessment and permitting, it will be implemented.

### **FOX-M (Hall Beach); PIN-4 (Byron Bay); and DYE-M (Cape Dyer)**

*(Department of National Defence)*

These sites in Nunavut operated as radar sites on the DEW Line that was built in the late 1950s. The sites are now abandoned.

Contamination at the three sites is similar and includes soils contaminated with arsenic, cadmium, copper, chromium, lead, petroleum hydrocarbons, and polycyclic aromatic hydrocarbons (PAHs). The Byron Bay site includes PCBs in painted surfaces on various structures, while the Cape Dyer site includes high concentrations of background metals, including lead, copper, cadmium, and zinc.

These remediation projects began in 1998 and will continue until 2008. The goal is to keep chemical contamination out of the Arctic food chain and ensure that the sites are restored to an environmentally safe condition.

Clean up activities involve demolition and landfilling of remaining unused infrastructure and site debris; landfill repair, containment, and monitoring; the removal of hazardous materials; excavation and treatment or disposal of contaminated soils; testing to ensure that the soil is no longer contaminated; and site grading and restoration.



Remediation work will take place during the summer months.

The work is proceeding under an agreement between DND and Nunavut Tunngavik Incorporated, which ensures that the promises made in the Nunavut Land Claims Agreement are carried out. The agreement includes provisions on a minimum Inuit employment content that contractors must meet on the projects (about 75 percent) and a DEW Line cleanup training plan to maximize Inuit employment in the project.

### **CAM-F (Sarcapa Lake)**

*(Indian Northern Affairs Canada)*

CAM-F is located by Sarcapa Lake, 85 kilometres west of Hall Beach, Nunavut. The location was used as a DEW Line station from 1957 to 1963. The site has a number of health and safety hazards that are a concern, since it is used as a camp by hunters from Igloolik and Hall Beach. Hazards include debris, abandoned drums, and contaminated soil containing elevated levels of PCBs and inorganic elements such as zinc, cadmium, lead, and copper. Excavated soils were removed from the site and destroyed at an approved facility in 2005.

A four-year remediation plan for the site has been proposed. It includes excavation and containerization of the contaminated soils, shipping hazardous wastes off site for disposal, demolition of all structures, collection of debris, and burial of material in landfills. Remediation will begin in 2005, with mobilization of equipment to Hall Beach.

This project has the potential to enhance the skills of the local labour force in Igloolik and Hall Beach. Areas where skills could be enhanced include carpentry, welding, plumbing, electrical, crane truck operation, environmental monitoring, heavy equipment mechanics and operations, and first aid and emergency response.

### **BAF-5 (Resolution Island)**

*(Indian Northern Affairs Canada)*

This site, on Resolution Island off the southeast coast of Baffin Island, Nunavut, was operated as part of



Resolution Island, Nunavut

the Pole Vault Line by the U.S. Air Force from 1953 to 1972. The site contains a number of health and safety hazards, including buildings in various states of disrepair, soil contaminated with PCBs, lead, cobalt, hydrocarbons, mercury, and copper, various hazardous materials, and eight landfills. It is currently under active remediation.

The revised remediation plan developed in 2002 for the Resolution Island project was designed to have the site remediated by the end of 2005 and all equipment and personnel removed from the site by the end of 2006.

Contaminated soil has been excavated and containerized so that it can be shipped south for disposal. The remediation of old dump sites will continue, a new engineered landfill has been completed, and the site will be demobilized.

In 2003, 91 percent of the 78 full-time workers on the project were Inuit. In 2004, this number increased to 95 percent. The workers gained experience and training; many of them learned new trades and obtained certification. Nunavut workers from 12 communities are now recognized as experienced contaminated site workers.

To date, procurement related to the Resolution Island project has generated over \$7 million in business opportunities for Nunavut. It is estimated that over 30 organizations indirectly benefit from the project.

**FOX-C (Ekalugad Fjord)***(Indian Northern Affairs Canada)*

In 1957, a DEW Line radar station was erected on Ekalugad Fjord, about 200 kilometres south of Clyde River, Nunavut. The station was abandoned in 1963. Even though some remediation work was done in 1985, the site is still littered with debris (10,000 barrels, deteriorating buildings, equipment) and contaminated with PCBs, asbestos, petroleum hydrocarbons, and heavy metals.

A three-year remediation plan has been proposed. It will involve waste characterization, landfill development, asbestos abatement, building demolition, barrel handling, and contaminated soil excavation. The remediation will start in 2005, with mobilization to the site.

This project will provide training and skill enhancement opportunities for the local labour force in Clyde River and Qikiqtarjuaq. Workers will be required to use and improve their skills in a number of areas, including carpentry, welding, plumbing, electrical work, operating crane trucks, and providing mechanical services for small equipment. The project will also provide an opportunity for training in contaminated health and safety procedures and first aid and emergency response.

**British Columbia**

There are 23 sites in British Columbia on the list of 57 priority federal contaminated sites funded since 2003. They include 20 lightstations (lighthouses):

*Trial Islands, Scarlett Point, Chrome Island Range, Quatsino (Kains Island), Pine Island, Pachena Point, Nootka Island, McInnes Island, Merry Island, Green Island, Estevan Point, Entrance Island, Lennard Island, Carmanah Point, Egg Island, Langara Island, Cape Beale, Ivory Island, Cape Mudge, and Chatham Point (All Department of Fisheries and Oceans)*

These 20 sites, located on coastal areas of the mainland and on or around Vancouver Island, are all lightstations that are occupied on a full-time basis by lightkeepers and their families. The historical use of

lead-based paints, the incineration and dumping of solid wastes, and fuel spills and leaks have resulted in metal and petroleum hydrocarbon contamination.

Many of the lightstations in British Columbia are in ecologically sensitive areas, with about one-third located in parks or other protected areas. There are over 300 occurrences of rare species at or adjacent to these staffed lightstations.



Nootka Island, Pacific coast

The risk management plan includes measures to reduce risks and track uncertainties from all sources of exposure. Elements of the plan include:

- targeted remediation or risk management of contaminated garden soils and indoor dusts;
- implementation of a drinking water management plan;
- ongoing voluntary blood lead monitoring for all lighthouse residents and maintenance staff; and
- an outreach and education program for all lighthouse residents and maintenance staff.

**Pacific Environment Centre***(Environment Canada)*

Groundwater at this Vancouver site, located under the Lion Gate's Bridge on the Capilano Indian Reserve No. 5, is contaminated with heavy metals, including copper and zinc.

The site will be remediated using technology developed by the University of Waterloo. Rather than pump and treat groundwater and excavate and remove large volumes of soil, a wall known



as a permeable reactive barrier will be installed below grade to intercept and treat contaminated groundwater.

### **Rock Bay**

*(Transport Canada)*

Victoria Harbour's Rock Bay is one of the most contaminated sites in British Columbia. It is the location of a former coal gasification plant that operated from the 1860s to the early 1950s. Coal tar, which is the main source of contamination at Rock Bay, was largely a waste by-product of the coal gasification process, which produced gas to power city lights and heat the community for over 90 years. In addition, the site is also contaminated with heavy metals (such as lead and mercury), ammonia nitrogen, sulphate, cyanide, PAHs, petroleum hydrocarbons, and PCBs. The residual contamination poses minimal health risks, but it does exceed allowable levels and limits most future activities at this site.



Rock Bay, Victoria

Work on the site began in 2004 and is scheduled to be completed in 2007. Over 36,000 cubic metres of contaminated soil and sediment, the equivalent of 4,000 dump truck loads, will be removed from the site and transported to approved off-site treatment or disposal facilities.

The Rock Bay remediation plan was developed with input from both federal and provincial environmental agencies, the City of Victoria, technical and academic experts, and various community groups. The remediation approach includes implementing a comprehensive stormwater management plan by the City of Victoria to address ongoing

contamination from the two municipal outfalls that discharge into the bay.

### **Colwood Aggregate**

*(Department of National Defence)*

This site, in Esquimalt, was contaminated as a result of firefighter training and historical fuel spills. PAH contamination has a high probability of off-site migration if not removed or treated.

The remediation proposal is to remove existing infrastructure that is covering the contamination and to complete the remediation, excavation, and testing of contaminated soils. The soils will then be moved into a biocell that will be constructed on site. The remediation process involves adding nutrients and oxygen to enhance soil microbes. The project will also include backfilling the site with clean fill material based on the needs of the site/development plan.

## **Prairie Provinces**

There are six sites in the Prairie Provinces on the list of 57 priority federal contaminated sites funded since 2003.

### **Goodfish Lake**

*(Indian Northern Affairs Canada)*

This site, located in east-central Alberta near Fort McMurray, was contaminated by discharges of sludge containing tetrachloroethylene (also known as perchlorethylene) from a large dry-cleaning facility operated by the Whitefish (Goodfish) Lake First Nation #128 since 1977. Additional spills and discharges of tetrachloroethylene onto lands surrounding the plant also contributed to significant contamination of the area.

An assessment has determined that the soil is contaminated to a depth of several metres. The soil is a hazard to the natural environment and presents health risks to workers within the dry-cleaning facility.

Most of the contaminated soil has been excavated, and the area has been backfilled with clean fill. While some of the contaminated soil has been





removed to a registered landfill, approximately 14,000 tonnes of stockpiled soil are awaiting removal. Additional work will be done at the site following the decommissioning of the dry-cleaning facility. A new dry-cleaning facility is being built.

In addition to the removal of contaminated soil, siphons were installed under the building to dissipate toxic vapours entering the facility through the concrete slab. Fans were also installed in the building to further assist the removal of harmful vapours from the facility.

First Nations equipment was employed to the extent possible in this project.

### **Banff National Park**

*(Parks Canada Agency)*

*(Note: Two separate locations in Banff National Park are considered as one site)*

### **Cougar Street, Banff**

This site in a Banff residential neighbourhood was contaminated with lead, copper, zinc, arsenic, barium, mercury, and chromium. The contamination is believed to have come from an old dump that was used between 1901 and 1907 to dispose of ash from coal/wood-burning appliances, and other debris.

The remediation involved excavating approximately 1,600 cubic metres of soils on eight residential properties on Cougar and Marten streets in Banff. Great care was taken during the preparatory phase to photograph the work area, landscape, and built features, as well as to survey property features and fence lines. This preparatory work was undertaken to allow the site to be restored to its original landscaped condition once the excavation was completed.

In total, 2,461 tonnes of heavy metal soils were removed, disposed of in a provincially certified landfill, and replaced with clean subsoil and topsoil. The site has now been fully reclaimed.

### **Saskatchewan Crossing Warden Station, Banff National Park**

The Saskatchewan Crossing Warden Station is located within Banff National Park in Alberta, approximately 75 kilometres north of Lake Louise. This multifunctional site consists of living quarters for park personnel, an information kiosk, outbuildings, and corrals. In addition, it has been used as a staging area for the warden service and as a highway maintenance yard. Previous on-site facilities have included hydrocarbon storage tanks, generators, a rifle range area, and a road salt storage area. Over time, the soil had become contaminated with hydrocarbons from the gasoline underground storage tank (UST), used generator oil, diesel fuel from an aboveground storage tank, lead from the former rifle range area, and road salts.



Banff, Alberta

In October 2004, remediation of four impacted areas began by excavating and aerating the soils to reduce volatile vapours to an acceptable level for disposal. In total, 357 tonnes of gasoline-contaminated soils at the former UST area were excavated, as well as 15 tonnes from the used oil area, 30 tonnes from the rifle range / bullet backdrop area, and 60 tonnes from the generator building area. Excavated soils were transported to an industrial landfill facility, and the former UST and generator areas were backfilled with sandy gravel. As part of the project, six groundwater monitoring wells were installed. Groundwater will be monitored to ensure that any remaining hydrocarbons do not exceed acceptable guidelines. There remains a salt-impacted area from the highway abrasive storage pile. This will be remediated after a proper storage facility is installed.



### **Suffield Experimental Proving Ground**

*(Department of National Defence)*

This project involves remediating parts of CFB Suffield that are contaminated with chemical and biological weapons or their residues. CFB Suffield is located in southeastern Alberta, approximately 225 kilometres southeast of Calgary.

It is believed that chemical and biological weapons remain on some parts of the 431-square-kilometre Experimental Proving Ground, while other parts are contaminated by their residual breakdown by-products. The agents most likely to remain include mustard and VX. Analysis of areas where mustard was destroyed by burning or stored has indicated elevated levels of many compounds, including arsenic, boron, copper, sulphur, and zinc.

Work will be carried out at six specific sites within the Experimental Proving Ground. All of the sites have toxins that are related to the destruction or burial of chemical warfare agents. The sites are considered toxic. If they are disturbed or dug into by wildlife or humans, exposure could be fatal.

The remediation work requires specific expertise, personnel, and equipment. Work will begin on lower-risk sites, and project staff will increase their capabilities to address high-risk sites, which requires considerable resources with strategic considerations for the future.

### **Oxford House**

*(Indian Northern Affairs Canada)*

This project involves cleaning up a bulk fuel storage tank area at an elementary school on a First Nations Reserve in Manitoba. Soil contaminated with hydrocarbons will be removed and replaced with clean soil.

First Nations will benefit from economic development as a result of the use of First Nations machinery and heavy equipment. Band staff also assisted with the assessment and excavation stages.

### **Barren Lands (Brochet)**

*(Indian Northern Affairs Canada)*

This project involves remediating a bulk fuel storage and equipment maintenance site near Brochet, Manitoba. The soil at the site is contaminated with hydrocarbons. An assessment has been completed, and excavation and removal of the contaminated soil are proceeding in 2005. The area will be backfilled with clean soil.

First Nations workers are involved with construction activities at the site, and First Nations machinery and equipment are being used.

### **Harvey Barracks**

*(Department of National Defence)*

The Harvey Barracks site is divided into two areas: the practice area lands, consisting of the former small arms ranges, obstacle course, and dry training areas, and the barracks area lands, consisting of the former housing area, mess, fire hall, hospital, etc. The type and amount of contamination vary considerably in different parts of the site, depending on the activities that were conducted there. Contaminants detected in the Harvey Barracks area include petroleum hydrocarbons (including benzene, toluene, ethylbenzene, and xylenes, or BTEX), metals, PAHs, and volatile organic compounds (VOCs).

The Harvey Barracks project is almost finished. To date, the Buffalo Buttriss site, which was contaminated with lead, has been remediated; two sites on the Elbow River escarpment that contained waste material, paints, solvents, PAHs, and metals



Harvey Barracks, Calgary



have been remediated; and waste materials at a former chemical warfare storage area have been excavated and separated.

Excavation and separation of waste materials at a former chemical medical facility site are currently ongoing. The work is expected to be completed in 2005. Due to the nature of the contamination and the effectiveness of the remediation plan, there will be no need for long-term monitoring of this site once the work is completed.

Under the terms of a settlement agreement reached in 1991, DND is returning the Harvey Barracks land to the Tsuu T'ina Nation. By working in partnership with the Tsuu T'ina Nation on the project, DND has passed on a great deal of technical expertise and knowledge about environmental remediation and unexploded ordnance to the First Nation. This knowledge has assisted the First Nation in developing its own companies with the required expertise to work on other contaminated sites across the country.

## Ontario

There are four sites in Ontario on the list of 57 priority federal contaminated sites funded since 2003. They include three former nursing stations on First Nations Reserves.

### Weagamow Lake

*(Health Canada)*

The former nursing station at Weagamow Lake is contaminated by petroleum hydrocarbons. Excavation is required to remove the contaminants. This will involve decommissioning and removing the old nursing station building. Liquid contaminants are being pumped out and treated. The construction of a cell for landfarming is also anticipated.

### Lansdowne House and Kasabonika Lake

*(Health Canada)*

Soil near two former nursing stations located at Lansdowne House and Kasabonika Lake is contaminated by diesel fuel oil. The diesel fuel

contamination will be excavated and moved to a bioremediation cell.

### Belleville Small Craft Harbour

*(Fisheries and Oceans Canada)*

Belleville Harbour was used for over 50 years as a commercial harbour mainly for the storage of coal and fuel products. Landfill sites were operated on the property for a number of years. These activities led to contamination of the property by petroleum hydrocarbons and heavy metals. The property has been leased to the City of Belleville for park and recreational use, but development has been held up pending a resolution of environmental issues. After almost a decade of environmental studies on the property, a multiyear project to remediate site contamination began in 2004.

The project includes treating contaminated soil and preventing contaminants in groundwater from discharging into the adjacent Bay of Quinte.



Belleville Small Craft harbour, Ontario

## Quebec

There is one site in Quebec on the list of 57 priority federal contaminated sites funded since 2003.

### Valcartier

*(Department of National Defence)*

A major regional aquifer has been contaminated by trichloroethylene. This aquifer is used as a potable drinking water source by the surrounding area (Shannon Township).



The site has been assessed, and remedial strategies to address the contamination are being developed. The strategies may include remediation, risk management, or a combination of both.

## **Atlantic Provinces**

There are seven sites in the Atlantic Provinces on the list of 57 priority federal contaminated sites funded since 2003.

### **Former Remote Radar Site 59, Newfoundland and Labrador**

*(Transport Canada)*

This former U.S. military site located at the Gander International Airport in Newfoundland and Labrador contains several hot spots that are heavily contaminated with PCBs. The contamination occurred when buildings at the radar site were demolished. Various pieces of debris, including items containing or coated with PCBs, were mixed into the ground, resulting in several hot spot areas.

The remediation plan for the site combines active remediation and risk management. Most of the contaminated soil has been taken to a hazardous waste treatment facility, and a one-metre cap of clean material will be placed over areas contaminated with lower levels of PCBs. The remaining work is anticipated to be completed in 2005–06.

Various debris and abandoned infrastructure will be removed from the site. Once the remediation is complete, ongoing monitoring of groundwater, sediment, and soil will be conducted, and sampling of small mammals (hare, shrew, and vole), berries, and fish tissue will be done to ensure that the project was successful.

### **Upper Tank Farm, Survival Tank Farm**

*(Department of National Defence)*

Both of these sites are located at the 5 Wing Air Force Base at Happy Valley-Goose Bay. The majority of environmental contamination can be attributed to past storage and handling practices of a broad range of environmental contaminants, including hydrocarbons,

heavy metals, chlorinated compounds such as PCBs, and pesticides, including DDT.

Contaminants at the Survival Tank Farm include petroleum hydrocarbons (including BTEX), metals, and PAHs. Contamination has likely impacted surface water quality in the bog, which may affect terrestrial and aquatic life. Nine storage tanks will be removed, along with all associated structures. Remediation of the contaminated soil and groundwater will be undertaken.

Approximately four million litres of fuel were released in the 1960s at the Upper Tank Farm. A fuel recovery project has been under way since 1991 and is continuing. New technologies are being evaluated to increase the recovery rate.

This project will benefit the local economy and provide new employment opportunities in the Lake Melville region.



Wing Air Force Base, Happy Valley-Goose Bay

### **CFB St. John's Southside Tank Farm / Shea Heights Aggregate**

*(Department of National Defence)*

Shea Heights and Southside are tank farms with several aboveground storage tanks. Extensive petroleum hydrocarbon contamination has been confirmed at the site. Contaminated soil near the property boundaries at Shea Heights is suspected. A residential community is adjacent to the contaminated site.

Additional site investigation (sampling groundwater, surface water, sediments, and soil) is required to further delineate petroleum hydrocarbon, PAH, and





metal contamination. Improved knowledge of the extent of contamination will assist with determining the type and extent of remedial activity, which is expected to start in 2005–06.

### **Saglek**

*(Department of National Defence)*

The most ambitious cleanup of PCB-contaminated soil undertaken to date in Canada is now in progress at the remote site of Saglek, on the northeastern Labrador coast in Newfoundland and Labrador. This project presents an enormous challenge, not only because of the quantity of soil that must be treated or removed, but also because of the difficulties presented by the rugged terrain and harsh climate at Saglek.

During an environmental investigation in 1996, a significant amount of PCB contamination was discovered in soil at the former radar station, and PCBs were found in samples of marine life taken from Saglek Bay. Much of the contaminated soil has been excavated since it was discovered.

The Saglek Soil Remediation Project addresses 20,000 cubic metres of excavated PCB-contaminated soil, which is being stored temporarily on site. Action is required to remediate this soil, as storage at the staging area is not a long-term solution that will protect human health and the environment.



Saglek, Newfoundland and Labrador

### **Greenwood**

*(Department of National Defence)*

As a result of historical training, maintenance, storage, landfill, and other military activities at 14 Wing Greenwood, Nova Scotia, parts of the largest air force base in eastern Canada have become contaminated. Soil, groundwater, sediment, and surface water in an area known as the North Side Lower Zeke's Brook are contaminated with metals (including mercury), PAHs, VOCs, and petroleum hydrocarbons (including BTEX). Other chemicals that have been detected include soluble inorganics and sulphonates.

Excavation of the impacted soil will be conducted, or a multiphase extraction system will be implemented. Additional installation of monitoring wells and test pitting will also be required as part of the remediation implementation program.



## Looking forward

In just over two years, the federal government has made some significant strides, allowing accelerated action to proceed at numerous federal contaminated sites across the country. Momentum will continue to grow from the Budget 2004 announcement of the government's long-term commitment to taking action on the federal contaminated sites that pose the greatest risks to human health and the environment.

The nature of government action to address contaminated sites will continue to evolve as additional sites are identified each year for priority action.

## Contact information

For additional information on the Federal Contaminated Sites Action Plan, please contact:

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## High Priority Federal Contaminated Sites

Sites that received funds in 2003–2004  
and 2004–2005 for accelerated action

