



**ASSESSMENT AND REMEDIATION OF ABANDONED MINING
EXPLORATION SITES IN NUNAVIK**

PROGRESS REPORT

**Kativik Regional Government
Renewable Resources Department**

MARCH 2005

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Part A of the report describes the completion of the assessment of the sites located in the Kangiqsujuaq-Salluit sector. Part B of the report is the preparation and coordination of a pilot project to remediate a major site. Part C of the report is the preparation of a practical guide on remedial measures addressed to Northern Quebec communities.

1. PROJECT LEADERS AND TEAM MEMBERS

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2. INTRODUCTION

This report presents a follow-up to the *Abandoned Mining Exploration Site Assessment and Prioritization Study* conducted by the Kativik Regional Government (KRG) and the Makivik Corporation in 2001 and 2002. There remain 403 non-validated abandoned mining exploration sites in northern Quebec (herein after referred to as the « region »). Based on projections from the filed work, we expect to locate an additional 7 major, 68 intermediate and 95 minor sites using the criteria adapted from the National Classification System for Contaminated Sites. This four-year project will complete the assessment of these sites. The methodology used will be that recommended in the report of March 2003.

In the Kangiqsujuaq-Salluit sector alone, local informants indicated 125 potential abandoned mining exploration sites during the 2001-2002 assessment. A subsequent phase will consist of validating the information regarding these potential sites with the collaboration of currently active mining exploration companies.

Moreover, following the KRG's two-year inventory project, a remediation plan is being prepared for one abandoned mining exploration site. The site KAW-35 located in the Schefferville area has been validated and characterized as a major site with a high prioritization for remediation. Clean-up procedures are being developed and equipment is being brought up to carry out the restoration of the site. Considering the immediate threat to the environment, this experimental project will be a prelude to a more ambitious

clean-up project of abandoned mining exploration sites found throughout the Northern Quebec territory.

In addition, a practical guide has been produced with the collaboration of the Ministère de l'Environnement du Québec (MENV) in order to transfer the knowledge and skills to a local community level and ensure that the proper support is provided regarding the management and safe handling of hazardous materials during their removal from abandoned mining exploration sites. This guide specifically targets the communities of the region concerned by the presence of contaminated sites.

3. ABANDONED SITES INVENTORY UP-DATE

With the help and collaboration of currently active exploration mining companies working in the Kangiqsujaq-Salluit sector, also known as the Ungava Trough, a preliminary validation of some potential abandoned sites was conducted. The companies were first contacted over the course of January 2005 and informed concerning their requested participation over this inventory up-date. Later in February, meetings were held at the respective companies offices in order to validate and point out on maps the potential sites. The up-dated information brought up was mostly related to the sites located within or surrounding the properties where the companies operate. Charter companies, which flew over the targeted area, were also contacted to confirm the existence of potential sites.

The mining exploration companies, organizations, and charter companies contacted for this validation include:

- **Members of the Raglan Committee (Falconbridge Ltd. Raglan Mine, Makivik Corporation, Salluit and Kangiqsujaq communities)**
- **Falconbridge-Noranda Ltd., Exploration Department**
- **Novawest Resources Inc.**
- **Cygnus Consulting**
- **Anglo-American Exploration Canada**
- **Canadian Royalties Inc.**
- **Nunavik Rotors**
- **Qekeirriq, Akulivik Landholding corporation**

To date, the information provided by these organizations indicate that:

- 1) 7 potential sites (I-6, K-30,31,33,34,35, and K-60) were correlated to one already assessed major site;
- 2) 3 sites from mining archive sources (P35G/08-1, P35G/08-1002, and P35G/08-1002A) correspond to an active exploration camp;
- 3) 3 other potential sites (P35G/06-6, SW-47, and WB-6) were validated as intermediate abandoned sites;
- 4) 1 potential site (SW-55) was designated as a minor abandoned site.

The mining exploration companies also indicated two new minor abandoned site locations (see Table 1). In addition, the Landholding Corporation of Akulivik reported one new major abandoned site in their sector. The mining exploration companies also undertook the clean up of some sites situated within or in close proximity to their mining exploration properties located in the sector. In total, four of these potential sites have been cleaned (SW-23, P35G/07-4, P35G/07-6, and P35G/07-7).

Some of the sites indicated by the local informants happened to correspond to pre-identified abandoned site assessed during the two-year inventory. In addition, some designated potential sites are still active and used by the current mining exploration companies. These sites are often fuel caches, or exploration camps planned to be occupied for the 2005 exploration campaign. Finally, the companies also indicated their intention to bring future remediation interventions on validated and characterized sites. The Raglan Mine stated that it would be possible for them to clean the major site SW-34, considering its accessibility and location next to their property. Canadian Royalties Inc. would eventually carry out the clean up of the major site K-28.

The validation of the potential abandoned mining exploration sites is not exhaustive since the companies have not started their next exploration campaigns and are not on the land to confirm the existence of such sites. As soon as the fieldwork campaigns will start next summer, the validation of these sites will continue and, help maintain the inventory updated.

The following table presents the up-dated information on potential abandoned sites in the Kangiqsujaq-Salluit sector. The coding for the sites (SW-24, K-1...) comes from the 2002 GETIC group inventory report. Each code represents the informant's village abbreviation followed by a chronological number. The potential site locations and coding of the GETIC report correspond accurately to the locations designated by the informants during the two-year inventory project conducted by the KRG.

The *Validated potential mining exploration sites in Kangiqsujaq-Salluit sector* map (see Appendix 1) shows the distribution of the potential abandoned mining exploration sites indicated by local informants in the Kangiqsujaq-Salluit sector. The classification of the validated abandoned sites is based mainly on general descriptions given by the companies on the number of buildings, materials and debris observed. Available pictures of some sites also help to classify the sites (see Appendix 2). A more thorough assessment of these validated sites will have to be carried out in order to characterize and accurately classify them following the criteria used for the classification and prioritization of abandoned mining sites (Kativik Regional Government, 2003).

4. REMEDIATION PILOT PROJECT

One major site (KAW-35) situated near Retty Lake at about 60 km E-N-E of Kawawachikamach community, was assessed during the KRG 2001-2002 inventory and has been designated as a priority for clean-up. This site forms an excellent target to carry out a remediation pilot project. Such an experimental project will be a prelude to a more ambitious clean-up project of abandoned mining exploration sites found throughout the Northern Quebec territory.

TABLE 1

Up-dated information on potential abandoned mining exploration sites in Kangiqsujaq-Salluit sector

Site code	Location	Classification	Description	Informant
I-6 K-30,31,33,34,35 K-60	61 33.25'N 73 27.25'W	major	All sites correspond to the assessed major site K-61	Canadian Royalties
P35G/08-1002 P35G/08-1 P35G/08-1002A	527000E 6816410N	major	Correspond to active exploration camp	Novawest
P35G/06-6	499750E 6806550N	intermediate	Camp remains, >12 barrels, metal rods	Cygnus
SW-47	506350E 6825700N	intermediate	>20 barrels, wood-metal debris	Cygnus
WB-6	517300E 6835500N	intermediate	3 tents, 1 dwelling, >20 barrels, 5 propane tanks	Cygnus/Anglo American
SW-55	506840E 6805880N	minor	<10 barrels	Cygnus
New site-NEW1	61 06' 42.4" N 76 57' 91.9"W	major	>100 barrels, >25 propane tanks, metal debris	Akulivik Landholding Corporation
New site-NEW2	509200E 6807000N	intermediate	camp remains, >10 barrels, propane tanks	Cygnus
New site-NEW3	502000E 6823000N	minor	<10 barrels	Cygnus

TABLE 1 (cont'd)

**Up-dated information on potential abandoned mining exploration
sites in Kangiqsujaq-Salluit sector
CLEANED ABANDONED SITES**

Site code	Location		Classification	Description	Informant
SW-23	454820E	6802800N	-	site cleaned by cie	Anglo American
P35G/07-4	514535E	6812370N	-	site cleaned by cie	Novawest
P35G/07-6	521600E	6814000N	-	site cleaned by cie	Novawest
P35G/07-7	519290E	6813580N	-	site cleaned by cie	Novawest

Since, *le Groupe Platine de la Fosse* (GPLF), the mining exploration company who operated on this site (Vachon et al.) has been dissolved for many years, le Ministère des Ressources Naturelles et de la Faune du Québec (MNRF) has jurisdiction over the site given that it has been officially declared orphaned. During the first week of February, the Kativik Regional Government (KRG) sent a letter to the Minister for MNRF, confirming its intention to carry out remedial measures on this specific abandoned mining exploration site (KAW-35). The MNRF signified that it is prepared to contribute financially towards the completion of the abandoned mining exploration sites assessment. An amount of 150 000\$ was requested for the completion of the global inventory project. An additional financial contribution of 100 000\$ was also requested from MNRF for the remediation pilot project. This financial support will be exclusively used for the hiring of human resources, the purchasing of equipment and transportation of materials, and general logistics that such a pilot project entails.

A re-assessment of this site is also planned for the Year 2 of the four-year project. Further identification of the hydrocarbon residues contained in barrels and evaluation of soil contamination on two major sites (KAW-35, PJ-1) still need to be done. Soil bioremediation will also be performed on these sites, as recommended in 2003 KRG report.

4.1 COORDINATION OF REMEDIAL MEASURES

Every participant who will be directly involved in the remedial measures of the KAW-35 site was contacted concerning the project. The Naskapi Nation Council of Kawawachikamach, the air charter NORPAQ, which will provide transportation logistics, soil remediation experts from the MENV, suppliers for remedial measures equipment, and chemical products treatment centers have all been informed and are aware of the remedial project. Based on the financial contribution of the MNRF, the coordination of the pilot project planned for the major site KAW-35 will involve a remediation team of 5 people hired within the Naskapi community of Kawawachikamach. These technicians will receive training and instructions on hazardous material handling as well as equipment operation. The remediation team, the project coordinator and soil expert will conduct a 20-day fieldwork campaign in order to safely and effectively remove hazardous materials from the site in accordance with applicable laws and regulations. All hazardous materials and debris collected will be brought and properly stored in the local northern community of Schefferville. The hazardous materials will then be transported to an authorized hazardous waste management centre in southern Quebec.

Table 2 presents a preliminary account of the expenses related to the remedial pilot project that will be carried out on the site KAW-35, and according to the conditions stipulated in the contribution agreement between KRG and EC for Year 2 of the project.

TABLE 2
Remedial pilot project, preliminary account of expenses.
(period of july to august 2005)

REVENUE	
NEI income	\$19,000.00
MNRF income	\$50,000.00
Total revenues	\$69,000.00
EXPENDITURES	
Salaries	
Community technicians	\$15,000.00
Coordinator	\$7,000.00
Equipment purchase (miscellaneous tools, camp materials...)	\$1,500.00
Equipment location (tents, tools, generators, stoves...)	\$3,000.00
Supplies	\$8,000.00
Training	\$2,500.00
Transportation logistics (Teams transport-barrels removal by Otter including fuel costs)	\$20,000.00
Site re-assessment	\$3,250.00
Material storage	\$1,000.00
Hazardous materials transportation to treatment center	\$1,000.00
Travel expenses	\$5,000.00
Report production (including translation costs)	\$1,250.00
Communication	\$500.00
Total expenditures	\$69,000.00

4.2 EQUIPMENT PURCHASING

Two remediation toolkits were purchased specifically for the pilot project and for further remediation interventions. One toolkit will be used exclusively for the remediation pilot project conducted on the KAW-35 site in the Kawawachikamach sector. The second toolkit will be provided to remediation teams working on the PJ-1 site in the Tasiujaq-Aupaluk sector and eventually on other prioritized sites assessed during 2001-2002. Table 3 presents the list of equipment purchased for remedial measures with detailed prices.

5. PRATICAL GUIDE FOR REMEDIAL MEASURES ON ABANDONED MINING EXPLORATION SITE

A guide (see Appendix 2) concerning remedial measures for abandoned mining exploration sites located in the region has been produced in order to inform and transfer knowledge to local communities on how to properly and safely manage and handle hazardous materials found on such site. The main objectives of the guide distributed to Northern Quebec communities are :

- To carry out safe and effective remedial measures of abandoned exploration mining sites in accordance with applicable laws and regulations;
- To reduce threats to the fragile arctic ecosystem, particularly where it impacts the food chain and human health;
- To remove as much debris and hazardous materials from the land as environmentally and logistically feasible. Any debris left from mining exploration activities counters Inuit and Naskapi respect for the land;
- To treat contaminated areas with the help of experts in order to restore their bio-diversity and life;
- To transfer an expertise and to bring support to concerned communities in the coordination, the prioritization and carrying out of remedial efforts;

The guide is subject to be updated, as subsequent editions of the document will be elaborated with the close collaboration of the MENV and other involved participants. New editions of the guide will be provided to communities as remedial projects are carried out in the region and as on-site remedial measures are proven to be effective and safe for both public and environmental health.

TABLE 3
Pilot Project - Remedial Equipment Listing

Article	Price (\$)	Qty needed	\$ total	Suppliers
Hydrocarbon spill kit	135.15	2	270.30	Produits chimiques Cartier
Battery acid spill kit	289.95	2	579.90	Produits chimiques Cartier
Hydrocarbon pads	81.77	4	327.08	Produits chimiques Cartier
Universal pads	106.10	4	424.40	Produits chimiques Cartier
Organic absorbants	34.75	10	347.50	Produits chimiques Cartier
Electric deheader	3740.00	2	7480.00	Tenaquip
Manual drum deheader	140.60	4	562.40	Tenaquip
Deheader blades	16.28	4	65.12	Tenaquip
Drum lid lifter	143.95	2	287.90	Tenaquip
Manual rotary pump	49.03	1	49.03	Tenaquip
Metal-cutting grinder	315.00	2	630.00	Hilti Canada
Grinder blades (50/box)	150.00	2	300.00	Hilti Canada
Tyvek suits	29.75	20	595.00	Produits chimiques Cartier
Gloves	2.75	20	55.00	Produits chimiques Cartier
Masks	3.97	20	79.40	Produits chimiques Cartier
Glasses	8.75	20	175.00	Produits chimiques Cartier
Metal barrels (solid waste)	28.57	8	228.56	Les contenants Jos LeBel
Metal barrels (diesel residu)	25.33	30	759.90	Les contenants Jos LeBel
Universal key	11.00	2	22.00	Les contenants Jos LeBel
TOTAL:			13238.49	

6. FINANCIAL DATA

Table 4 presents the detailed account of expenditures made over the course of Year 1 (September 2004 to March 31, 2005).

7. UPCOMING ACTIVITIES-SCHEDULE FOR YEAR 2 (April 1, 2005- March 31, 2006)

The following activities will be undertaken during Year 2 of the project :

- Hiring and training of local technicians (hazardous material handling and processing, equipment operation);
- Re-assessment of the sites with soil expert;
- Development of methodology, performing and testing of remedial measures on KAW-35 and PJ-1 sites;
- Compacting of empty barrels, proper collecting of hydrocarbon residues, secure storage and preparation of transportation of materials from sites;
- Transportation of materials and debris from sites to accessible disposal centres;
- Production of progress report describing site re-assessment and remedial measures including compilation of all debris, removed and remaining, hydrocarbons collected, records of impacts, operations costs, pictures and recommendations;
- Production of a report recapitulating designated and newly validated sites, remedial measures, cleaned sites, participants involved and recommendations for upcoming remediation projects on other abandoned mining exploration sites.

TABLE 4
Financial Data year 1 (Sept. 2004 to March 31, 2005)

Revenue	
Northern Ecosystems initiative	\$33,000.00
total revenues	\$33,000.00
Expenditures	
Coordinator salary	\$10,150.00
Equipment (remediation toolkits)	\$13,238.49
Shipping costs (equipment purchase)	\$929.97
Travel expenses (airfare, accomodations...)	\$7,431.54
Report production (including translation costs)	\$1,250.00
Communications	\$500.00
total expenditures	\$33,000.00

8. LITERATURE CITED

- Barrett, M., Lepage, H., 1999, *Projet de nettoyage environnemental*, Administration régionale Kativik/Société Makivik, mai 1998, 6p.
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APPENDIX 1

Map 1- Validated potential abandoned mining exploration sites
in Kangiqsujuaq-Salluit sector

APPENDIX 2

Photographs of newly validated sites
in Kangiqsujuaq-Salluit sector



Photo 1. WB-6 intermediate abandoned site near Spartan Lake. Propane tanks, empty barrels, dwelling and tents.



Photo 2. WB-6 site. One dwelling, barrels and wood debris.



Photo 3. WB-6 site. Three abandoned prospecting tents.



Photo 4. WB-6 site. Wood and metal debris.



Photo 5. Aerial view of new assessed abandoned site NEW-1. Barrels on the sand beach and near the water.



Photo 6. Closer view of the site NEW-1. Barrels on the beach.



Photo 7. Site NEW-1. Empty barrels near water source.



Photo 8. NEW-1 site. Barrels in water.

APPENDIX 3

-Practical Guide-

CLEANING AND HANDLING HAZARDOUS PRODUCTS
IN ABANDONED MINING EXPLORATION SITES
IN NUNAVIK

**PRACTICAL GUIDE:
CLEANING AND HANDLING HAZARDOUS PRODUCTS
IN ABANDONED MINING EXPLORATION SITES
IN NUNAVIK**

This document will serve as a guide to Nunavik communities concerned by the presence of abandoned mining exploration sites and contaminants, and willing to carry out the remediation and clean-up of these sites. The document presents a safe and effective methodological approach related to the handling of hazardous products, the storage of these products and the transportation of materials in order to diminish existing environmental impacts. Consequently, the remediation of the sites will improve public and environmental safety.

INTRODUCTION

During the Kativik Regional Government's (KRG) two-year project of the survey of abandoned mining exploration sites conducted during 2001-2002, 193 sites were visited. Out of the 193 assessed sites, 90 were characterized and classified abandoned mining sites. Hence, there are nearly 300 other potential sites distributed on the Nunavik territory.

Environmental impacts are present and the safety of both public health and surrounding ecosystems are in threat especially on major sites locations. For these evident reasons, it is imperative to take action to clean up these sites and set up effective procedures for remedial measures. It is also important to involve Nunavik communities, which are knowledgeable of the land and, virtually all abandoned sites locations.

Both expertise techniques and the knowledge of local communities will be put into use throughout all stages of execution and daily decision-making. The transfer of knowledge, techniques and skills will take place both informally during clean-up efforts, as well as formally as each community team will be instructed on how to safely manage and perform hazardous waste removal.

The guide is addressed to Nunavik communities ready to participate in remediation efforts on abandoned mining exploration sites. During the KRG's 2001-2002 abandoned sites inventory, in several cases it showed that the use of local knowledge proved to be more reliable than any other documentation in region where the territory is well known by Inuit communities. It is expected that local populations will be a vital source of information for issues related to weather and travel, but they are also expected to provide knowledge and expertise important to remedial efforts performed on abandoned sites.

The main objectives of this guide are:

- To transfer an expert knowledge, to involve the communities and bring close support in the coordination, the prioritization and carrying out remedial efforts;
- To carry out safe and effective remedial measures for abandoned exploration mining sites in accordance with applicable laws and regulations;
- To reduce threats to the fragile arctic ecosystem, particularly where it impacts the food chain and human health;
- To remove as much debris and hazardous materials from the land as environmentally and logistically possible. Any debris left from mining exploration activities is contrary to Inuit and Naskapi respect for the land;
- To treat contaminated areas with the help of experts in order to restore their bio-diversity;

The present document has been prepared by the KRG's Renewable Resources Department and synthesized information extracted from KRG's report, *Assessment and Prioritization of Abandoned Mining Exploration Sites in Nunavik*. The content of this guide is purely indicative, is subject to change at any time according to applicable laws, regulations, and evaluation of proposed remediation methodology and has no legal value whatsoever. Further improved editions of this guide will eventually be distributed to communities as the methodology and remedial measures performed on different sites demonstrate its efficiency and prove to safe for both public and environment health.

The guide gives general procedures concerning remedial measures of abandoned sites following these steps:

1-Indication, location and evaluation of abandoned exploration mining sites

2-Delimitation of the site

3-Remedial measures

3.1-Treatment of materials

3.1.1 Hazardous materials

3.1.2 Non-hazardous materials

4-Transportation of materials to local communities

5-Storage and final transportation of materials to treatment centers

6-Recovery of debris, recycling

7-Treatment of contaminated soils

1) INDICATION, LOCATION, EVALUATION OF ABANDONED EXPLORATION MINING SITES

Every new abandoned mining exploration site presence should be communicated to the Renewable Resources Department of the Kativik Regional Government (KRG) in order to evaluate a proper remediation strategy to limit environmental impacts.

Each abandoned exploration mining site indication should include its precise location (on map or GPS location), an approximate evaluation of the site surface, and a complete and detailed inventory of the buildings, materials, debris and products observed on-site. A visual detection of any presence of soil and water contamination is crucial to report. Pictures, if possible, are also useful to complete the site description.

2) DELIMITATION OF THE SITE

Once an abandoned site is reported, a delimitation of it should be done by indicating its presence with ribbons, visible flags or other markers in order to avoid any public hazards. A quick inspection of the site, will determine any hazardous outcropping metal debris, wires, or other elements dangerous for public safety (ex. snowmobiles circulation).

3) REMEDIAL MEASURES

The designated abandoned exploration mining sites should be cleaned systematically in the following way :

- 1- Removal of all hazardous materials from the site (hydrocarbons, chemical products, paints, solvents...)
- 2- On-site burning of all combustible, non-toxic debris (wood, paper, cardboard...)
- 3- Recovery of materials for recycling where possible
- 4- Treatment or removal of contaminated soils to eliminate as much as possible their environmental hazard and restore biological feasibility
- 5- On-site waste disposal established in accordance with the Environment Québec (MENV) approval. When not possible, as much as possible of the remaining debris will be carried out to the nearest municipal disposal sites or sent to the south for proper treatment.

In all cases, the authorities responsible must, before any remedial work carried out, inform and reach an agreement with the KRG and the MENV on the measures to be taken and the monitoring to be provided. Training activities to be organized by the MENV shall

be held at the start of implementation of the fieldwork in order to give all the communities participants details on the remediation work plan and procedures.

3.1) TREATMENT OF MATERIALS

3.1.1 Hazardous materials

The main hazardous materials found in Nunavik are:

- A-Petroleum products: diesel, motor oil, grease, airplane/helicopter fuel (jet-B)
- B-Batteries and chemical products: acids, bases, fire extinguisher powder, paints
- C-Electrical transformers, heavy equipment, generators, propane tanks etc.

A-Petroleum products

As petroleum hydrocarbons are the main contaminants on the abandoned exploration mining sites, their remedial measures are required to ensure the protection of the environment and wildlife health. Remedial measures may be applied directly on site.

Petroleum products, barrels and pails contaminated by rust are no longer usable. As they constantly decay and are very often located near water, the time recovery of the petroleum products is crucial. Rusty barrels conditions have to be carefully evaluated so as to prevent any additional hydrocarbons from leaking while handling the barrels. Any residual products will have to be placed in appropriately sealed containers and properly identified with proper labels. They will be subsequently safely carried off the site and either transported to an authorized hazardous waste management site in southern Quebec. **IT IS REQUIRED TO HAVE AN EXPERT PRESENT ON SITE TO OBTAIN ALL THE AUTHORIZATIONS, THE APPROPRIATE CONTAINERS AND LABELS, AND GIVE TRAINING TO THOSE INVOLVED IN THE CLEAN-UP AND THE MANAGEMENT OF HAZARDOUS PRODUCTS.**

B-Batteries and chemical products

These products will also have to be placed in appropriately sealed containers, properly packaged and identified, then safely carried off the site and transported to an authorized hazardous waste management site in southern Quebec. It is prohibited to place chemical products and related hazardous products in local and municipal disposal sites (waste dumps).

Where there are hazardous chemical products, **it is required to have a specialist present on site to obtain the required disposal and transportation authorizations, the appropriate containers, to prepare hazardous materials for transport, and take charge of them until their delivery to an authorized hazardous waste management site in southern Quebec.** The specialist will also have to instruct those involved in the clean-up actions and the hazardous chemical products management.

C- Electrical transformers, heavy equipment, generators , propane tanks etc.

Like the treatment of diesel barrels, and other hydrocarbon products, it is important to empty and remove all residues from these items. The residues should be placed in appropriate and well-labeled containers. The residues should be safely transported to authorized hazardous waste treatment centre in southern Quebec or recycled within local communities.

It is improbable that it will be possible to dismantle abandoned heavy equipment to the point that they can be completely carried back to a municipal waste disposal site. Vehicles, heavy equipment and large waste debris should be managed in such a way as to clean and secure sites against environmental and public threat. The large items should be placed, as much as possible, in nearby disposal sites where topography, soil composition and distance from water sources permit. **Such sites must be managed following MENV recommendations and approval.**

3.1.2 Non-hazardous materials

Large volumes of non-hazardous debris and materials are found on different sites. Their management will be related to their capacity for burning without generating toxic substances. The main materials found on abandoned sites are:

- A-Combustible, non-toxic debris
- B-Non-combustible, non-toxic debris
- C-Dwellings, cabins, sheds...

A-Combustible, non-toxic materials

These materials (**wood frames, floors, sheds, canvas...**) can be safely burned on-site. However, authorization must be requested from the MENV to burn any combustible debris on-site. Such combustion may take place in empty, abandoned tanks or empty drums. Given that the materials being burned have no chemical ingredients, ashes will be non-toxic and can be left at the site where they are burned.

B-Non-combustible, non-toxic materials

One nearby disposal site should be set up with MENV approval. All non-combustible debris should be brought and properly piled to that site. If transport is feasible, the debris may be carried back to the local community and, with authorization, placed in the local municipal waste disposal dump.

Crushing, compacting empty barrels and secure storage ready for transportation

All transportable debris should be securely placed, considering harsh weather conditions (wind, snow precipitations...) in one single location at a secure minimum distance from

water and ready to be carried off the site. Empty barrels previously washed with proper chemical absorbents and, where possible, some heavy equipment and non-combustible debris are to be compacted prior to be transported to a municipal dump or approved local waste disposal site. Where there are many empty barrels (>50), appropriate equipment will be provided to remedial measures teams in order to decrease volume of debris and to ease the transportation of the barrels. **The above procedures require the instructions of a specialist who will elaborate and supervise a safe procedure concerning all the actions taken in the processing of the barrels (washing fluids and contaminated materials management).**

C-Dwellings, cabins, sheds

If the structures are in good condition and titleship of the owner of the land has lapsed, it should be up to the community whether they are interested in taking over the management for hunting/camping purposes. However, all dwellings, cabins and sheds will have to be cleaned of waste. If the dwelling is in poor condition, unsafe and unsalvageable, the structure should be torn down and its components dealt with according to the above guidelines.

4) TRANSPORTATION OF MATERIALS TO LOCAL COMMUNITIES

Contaminated materials (empty compacted barrels) and hazardous materials, such as petroleum and chemical products, will first be transported in secured, appropriately sealed containers to the nearest local community. Collection and transportation of the secured hazardous materials and non-combustible debris will take place in winter. In most cases, the debris will be carried out by local team members by snowmobiles/qamutik. Sites which are over 150 km round-trip will require a Twin-Otter depending of the location of the site and its access.

5) SECURE STORAGE OF MATERIALS AND FINAL TRANSPORTATION TO TREATMENT CENTERS

Once transported to the local community, the materials will be temporarily securely and properly stored before being delivered by boat to the previously contacted authorized hazardous waste management site or treatment center in southern Québec for the final elimination of the hazardous materials. The community storage space must first be authorized by the MENV. The transportation, the storage and management of the hazardous materials and contaminated debris will also be subject to the supervision of the MENV specialist for each procedure until the materials are definitively sent south.

Once the elimination of the hazardous materials done in southern Quebec, a valid proof (invoice, bills...) of the procedure must be communicated to the MENV.

6) RECOVERY OF METAL DEBRIS, EQUIPMENT FOR RECYCLING

In some cases where the metal debris and equipment collected from the abandoned mining exploration sites are still useable, it would be helpful if they could be claimed by residents of local communities for recycling.

7) TREATMENT OF CONTAMINATED SOILS

Petroleum residue leaking onto soil results in contamination of the local environment and, consequently, the capacity to sustain soil microorganisms and plant life. Remediation can be achieved through soil bio-remediation. Such treatment involves the biodegradation of the petroleum compounds by indigenous bacteria in the presence of the appropriate nutrients and water concentrations. This treatment has proved to be successful on other sites in Nunavik.

Soil bioremediation treatments should be performed on-site by an environmental expert in soil remediation with the help of local communities. To be most effective, treatments should be carried out in the spring and early summer when the soil has thawed.

Each site will require an individual analysis to determine the optimal approach to implementing a clean-up strategy. Residents of nearby villages who have visited the abandoned sites know the area well. They will be directly involved in this process. Scientists and specialists understand the specific challenges and their implications and will provide the necessary knowledge to carry out the safe and effective remediation of these abandoned mining exploration sites. The objective of the remedial measures applied to the subarctic environment of the region north of the 55th parallel to return the ecosystem to its original condition. This practical guide takes into account the sensitivity of the environment and the impact of such remedial measures. If they are more damaging to the environment than leaving the contaminants in place, or if it proves technologically impossible, some or all of the abandoned materials may should be left in place.

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