CUMBERLAND
RESOURCES LTD.

MEADOWBANK GOLD PROJECT

HAZARDOUS MATERIALS MANAGEMENT PLAN

JANUARY 2005

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

DESCRIPTION OF SUPPORTING DOCUMENTATION

Cumberland Resources Ltd. (Cumberland) is proposing to develop a mine on the Meadowbank property. The property is located in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands. Cumberland has been actively exploring the Meadowbank area since 1995. Engineering, environmental baseline studies, and community consultations have paralleled these exploration programs and have been integrated to form the basis of current project design.

The Meadowbank project is subject to the environmental review and related licensing and permitting processes established by Part 5 of the Nunavut Land Claims Agreement. To complete an environmental impact assessment (EIA) for the Meadowbank Gold project, Cumberland followed the steps listed below:

1. Determined the VECs (air quality, noise, water quality, surface water quantity and distribution, permafrost, fish populations, fish habitat, ungulates, predatory mammals, small mammals, raptors, waterbirds, and other breeding birds) and VSECs (employment, training and business opportunities; traditional ways of life; individual and community wellness; infrastructure and social services; and sites of heritage significance) based on discussions with stakeholders, public meetings, traditional knowledge, and the experience of other mines in the north.

2. Conducted baseline studies for each VEC and compared / contrasted the results with the information gained through traditional knowledge studies (see Column 1 on the following page for a list of baseline reports).

3. Used the baseline and traditional knowledge studies to determine the key potential project interactions and impacts for each VEC (see Column 2 for a list of EIA reports).

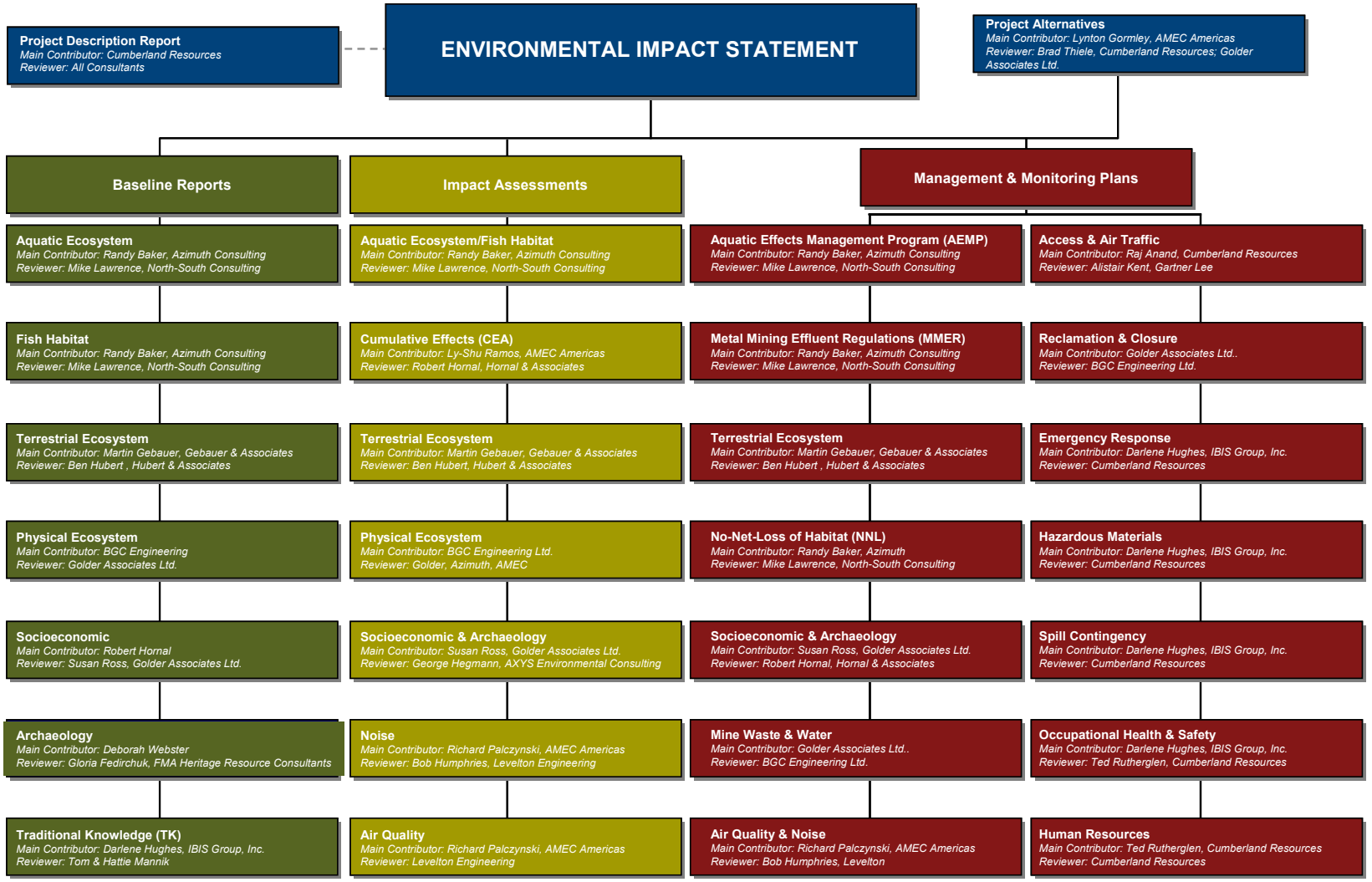
4. Developed preliminary mitigation strategies for key potential interactions and proposed contingency plans to mitigate unforeseen impacts by applying the precautionary principle (see Column 3 for a list of management plans).

5. Developed long-term monitoring programs to identify residual effects and areas in which mitigation measures are non-compliant and require further refinement. These mitigation and monitoring procedures will be integrated into all stages of project development and will assist in identifying how natural changes in the environment can be distinguished from project-related impacts (monitoring plans are also included in Column 3).

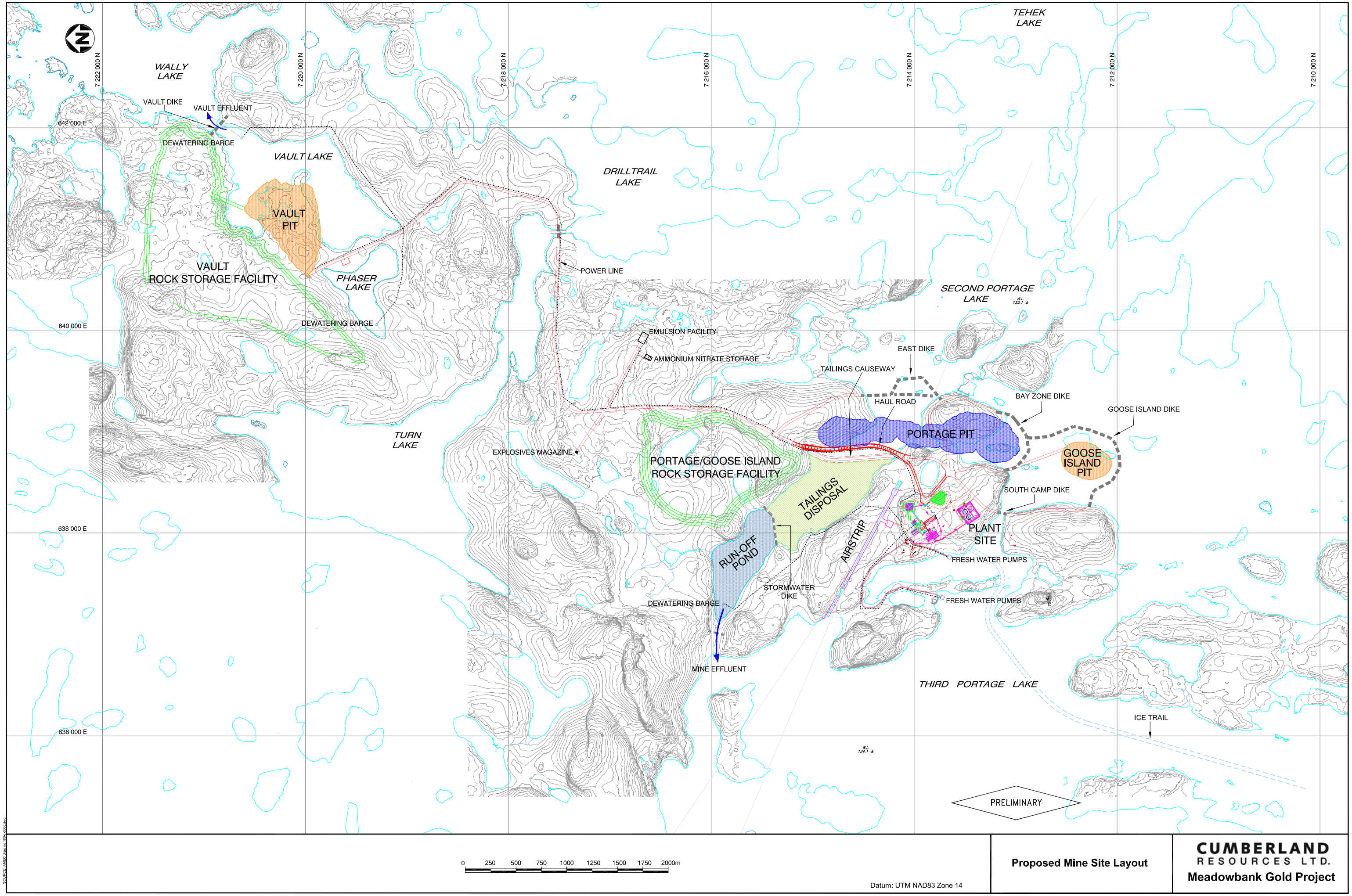
6. Produce and submit an EIS report to NIRB.

As shown on the following page, this report is part of the documentation series that has been produced during this six-stage EIA process**.**

SUPPORT DOCUMENTATION ORGANIZATION CHART



PROJECT LOCATION MAP


7 222 000 N
7 220 000 N
7 218 000 N
7 216 000 N
7 214 000 N
7 212 000 N
7 210 000 N
642 000 E
640 000 E
638 000 E
636 000 E
WALLY LAKE
TEHEK LAKE
VAULT DIKE
VAULT EFFLUENT
DEWATERING BARGE
VAULT LAKE
DRILLTRAIL LAKE
VAULT PIT
VAULT ROCK STORAGE FACILITY
PHASER LAKE
POWER LINE
SECOND PORTAGE LAKE
DEWATERING BARGE
EMULSION FACILITY
AMMONIUM NITRATE STORAGE
EAST DIKE
TAILINGS CAUSEWAY
HAUL ROAD
BAY ZONE DIKE
GOOSE ISLAND DIKE
PORTAGE PIT
GOOSE ISLAND PIT
TURN LAKE
EXPLOSIVES MAGAZINE
PORTAGE/GOOSE ISLAND ROCK STORAGE FACILITY
TAILINGS DISPOSAL
SOUTH CAMP DIKE
PLANT SITE
AIRSTRIP
FRESH WATER PUMPS
RUN-OFF POND
STORMWATER DIKE
FRESH WATER PUMPS
DEWATERING BARGE
MINE EFFLUENT
THIRD PORTAGE LAKE
ICE TRAIL
PRELIMINARY
0 250 500 750 1000 1250 1500 1750 2000m
Datum: UTM NAD83 Zone 14
Proposed Mine Site Layout
CUMBERLAND RESOURCES LTD.
Meadowbank Gold Project

SECTION 1 • INTRODUCTION

1.1 PURPOSE & SCOPE OF THE PLAN

The purpose of this plan is to provide a consolidated source of information on the safe and environmentally sound transportation, storage, and handling of the major hazardous products to be used at the Meadowbank Gold project. A hazardous material is one that, as a result of its physical, chemical, or other properties, poses a hazard to human health or the environment when it is improperly handled, used, stored, disposed of, or otherwise managed. In combination with Cumberland's "Emergency Response Plan" and "Spill Contingency Plan," this Hazardous Materials Management Plan (HMMP) provides instruction on the prevention, detection, containment, response, and mitigation of accidents that could result from handling hazardous materials.

The plan is based on the following principles for best practice management of hazardous materials:

- identify and prepare materials and waste inventories
- characterize potential environmental hazards posed by those materials
- allocate clear responsibility for managing hazardous materials
- describe methods for transport, storage, handling, and use
- identify means of long-term storage and disposal
- prepare contingency and emergency response plans
- ensure training for management, workers, and contractors whose responsibilities include handling hazardous materials
- maintain and review records of hazardous material consumption and incidents in order to anticipate and avoid impacts on personal health and the environment.

Cumberland recognizes that incorporating proper hazardous material management into other environmental management plans and systems leads to risk reduction, improved process control, and cost savings.

All hazardous materials to be used at the Meadowbank operation will be manufactured, delivered, stored, and handled in compliance with all applicable federal and territorial regulations, as well as ISO 14001 environmental management standards. Cumberland is strongly committed to preventing, to the greatest extent possible, both inadvertent release of these substances to the environment and accidents resulting from mishandling or mishap. Cumberland will institute programs for employee training, facility inspection, periodic drills to test systems, and procedural review to address deficiencies, accountability, and continuous improvement objectives.

Cumberland will actively work towards minimizing the generation of hazardous wastes by investigating alternatives to the use of hazardous materials, by recycling products and containers wherever feasible, and by treating wastes using state-of-the-art technologies before any release to the environment.

As with all other aspects of health and safety policy at the Meadowbank mine, all employees will be expected to comply with all applicable precautions and handling procedures with regard to hazardous materials. Employees are also expected to report any concerns to their supervisors, the Health and Safety Committee, or senior site management. All staff is encouraged to bring forward suggestions for improvements that can be incorporated into procedure revisions as appropriate.

1.2 APPLICABLE LEGISLATION

Both federal and territorial legislation regulates the management of hazardous materials in Nunavut. Copies of relevant legal documents will be kept on file at the mine site. Management and safety personnel will provide an overview of the applicable regulations to all employees as part of their initiation and ongoing training. The acts, regulations, and guidelines pertinent to the hazardous products that will be used at the Meadowbank Gold project are listed below.

Federal

- *Transportation of Dangerous Goods Act* and Regulations (TDGA and TDGR)
- *Explosives Act*
- National Fire Code
- Canadian Council of Ministers for the Environment (CCME) Guidelines for Above-Ground Storage Tanks.

Territorial

- *Transportation of Dangerous Goods Act* (RSNWT 1988) and Regulations
- *Explosives Use A*ct and Regulations
- *Fire Prevention Act* and Regulations
- *Mine Health and Safety Act* and Regulations
- Work Site Hazardous Materials Information System Regulations (WHMIS).

The TDGA classifies hazardous materials into nine main classes according to an internationally recognized system, as follows:

- Class 1 – Explosives
- Class 1 – Gases
- Class 3 – Flammable liquids
- Class 4 – Flammable solids
- Class 5 – Oxidizing substances and organic products
- Class 6 – Poisonous (toxic) and infectious substances

- Class 8 – Corrosives
- Class 9 – Miscellaneous products or substances.

The materials addressed in this document are identified by class in the product description tables in specific sections.

SECTION 2 • OVERVIEW OF HAZARDOUS MATERIALS

2.1 TYPES OF HAZARDOUS MATERIALS

The Meadowbank Gold project will require the use of the following types of classified hazardous materials:

- *Fuel and Lubricants* – diesel fuel, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance
- *Process Plant Consumables* – sodium cyanide, metabisulphide, hydrochloric acid, lime, flocculants, and anti-scalants used in mineral extraction
- *Explosives* – ammonium nitrate and high explosives used for blasting in the mine
- *Laboratory Wastes* – various by-products classified as hazardous waste and chemicals used in the assay laboratory.

Sections 3, 4, and 5 contain detailed lists of product quantities and safe handling procedures for the first three categories above. Laboratory wastes are generally very limited in quantity and will be handled only by specialist lab technicians. These wastes will be pumped to the grinding circuit in the process plant for recycle and eventually become part of the tailings disposal stream. As such, they are not addressed separately in this document.

2.2 MATERIALS OF SPECIAL INTEREST

Three particular products—sodium cyanide, ammonium nitrate, and diesel fuel—will be used in relatively large quantities throughout the life of the mine. Detailed procedures have been developed to ensure that these materials are handled and used with no adverse effect on people or the environment. Product characteristics and use are briefly described below. Representative material safety data sheets (MSDSs) for sodium cyanide and ammonium nitrate are provided in Appendix A.

2.2.1 Sodium Cyanide

2.2.1.1 Physical Properties

Cyanide solutions have been used in the mining industry to aid in the recovery of precious metals since the late 18th century. Its use permits effective processing of lower grade ores and those not amenable to treatment through simple physical processes such as crushing and gravity separation. Although the mining industry has spent many millions of dollars over many years pursuing alternatives to cyanide, at present there is no substitute for it that is more effective, safer, easier to use, and less costly. Mining uses about 20% of total cyanide production worldwide.

Fear of cyanide arises from several historical sources and incidents. If used improperly, cyanide is toxic to humans and the environment. Humans can be exposed to cyanide by inhalation, ingestion, or absorption through the skin. However, this is also true for many other chemicals such as gasoline and common household cleaning products like bleach, which contains chlorine, a chemical as toxic as

cyanide. It should be noted that the number of recorded mishaps related to cyanide use in mining is very low compared to environmental disasters caused by nature, other chemicals, and other industries.

Cyanide is a naturally occurring molecule of carbon and nitrogen. Low concentrations of cyanide are present in many insects and plants, including a wide range of vegetables, fruits, and nuts, where it provides protection against predators. It is also present in the everyday environment to which many people are exposed, for example, in road salt and automobile exhaust—not to mention tobacco smoke. The most toxic form of cyanide is HCN (hydrogen cyanide) gas.

Cyanide is one of only a few chemical reagents that will dissolve in water. Gold mining operations use very dilute solutions of sodium cyanide, typically in the range of 0.01% to 0.05% cyanide (100 to 500 ppm). Unlike many synthetic chemicals, cyanide oxidizes and decomposes when exposed to air or other oxidants, and does not persist in the environment. As such, it does not give rise to chronic health or environmental problems when present in low concentrations.

For more information on cyanide, see Appendix A.

2.2.1.2 Production & Handling

Cyanide production and handling are highly regulated, and its risk management is well documented. Responsible companies in both the chemical industry and the mining industry employ stringent risk management systems to prevent injury or damage from the use of cyanide. All companies and individuals in contact with cyanide must take responsibility for its safe use.

There are three primary *producers* of cyanide in the world: Dupont, in the United States; Degussa, in Germany; and ICI, in England. These producers understand their responsibility for their products and sell them only to companies that have the ability and commitment to protect workers, the public, and the environment. Sodium cyanide for use in mining is generally produced as solid, white briquettes about 10 cm square. The briquettes are maintained under controlled temperature and moisture conditions, and are packaged in labelled, sealed containers to protect the briquettes from both crushing and moisture. Cyanide producers audit purchasers and transportation systems. They design special packaging for the transport of cyanide and inventory all shipments against delivery records to ensure proper surveillance at all times. All shipments are accompanied by MSDSs that provide the chemistry and toxicity of sodium cyanide, instructions in case of accidents, and emergency telephone numbers for assistance.

Truck, rail, and barge transporters screen their employees, carefully inventory packages, and establish and maintain systems for loading and unloading cyanide products. Product handling and transportation are in accordance with protocols set by the industries and in compliance with national and international regulations.

Mining companies establish inventory control systems, maintain worker training and industrial hygiene programs, and build and maintain process solution and waste management systems specifically designed to mitigate and prevent exposure to cyanide. Cyanide is stored in secure areas that are kept cool, dry, dark, and ventilated. After gold removal from the process solution, cyanide waste products are collected and recycled or destroyed. Empty containers are washed, and the rinse

water is used in the gold recovery plant or processed through the tailings treatment system before discharge under controlled and permitted conditions.

At Meadowbank, cyanide safety procedures will include instructions for chemical storage, containment, piping, transportation, handling, use, protective equipment, personal hygiene, monitoring, and emergency contingencies. All personnel potentially exposed to cyanide, including contractors and visitors, will receive appropriate training (see Section 7).

2.2.1.3 International Cyanide Management Code

Cumberland is committed to becoming a signatory to the International Cyanide Management Code (the Code) for the manufacture transport and use of cyanide in the production of gold. The Code is administered by a non-profit institute consisting of participants from the gold mining industry, governments, non-governmental organizations, labour, cyanide producers, and other interested parties.

The Code represents a voluntary commitment on the part of all signatories to identify and follow basic principles and guidelines for safe cyanide use at gold mining operations. This is the first such generic international code in the history of the mining industry. Under the Code, gold mines are required to manage their cyanide from source to site, thus assuming “cradle to grave” responsibility for all cyanide used at their operation.

A copy of the Code is provided in Appendix B.

2.2.2 Ammonium Nitrate

2.2.2.1 Background

Ammonium nitrate (AN) (NH_4NO_3) is essentially a fertilizer product manufactured and used for agricultural purposes in many parts of the world. It is also used in the manufacture of commercial blasting explosives. Though inert and difficult to explode on its own, public concerns about the storage of large quantities of AN have increased in recent years because of its reputation as a constituent in illegal bombs. Given the high economic importance of AN-based fertilizers and explosives, it is essential that risks to society resulting from the manufacture and use of AN be kept as low as possible.

AN has been used in the production of industrial explosives since 1934. In addition to ANFO—a combination of ammonium nitrate and fuel oil—AN is a major raw material in the manufacture of nitroglycerine, water gels/slurries, and other types of blasting emulsions. Trials with modern ANFO blasting agent were conducted through the 1950s and 1960s, leading to its current status as the most widely used commercial explosive in the world, representing about 70% of total usage. AN-based explosives are a vital part of every construction project and are indispensable in the mining industry.

Millions of tonnes of AN are produced annually throughout the world and handled without incident. Despite its benign characteristics under proper storage conditions, large-scale, accidental explosions involving bulk AN have occurred in the past at manufacturing plants and on cargo ships. These events were analyzed in detail and led to international improvements in AN handling and storage

procedures. It must be emphasized that NO accidents of this type, involving explosions or fires related to AN, have ever been recorded in the Canadian mining industry.

2.2.2.2 Physical Properties

AN is a stable, inorganic, solid compound. It is completely soluble in water and must be kept dry to remain effective for its intended purpose. AN products vary in composition, blend, and surface treatment. For instance, granular fertilizer products are coated with various materials to seal the particles from moisture contamination, whereas AN prills (pellets) produced for use in ANFO explosives are intentionally porous to permit the oil to be absorbed. The prills are generally white or off-white, and shelf life in a tightly closed container is unlimited.

AN itself is not an explosive, but it is an oxidizer and can explode or decompose under specific conditions, such as: high temperature (between 160°C and 200°C); bulk storage in a confined space; contamination with organic substances such as oil or waxes; contamination with inorganic materials such as chlorides and metals (chromium, copper, cobalt, nickel); and exposure to strong shock waves from other explosions. Similarly, AN is not combustible in itself, but as an oxidizing agent it increases fire hazard when in contact with other combustible materials, even in the absence of air. AN must be stored in a dry, well-ventilated area away from all possible sources of heat, fire, or explosion.

AN is odourless under normal conditions but releases toxic nitrous and ammonia fumes on explosion, decomposition, or involvement in a fire. Direct, unprotected contact with dry AN can cause discomfort and inflammation of eyes, skin, and respiratory membranes. Its oral toxicity is slight to moderate, although swallowing large amounts can have serious, if not fatal, effects from the ammonia and nitrate salts. It has no known chronic effects, however, and repeated or prolonged exposure is not known to aggravate pre-existing medical conditions.

AN is of low toxicity to aquatic life but may promote eutrophication in waterways (water becomes pollution rich in dissolved nutrients).

For more information on ammonium nitrate, see Appendix A.

2.2.2.3 Handling & Storage at Meadowbank

Although AN is classified as a hazardous product, its storage and handling at Meadowbank is not considered to be a significant risk activity. AN will be delivered to site in heavy-duty, one-tonne tote-bags via Cumberland's marshalling and expediting system. At site, a qualified explosives contractor will manage AN and all other explosives-related materials. The AN bags will be stored in a safe area away from water bodies and from the explosives storage magazine. The bags will be handled individually when needed for the preparation of batches of explosive.

Any spills will be swept up and placed in suitable containers for use or disposal. Empty bags are not considered to be hazardous waste, and will likely be burned in the site incinerator.

All personnel exposed to AN will wear suitable personal protective equipment.

2.2.2.4 Regulatory Setting

In Canada, the production, storage, and use of AN are subject to strict precautionary measures under the *Explosives Act* and Regulations, and the *Canada Transportation Act*, Ammonium Nitrate Storage Facilities Regulations. The *Explosives Act* is administered by the Explosives Regulatory Division (ERD) of Natural Resources Canada.

Traditionally, the principal aim of the *Explosives Act* has been public and worker health and safety. After the terrorist attack of 11 September 2001, the ERD proposed certain amendments to the Act to protect Canada's domestic explosives supply from criminal and terrorist interests. The amendments became part of Bill C-17, the *Public Safety Act*, passed in 2002. The amendments provide for the implementation of more stringent controls and tracking systems for the acquisition, transport, and storage of explosives and precursor materials such as AN.

2.2.3 Diesel Fuel

Products such as combustible diesel fuels, toxic anti-freeze, compressed gases, lubricants, and cutting oils are widely used in the North. These products meet vital needs for power generation, heating, and vehicle operation. Diesel fuel is by far the largest volume of petroleum product shipped annually to communities in Nunavut. Supplies of diesel are brought in variously by barge, winter roads, and aircraft, usually in 45 gallon drums. The potential environmental dangers of transporting and burning diesel fuels are well understood.

The transportation, storage, and handling of diesel products are strictly regulated by both federal and territorial legislation. Cumberland will ensure that all such requirements are met. Standard procedures are discussed in Section 3 of this document. Cumberland will emphasize the need for regular inspection of all storage and distribution facilities on site to assure mechanical soundness and to prevent leaks or any other uncontained release of diesel fuel.

It is of note that over the next three or four years, the Canadian government will be implementing a series of regulations requiring suppliers and end-users to convert to diesel fuel containing lower levels of sulphur; the sulphur released from burning diesel fuel is a major contributor to air pollution.

2.3 LIFE CYCLE MANAGEMENT

"Life cycle management" implies the assessment of a particular product over its entire life—from the time a material need is identified to the time the product is fully consumed or disposed of as waste. It covers product supply, transportation, storage, handling, recycle, and waste disposal. Cumberland is committed to ensuring proper life cycle management of all products used at the Meadowbank site, including hazardous materials. Cumberland and its contractors will deal only with reputable, certified suppliers, transporters, and expediters.

2.3.1 Delivery

All hazardous materials will be delivered to site by commercial carriers in accordance with the requirements of the *Canadian Transportation of Dangerous Goods Act* (TDGA). Carriers will be licensed and inspected as required by the Department of Transportation. All required permits,

licences, and certificates of compliance are the responsibility of the carrier. All shipments must be properly identified and placarded. Shipping papers must be accessible and include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

Each transportation company will be required to develop a spill prevention, control, and countermeasures plan to address the materials they are importing. In the event of a release during transport, the commercial transportation company is responsible for first response and cleanup.

2.3.2 On-Site Handling

Once dangerous goods are received at the workplace, additional regulations apply. The federal Workplace Hazardous Materials Information System (WHMIS) calls for the proper labelling of products, the availability of product information in the form of MSDSs, and employee education on how to identify and handle hazardous products. A chemical tracking system will be established, as outlined in Appendix C. All hazardous materials will be stored in secured areas to prevent access by unauthorized personnel or any tampering.

All tanks used for the storage of hazardous materials will be installed in secondary containment areas sized to hold at least 110% of the volume of the largest tank. Tanks and vessels in the process plant will be installed on concrete surfaces sloping to interior sumps that will route spilled solutions to lined collection areas.

Cumberland has prepared emergency response procedures for spilled chemical substances, as provided in Appendix C. These procedures outline the correct response to accidental spills or releases of hazardous materials to minimize health risks and environmental effects. Included are procedures for evacuating personnel, maintaining safety, cleanup and neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation.

2.3.3 Wastes

On becoming wastes, materials will be stored and/or disposed of in accordance with specific government regulations and guidelines. Overall, hazardous waste treatment, recycling, and disposal facilities are lacking in Nunavut. Cumberland will therefore store most waste materials in secure facilities until they can be transported south for recycling or disposal.

Process plant tailings will pass through a treatment plant for cyanide destruction using the standard Inco SO_2/air process before being disposed of in the tailings pond. The cyanide content of the tailings material will be reduced to 10 ppm, which will dissipate naturally on exposure to air in the outdoor tailings storage facility. The current regulatory requirement for cyanide content in liquids released to the environment is 30 ppm.

2.3.4 Empty Product Containers

Many empty chemical containers are not safe to dispose of directly and require handling precautions identical to those for full containers. Chemical users must be familiar with safe waste handling and storage procedures supplied by manufacturers in MSDSs. The containers will be backhauled to the Baker Lake staging area during the ice road supply period for ultimate return to the original suppliers.

SECTION 3 • FUELS & LUBRICANTS

3.1 PRODUCT DESCRIPTION

Material categories, site handling and storage requirements, and personal protective equipment recommended by manufacturers in MSDSs are summarized in Tables 3.1 to 3.4.

Table 3.1: Fuel Products – Hazard Classes & Potential Impacts

Material	Class	Potential Impact
Diesel	3	Water & soil contamination
Motor oil	Not regulated	Soil contamination
Aviation fuel	3	Water & soil contamination
Hydraulic fluid	Not regulated	Soil contamination
Varsol	3	Soil contamination
Automotive grease	Not regulated	Negligible risk with proper handling
Ethylene glycol	Not regulated	Negligible risk with proper handling

Table 3.2: Fuel Products – Storage Locations

Product	Total Quantity On-Site	Storage Location	Container
Diesel	45 ML	Fuel farm	bulk of 45 ML in bermed area
		Powerhouse	5,000 L silled tank
		Construction (waste dump)	1,000 L bermed tank at crusher
		Exploration camp	1,000 L in barrels
		Airstrip	250 L silled tank
		Mechanical shop	1,000 L silled tank
		Explosives truckshop	1,000 L silled tank
Motor oil	1,000 L or less	Mechanical shop	500 L in barrels
		Powerhouse	205 L in barrels
		Exploration camp	205 L in barrels
Aviation fuel	1,000 L or less	Airstrip	1,000 L in barrels
Hydraulic fluid	1,000 L or less	Mechanical shop	500 L in barrels
		Powerhouse	205 L in barrels
		Plant	205 L in barrels
Varsol	205 L or less	Mechanical shop	205 L in barrels and solvent recycler
Automotive grease	1,000 L or less	Mechanical shop	fifty 20 L pails
Ethylene glycol	205 L or less	Mechanical shop	205 L in barrels

Table 3.3: Fuel Products – Safe Handling Procedures

Product	Handling Procedures
Diesel	Do not get in eyes, on skin, or on clothing. Avoid breathing vapours, mist, fume, or dust. Do not swallow. May be aspirated into lungs. Wear protective equipment and/or garments if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation. Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.
Motor oil	Wear protective clothing and impervious gloves when working with used motor oils.
Aviation fuel	See diesel procedures above.
Hydraulic fluid	Keep container closed until ready for use.
Varsol	Avoid eye contact. Use with adequate ventilation. Wash thoroughly after handling. Empty container retains residue. Follow label instructions. Avoid repeated skin contact. Store in cool, ventilated area, away from ignition sources and incompatibles. Keep container tightly closed.
Automotive grease	Minimize breathing vapour, mist, or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean before re-use; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water. To prevent fire or explosion risk from static accumulation and discharge, effectively ground product transfer system in accordance with the National Fire Code. Keep containers closed when not in use. Do not store near heat, sparks, flame, or strong oxidants.
Ethylene glycol	Ensure adequate ventilation. Wear protective gloves and chemical safety goggles. Keep in tightly closed container, stored in a cool, dry, ventilated area. Separate from acids and oxidizing materials. Empty containers of this product retain product residues and may be hazardous.

Table 3.4: Fuel Products – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	Skin	Respiration
Diesel	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Motor oil	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Aviation fuel	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation
Hydraulic fluid	Chemical goggles	None usually required	None usually required
Varsol	Chemical goggles	Rubber gloves	None usually required; ensure adequate ventilation
Automotive grease	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation
Ethylene glycol	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation

3.2 DELIVERY TO SITE

With the exception of diesel fuel, most petroleum fuel and lubricant products will be delivered to site and stored in the original packing container from the manufacturer. These types of containers include a variety of sealed drums, pails, cans, and tubes.

Diesel fuel will be transferred between transport and storage facilities at a number of points along the delivery route to Meadowbank. During summer, diesel will be shipped from the east coast of Canada (Halifax) to Hudson's Bay and up Chesterfield Inlet in ocean-going tanker vessels or barges. The vessel will anchor in deep water off shore from Baker Lake, and the fuel will be pumped through a floating pipeline to storage tanks at the project staging area. Once the winter ice road is available, the diesel will be transferred to ATV tanker trucks for delivery to site. The fuel will then be transferred again to the on-site storage tanks.

The storage tanks at both Baker Lake and the mine site will be sized to hold a total of 45 ML of diesel fuel. Four tanks are currently foreseen at each station. The tanks will be single-walled, constructed of welded steel. The fuel unloading facilities in each area will include a concrete pad enclosed by a gravel berm and equipped with a spill containment sump. A continuous 60 mm high-density, polyethylene liner sheet will be installed under the tanks and the internal sides of the berm. The containment area will be sized to hold 110% of the volume of the largest tank. A manual drain connection from the sump will extend outside the berm.

All fuel transfer and storage facilities will be designed in accordance with the CCME (1994) Environmental Code of Practice for Above Ground Storage Tank Systems Containing Petroleum Products, and the National Fire Code.

3.3 FUEL TRUCK TRANSFER PROCEDURES

A contract supplier will fill the storage tanks in the main tank farm. General procedures to be followed are listed below. Similar procedures would be followed for fuelling remote station tanks.

Before fuel transfer, verify that:

- all fuel transfer hoses have been connected properly and couplings are tight
- transfer hoses are not obviously damaged
- fuel transfer personnel are familiar with procedures
- personnel are located at both the fuel delivery truck and fuel transfer tank(s) and can manually shut off the flow of fuel
- if a high liquid level shutoff device is installed at the delivery tank, verify that the shutoff is operating correctly each time it is used.

Fuel transfer will then proceed per the established procedures of the contract supplier.

Any accidents or spills must be reported immediately to the mine superintendent or plant manager and in writing to Cumberland's environmental or lands manager.

3.4 LAND FARM

Soils contaminated by hydrocarbons from spills will be salvaged and deposited within a land farm cell for bioremediation. The land farm will initially be approximately 50 x 50 m in size and no more than 2 m deep to ensure the soils are kept within the thermally active zone. The cell will be confined within a berm and underlain by an Arctic geomembrane beneath select fill material. The contaminated soils will be placed and spread during summer months for remediation through natural microbiological and evaporative processes. Soil that has reached acceptable levels of hydrocarbon degradation will be removed and transferred to the landfill.

The land farm will be operated in accordance with Nunavut government guidelines. The soil will be turned regularly to provide aeration and promote the remediation process. Inspections and sampling will be done to assess the effectiveness of the cell under different climatic conditions. If the harsh climatic conditions at Meadowbank inhibit natural biological activity, special bacteria may be introduced. If it becomes evident that effective remediation is still not achievable, Cumberland will source an off-site land farm for disposal.

3.5 USED PETROLEUM PRODUCTS

Used oil is a hazardous waste. Cumberland intends to arrange for a permit to incinerate used petroleum on site at the landfill; use the oil as an accelerator in the camp incinerator; or use the oil in the production of ANFO. All used petroleum products will be collected in tanks marked “Waste Oil” and disposed of under the direction of the process plant manager. Empty petroleum containers will be stored on site in a designated area and returned to the supplier on backhauls during the winter resupply period.

3.6 CLOSURE

On closure of the mine and facilities, some storage capacity will be left in place at site for diesel fuel for the use of personnel involved in close-out and reclamation activities. Small amounts of other petroleum products will also continue to be available. More details are provided in the “Reclamation and Closure Plan.”

SECTION 4 • EXPLOSIVES

4.1 PRODUCT DESCRIPTION

Explosives are required for blasting waste rock and ore in the open pit mine. Storage, use, and handling of blasting materials are strictly regulated in Nunavut.

Material categories, site handling and storage requirements, and personal protective equipment recommended by manufacturers in MSDSs are summarized in the Tables 4.1 to 4.3.

Table 4.1: Explosives – Hazard Classes & Potential Impacts

Material	Class	Potential Impact
Ammonium nitrate	5.1	Water contamination
High explosive detonators	1	Negligible with proper handling
Blasting caps	1	Negligible with proper handling

Table 4.2: Explosives – Safe Handling Procedures

Product	Handling Procedure
Ammonium nitrate	Do not get in eyes or on skin. Avoid breathing dust. Do not swallow. Separate from all organic materials or other possible contaminants that are not compatible. Store in well-ventilated location, away from all sources of heat, fire, or explosion.
High explosive detonators	Store under dry conditions in a well-ventilated magazine. Keep away from heat, sparks, and flames. Keep containers closed.
Blasting caps	Store in cool, well-ventilated area in an approved magazine.

Table 4.3: Explosives – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	Skin	Respiration
Ammonium nitrate	Safety glasses or goggles	Non-absorbent rubber or equivalent gloves	NIOSH/MSHA approved respirator, if required
High explosive detonators	Safety glasses or goggles	Rubber gloves and protective clothing made from cotton	NIOSH/MSHA approved respirator, if required
Blasting caps	Safety glasses or goggles	Rubber gloves and protective clothing made from cotton	NIOSH/MSHA approved respirator, if required

4.2 STORAGE & USE

All explosives materials will be stored at an isolated facility approximately half-way between the Portage deposit and the Vault deposit. Ammonium nitrate (AN) will be stored outdoors in protected tote-bags over a geotex liner covered with approximately 7 cm of gravel. The high explosive detonators and blasting caps will be kept in an enclosed magazine. Distances between storage locations are specified in federal and territorial regulations. A small explosives manufacturing plant will be constructed for preparation of blasting agents and for washing and minor repair of trucks and equipment used to handle the explosives.

A qualified explosives contractor will be responsible for the management and preparation of all explosives materials at site, including preparation of ANFO and delivery of the prepared blasting agent to the drill holes in the mine.

SECTION 5 • PROCESS PLANT REAGENTS & CONSUMABLES

5.1 PRODUCT DESCRIPTION

The process plant will use a number of chemicals and reagents to treat the ore and recover the entrained gold. Material categories, site handling and storage requirements, and personal protective equipment recommended by manufacturers in MSDSs are summarized in Tables 5.1 to 5.4.

Table 5.1: Process Plant Reagents – Use, Consumption & Storage

Reagent	Use	Approximate Consumption		Solid/ Liquid	Normal Delivery Format	On-Site Storage
		Daily	Annual			
Quicklime (CaO)	pH control	20 t	7,200 t	solid	1 t supersacs	Pallet
Flocculant	Settling aid	180 kg	65 t	solid	25 kg bags	Pallet
Activated carbon (granular)	Gold recovery	200 kg	75 t	solid	500 kg bags	Pallet
Anti-scalant	Water treatment	0.05 m^3	18.5 m^3	liquid	650 kg tote tank	Pallet drums
Sodium cyanide (NaCN)	Leaching	1,500 kg	550 t	solid	1 t box bags	Pallet
Sodium hydroxide (caustic soda) (NaOH)	Refining/stripping	200 kg	80 t	solid	25 kg bags	Pallet
Hydrochloric acid (HCl)	Refining/stripping	200 kg	75 t	liquid	20 gal drums	Pallet drums
Sodium metabisulphite ($Na_2S_2O_5$)	CN destruction	3,500 kg	1,500 t	solid	1 t supersacs	Pallet
Copper sulphate ($CuSO_4$)	CN destruction	120 kg	40 t	solid	25 kg bags	Pallet

Table 5.2: Process Plant Reagents – Hazard Classes & Potential Impacts

Material	Class	Potential Impact
Quicklime	Not regulated	Negligible with proper handling
Flocculant	Not regulated	Negligible with proper handling
Activated carbon	4.2	Negligible with proper handling
Anti-scalant	Not regulated	Negligible with proper handling
Sodium cyanide	6.1	Water contamination
Caustic soda	8	Negligible with proper handling
Hydrochloric acid	8	Negligible with proper handling
Sodium metabisulphite	Not regulated	Negligible with proper handling
Copper sulphate	9	Negligible with proper handling

Table 5.3: Process Plant Reagents – Safe Handling Procedures

Product	Handling Procedure
Quicklime	Store in closed containers in a controlled drainage area under cover. Use in a well-ventilated area. Empty containers retain product residues and may be hazardous.
Flocculant	Store in dry area on concrete floor away from any sources of ignition.
Activated carbon	Store in dry area on concrete floor away from any sources of ignition.
Anti-scalant	Used in extremely small quantities. Can cause mild to moderate irritation of eyes, skin, and upper respiratory tract. Wash thoroughly after handling. Use sensible industrial hygiene and housekeeping products. Not flammable. Keep containers tightly closed
Sodium cyanide	Highly toxic, corrosive to eyes, skin, and respiratory tract. Can be fatal if swallowed, inhaled, or absorbed through skin. Keep cyanide antidote kit available in any cyanide work area. Wear personal protective clothing at all times. Keep in tightly closed container in cool, dry, ventilated area. Protect against physical damage to containers. Do not store under sprinkler systems. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Caustic soda	Can cause severe injury to eyes, skin, and respiratory tract. Use personal protective equipment at all times and DO NOT contact product directly. Wash thoroughly after handling. Store in dry, well-ventilated area. Keep in original container, tightly closed. Empty containers retain product residues and may be hazardous.
Hydrochloric acid	Do not get in eyes, on skin, or on clothing. Wear protective clothing. Avoid breathing vapours or fumes. Store in cool, dry ventilated area with acid-resistant floors. Keep container closed, out of direct sunlight, and away from heat, water, and incompatible materials. When diluting, add acid slowly to water and in small amounts. Never use hot water and never add water to acid. When opening metal drum, use non-sparking tools because hydrogen gas may be present. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Sodium metabisulphite	May cause irritation to eyes, skin, and respiratory tract with prolonged exposure. Sulphite-sensitive individuals may experience severe allergic reaction to dust. Releases sulphur dioxide gas when mixed with water. Wear personal protective equipment and wash thoroughly after handling. Store in dry, well-ventilated area away from heat, acids, and oxidizers. Keep container tightly closed. Use vacuum to clean up dust.
Copper sulphate	Avoid contact with skin and eyes. DO NOT breathe dust. Always wash hands thoroughly after contact. Store and use only in dry, well-ventilated areas. Keep container tightly closed.

Table 5.4: Process Plant Reagents – Personal Protective Equipment

Product	Personal Eyes	Protective Skin	Equipment Respiration
Quicklime	For splash protection use chemical goggles or full face shield	Rubber, neoprene, or nitrile gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator, if required
Flocculant	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Dust mask
Activated carbon	None required	None required	None required
Anti-scalant	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Not normally needed
Sodium cyanide	For dust and splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious lab coat, apron, or coveralls and boots	NIOSH/MSHA approved respirator, if required
Caustic soda	Tight-fitting goggles if dust is generated. For splash protection use chemical goggles or full face shield	Gauntlet type rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Hydrochloric acid	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Sodium metabisulphite	Chemical safety goggles	Cotton gloves adequate for handling dry product. For solutions, use rubber or neoprene gloves; impervious apron or overalls and boots	NIOSH/MSHA approved respirator
Copper sulphate	Chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Dust mask; NIOSH/MSHA approved respirator, if required

SECTION 6 • INVENTORY, INSPECTION & RECORDS

A contract expediting company will arrange all deliveries from the Baker Lake staging area to the Meadowbank site over the ice road each year. This will include the hazardous materials discussed in this plan. The mine superintendent and plant manager have ultimate responsibility for supervising the receipt, inspection, and recording of all material inventories at site. The division managers will reconcile total amounts received against amounts ordered.

6.1 FUELS & LUBRICANTS

6.1.1 Inventory Management

Diesel fuel use will be metered automatically when it is pumped from the bulk tanks. The metered volumes will be summarized weekly and reconciled against tank levels determined manually with a dipstick from the top of the tanks. Diesel fuel consumption for the power generators will be recorded weekly.

Aviation fuel will be dispensed from 205 L barrels as required under the supervision of aircraft personnel. Consumption and on-site volumes will be reconciled monthly.

Lubricants and other petroleum products will be inventoried monthly.

6.1.2 Inspection

The plant manager will coordinate with the mine superintendent for inspection of all fuel and lubricant storage areas. The inspection schedule and procedure to be followed are summarized in Table 6.1. All inspections will be logged with the date and time of inspection, facility inspected, and name of the person making the inspection.

Table 6.1: Inspection of Petroleum Storage Sites

Fuel Tanks	*Schedule* – Quarterly by plant manager, annually by Cumberland's environmental manager. *Procedure* – Repair leaks and report promptly. Inspections will be reported and filed with the mine superintendent or plant manager and Cumberland's environmental or lands manager.
Diesel Generating Plant	*Schedule* – Monthly by plant manager as part of internal environmental audit. *Procedure* – Inspections will be reported and filed as above.
Other Fuelling Stations	*Schedule* – Weekly by plant manager or designate as part of internal environmental audit. *Procedure* – Inspections will be reported and filed as above.
Spill Kits	*Schedule* – Quarterly by plant manager or designate, annually by Cumberland's environmental manager. *Procedure* – Inspections will be reported and filed as above.
Other Hazardous Material Storage	*Schedule* – Monthly by plant manager when materials are on site. *Procedure* – Inspections will be reported and filed as above.

Any accidental damage to containment structures will be inspected immediately and appropriate repairs undertaken. The extent of damage will be reported in writing to the mine superintendent and plant manager, or alternate. The report will note any remedial repairs that may be made, the date of any repairs, and the need for any follow-up inspection.

6.1.3 Records

Records pertaining to storage, use, and loss of fuels and lubricants are required by the Canadian Council of Ministers for the Environment (CCME) and the Fire Marshal (under the National Fire Code*).* The following records will be prepared under the supervision of the plant manager, in consultation with the mine superintendent:

- reconciliation of bulk inventory from winter resupply
- weekly use summaries
- weekly reconciliation for each storage tank
- overfill alarm tests
- pressure tests (if applicable)
- inspections and maintenance checks of the storage tank, piping, and delivery systems
- any alteration to the systems
- reports of leaks or losses
- reports of spill responses
- records of training.

6.2 EXPLOSIVES

6.2.1 Inventory Management

The explosives contractor will record daily use of ammonium nitrate and high explosives. The mine superintendent will check the records weekly and complete a monthly reconciliation.

6.2.2 Inspection

Access to and use of explosives will be under the exclusive control of the explosives contractor, operating under the authority of the mine superintendent. The contractor will be responsible for inspection of all explosives facilities, including the ammonium nitrate storage area, the magazine for high explosive detonators and blasting caps, and the explosives manufacturing plant.

The explosives contractor will be responsible for the safe operation of all explosives equipment. Any concerns or issues must be discussed immediately with the mine superintendent and, if necessary, with the plant manager.

6.2.3 Records

The *Federal Explosives Act* requires that the following records be kept with regard to explosives products:

- annual quantity of each explosive issued to the mine site from the factory, including the dates of shipments
- annual quantity of each explosive present at the site.

The explosives contractor will provide weekly reports to the mining superintendent that will include:

- staffing
- safety concerns or incidents
- total explosives consumption
- the amount of ammonium nitrate remaining on site
- inventory of other explosives and accessories to be audited for fiscal month-end balances.

6.3 PROCESS PLANT CONSUMABLES

6.3.1 Inventory Management

Process plant consumables will be reconciled against orders on receipt. The plant manager is responsible for reconciling the winter resupply inventory.

6.3.2 Inspection

On each shift, the process plant operators will be responsible for daily inspection and operation of consumables storage facilities in the plant. Any problems will be noted and reported to the plant manager. The plant manager will be responsible for weekly or monthly inspections of plant consumables and storage areas.

6.3.3 Records

The plant operators will keep daily records of consumables use. Weekly and monthly summaries will be provided to the plant manager for records keeping.

6.4 CHEMICAL TRACKING

A procedure for tracking chemical purchase and use has been developed for the Meadowbank mine site. A copy of the procedure is provided in Appendix C.

SECTION 7 • TRAINING

7.1 GENERAL

As outlined in Cumberland's Occupational Health & Safety Plan (OHSP), all staff and contractors at the Meadowbank Gold project will receive the following training:

- WHMIS
- emergency and spill response
- operations overview.

Mine employees will receive additional training in mine safety as specified by the NWT *Mine Health and Safety Act* and regulations. If mining is carried out as a contract operation, this will be the responsibility of the mine contractor; Cumberland will ensure compliance.

Plant employees will receive additional training specific to their area of work and duties, including safe operating practices, safe handling and storage of chemicals, and use of personal protective equipment. This training will be the responsibility of Cumberland.

Periodically, Meadowbank staff will carry out fire drills. The drills will test emergency response procedures and will be scheduled so as not to disrupt work. The results of the drills will be recorded and forwarded to the mine and plant managers and the Health and Safety Committee. The results may indicate that additional, or refresher, training is required. Safety Committee recommendations will be enacted expeditiously.

Medical and mine rescue staff, and others responsible for first response to emergencies, will conduct periodic drills to test their emergency response procedures. Reports on the drills will be provided to the mine and plant managers for action as required.

7.2 FUEL & LUBRICANTS HANDLERS

Personnel who handle fuel and lubricants will be expected to be conversant with relevant MSDS information. As well, these personnel will be given training in the following:

- transportation of dangerous goods (TDGR)
- Cumberland's fuel handling procedures (outlined in Section 3)
- spill response and cleanup procedures for petroleum
- emergency response, especially firefighting procedures.

7.3 EXPLOSIVES HANDLERS

Only trained and certified persons will work with explosives. The explosives contractor will undertake formal training and on-the-job training to ensure compliance with legislation. The mine superintendent will check the adequacy of training. Training requirements will include (but not necessarily be limited to):

- specific fire procedures as per the *Federal Explosives Act*
- first aid
- transportation of dangerous goods (TDGR)
- pump and hydraulics training.

7.4 PLANT EMPLOYEES

Plant operators may receive TDGR training, if appropriate. All plant employees will be trained in spill and emergency response procedures. A draft version of Cumberland's emergency response procedures for spilled chemical substances is provided in Appendix C.

For more information on employee training and safety guidelines, see Cumberland's OHSP Plan, included under separate cover as part of this EIA submission.

SECTION 8 • PLAN EVALUATION, AUDIT & IMPROVEMENT

The Hazardous Materials Management Plan will be reviewed and audited regularly to identify any components that need to be corrected, adjusted, upgraded, or otherwise modified. Audits will be both internal, by Cumberland or contractor personnel, and less often by external, independent specialists. Aspects of the plan that affect the safety of employees at the facility and of the general public will be most important.

Formal evaluations of the plan will be documented, deficiencies will be noted, and progress in addressing deficiencies will be tracked in writing. Individual responsibilities and accountabilities will be assigned, and deadlines will be set for addressing the required changes. The Meadowbank plant manager will assume overall responsibility for the process.

As part of Cumberland's commitment to attain certification under the International Cyanide Management Code, it will sponsor regular audits by Institute-approved, third-party professionals to verify its compliance with the Code's principles and standards of practice with regard to cyanide handling.

In line with Cumberland's goal of continuous improvement in all health and safety matters, all employees will be encouraged to offer suggestions for more efficient and safer materials handling procedures.

APPENDIX A

Material Safety Data Sheets

Safety (MSDS) data for sodium cyanide

General

Synonyms: hydrocyanic acid sodium salt, cyanogran
Molecular formula: NaCN
CAS No: 143-33-9
EC No:

Physical data

Appearance: white granules or powder
Melting point: 564 C
Boiling point: 1496 C
Vapour density: 1.7 (air = 1)
Vapour pressure:
Density (g cm^{-3}): 1.6
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: appreciable

Stability

Stable. Incompatible with water, strong acids, strong oxidizing agents.

Toxicology

Poison - may be fatal if inhaled or swallowed. Contact with acid releases highly poisonous HCN gas. Note low LD50s below. Causes burns. Skin and eye irritant. Typical TLV/TWA 5 mg m^{-3}

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-RAT LD50 6.4 mg kg^{-1}

IPR-RAT LD50 4.3 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)

Transport information

Personal protection

Safety glasses, gloves, good ventilation. **If there is any possibility of exposure to HCN, work only when a cyanide antidote kit is to hand.**

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

---

up-to-date.

Industrial Resources Group, Inc.

Ammonium Nitrate

Safety Procedures

Safety should be in the forefront of everyone's mind when handling hazardous products. When an accident or emergency occurs, it is very important to know what safety procedures should be used. We offer safety training and assistance to develop safety programs for your facility. Your health and safety is very important to us!

Physical Data	
Vapor Pressure:	9
Solubility in Water:	Complete (100%)
Appearance & Odor:	Clear, colorless liquid, suffocating odor.

Health Hazards	
Eyes:	Flush with large amounts of water for a minimum of 15 minutes. Get medical attention.
Skin:	Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Inhalation:	Provide fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:	Do not induce vomiting. If conscious, give water, milk or milk of magnesia. Get medical attention.
Overexposure	Severe irritation or burns of respiratory system, coughing, difficult breathing, chest pains, pulmonary edema, lung inflammation, unconsciousness, and possibly fatal.

Employee Protection	
Respiratory:	A NIOSH-approved dust respirator is recommended when exposure limit is exceeded.
Eye:	Safety goggles.
Ventilation:	Provide ventilation for nuisance dust protection to maintain exposure below exposure limits.
Other:	Other protective equipment as needed to prevent direct contact with the skin.

Fire & Explosion Hazards	
Flammable levels:	Nonflammable
Flash Point:	N/A
Extinguishing Media:	Water spray
Special Procedures:	Firefighters should wear self-contained breathing apparatus and full protective clothing. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool; do not get water inside containers.

Reactivity	
Stability:	Stable
Materials to Avoid:	Strong bases, carbonates, sulfides, cyanides, combustible materials, organic materials, strong reducing agents, most common metals, powdered metals, carbides, ammonium hydroxide, water, alcohol.
Conditions to Avoid:	Heat, light, moisture.

Spill or Leak Procedures	
Spills:	Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water. Keep combustibles (wood, paper, oil, etc.) away from spilled material.
Disposal:	Dispose in accordance with all applicable federal, state, and local environmental regulations.

We are providing this data for informational purposes only. If a person comes in contact with any of the chemicals mentioned, it is imperative to contact your local emergency personnel and/or a physician. This information is intended only as guidance for appropriate precautionary handling of the material and is believed to be accurate. Industrial Resources provides no guarantee of the accuracy or completeness of the data and shall not be liable for any damages. Users of these products are responsible for investigating and verifying the precautions and dangers involved in the application that they have chosen. Federal, state, municipal, and insurance requirements, and national safety codes must be followed and are not to be confused with the precautionary data.

PETRO-CANADA

Material Safety Data Sheet

WHMIS (Pictograms)	WHMIS (Classification)	Protective Clothing	TDG (pictograms)
	B-3, D-2B		

Section 1. Chemical Product and Company Identification

Product Name	**DIESEL FUEL**	**Code**	W104, W293 SAP: 120, 121, 122, 287
Synonym	Diesel 50, Diesel 50 LS, #1 Diesel , #1 Diesel LS, Diesel LC, Seasonal Diesel, Seasonal Diesel LS, Diesel AA, Domestic Marine Diesel, International marine Diesel, Seasonal Diesel Locomotive, Domestic Marine diesel LS, diesel -20°C (LS), LSD, Low Sulphur Diesel, dyed diesel, marked diesel, coloured diesel, Naval Distillate, Ultra Low Sulphur Diesel, ULS Diesel, Mining Diesel, Mining Diesel Special, Mining Diesel Special LS, High Flash Mining Diesel, Furnace Oil, Stove Oil.	**Validated on**	**2/6/2004.**
Manufacturer	PETRO-CANADA P.O. Box 2844 Calgary, Alberta T2P 3E3	**In case of Emergency**	Petro-Canada: 403-296-3000 Canutec Transportation: 613-996-6666 Poison Control Centre: Consult local telephone directory for emergency number(s).
Material Uses	Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining Diesel has a higher flash point requirement, for safe use in underground mines.		

Section 2. Composition and Information on Ingredients

			Exposure Limits (ACGIH)		
Name	**CAS #**	**% (V/V)**	**TLV-TWA(8 h)**	**STEL**	**CEILING**
1) Diesel oil.	68334-30-5	>99.9	100 mg/m³ (as total hydrocarbons) *	Not established	Not established
2) Proprietary additives.	Not available	<0.1	Not established	Not established	Not established
Aromatic content is 50% maximum (benzene: nil). Sulphur content is 0-0.50%.					

Manufacturer Recommendation	* Avoid prolonged or repeated skin contact to diesel fuels which can lead to dermal irritation and may be associated with an increased risk of skin cancer.
Other Exposure Limits	Consult local, state, provincial or territory authorities for acceptable exposure limits.

Section 3. Hazards Identification.

Potential Health Effects	Combustible liquid. Exercise caution when handling this material. Contact with this product may cause skin and eye irritation. Prolonged or repeated contact may cause skin irritation, defatting, drying and dermatitis. Inhalation of this product may cause respiratory tract irritation and Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death. Ingestion of this product may cause gastro-intestinal irritation. Aspiration of this product may result in severe irritation or burns to the respiratory tract. For more information refer to Section 11 of this MSDS.

Section 4. First Aid Measures

Eye Contact	IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention.
Skin Contact	Remove contaminated clothing - launder before reuse. Wash gently and thoroughly the contaminated skin with running water and non-abrasive soap. Seek medical attention.
Inhalation	Evacuate the victim to a safe area as soon as possible. If the victim is not breathing, perform artificial respiration. Allow the victim to rest in a well ventilated area. Seek medical attention.
Ingestion	DO NOT induce vomiting because of danger of aspirating liquid into lungs. Seek medical attention.
Note to Physician	Not available

Section 5. Fire-fighting Measures

Flammability	Class II - combustible liquid (NFPA).	**Flammable Limits**	LOWER: 0.7%, UPPER: 6% (NFPA)
Flash Points	Diesel Fuel: Closed Cup: >40ºC (>104ºF) Marine Diesel Fuel: Closed Cup: >60ºC (>140ºF) Mining Diesel: Closed Cup: 52ºC (126ºF)	**Auto-Ignition Temperature**	225ºC (437ºF)
Fire Hazards in Presence of Various Substances	Flammable in presence of open flames, sparks, or heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite. May accumulate in confined spaces.	**Explosion Hazards in Presence of Various Substances**	Containers may explode in heat of fire. Do not cut, weld, heat, drill or pressurize empty container. Vapour explosion hazard indoors, outdoors or in sewers. Runoff to sewer may create fire or explosion hazard.
Products of Combustion	Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S), water vapour (H2O), smoke and irritating vapours as products of incomplete combustion. See Section 11 (Other Considerations) for information regarding the toxicity of the combustion products.		
Fire Fighting Media and Instructions	NAERG96, GUIDE 128, Flammable liquids (Non-polar/Water-immiscible). CAUTION: This product has a moderate flash point above 40ºC: Use of water spray when fighting fire may be inefficient. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also consider initial evacuation for 800 meters (1/2 mile) in all directions. SMALL FIRES: Dry chemical, CO2, water spray or regular foam. LARGE FIRES: Water spray, fog or regular foam. Do not use straight streams. Move containers from fire area if you can do it without risk. Fires Involving Tanks or Car/Trailer Loads: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting devices or any discolouration of tank. ALWAYS stay away from the ends of tanks. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible withdraw from area and let fire burn. Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.		

Section 6. Accidental Release Measures

Material Release or Spill	Consult current National Emergency Response Guide Book (NAERG) for appropriate spill measures if necessary. IN THE EVENT OF A LARGE SPILL CONSIDER THE FOLLOWING CONTROL MEASURES: Extinguish all ignition sources. Stop leak if safe to do so. Ventilate area. Dike spilled material. Use appropriate inert absorbent material to absorb spilled product. Collect used absorbent for later disposal. Avoid contact with spilled material. Avoid breathing vapours or mists of material. Avoid contaminating sewers, streams, rivers and other water courses with spilled material. Evacuate non-essential personnel. Ensure clean-up personnel wear appropriate personal protective equipment. Ground and bond all equipment used to clean up the spilled material, as it may be a static accumulator. Notify appropriate authorities immediately.

Section 7. Handling and Storage

Handling	COMBUSTIBLE MATERIAL. Handle with care. Avoid contact with any sources of ignition, flames, heat, and sparks. Avoid skin contact. Avoid eye contact. Avoid inhalation of product vapours or mists. Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not reuse containers without commercial cleaning and/or reconditioning. Personnel who handle this material should practice good personal hygiene during and after handling to help prevent accidental ingestion of this product. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated. Avoid confined spaces and areas with poor ventilation. Ensure all equipment is grounded/bonded. Wear proper personal protective equipment (See Section 8).
Storage	Store away from heat and sources of ignition. Store in dry, cool, well-ventilated area. Store away from incompatible and reactive materials (See section 5 and 10). Ensure the storage containers are grounded/bonded.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	For normal application, special ventilation is not necessary. If user's operations generate vapours or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit. Make-up air should always be supplied to balance air removed by exhaust ventilation. Ensure that eyewash station and safety shower are close to work-station.
Personal Protection - ***The selection of personal protective equipment varies, depending upon conditions of use.***	
Eyes	Eye protection (i.e., safety glasses, safety goggles and/or face shield) should be determined based on conditions of use. If product is used in an application where splashing may occur, the use of safety goggles and/or a face shield should be considered.
Body	Wear appropriate clothing to prevent skin contact. As a minimum long sleeves and trousers should be worn.
Respiratory	Where concentrations in air may exceed the occupational exposure limits given in Section 2 (and those applicable to your area) and where engineering, work practices or other means of exposure reduction are not adequate, NIOSH approved respirators may be necessary to prevent overexposure by inhalation.
Hands	Wear appropriate chemically protective gloves. When handling hot product ensure gloves are heat resistant and insulated.
Feet	Wear appropriate footwear to prevent product from coming in contact with feet and skin.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Bright oily liquid.	**Viscosity**	1.3 - 4.1 cSt @ 40ºC (104ºF)
Colour	Clear to yellow / brown (may be dyed for taxation purposes).	**Pour Point**	Variable, -50ºC to 0ºC (-58ºF to -32ºF)
Odour	Petroleum oil like.	**Softening Point**	Not applicable.
Odour Threshold	Not available	**Dropping Point**	Not applicable.
Boiling Point	150 - 371ºC (302-700ºF)	**Penetration**	Not applicable.
Density	0.80 - 0.85 kg/L @ 15ºC (59ºF)	**Oil / Water Dist. Coefficient**	Not available
Vapour Density	4.5 (Air = 1)	**Ionicity (in water)**	Not applicable.
Vapour Pressure	Not available	**Dispersion Properties**	Not available
Volatility	Semivolatile to volatile.	**Solubility**	Insoluble in cold water, soluble in non-polar hydrocarbon solvents.

Section 10. Stability and Reactivity

Corrosivity	Not available		
Stability	The product is stable under normal handling and storage conditions.	**Hazardous Polymerization**	Will not occur under normal working conditions.
Incompatible Substances / Conditions to Avoid	Reactive with oxidizing agents and acids.	**Decomposition Products**	May release COx, NOx, SOx, H2S, H2O, smoke and irritating vapours when heated to decomposition.

Section 11. Toxicological Information

Routes of Entry	Skin contact, eye contact, inhalation, and ingestion.
Acute Lethality	Acute oral toxicity (LD50): 7500 mg/kg (rat).
Chronic or Other Toxic Effects	
Dermal Route:	This product contains a component (at >= 1%) that can cause skin irritation. Therefore, this product is considered to be a skin irritant. Prolonged or repeated contact may defat and dry skin, and cause dermatitis. (See Other Considerations)
Inhalation Route:	Inhalation of this product may cause respiratory tract irritation. Inhalation of this product may cause Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death.
Oral Route:	Ingestion of this product may cause gastro-intestinal irritation. Aspiration of this product may result in severe irritation or burns to the respiratory tract. Ingestion of this product may cause Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death.
Eye Irritation/Inflammation:	This product contains a component (at >= 1%) that can cause eye irritation. Therefore, this product is considered to be an eye irritant.
Immunotoxicity:	Not available
Skin Sensitization:	Contact with this product is not expected to cause skin sensitization, based upon the available data and the known hazards of the components.
Respiratory Tract Sensitization:	Contact with this product is not expected to cause respiratory tract sensitization, based upon the available data and the known hazards of the components.
Mutagenic:	This product is not known to contain any components at >= 0.1% that have been shown to cause mutagenicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a mutagen.
Reproductive Toxicity:	This product is not known to contain any components at >= 0.1% that have been shown to cause reproductive toxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a reproductive toxin.
Teratogenicity/Embryotoxicity:	This product is not known to contain any components at >= 0.1% that have been shown to cause teratogenicity and/or embryotoxicity. Therefore, based upon the available data and the known hazards of the components, this product is not expected to be a teratogen/embryotoxin.
Carcinogenicity (ACGIH):	ACGIH A3: animal carcinogen. [Diesel oil] (See Other Considerations)
Carcinogenicity (IARC):	This product is not known to contain any chemicals at reportable quantities that are listed as Group 1, 2A, or 2B carcinogens by IARC.
Carcinogenicity (NTP):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by NTP.
Carcinogenicity (IRIS):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by IRIS.

Carcinogenicity (OSHA):	This product is not known to contain any chemicals at reportable quantities that are listed as carcinogens by OSHA.
Other Considerations	Avoid prolonged or repeated skin contact to diesel fuels which can lead to dermal irritation and may be associated with an increased risk of skin cancer. Diesel engine exhaust particulate is probably carcinogenic to humans (IARC Group 2A).

Section 12. Ecological Information

Environmental Fate	Not available	**Persistance/ Bioaccumulation Potential**	Not available
BOD5 and COD	Not available	**Products of Biodegradation**	Not available
Additional Remarks	No additional remark.		

Section 13. Disposal Considerations

Waste Disposal	Spent/ used/ waste product may meet the requirements of a hazardous waste. Consult your local or regional authorities. Ensure that waste management processes are in compliance with government requirements and local disposal regulations.

Section 14. Transport Information

TDG Classification	DIESEL FUEL, 3, UN1202, PGIII (CL-TDG)	**Special Provisions for Transport**	See Transportation of Dangerous Goods Regulations.

Section 15. Regulatory Information

Other Regulations	This product is acceptable for use under the provisions of WHMIS-CPR. All components of this formulation are listed on the CEPA-DSL (Domestic Substances List). All components of this formulation are listed on the US EPA-TSCA Inventory. All components of this product are on the European Inventory of Existing Commercial Chemical Substances (EINECS). This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR. Please contact Product Safety for more information.

DSD/DPD (Europe)	Not evaluated.	**HCS (U.S.A.)**	CLASS: Irritating substance. CLASS: Target organ effects. CLASS: Combustible liquid having a flash point between 37.8°C (100°F) and 93.3°C (200°F).
ADR (Europe) (Pictograms)	**NOT EVALUATED FOR EUROPEAN TRANSPORT** **NON ÉVALUÉ POUR LE TRANSPORT EUROPÉEN.**	**DOT (U.S.A) (Pictograms)**	

HMIS (U.S.A.)

Health Hazard	2*
Fire Hazard	2
Reactivity	0
Personal Protection	H

NFPA (U.S.A.)

Rating	
0	Insignificant
1	Slight
2	Moderate
3	High
4	Extreme

Section 16. Other Information

References Available upon request.

* Marque de commerce de Petro-Canada - Trademark

Glossary

ACGIH - American Conference of Governmental Industrial Hygienists
ADR - Agreement on Dangerous goods by Road (Europe)
ASTM - American Society for Testing and Materials (
BOD5 - Biological Oxygen Demand in 5 days
CAN/CGA B149.2 Propane Installation Code
CAS - Chemical Abstract Services
CEPA - Canadian Environmental Protection Act
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CFR - Code of Federal Regulations
CHIP - Chemicals Hazard Information and Packaging Approved Supply List
COD5 - Chemical Oxygen Demand in 5 days
CPR - Controlled Products Regulations
DOT - Department of Transport
DSCL - Dangerous Substances Classification and Labeling (Europe)
IRIS - Integrated Risk Information System
LD50/LC50 - Lethal Dose/Concentration kill 50%
LDLo/LCLo - Lowest Published Lethal Dose/Concentration
NAERG'96 - North American Emergency Response Guide Book (1996)
NFPA - National Fire Prevention Association
NIOSH - National Institute for Occupational Safety & Health
NPRI - National Pollutant Release Inventory
NSNR - New Substances Notification Regulations (Canada)
NTP - National Toxicology Program
OSHA - Occupational Safety & Health Administration
PEL - Permissible Exposure Limit
RCRA - Resource Conservation and Recovery Act
SARA - Superfund Amendments and Reorganization Act
SD - Single Dose
STEL - Short Term Exposure Limit (15 minutes)

DSD/DPD - Dangerous Substances or Dangerous Preparations Directives (Europe)
DSL - Domestic Substance List
EEC/EU - European Economic Community/European Union
EINECS - European Inventory of Existing Commercial Chemical Substances
EPCRA - Emergency Planning and Community Right to Know Act
FDA - Food and Drug Administration
FIFRA - Federal Insecticide, Fungicide and Rodenticide Act
HCS - Hazardous Communication System
HMIS - Hazardous Material Information System
IARC - International Agency for Research on Cancer
TDG - Transportation Dangerous Goods (Canada)
TDLo/TCLo - Lowest Published Toxic Dose/Concentration
TLm - Median Tolerance Limit
TLV-TWA - Threshold Limit Value-Time Weighted Average
TSCA - Toxic Substances Control Act
USEPA - United States Environmental Protection Agency
USP - United States Pharmacopoeia
WHMIS - Workplace Hazardous Material Information System

For Copy of MSDS
Internet: www.petro-canada.ca/msds

Western Canada, Ontario & Central Canada, telephone: 1-800-668-0220; fax: 1-800-837-1228
Quebec & Eastern Canada, telephone: 514-640-8308; fax: 514-640-8385

For Product Safety Information: (905) 804-4752

Prepared by Product Safety - JDW on 2/6/2004.

Data entry by Product Safety - JDW.

APPENDIX B

International Cyanide Management Code

INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

www.cyanidecode.org

International Cyanide Management Code

For The Manufacture, Transport and Use Of Cyanide in the Production of Gold

May 2002

BACKGROUND

For over a century, cyanide has been the primary reagent used by the mining industry for the production of gold. It is a hazardous chemical that requires careful management. Since no other commercially viable and environmentally sound alternatives currently exist, gold mines will continue to use cyanide.

In January 2000, the accidental release of large amounts of cyanide solutions and tailings from the Aurul mine in Romania resulted in significant pollution of the receiving river system. This incident dramatically increased the consciousness of governments, international organizations, industry and the public of the environmental hazards associated with the use of cyanide in the gold mining industry.

To address concerns about cyanide use and management, a two-day multi-stakeholder workshop was held in May 2000 to consider development of a voluntary industry code of practice for the use of cyanide in mining. Workshop participants determined that a voluntary code, implemented industry-wide, could improve the management of cyanide.

The International Cyanide Management Code For The Manufacture, Transport and Use of Cyanide in the Production of Gold ("the Code") were developed as this voluntary industry code. The Code was prepared under the direction of a multi-stakeholder Steering Committee, whose members were chosen by the United Nations Environment Programme and the International Council on Metals and the Environment. The Committee, consisting of participants from the gold mining industry, governments, non-governmental organizations, labor, cyanide producers and financial institutions, worked cooperatively toward the common goal articulated in the Code's Mission Statement:

To assist the global gold mining industry in improving cyanide management, thereby minimizing risks to workers, communities and the environment from the use of cyanide in gold mining, and reducing community concerns about its use.

The objectives of the Code as identified by the Committee are:

- ***To protect workers, communities and the environment from adverse effects of cyanide.***
- ***To improve cyanide management.***
- ***To be used by large and small gold mining companies, cyanide manufacturers and transporters.***
- ***To serve as a form of assurance for interested parties including regulators, financiers, communities and non-governmental organizations.***
- ***To be applied internationally, in both developed and developing countries.***
- ***To be credible and verifiable.***
- ***To be dynamic over time.***

The Code encourages improvement on an industry-wide basis by aggressively promoting participation in the Code, and by requiring signatories to the Code to take appropriate action to manage cyanide responsibly. The public, workers, industry and the environment will derive their

greatest benefits if operations using cyanide to extract gold adopt the Code and upgrade their practices as required to meet the Code.

SCOPE

The Code is a gold mining industry voluntary code, intended to complement an operation's existing regulatory requirements. Compliance with the rules, regulations and laws of the applicable political jurisdiction is necessary; this Code is not intended to contravene such laws.

The Code focuses exclusively on the safe management of cyanide and cyanidation mill tailings and leach solutions. It addresses production, transport, storage, and use of cyanide and the decommissioning of cyanide facilities. It includes requirements related to financial assurance, accident prevention, emergency response, training, public reporting, stakeholder involvement and verification procedures.

It does not address all safety or environmental activities that may be present at gold mining operations such as the design and construction of tailings impoundments or long-term closure and rehabilitation of mining operations.

The term "cyanide" used throughout the Code generically refers to the cyanide ion, hydrogen cyanide, as well as salts and complexes of cyanide with a variety of metals in solids and solutions. It must be noted that the risks posed by the various forms of cyanide are dependent on the specific species and concentration. Information regarding the different chemical forms of cyanide is found at *www.cyanidecode.org/library/cyanide facts/cyanide chemistry*.

CODE IMPLEMENTATION

The Code is comprised of two major elements. The Principles broadly state commitments that signatories make to manage cyanide in a responsible manner. Standards of Practice follow each Principle, identifying the performance goals and objectives that must be met to comply with the Principle. Operations are certified as being in compliance with the Code upon an independent third-party audit verifying that they meet the Standards of Practice.

For implementation guidance, visit *www.cyanidecode.org/thecode/implementationresources*

The programs and procedures identified by the Code's Principles and Standards of Practice for the management of cyanide can be developed separately from other programs, or they can be integrated into a site's overall safety, health and environmental management programs. Since operations typically do not have direct control over all phases of cyanide production, transport or handling, gold mines will need to require that other entities involved in these activities commit to and demonstrate that they adhere to the Code's Principles and meet its Standards of Practice for these activities.

This Code, the implementation guidance, mine operators guide, and other documents or information sources referenced at *www.cyanidecode.org* are believed to be reliable and were prepared in good faith from information reasonably available to the drafters. However, no guarantee is made as to the accuracy or completeness of any of these other documents or information sources. The implementation guidance, mine operators guide, and the additional documents and references are not intended to be part of the Code.

No guarantee is made in connection with the application of the Code, the additional documents available or the referenced materials to prevent hazards, accidents, incidents, or injury to employees and/or members of the public at any specific site where gold is extracted from ore by the cyanidation process.

Compliance with this Code is not intended to and does not replace, contravene or otherwise alter the requirements of any specific national, state or local governmental statutes, laws, regulations, ordinances, or other requirements regarding the matters included herein.

Compliance with this Code is entirely voluntary and is neither intended nor does it create, establish, or recognize any legally enforceable obligations or rights on the part of its signatories, supporters or any other parties.

PRINCIPLES AND STANDARDS OF PRACTICE

---

1. PRODUCTION **Encourage responsible cyanide manufacturing by purchasing from manufacturers who operate in a safe and environmentally protective manner.**

Standard of Practice

1.1 Purchase cyanide from manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide and to prevent releases of cyanide to the environment.

---

2. TRANSPORTATION **Protect communities and the environment during cyanide transport.**

Standards of Practice

2.1 Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters.

2.2 Require that cyanide transporters implement appropriate emergency response plans and capabilities, and employ adequate measures for cyanide management.

3. *HANDLING AND STORAGE* **Protect workers and the environment during cyanide handling and storage.**

Standards of Practice

3.1 Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, spill prevention and spill containment measures.

3.2 Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.

4. *OPERATIONS* **Manage cyanide process solutions and waste streams to protect human health and the environment.**

Standards of Practice

4.1 Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.

4.2 Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

4.3 Implement a comprehensive water management program to protect against unintentional releases.

4.4 Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

4.5 Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.

4.6 Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of ground water.

4.7 Provide spill prevention or containment measures for process tanks and pipelines.

4.8 Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.

4.9 Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water quality.

5. *DECOMMISSIONING* **Protect communities and the environment from cyanide through development and implementation of decommissioning plans for cyanide facilities.**

Standards of Practice

5.1 Plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife and livestock.

5.2 Establish an assurance mechanism capable of fully funding cyanide-related decommissioning activities.

---

6. *WORKER SAFETY* — Protect workers' health and safety from exposure to cyanide.

Standards of Practice

6.1 Identify potential cyanide exposure scenarios and take measures as necessary to eliminate, reduce and control them.

6.2 Operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.

6.3 Develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.

---

7. *EMERGENCY RESPONSE* — Protect communities and the environment through the development of emergency response strategies and capabilities.

Standards of Practice

7.1 Prepare detailed emergency response plans for potential cyanide releases.

7.2 Involve site personnel and stakeholders in the planning process.

7.3 Designate appropriate personnel and commit necessary equipment and resources for emergency response.

7.4 Develop procedures for internal and external emergency notification and reporting.

7.5 Incorporate into response plans monitoring elements and remediation measures that account for the additional hazards of using cyanide treatment chemicals.

7.6 Periodically evaluate response procedures and capabilities and revise them as needed.

---

8. *TRAINING* — Train workers and emergency response personnel to manage cyanide in a safe and environmentally protective manner.

Standards of Practice

8.1 Train workers to understand the hazards associated with cyanide use.

8.2 Train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.

8.3 Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

9. *DIALOGUE* **Engage in public consultation and disclosure.**

Standards of Practice

9.1 Provide stakeholders the opportunity to communicate issues of concern.

9.2 Initiate dialogue describing cyanide management procedures and responsively address identified concerns.

9.3 Make appropriate operational and environmental information regarding cyanide available to stakeholders.

CODE MANAGEMENT

Administration

The International Cyanide Management Institute ("The Institute") is a non-profit corporation established to administer the Code through a multi-stakeholder Board of Directors consisting of representatives of the gold mining industry and participants from other stakeholder groups. For additional information on the Institute, see: www.cyanidecode.org/theinstitute.

The Institute's primary responsibilities are to:

- Promote adoption of and compliance with the Code, and to monitor its effectiveness and implementation within the world gold mining industry.
- Develop funding sources and support for Institute activities.
- Work with governments, NGOs, financial interests and others to foster widespread adoption and support of the Code.
- Identify technical or administrative problems or deficiencies that may exist with Code implementation, and
- Determine when and how the Code should be revised and updated.

Code Signatories and Supporters

Companies with either single or multiple operations can become signatories to the Code; the signature of an owner or corporate officer of the operating company is required. By becoming a signatory, a company commits to follow the Code's Principles and implement its Standards of Practice. Code signatories' operations will be audited to verify their operation's compliance with the Code.

A signatory is not required to have all operations certified. When becoming a signatory, a company must specify which of its operations it intends on having certified. A company that does not have these operations audited within 3 years of signing the Code will lose its signatory status. See: www.cyanidecode.org/signatories&certifiedoperations.

Cyanide producers, transporters, and other companies or individuals not currently or directly engaged in production of gold by cyanidation can demonstrate their support of the Code's objectives by conducting audits and where appropriate becoming Code Supporters.

Code Verification and Certification

Audits are conducted every three years by independent, third-party professionals who meet the Institute's criteria for auditors. Auditors evaluate an operation to determine if its management of cyanide achieves the Code's Principles and Standards of Practice; the Code's Verification Protocol contains the criteria for all audits. Operations must make all relevant data available to the auditors, including the complete findings of their most recent independent Code Verification, in order to be considered for certification.

During an initial verification audit, an operation's compliance at the time of the audit will be evaluated. Subsequent re-verification audits will also evaluate compliance during the period between the preceding and current audits.

Upon completion of the audit, the auditor must review the findings with the operation to ensure that the audit is factually accurate and make any necessary changes. The auditor must submit a detailed "Audit Findings Report" addressing the criteria in the Verification Protocol and a "Summary Audit Report" that includes the conclusion regarding the operation's compliance with the Code to the signatory, the operation and to the Institute. The operation is certified as complying with the Code if the auditor concludes that it is in full compliance with the Code's Principles and Standards of Practice. The detailed "Audit Findings Report" is the confidential property of the operation. The "Summary Audit Report" of certified operations will be made available to the public on the Code website. The operation may submit its comments regarding the Summary Audit Report to the Institute, which will be posted along with the Summary Audit Report on the Institute's website.

Operations that are in substantial compliance with the Code are conditionally certified, subject to the successful implementation of an Action Plan. Substantial compliance means that the operation has made a good-faith effort to comply with the Code and that the deficiencies identified by the auditor can be readily corrected and do not present an immediate or substantial risk to employee or community health or the environment. Operations that are in substantial compliance with a Standard of Practice must develop and implement an Action Plan to correct the deficiencies identified by the verification audit. The operation may request that the auditor review the Action Plan or assist in its development so that there is agreement that its implementation will bring the operation into full compliance. The Action Plan must include a time period mutually agreed to with the auditor, but in no case longer than one year, to bring the operation into full compliance with the Code. The Auditor must submit the Action Plan to the Institute along with the Audit Findings Report and Summary Audit Report.

The operation must provide evidence to the auditor demonstrating that it has implemented the Action Plan as specified and in the agreed-upon time frame. In some cases, it may be necessary for the auditor to re-evaluate the operation to confirm that the Action Plan has been implemented. Upon receipt of the documentation that the Action Plan has been fully

implemented, the auditor must provide a copy of the documentation to the Institute along with a statement verifying that the operation is in full compliance with the Code.

All operations certified as in compliance with the Code will be identified on the Code website, *www.cyanidecode.org/signatories&certifiedoperations*. Each certified operation's Summary Audit Report will be posted and operations with conditional certification will have their Summary Audit Report and their Action Plan posted.

An operation cannot be certified if the auditor concludes that it is neither in full compliance nor in substantial compliance with any one of the Standards of Practice. An operation that is not certified based on its initial verification audit can be verified and certified once it has brought its management programs and procedures into compliance with the Code. Its signatory parent company remains a signatory during this process.

An operation that is not yet active but that is sufficiently advanced in its planning and design phases can request conditional certification based on an auditor's review of its site plans and proposed operating procedures. An on-site audit is required within one year of the operation's first production of gold by cyanidation to confirm that the operation has been constructed and is being operated in compliance with the Code.

An operation or an individual cyanide facility at an operation is no longer subject to certification after decommissioning of the cyanide facilities.

Certification Maintenance

In order to maintain certification, an operation must meet all of the following conditions:

- The auditor has concluded that it is either in full compliance or substantial compliance with the Code.
- An operation in substantial compliance has submitted an Action Plan to correct its deficiencies and has demonstrated that it has fully implemented the Action Plan in the agreed-upon time.
- There is no verified evidence that the operation is not in compliance with the Code.
- An operation has had a verification audit within three years.
- An operation has had a verification audit within two years of a change in ownership, defined as a change of the controlling interest of the operating company.

Auditor Criteria and Review Process

The Institute will develop specific criteria for Code Verification auditors and will implement procedures for review of auditor credentials. Criteria will include requisite levels of experience with cyanidation operations and in conducting environmental, health or safety audits, membership in a self-regulating professional auditing association and lack of conflicts of interest with operation to be audited.

Dispute Resolution

The Institute will develop and implement fair and equitable procedures for resolution of disputes regarding auditor credentials and certification and/or de-certification of operations. The procedures will provide due process to all parties that may be affected by these decisions.

Information Availability

The Code and related information and code management documentation are available via the Internet at www.cyanidecode.org. The website is intended to promote an understanding of the issues involved in cyanide management and to provide a forum for enhanced communication within and between the various stakeholder groups with interest in these issues. The site is the repository for Code certification and verification information.

ACKNOWLEDGEMENTS

This project was underwritten by a group of gold companies and cyanide producers from around the world. The Gold Institute was instrumental in organizing this financial and technical support and provided the administrative and logistical support necessary to successfully complete the project; this effort represents the first time that an industry has worked with other stakeholders to develop an international voluntary industry Code of Practice.

The individuals listed below participated in the process. Participation by these individuals does not necessarily represent an endorsement of the Code by their respective organizations.

Steering Committee

Harold Barnes (Chairman)[1]	Homestake Mining Company, United States
Stephen Bailey	International Finance Corporation, United States
Julio Bonelli	Government of Peru
Gordon Drake, Ph.D[2]	WMC Resources, Ltd., Australia
John den Dryver[3]	Normandy Mining Limited, Australia
Bill Faust	Eldorado Gold Company, Canada
Fred Fox[4]	Kennecott Minerals Company, United States
John Gammon, Ph.D.	Government of Ontario, Canada
Steven Hunt[5]	United Steelworkers of America, Canada
Juergen Loroesch, Ph.D.	Degussa, Germany
Basie Maree	Anglogold Company, South Africa
Glenn Miller, Ph.D.	University of Nevada, Reno, United States
Anthony O'Neill	WMC Resources, Ltd., Australia
Michael Rae	World Wide Fund For Nature, Australia
Stan Szymanski	International Council of Chemical Associations, United States
Stephan Theben[6]	European Commission, Spain
Federico Villasenor[5]	Minas Luismin, Mexico
Juergen Wettig	European Commission, Belgium

[1] Elected Chairman by the Steering Committee
[2] Substituted for Anthony O'Neill at Washington and Vancouver Meetings
[3] Substituted for Anthony O'Neill at Santiago Meeting
[4] Replaced Bill Faust on Committee after Napa Meeting
[5] Added to Steering Committee at Vancouver Meeting
[6] Substituted for Juergen Wettig at Washington, Vancouver and Santiago Meetings

Code Manager

Norman Greenwald	Norm Greenwald Associates, United States

Secretariat

Wanda Hoskin	United Nations Environment Programme, France
Tom Hynes, Ph.D.	International Council on Metals and the Environment, Canada
Kathryn Tayles	United Nations Environment Programme, France

Gold Institute

Paul Bateman	The Gold Institute, United States

Industry Advisory Group

Anglogold, South Africa
Ashanti Goldfields Company, Ghana
Australian Gold Council, Australia
Australian Gold Reagents, Australia
Barrick Gold Corp., Canada
Degussa, Germany
Dupont, United States
Glamis Gold, Ltd., United States
Gold Fields Limited, South Africa
The Gold Institute, United States
Homestake Mining Company, United States
Kinross Gold Corp., Canada
Lihir Management Corp., Paupa New Guinea
Mining Project Investors, Australia
Newmont Gold Company, United States
Normandy Mining, Australia
Placer Dome, Inc., Canada
South African Chamber of Mines, South Africa
Rio Tinto, United Kingdom
WMC, Australia

APPENDIX C

Emergency Response Procedures for Spilled Chemical Substance

CYANIDE SPILLS
PREVENTION AND RESPONSE

by
Dr. T. I. Mudder

INTRODUCTION

This document provides an introductory discussion of a preferred approach for preventing, and if needed, responding to releases into the environment of cyanide containing solutions at gold mining operations. The gold mining industry should demonstrate that it understands the health, safety, and environment risks of using cyanide, and has taken all the necessary precautions to reduce those risks to the extent practicable. It should also demonstrate that it could effectively respond to an accident to mitigate any short and long-term environmental impacts. By definition an accident is neither routine or planned, therefore it is essential to develop and emergency preparedness plans and procedures with the objective of effectively respond to unforeseen accidents. The emergency preparedness plans and procedures must be updated and tested periodically to maintain the level of preparedness at its optimum readiness.

This document deals specifically with cyanide spills that can potentially affect the environment. Issues related to worker health and safety arising out of the use of cyanide in metallurgical processing is covered in other documents. The gold mining industry has had a good record with respect to worker health and safety globally over the last century of cyanide use. Beyond worker health and safety during operations, the major onsite environmental issue relates to controlling the cyanide concentration in uncovered ponds to protect wildlife. The new UNEP International Code for Management of Cyanide at gold mining operations puts forth recommendations as to the appropriate cyanide level that should be maintained in these ponds. A review of cyanide related spills over the last quarter century has shown the causes to include:

- The lack of a dynamic site water balance and comprehensive water management plan
- The lack of or implementation of improper water treatment capabilities
- The lack of integrity and secondary containment within the solution conveyance system

The environmental impacts of these spills have nearly all been related to the toxic effects on aquatic life resulting from cyanide entering surface water, such as a river. In some instances, the impacts were more severe than anticipated due to the type of response taken by the gold mining operation.

More specifically, the severe cyanide spills have resulted overwhelmingly from the breaching or overtopping of tailings dams during high precipitation or runoff events, or the rupture of pipelines without adequate secondary containment and collections systems. In conjunction with the spills, improper emergency treatment exasperated the impacts on aquatic life and the environment due to toxicity of the cyanide destruction chemicals employed, such as chlorine or sodium or calcium hypochlorite. In order to minimize the number and severity of these spills, there is a need for development and implementation of both spill prevention and emergency response plans and procedures.

PREVENTION

Of course preventing a cyanide spill is preferable to responding to one. There are three components to be considered in the development and implementation of a spill prevention plan including:

- Water management
- Water treatment
- Water quality

With respect to **water management**, a proper water balance must be generated that accurately reflects the annual variations in precipitation patterns with particular emphasis on high intensity events. These variations must be anticipated to the extent possible due to limitations in forecasting and adequate free board made available to accommodate the additional solution volumes. The use of average annual precipitation data is not appropriate for establishment of a site water balance.

In the case of **water treatment**, a permanent onsite facility is preferred to treat either excess process solutions or tailings slurries on a continuous or an as needed basis. There are several proven technologies available for the recovery, removal, or recycling of cyanide at gold mining operations. These include biological treatment, physical treatment with granular activated carbon, and chemical treatment using alkaline chlorination, copper catalyzed hydrogen peroxide, and the INCO sulfur dioxide/air process.

Although these treatment technologies are suitable when permanent onsite cyanide destruction is required or desired, each of them has distinct disadvantages and advantages. A careful decision must be made when selecting a specific treatment process or combination to ensure it is suitable for the specific application under consideration.

In conjunction with proper storage of cyanide solutions, it is the issue of proper conveyance of these solutions throughout the mine site and secondary containment of these solutions in the event a rupture in a pipeline results due to either natural and/or human causes.

In considering **water quality**, there are two important aspects to be considered. The first is the establishment of an appropriate program for the monitoring of water quality both on and off site. The second is the implementation of an appropriate system for minimizing on and off site environmental impacts through lowering of cyanide levels commensurate with the level of protection needed. For example, controlled discharges of excess process solutions into surface waters must be treated to the degree necessary to lower cyanide to levels protective of human health and other wildlife. In the case of direct discharges to surface water, the most vulnerable component of the ecosystem is aquatic life.

On site storage of uncovered solutions like those contained in tailings impoundments must involve lowering of residual cyanide levels that protect wildlife that comes in direct contact with the solution. The lowering of cyanide levels to protect wildlife also provides the additional benefit of reducing the severity of environmental impacts in the event there is an inadvertent release or spill of solution into the environment.

Adherence to the water management, treatment, and quality principles associated with a sound spill prevention program and the newly created UNEP International Code for Management of Cyanide will dramatically improve the status of environmental protection in the gold mining industry. To aid in the implementation of these principles, there is a need for ongoing training of the workforce to foster a sense of pride and purpose with respect to protecting the environment.

EMERGENCY RESPONSE

Regardless of the level of preparation and training, accidents do occur due to human error, mechanical failure, and nature. The goal of emergency response is to protect human health and the environment to the extent possible through minimization of impacts. It is critically important that emergency response be carried immediately in accordance with a well thought out and administered plan.

There are five basic elements to consider in developing and implementing an emergency response plan or procedure:

- Notification
- Containment
- Treatment
- Monitoring
- Training

Notification of the appropriate site personnel, as well as local, state, and federal agencies must be an immediate priority in the event a cyanide spill occurs at a mining operation, regardless of the time of day. Of critical importance in the event of a cyanide spill reaching surface water, is the notification of all down stream individuals, municipalities, or other industrial users that rely upon it as a primary source of potable water. Other notifications include those required under law or those noted in the operating permit for the mine. The notification process should involve a single call from a worker to an individual of authority, who is on call and on behalf of the company makes the appropriate notifications. A designated chain of command must be established to ensure the notification process proceeds without interruption.

Containment of the cyanide spill on site should be the first physical priority in conjunction with proper notification. If there is any indication that the pH of the solution has been lowered and hydrogen cyanide gas has been released, all personnel accessing the spill area should be equipped with a self-contained breathing apparatus. A decision must be made immediately regarding the evacuation of the other on site and off site personnel to some predetermined distance. Containment could involve diverting the spill to a holding pond, building a temporary dam or collection system, and/or pumping of solution. If the spill is from a tailings impoundment in which the cyanide levels have been lowered for protection of wildlife, then further treatment may not be necessary. However, if the cyanide levels are at full strength and/or the spill could enter surface water, then further treatment could be mandatory.

Treatment of the spill to lower the cyanide concentration may become necessary if it is or could eventually enter surface water and effect the environment or human health down stream of the mine site. Treatment is only effective if it can be accomplished in conjunction with the occurrence of the spill. If the spill has already occurred, then addition of treatment chemicals to surface water, like a stream, is not advised, since the addition of these chemicals could result in additional environmental impacts and are generally not effective in downstream cyanide levels.

Specifically, chlorine or hypochlorite reagents are not recommended for direct treatment of cyanide spills in flowing surface water, since these compounds are quite toxic and form additional toxic intermediates that can cause further undesirable environmental impacts. Furthermore, ferrous iron reagents should not be added directly to surface water to precipitate cyanide as this too will result in secondary adverse environmental impacts if done improperly.

If treatment is deemed necessary and appropriate and a permanent treatment facility is not already available, then selection of either hydrogen peroxide for treatment of solution spills or the INCO sulfur dioxide/air process for treatment of slurry spills is preferred. These chemicals should only be used as a last resort if containment is not achievable and the spill can be treated directly at the point of release.

Although additional chemicals are being added in conjunction with these treatment processes, their impacts are limited in comparison to those arising from the use of chlorine or hypochlorite. Removal of cyanide with ferrous sulfate is not recommended either as this process involves merely precipitation of the cyanide as an insoluble iron salt, which can again dissolve under elevated pH conditions releasing free cyanide. A permanent treatment facility of some type should be mandatory at a mining operation that utilizes cyanide in elevated concentrations.

Monitoring of on site and off site downstream water quality must be incorporated into an emergency response plan. If the cyanide spill reaches an off site surface water source, then extensive monitoring of water quality downstream must be initiated to determine the extent of the spill and potential environmental impacts. As soon as possible, additional monitoring of sensitive ecosystems, such as aquatic life, should be implemented. The more intensive water quality monitoring program should continue until there is no further threat to human health or the environment.

Training of on site personnel and members of the public should be associated with the entire spill prevention and emergency response program. Training should include the various aspects of cyanide chemistry, toxicity, analysis, and treatment. The training should be ongoing with periodic updates and simulated spill events to maintain optimal response performance. With respect to the public there should be ongoing awareness training of the community as a whole but also specific hazardous materials and emergency response training of specific individuals such as firemen, policemen, and other government personnel depending upon local conditions.