AREVA Resources Canada Inc.

Kiggavik Project, Nunavut

RADIATION PROTECTION PLAN

October 2007 – Version 2, Revision 0

REQUIRED USERS

Any other users are responsible for using the current version of the Waste Management Plan as posted on Q:\KS_Feasibility\Prefeasibility\KA200FieldProgram\Procedures. Users may print copies of this plan, but are ultimately responsible for ensuring they are using a current copy as posted. Users are requested to destroy all previously printed copies of the plan when they are informed of revisions.

HISTORY OF REVISIONS

Version	Date	Details of Revision
01	March 2007	Original submission
02	October 2007	Update to reflect changes in field activities/capabilities and goals of continual improvement

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1 PREAMBLE

This Radiation Protection Plan will be in effect for the duration of the Kiggavik Exploration Project located about 80 km west of Baker Lake (Figures 1 and 2):

- West Boundary 97° 57’ 50.4” W Longitude;
- East Boundary 97° 20’ 56.4” W Longitude;
- North Boundary 64° 39’ 28.8” N Latitude; and,
- South Boundary 64º 17’ 02.4” N Latitude.

2 INTRODUCTION

The Radiation Protection Program is designed to meet the requirements of the applicable Nunavut Occupational Health and Safety Regulations, Saskatchewan mineral exploration best practices, the Canadian Nuclear Safety Commission (CNSC) Regulations and the AREVA Resources Canada Inc. Integrated Quality System Manual (IQMS). The program elements include:

Administrative Elements

- Program documentation
- Training
- Designation of Nuclear Energy Workers (NEW)
- Dose limits and dose levels
- Obligations of NEW
- Pregnant workers

Program Elements

- ALARA
- Radiological monitoring
- Dosimetry monitoring
- Code of Practice
- Management of radioactive materials
- Shipping of radioactive materials
- Site abandonment and restoration
- Emergency response

3 ADMINISTRATIVE ELEMENTS

3.1 Program Documentation

The Radiation Protection Program is comprised of a series of key documents combined in the Radiation Protection Procedures Manual (RPPM). The RPPM includes one main procedure *KIG-740, Routine Radiological Monitoring Schedule (RRMS)* and associated work instructions that cover planning, monitoring and maintenance of the radiation protection program for exploration activities.

The Radiation Protection Program includes comprehensive work instructions for worker dosimetry, radiological monitoring and the safe handling of radioactive materials. A summary of the current Radiation Protection Program procedures and associated work instructions is provided in Table 1.

The procedure *KIG-740, Routine Radiological Monitoring Schedule (RRMS)* provides for routine radiological and dosimetry monitoring of staff and Exploration facilities, specifically sites where radioactive materials (drill core, rock samples etc.) are being handled and where actions are required. When gamma dose rates on contact with radioactive material exceed 10 µSv/h, additional radiological monitoring is required in accordance with *Work Instruction KIG-740-03*, *Review of Worker Doses Involved in Exploration Activities*.

The shipping of radioactive materials is carried out under *Procedure KIG-752, Shipping Radioactive Material* and associated work instructions and in accordance with federal transport regulations.

Table 1: Radiation Protection Program Documentation

File Name	Title	Version
Radiological and Dosimetry Monitoring		
KIG-740	Routine Radiological Monitoring Schedule (RRMS)	04
KIG-740-01	Dose Assessment and Planning	04
KIG-740-01-01	Dose Assessment and Planning	02
KIG-740-02	Handling and Logging of Radioactive Core	04
KIG-740-03	Review of Worker Doses Involved in Exploration Activities	04
KIG-740-03-01	Direct Reading Dosimeter (DRD) Log Sheet	02
KIG-740-04	Monitoring and Control of Workspace Contamination Associated with Exploration Activities	04
KIG-740-04-01	Daily Monitoring and Swipe Log Sheet	02
KIG-740-05	Ensuring Adequate Ventilation and Controlling Radon Progeny Exposures When Handling Mineralized Core	04
KIG-740-05-01	Exploration Ventilation and Radiological Monitoring	03
KIG-740-06	Routine Workplace Inspections Associated with Exploration Activities	04
KIG-740-06-01	Routine Workplace Inspections	02
KIG-740-07	OLD Management	04
KIG-740-07-01	Request for OLD Badges	02
KIG-740-07-02	OLD Field Tracking	02
KIG-740-07-03	Employee Information and Exposure Record Release	02
KIG-740-08	Operation of Ludlum Model 12 Count Rate Meter with Pancake G-M Detector	04
KIG-740-08-01	Instrument Service Record	02
KIG-740-09	Operation of Automess 6150 AD6 Radiation Survey Meter	04
KIG-740-10	Operation of the Tri-Met Model TMA 372A Sample Counter	05
KIG-740-10-01	Long Lived Radioactive Dust Sampling	01
KIG-740-11	Operation of Direct Reading Dosimeter (DRD)	04
KIG-740-12	Operation of the Airflow AV2 Anemometer	04
KIG-740-13	Operation of SKC Aircheck Air Pump	04
KIG-740-14	Management and Disposition of Radioactive Drill Cuttings	01
KIG-740-15	Contamination Monitoring for Equipment and Materials Leaving an Exploration Site	01
COP-Radiation	Code of Practice (in development)	
Shipping of Radioactive Materials		
KIG-752	Shipping Radioactive Material	04
KIG-752-01	Preparation for Shipping of Radioactive Material	04
KIG-752-01-01	Dangerous Goods Shipping Form	02
KIG-752-01-02	Radioactivity Calculation Worksheet	02
KIG-752-01-03	Licensce Limit Confirmation	03
KIG-752-01-04	Radioactive Shipment Checklist - Drill Core / Samples	02
KIG-752-02	Safe Handling and Use of Exploration Sources	03
KIG-752-02-01	Dangerous Goods Shipping Form - Excepted Radioactive Material Class 7	03

3.2 Training

AREVA Resources Canada Inc. provides necessary training to all its employees and contractors to ensure worker safety and protection of the environment during project activities. The training programs provided are designed to meet the requirements of the Canadian Nuclear Safety Commission (CNSC) *Uranium Mines and Mills Regulations* and provincial/territorial *Occupational Safety & Health Regulations* and *ISO14001:2004 Standard.* The Kiggavik project is currently not ISO certified, however AREVA strives to meet those standards in preparation of becoming certified.

The Quality Representative with support and guidance from the Manager, Organizational Effectiveness and Training, specify the training requirements to meet various operational needs. All training programs place a high emphasis on the safe management of operations, specifically: environment, health, safety and radiation protection.

All new employees, including contractors, receive appropriate radiation protection training prior to beginning work. Employees and contractors are instructed in the origins of ionizing radiation, the types of radiation, the associated health risks, the principles of radiation safety and regulatory compliance. Training also includes the safe handling, management and disposition of radioactive materials such as drill muds and cuttings, and radioactive core. Training is in the form of a PowerPoint presentation and all personnel are expected to pass a written exam.

All Long term visitors to an exploration site (more than 72 hours), or who will be left without an escort will receive radiation protection training.

All personnel supervising the shipment of radioactive materials are required to take Transportation of Dangerous Goods (TDG) training and must possess a valid TDG certificate in accordance with Transport Canada Transportation of Dangerous Goods Regulations. If radioactive materials are to be transported by aircraft, TDG training is to include the necessary aviation components for Class 7 materials.

All AREVA field personnel and contractors establishing temporary work camps and/or handle fuel and lubricants and radioactive material require spill response training. If the contractors have their own training program they must submit evidence of the training program. Training for AREVA employees is in accordance with *Procedure KIG-715, Emergency Preparedness and Response* and the *Environmental Emergency Response Plan*. Contractors are given a copy of the *Environmental Emergency Response Plan*. If the contractors do not have a training program in place, AREVA will supply the training material and/or provide the training as required.

3.3 Designation of Nuclear Energy Workers

The designation of a person as a Nuclear Energy Worker (NEW) is conducted in accordance with *Work Instruction KIG-740-01*, *Dose Assessment and Planning* pursuant the CNSC *Radiation Protection Regulations*. A Nuclear Energy Worker is defined as a person with a reasonable probability of receiving an occupational dose of radiation that is greater than 1 milliSievert per year (1 mSv/y), the prescribed limit for the general public. Nuclear Energy Workers are informed in writing of their NEW designation and a written acknowledgement is obtained from the worker and kept in central records.

3.4 Dose Limits and Dose Levels

A NEW is informed of the risks associated with radiation to which the worker may be exposed in the course of their work, and the applicable dose limits, during radiation protection training. Nuclear Energy Workers are limited to a maximum annual effective dose of 50 mSv in a one year dosimetry period, not to exceed 100 mSv in a five year dosimetry period. A pregnant NEW is limited to 4 mSv for the balance of the pregnancy, once notification has been made to the employer. In the control of an emergency and the consequent immediate and urgent remedial work, the effective dose shall not exceed 500 mSv. The relaxation of normal dose limits in emergency situations does not apply to pregnant workers.

Administrative control levels and Action levels have been defined in site wide Code of Practice to limit the dose to less than 0.4 mSv per week or 2.5 mSv per quarter.

Nuclear Energy Workers are informed of their radiation dose levels, in writing, on a quarterly basis.

3.5 Obligations of Nuclear Energy Workers

Nuclear energy workers (NEW) are obliged to provide information required to identify them to the National Dose Registry (i.e. given name, surname, previous surname, SIN, sex, date and province and country of birth) and release their dose histories for the current one and five year dosimetry periods. The purpose of this information is described to the NEW during radiation protection training. Nuclear Energy Workers are obliged to provide written acknowledgement that they have received information regarding the risks associated with exposure to radiation and dose limits.

3.6 Pregnant Nuclear Energy Workers

All NEW are informed, in writing, of the risks associated with radiation to which the worker may be exposed in the course of their work, including the risks associated with the exposure of embryos and foetuses to radiation. All female NEW are informed of their obligation to inform their employer, in writing, when they become pregnant and are informed of the applicable effective dose limit of 4 mSv for the balance of the pregnancy.

4 PROGRAM ELEMENTS

4.1 ALARA

Radiation protection practice has its foundation in the ALARA principle, As Low As Reasonably Achievable. The commitment to maintain worker doses ALARA is established as a policy within the Integrated Quality Management System Manual (IQMS) for AREVA. This policy is established by senior management and is approved by the President and Chief Executive Officer.

4.2 Radiological Monitoring

Routine radiological monitoring is performed for gamma radiation, radon progeny (RnP), and long-lived radioactive dust (LLRD) in order to detect potentially abnormal radiological conditions, estimate worker doses, and document radiological conditions. Radiological monitoring is conducted in accordance with the *RRMS* and associated work instructions (see Table 1).

Contamination control measures are in place to minimize the spread of radioactive materials into unintended locations. Contamination monitoring and control is conducted in accordance with work instructions*, KIG-470-02, Handling and Logging of Radioactive Core*, *KIG-740-04, Monitoring and Control of Workspace Contamination Associated with Exploration Activities*, and *KIG-752 Shipping of Radioactive Material*.

4.3 Dosimetry Monitoring

Dosimetry monitoring is conducted to determine and document worker exposures to radiological components which include gamma radiation, radon progeny (RnP) and long-lived radioactive dusts (LLRD). Workers are assigned appropriate dosimetry based on the anticipated radiological hazard in accordance with the *RRMS* and *Work Instruction KIG-740-01, Dose Assessment and Planning*.

Worker doses to external gamma radiation are measured using optically stimulated luminescent dosimeters (OLDs) provided by a licensed dosimetry provider. Workers handling and logging radioactive drill core and rock samples are also issued direct reading dosimeters (DRDs) in accordance with *Work Instruction KIG-740-11, Operation of Direct Reading Dosimeters*.

Worker doses to RnP are estimated from accepted area monitoring techniques and occupancy time information in accordance with the *RRMS* and *Work Instruction, KIG-740-05, Ensuring Adequate Ventilation and Controlling Radon Progeny Exposures When Handling Mineralized Core.*

Worker doses to LLRD are estimated from accepted area monitoring techniques and occupancy time information in accordance with the *RRMS* and *Work Instruction KIG-740-13, Operation of SKC Aircheck Air Pump*. Workplace monitoring for LLRD is only performed during and after dust generating activities including cutting or splitting of core samples.

As required, dosimetry monitoring is provided for all workers including contractors and visitors. A distinction is made between Nuclear Energy Workers (NEW) and non-NEW staff. Dosimetry monitoring of NEW staff is a regulatory requirement necessitating routine regulatory reporting. Dosimetry monitoring for non-NEW workers is routinely reported to regulators and suitable records are maintained on file. Individual exposure records are regularly mailed to employees.

4.4 Code of Practice

In keeping with ALARA principles, a Code of Practice is established for the control of radiological levels and worker doses during exploration activities. The Code of Practice sets out specific actions that are to be carried out when worker exposures or radiological levels exceed prescribed values.

The Code of Practice is intended to ensure that appropriate actions are taken when potentially upset conditions occur.

4.5 Management of Radioactive Materials

4.5.1 Radioisotopes

The primary source employed by Exploration is a Cesium-137 (Cs-137) gamma source which is used for testing the operation of down hole probes. Other sources that may be used include small instrument calibration sources.

The transport, storage and use of radioactive sources is carried out in accordance with *Work Instruction KIG-752-02, Safe Handling and Use of Exploration Sources*.

Radiation sources are maintained at all times and stored in a secure location when not being used.

The disposal of radioactive sources used during KIGloration activities will be carried out in accordance with CNSC *Nuclear Substances and Radiation Devices Regulations* and licence conditions.

4.5.2 Core Storage

Nunavut currently has no regulations or guidelines for mineral exploration or mineral industry environmental protection. In the absence of territorial regulations, the storage and disposal of radioactive materials arising from exploration activities will be carried out in accordance with Saskatchewan *Mineral Industry Environmental Protection Regulations, 1996*. Exploration for uranium in Saskatchewan has been ongoing for the last 35 years and continues to this day.

Permanent and long-term storage areas of radioactive material must be located at least 30 m from the main camp and at least 100 m from the high waterline of all water bodies.

Gamma radiation levels at 1 m from the surface of a storage area should be reduced to 1 µSv/h and in no instances exceed 2.5 µSv/h.

Permanent core storage areas are to be locked when not in use and appropriately labelled with radiation warning signs.

4.5.3 Disposition of Drill Cuttings

During drilling activities, drill mud solids or cuttings in non-mineralized zones are deposited on the ground. When mineralized core is intercepted, all drill mud and cuttings will be collected in appropriate containers and categorized as radioactive through appropriate radiation measurements in accordance with work instructions *KIG-741 Management and Disposition of Radioactive Drill Cuttings* and the *Abandonment and Restoration Plan*.

Drill mud or cuttings with a uranium content greater than 0.05% that are not otherwise retained will be disposed down a drill hole and filled with cement. Where down hole disposal is not practicable, drill cuttings will be collected and stored in the long-term core storage area with appropriate containment systems in place.

4.5.4 Spills

The uncontrolled or accidental release of any radioactive materials including drill mud solids and cuttings is considered a spill. All spills of radioactive material will be appropriately reported and responded to in accordance with the *Spill Contingency Plan*.

In the event of a spill, radioactive materials will be collected and necessary site remediation undertaken to meet the site abandonment criteria of less than 1 µSv/h at a height of 1 m above background. To the greatest extent possible, all spill affected areas will be decontaminated.

4.6 Shipping of Radioactive Materials

Shipping and receiving radioactive material is carried out in accordance with *Procedure KIG-752 Shipping Radioactive Material,* the CNSC *Packaging and Transport of Nuclear Substances Regulations* and the Transport Canada *Transportation of Dangerous Goods Regulations*.

All personnel responsible for or directly involved with the shipment of radioactive materials must possess a valid transportation of dangerous goods (TDG) certificate which includes the transportation of Class 7 materials. Support personnel providing assistance during the preparation and shipment of radioactive material do not require TDG training as long as they are working under the direct supervision of trained individuals.

4.7 Site Abandonment and Restoration

Site abandonment and restoration is carried out in accordance with the work instruction *Abandonment and Restoration Plan*.

Prior to final abandonment, all drill sites will undergo a radiation survey for radioactive contamination. Contaminated soil or cuttings will be collected in appropriate containers and stored in the long-term core storage area for future handling, which may include transfer to an operating mine site.

All drill sites will be cleaned to ensure that the gamma dose rate at a height of 1 m is less than 1 μSv/h above background.

All materials and equipment leaving the drill site will be monitored for contamination in accordance with work instruction *KIG-740-15 Contamination Monitoring for Equipment and Materials Leaving an Exploration Site*. Materials or equipment that cannot be decontaminated to meet unrestricted release criteria will either be stored in the long-term core storage area or will be shipped to the McClean Lake Operation in accordance with the CNSC *Packaging and Transport of Nuclear Substances Regulations* and the Transport Canada *Transportation of Dangerous Goods Regulations*.

4.8 Emergency Response

Emergency response is co-ordinated through the corporate office in Saskatoon. The AREVA corporate *Management Emergency Response Manual* details the organization, responsibilities, procedures and mitigative measures to be followed in the event of an offsite emergency. Environmental emergencies are considered secondary to the safety of personnel.

In the event of a spill involving radioactive material, actions will be taken immediately to contain the spill, limit the spread of contamination and control access to the spill area. Appropriate radiological and dosimetry monitoring will also be performed to ensure worker doses remain ALARA. Mitigation procedures to be followed include recovering the radioactive material, decontaminating affected areas and reporting the details of the incident as required.

If a radiation source used for exploration appears to be damaged it will be removed from service immediately. The McClean Lake Radiation Protection Department will be notified and arrangements made to ship the source to the McClean Lake Operation.

If at anytime it appears that a gamma source has been lost, misplaced or stolen, the General Manager of the Kiggavik Project and the McClean Lake Radiation Protection Department must be contacted immediately.

In the event of any incident involving a radiation source, federal and provincial agencies will notified in accordance with applicable regulations and AREVA CNSC licence conditions.