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Radiological Control Plan

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Engelhard Corporation

Revision 0
May 1995

Prepared by:
B. Koh & Associates, Inc.

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1.0 DISCLAIMER NOTICE

The radiological control and safety requirements/guidelines contained within this Radiological Control Plan were developed for B. Koh & Associates, Inc. specifically for the Engelhard characterization and remediation project and should not be used on any project or site without prior approval of the site Radiological Safety Officer.

The B. Koh & Associates, Inc. Radiological Control Plan requirements and guidelines are effective only if each worker follows the requirements and guidelines. Intentional disregard by B. Koh & Associates, Inc. management or workers of the established requirements/guidelines may result in unnecessary exposure or release of radiation or radioactive materials.

2.0 POLICY STATEMENTS

2.1 Health and Safety Policy

It is the policy of B. Koh & Associates, Inc. to provide their employees and require all B. Koh & Associates, Inc. contractors and subcontractors to provide their employees with a safe and healthful workplace in accordance with all Federal, State, and Local regulations, as well as B. Koh & Associates, Inc. internal procedures. Safety of all employees is a primary consideration in the performance of B. Koh & Associates, Inc. activities. Consistent with prudent professional practice, B. Koh & Associates, Inc. will identify, evaluate and correct identified hazards at B. Koh & Associates, Inc. Project sites, thereby ensuring that the health, safety, and well-being of all employees are protected.

2.2 ALARA Policy

B. Koh & Associates, Inc. is committed to keeping radiation exposure to employees and the general public as low as reasonably achievable (ALARA), commensurate with sound economic and social considerations. B. Koh & Associates, Inc. management will demonstrate their commitment by assigning high priority to work plans and procedures that will reasonably reduce personnel and environmental radiation exposures. Therefore, in addition to implementation of the ALARA policy, B. Koh & Associates, Inc. will incorporate the ALARA philosophy into applicable operating procedures. Furthermore, B. Koh & Associates, Inc. will place primary emphasis on design and engineering features to maintain exposures ALARA. When practical, design features will be selected in lieu of administrative controls to maintain exposures ALARA.

The "As Low As Reasonably Achievable" (ALARA) philosophy is a fundamental objective of all effective radiation protection programs. Reducing individual and collective exposures is desirable. Control of radiation exposure is based on the assumption that any exposure to ionizing radiation involves some risk. However, occupational exposure within regulatory limits represents a very small risk compared to the voluntarily accepted hazards of normal life. This radiation exposure control philosophy has been presumed repeatedly in the guidance provided by such organizations as the National Council of Radiological Protection and Measurements (NCRP), the International Commission of Radiological Protection (ICRP), and the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation (NAS-BEIR).

Thus, maintaining individual and collective radiation exposures ALARA is a critical element of this Radiological Control Plan which improves other parts of the B. Koh & Associates, Inc. radiological protection program through better planning of work, training of workers, and tracking of exposures. Ultimately, these efforts benefit the safety and reliability of the activities by improving the quality and the efficiency of work performed.

3.0 PURPOSE, SCOPE, RESPONSIBILITY

3.1 Purpose

This Radiological Control Plan establishes the basic radiation control and protection practices to be implemented by B. Koh & Associates, Inc. consistent with Nuclear Regulatory Commission (NRC) standards, the National Council of Radiological Protection and Measurement (NCRP), and International Commission of Radiological Protection (ICRP) recommendations. In addition, this Plan promulgates the requirements contained in the B. Koh & Associates, Inc. Project administrative and field procedures for maintaining radiation exposure as low as reasonably achievable (ALARA) and within Federally mandated exposure limits.

3.2 Scope

This Radiological Control Plan has been developed in accordance with the current 10 CFR 19 and the revised 10 CFR 20 (NRC, January 1994) requirements and has been developed commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR 20. Specifically, this Plan provides the radiation protection standards and controls that will be in effect at the B. Koh & Associates, Inc. Project sites. Adherence to these controls is the responsibility of each individual as well as members of B. Koh & Associates, Inc. line management. Any deviation from this plan requires the written approval of the B. Koh & Associates, Inc. Project Radiation Safety Officer.

The major scope of this Plan is to establish the radiological protection practices to be implemented at the B. Koh & Associates, Inc. Project sites for ensuring control of radioactive materials and radiation exposures to personnel. It is the philosophy of B. Koh & Associates, Inc. to maintain radiation exposures to personnel and release of radioactive materials to the environs as low as reasonably achievable (ALARA), and to keep radioactive material contained in the smallest practical volume at all times.

3.3 Responsibilities of Workers

This Plan is available for review to all B. Koh & Associates, Inc., contractor and subcontractor personnel working at the B. Koh & Associates, Inc. Project sites. All individuals working or frequenting the radiologically controlled areas of the facilities are responsible for complying with the requirements of this Plan.

All personnel who could potentially come in contact with radioactive materials should understand that a knowledge of standard radiation protection rules and practices is an integral part of their job duties and responsibilities. Each person should be aware that it is their responsibility to minimize their own exposure to radiation and be cognizant of their obligations to B. Koh & Associates, Inc. and co-workers for the safe handling of radioactive materials. Each individual working at the B. Koh & Associates, Inc. Project sites is responsible to perform their job in accordance with B. Koh & Associates, Inc. procedures, job training and in accordance with the principle of maintaining his or her exposure ALARA. Each person who could reasonably be expected to handle radioactive materials will receive periodic instruction in the general and specific radiological aspects which they may encounter and will be made aware of their responsibility to the company, the public, and co-workers for safe handling of radioactive materials.

3.4 Responsibilities of Management

It is the responsibility of B. Koh & Associates, Inc. to provide its employees and require all subcontractors to provide their employees with a safe and healthful workplace in accordance with all Federal, State and Local regulations, as well as, B. Koh & Associates, Inc. site procedures.

In addition, B. Koh & Associates, Inc. project management personnel are responsible for:

(1) Being knowledgeable of the contents of this Plan.

(2) Ensuring that employees have been fully informed of, and possess a thorough understanding of the sections contained in this Plan which apply to their job assignment.

(3) Ensuring that all necessary training is scheduled and completed and for maintaining auditable training records which will include any follow-up training and all annual refresher training.

(4) Reviewing the Radiation Control and Protection Program content contained in this Plan and reviewing the efficiency of its implementation on an annual basis.

(5) Maintaining records (provisions of the program, audit and review, surveys) related to the Radiation Control and Protection Program.

4.0 PROJECT ORGANIZATION

4.1 Roles, Responsibility and Authority

4.1.1 General

The organizational structure plays a key role in the effectiveness of any Radiological Control and Protection Program. Responsibility, authority and accountability for radiological control and protection must be established within this structure to effectively carry out the objectives of the program. Lines of authority must be organized in such a way that radiological protection and safety has a channel to the top. In addition, top management must be supportive of radiological control and protection efforts.

The Engelhard/B. Koh & Associates, Inc. organizational structure depicted in Figure 4-1 has been developed to carry out the objectives of the policy statements presented in Section 2.0. This figure identifies employee titles and the lines of authority to be used throughout activities. The Engelhard/B. Koh & Associates, Inc. organizational structure may be reviewed and updated, if necessary, to reflect the current status of site operations.

Key positions are filled by those individuals that are responsible for assuring the safe and expedient characterization and/or remediation of the B. Koh & Associates, Inc. Project sites. The key positions for B. Koh & Associates, Inc. projects are described below.

4.1.2 B. Koh & Associates, Inc.

4.1.2.1 Program Manager

The B. Koh & Associates, Inc. Program Manager (PGM) has overall responsibility and authority for the planning and management of B. Koh & Associates, Inc. Project activities. The PGM is responsible for ensuring that the B. Koh & Associates, Inc. project(s) activities meet the established environmental health and safety and quality assurance requirements, technical performance, and budgeting and scheduling criteria. The PGM reports directly to the President (or his designee) at the Engelhard site.

4.1.2.2 Project Manager

The B. Koh & Associates, Inc. Project Manager (PM) has overall responsibility and authority to exercise management controls necessary to assure safe implementation of the site characterization and/or remediation activities, including matters related to health and safety, licensing, quality assurance and regulation. This responsibility and authority includes implementation of the Radiological control plan. The PM reports directly to the PGM. The PM will work together with the Engineering Manager, Remediation Project Manager (RPM) and the Project Radiation Safety Officer (PRSO) to ensure that all radiological protection and control measures are carried out.

Additionally, the PM will review and approve all radiation control procedures and work procedures that are developed for the project activities.

4.1.2.3 Project Radiation Safety Officer

The B. Koh & Associates, Inc. Project Radiation Safety Officer (PRSO) is responsible for developing and implementing policies and procedures in accordance with NRC Regulations (Title 10 CFR Parts 19 and 20) and any other applicable requirements/regulations. The PRSO has direct recourse to the PGM to prevent unsafe practices or to halt an operation which is deemed radiologically unsafe. The PRSO is also responsible to oversee and control the day-to-day radiation protection activities in accordance with the requirements contained in the Radiological Control Plan.

Specific duties of the RSO may include, but are not limited to, the following:

(1) Provide training to project personnel.

(2) Verify that site personnel receive (or have received) appropriate radiological training.

(3) Verify implementation of the Radiological Control Program, including ALARA.

(4) Provide technical expertise to on-site radiation safety personnel.

(5) Conduct periodic radiation safety audits at the site.

(6) Interface between site radiation safety personnel and site management.

(7) Review surveys conducted during and after the site activities.

(8) Implement additional health and safety requirements as directed by the PM.

(9) Develop and implement radiation control procedures specific to the project.

Qualifications of the Project Radiation Safety Officer are:

(1) A Bachelors of Science degree in Engineering or Science.

(2) A minimum of 5 years of applied radiation protection experience.

(3) Previous training consistent with Regulatory Guide 10.4, Item 7, Topics.

The Project Radiation Safety Officer for B. Koh & Associates, Inc. projects is Mr. Theodore G. Adams. Mr. Adams' qualifications are presented in Attachment 1.

4.1.2.4 Quality Assurance Coordinator

The Quality Assurance Coordinator (QAC) reports to the Program Manager for administrative activities and for quality assurance guidance. The QAC communicates and coordinates directly with the Project

Manager on project-related matters. The QAC has the delegated responsibility and authority to direct and control QA functions to assure that the QA objectives are met.

The QAC is responsible for the coordination, integration, and overview of project QA activities and for ensuring that the appropriate quality management, policy, training, and verification controls are present. The QAC is responsible for QA audits and surveillances, for prompt correction of conditions which could adversely affect quality, and for providing documented evidence that the required quality levels have been maintained in all remediation work activities.

4.1.2.5 Environmental Safety and Health Coordinator

The Environmental Safety and Health Coordinator (ES&HC) reports to the Project Manager. The ES&HC is responsible for the radiological, industrial, and environmental safety functions during characterization and/or remediation activities. The ES&HC is responsible for ensuring implementation measures that provide safe and healthy work conditions, for maintaining radiation exposures as low as reasonably achievable, and for minimizing release of radioactivity and chemicals to the environment. This is accomplished through the review of work plans, instructions, procedures, monitoring and surveillance, training, and investigation and evaluation of routine monitoring data and unusual events.

4.1.2.6 Laboratory Manager

The Laboratory Manager (LM) reports to the Project Manager. The LM is responsible for managing the laboratory activities for in-house and onsite laboratories and for the subcontractor laboratory services. The LM is responsible for ensuring that the chemical and radiological sampling and analyses for the remediation project is performed in accordance with approved procedures and Quality Assurance programs. The LM is also responsible for ensuring that the laboratory data is compiled, validated, and appropriate evaluation and comparisons to establish limits performed.

4.1.2.7 Field Operations Supervisor

The Field Operations Supervisor (FOS) reports directly to the Project Manager. The FOS is responsible for ensuring that characterization and/or remediation activities are being performed in accordance with plans, procedures, and design requirements established for the remediation project.

4.1.2.8 Radiological Control Technicians

The Radiological Controls Technician (RCT) is responsible for adhering to radiological control procedures under the direction of the PRSO.

Specific duties and authority include, but are not limited to the following:

(1) Surveying of areas, materials, equipment and personnel as needed.

(2) Recording of all survey finding on appropriate forms.

(3) Report unexpected findings to the PRSO or PM.

(4) Advise the PRSO or PM of any unsafe working conditions at the site.

(5) Remove employee(s) who have approached the established administrative radiation exposure limits or who have not demonstrated their continuing understanding of, or need for compliance with radiological safety procedures.

4.1.2.9 Engineering Manager (As Needed)

The B. Koh & Associates, Inc. Engineering Manager (EM) is responsible for the day-to-day oversight of Project activities. The EM reports directly to the PM.

4.1.2.10 Remediation Project Manager (As Needed)

The B. Koh & Associates, Inc. Remediation Project Manager (RPM) reports to the PM. The RPM is responsible to direct the remediation project workers in performing daily tasks and operations. The RPM will work with the PM and PRSO to complete the remediation project safely and expediently.

4.1.2.11 Remediation Contractor Personnel (As Needed)

All Remediation Project Contractor Personnel engaged by B. Koh & Associates, Inc. will comply with the requirements of this Radiological Control Plan.

4.1.2.12 Site Personnel

All B. Koh & Associates, Inc. Project and Contractor site personnel will comply with the requirements of this Radiological Control Plan.

4.2 Stop-Work Authority and Grounds for Dismissal

The B. Koh & Associates, Inc. PM, EM, PRSO, RCT, and the RPM have the authority to stop work when a situation is considered to pose an immediate threat to life, health, property or the environment. When an immediate threat does not exist, only the B. Koh & Associates, Inc. PM or his designee will have stop-work authority pursuant to the Radiological Control Plan. When it becomes necessary to stop a job due to a safety hazard, conditions will be stabilized immediately so that stopping the job does not in itself present an additional hazard pursuant to the Radiological Control Plan.

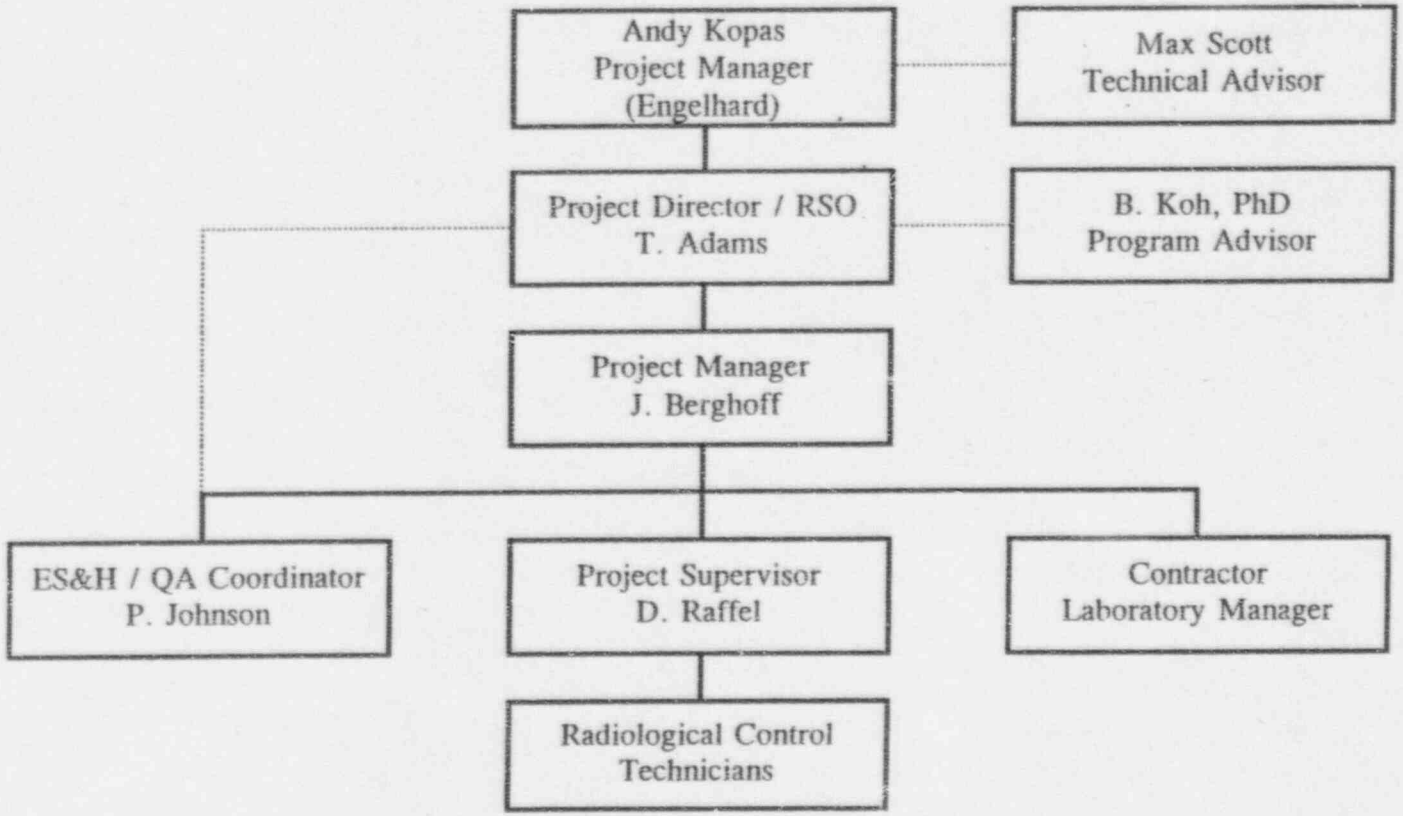
Any B. Koh & Associates, Inc. or Contractor person found to be wilfully disregarding any provisions of this Radiological Control Plan will be subject to immediate removal from further remediation work by the B. Koh & Associates, Inc. PM or his designee.

4.3 Administrative and Field Procedures and Review Requirements

The B. Koh & Associates, Inc. Radiological Control Plan establishes the policies and requirements to be followed during the conductance of site characterization or remediation activities, detailed administrative and field operational procedures which incorporate radiological, industrial and other general safety considerations are required to ensure that the identified policies and requirements are met. Preparation of such procedures minimizes the potential problems encountered during the conduct of activities by requiring explicit planning prior to initiation of the required work. Thus, written procedure(s) is a step-by-step guide for the personnel performing the work or activity. Prior to being issued for use, the procedure will be reviewed and approved by the PM and the PRSO. The approved procedure will be issued, as a restricted document, to ensure that the proper procedure is being used at the ork location.

FIGURE 4-1

ORGANIZATION CHART FOR ENGELHARD/B. KOH & ASSOCIATES, INC. REMEDIATION ACTIVITES



5.0 TRAINING REQUIREMENTS

5.1 Introduction

The purpose of radiation training for the B. Koh & Associates, Inc. characterization and remediation activities is to provide qualified personnel to work with the radiation hazard at a specific site. The training program will be reviewed by B. Koh & Associates, Inc. management and kept up to date to reflect changes in the facility and procedures, as applicable.

Training will be required of, but not limited to: all workers involved in day to day operations of the Project, project and management personnel who will visit the site regularly and B. Koh & Associates, Inc. and contractor personnel identified by the PM.

5.2 Site Orientation and Training

Prior to entry into radiologically controlled areas of the facility, all personnel will be given a radiological orientation. The objectives of this orientation are to familiarize personnel to:

(1) Recognize labeled hazardous chemicals and radioactive materials and understand the meaning of radiological and hazardous chemical warning signs;

(2) Understand that, as long as radiological control procedures and limits are followed, harmful effects to personnel or to the environment from radioactivity will be minimized; and

(3) Recognize and understand the meaning of, and proper response to, emergency signals and use of emergency equipment, such as fire extinguishers, fire hoses, and SCBA.

This orientation is required for all personnel visiting or working at the B. Koh & Associates, Inc. sites, including contractor and subcontractors.

All visitors will be escorted by personnel who are trained as radiation workers and have passed the radiation worker written exam. Visitors will be issued temporary TLDs or self-reading dosimeters by the Radiological Safety Officer or his designee and will be required to wear them whenever they are inside the radiologically controlled work zones.

5.3 Radiation Safety Training

5.3.1 General

A Radiation Safety Training Course provided by B. Koh & Associates, Inc. will consist of classroom and practical training and will be in accordance with 10 CFR Part 19.12 and USNRC Regulatory Guide 10.4 Item 8. B. Koh & Associates, Inc. will provide qualified instructors, as defined by 10 CFR Part 40.32(b) and USNRC Regulatory Guide 10.4 Item 7, to conduct radiation safety training.

Consistent with 10 CFR 19.12, the radiation safety training is commensurate with the potential health protection hazards associated with the restricted areas of the site and will cover the following areas:

(1) Identification and location of licensed radioactive materials and radiological hazards present in the restricted area to be entered by the individual.

(2) Health protection problems associated with exposure to such radioactive materials or radiation.

(3) Precautions and procedures to minimize exposures and the spread of contamination (e.g., use of Radiation Work Permits, dosimetry, and frisking for personal contamination when leaving a contaminated zone).

(4) Purposes and functions of protective devices required (if any).

(5) Applicable provisions of NRC regulations to be observed by individuals working in or frequenting restricted areas.

(6) Standard operating and emergency procedures, including response to warnings to be followed by individuals working in or frequenting restricted areas.

(7) Responsibility of individuals to report promptly to B. Koh & Associates, Inc. management unsafe acts or conditions observed in restricted areas that may lead to or cause a violation of NRC regulations or unnecessary exposure to radiation or to radioactive material.

(8) Rights of employees to receive radiation exposure reports upon request (10 CFR 19.13).

(9) For persons who actually work with radioactive material, instructions for the safe use of radioactive material.

5.3.2 Basic Radiation Safety Training

Personnel who will require routine unescorted site access (radiation workers) will receive basic Radiation Safety Training.

The basic Radiation Safety Training will include the following specific topics:

(1) Basic Fundamentals of Radiation.

(2) Biological Effects of Radiation.

(3) Risk of Low-Level Occupational Exposures to Radiation.

(4) Basic Radiation Protection, Exposure and Contamination Control Concepts.

(5) B. Koh & Associates, Inc. Radiation Protection Policies and Procedures.

(6) Employee and Management Responsibilities for Radiation Safety.

(7) ALARA.

(8) Signs and Postings.

(9) Personnel Monitoring and Dosimetry (including Bioassay).

(10) Proper Use of Protective Clothing and Frisking Techniques.

(11) Decontamination.

(12) Use of Radiation Work Permits (RWPs).

(13) Prenatal Exposure (Regulatory Guide 8.13).

(14) Contents of 10 CFR 19: Notices, Instructions and Reports to Workers.

(15) Emergency Procedures.

A written test will be administered to document adequate understanding of the subjects covered. Satisfactory completion is indicated by a score of 80% or greater. Prior to being allowed unescorted worker access to the site and issuance of a TLD, all personnel will be required to pass (80%) a written exam demonstrating a basic knowledge of radiation worker training and provide evidence of a recent medical examination as described in Section 14.0.

5.4 Other Training

Other training requirements such as the 40 Hour Hazardous Waste Site Training (OSHA Standard 29 CFR 1910.120(e)) may be required as determined appropriate by B. Koh & Associates, Inc. or site specific training, as determined at the specific facility.

5.5 Refresher Training

Personnel who will require routine unescorted site access will receive refresher training annually of the following:

(1) Review of initial Radiation Worker Training subjects;

(2) Site specific training requirements;

(3) Any critique of incidents that have occurred in the past year that can serve as training examples of related work; and

(4) Any other relevant topics.

5.6 Training Verification and Documentation

All persons working on-site will have evidence of initial training and pertinent refresher training as required by Sections 5.3 and 5.5 (e.g., training certificates, letter of certification, etc.) prior to being permitted to perform work involving a potential for exposure to radiation or health hazards. In addition, all site personnel will be required to sign a statement documenting that they have received site-specific training and that they understand the potential site hazards along with the necessary control measures to reduce and/or eliminate those hazards.

All training documentation, including the content of Site-Specific Training, test results, attendance sheets, any other subsequent training (e.g., periodic safety meetings, specific task safety training, etc.), and personnel training files will be maintained on site as part of the Project Files and available for inspection.

5.7 Employee Access to Information

All pertinent information concerning the health and safety of on-site workers will be conveyed initially via site-specific training. Subsequently, documents such as this Radiological Control Plan, Material Safety Data Sheets (MSDS), and regulatory standards, will either be provided to employees or be made available to them upon request. In addition, any new information concerning safety or health conditions associated with this project will be conveyed to project personnel.

Furthermore, in accordance with 10 CFR 19, current copies of the following documents will be made available for examination by all employees:

- 10 CFR 19 and 20 standards and regulations
- License, license conditions, and documents incorporated into the license by reference and amendments thereto.
- Administrative and field procedures applicable to project activities.
- Any notice of violation involving radiological working conditions, proposed imposition of civil penalty, and any response from B. Koh & Associates, Inc.

A notice which describes the documents and states where the documents are available for review will be posted in conspicuous locations throughout the work area.

6.0 ENVIRONMENTAL MONITORING

6.1 Introduction

Operations will be controlled such that no member of the general public will exceed the revised USNRC 10 CFR 20 non-occupational limit of 100 mRem/year. Operations will be conducted such that minimal releases to the environment of airborne and liquid radioactivity will occur. The concentration limits for specific radionuclides are taken from 10 CFR 20, Appendix B, Table 2, Columns 1 and 2.

In any event, exposure to the public, due to direct, inhalation and ingestion exposures of radioactive materials from the B. Koh & Associates, Inc. Project sites will be limited to 100 mRem in any year. Sampling for airborne and liquid radioactive materials will be performed in accordance with Sections 6.2.2 and 6.2.3 of the Radiation Control Plan and/or the direction of the PRSO.

6.2 Monitoring

To ensure that the non-occupational dose to the public is met, monitoring of the environment around the perimeter of the work site will be performed. Monitoring will consist of the three potential pathways of exposure to the public. The pathways consist of direct exposure to radiation, inhalation and ingestion of radioactive material from the B. Koh & Associates, Inc. Project sites.

6.2.1 Direct Exposure

Direct exposures will be monitored with environmental Thermoluminescent Dosimeters (TLDs). The TLDs will be placed at strategic locations along the perimeter of the site. The TLD's will be changed quarterly and analyzed and evaluated by a dosimeter processor that holds current dosimetry accreditation from National Voluntary Laboratory Accreditation Program (NAVLAP) of the National Institute of Standards and Technology. Additionally, during the B. Koh & Associates, Inc. Project activities, a TLD(s) will be established at a background location(s) that is not influenced by the radioactively contaminated site. All TLD results will be maintained on an NRC Form 5 or equivalent.

In addition to the placement of TLD's along the site perimeters, exposure rate measurements will be taken periodically as part of the general site radiation survey program. These measurements will be performed with calibrated instruments, qualified personnel and in accordance with approved procedures.

6.2.2 Airborne Radioactive Materials

Airborne materials are included in the environmental monitoring program to determine possible inhalation exposures to radioactive materials by the public. During remediation operations involving potentially or known radioactive materials, air samples will be collected around the perimeter of the project site using low volume or variable rate air samplers. The collection and analysis of the air samplers will be performed with qualified personnel, in accordance with approved procedures and with calibrated equipment as described in Section 13.0. The minimum detectable activity of the air sample and counter combination must be able to detect is less than the radionuclide specific administrative control limit.

Air sampler(s) will be positioned downwind at the site perimeter to collect air that may contain radioactive material during the B. Koh & Associates, Inc. Project activities (i.e., downwind of soil excavation, hauling and placement operations).

In addition, air sampler(s) will be located upwind from the site to collect air that will be used to determine background levels.

If any sample result is greater than the B. Koh & Associates, Inc. administrative limit then the PRSO and PM will be notified. If the sample results are greater than the NRC 10 CFR 20, Appendix B, Table 2 limits, an evaluation will be performed to determine proper corrective action.

6.2.3 Liquid Radioactive Materials

Liquid radioactive materials generated as a result of characterization or remediation activities will be sampled and analyzed to determine that the material is within the limits established by B. Koh & Associates, Inc. and the NRC 10 CFR 20, Appendix B, Table 2 limits. The sample collection and analysis will be performed with qualified personnel in accordance with approved procedures and calibrated equipment/instrumentation.

If the initial sample result is greater than the B. Koh & Associates, Inc. administrative limit, then the PM and PRSO will be advised. If sample results are greater than the NRC 10 CFR 20, Appendix B, Table 2 limits, an evaluation will be performed to determine proper corrective action and disposition of the liquid.

6.3 Actions

If any environmental pathway exposure exceeds the B. Koh & Associates, Inc. administrative limits, then remediation operations will be reviewed to determine the cause of increased pathway exposure and the effect of the exposure on the public and the environment.

Additional measures will be initiated to reduce the exposure pathway and operations can continue with the concurrence of the PM and PRSO.

7.0 IDENTIFICATION AND MONITORING OF CONTROLLED AREAS

7.1 Introduction

To aid in the control of radiation exposure and limit the spread of radioactive material, a system of identifying radiologically controlled areas will be implemented by B. Koh & Associates, Inc.

The B. Koh & Associates, Inc. Project sites will be divided into three distinct areas for radiation exposure control. These areas are unrestricted, controlled and restricted areas.

Restricted Area means any area access to which is controlled by B. Koh & Associates, Inc. for purposes of protection of individuals against undue risks from exposure to radiation and radioactive materials. "Restricted area" will not include any areas used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area. Within the restricted areas, different zones will be designated to aid in radiation exposure control and control of the radioactive materials present.

Unrestricted Area means any area access to which is neither limited nor controlled by B. Koh & Associates, Inc. for purposes of protection of individuals from exposure to radiation and radioactive materials.

Controlled Area means an area, outside a restricted area, but inside the site boundary, access to which can be limited by B. Koh & Associates, Inc. for any reason.

In all cases, the radiologically controlled areas will be delineated with distinctive barrier tape or rope and signs. The signs will have the radiation symbol, standard colors, and appropriate wording to warn workers of the potential hazard. A description of the radiation symbol and sign can be found in USNRC Regulatory Guide 8.1 and ANSI Standard N2.1-1969. The radiation symbol will not be used for any purpose other than radiological control.

All radiological posting will be done by or at the direction of radiological control personnel. Movement or removal of posted radiation warning signs, tags, or boundary markers by personnel other than radiological personnel or without their approval may be cause for disciplinary action.

Restricted areas and specific zones within the restricted area will be posted with the appropriate signs such that posting is readily identifiable from ordinary avenues of approach.

7.2 Radioactive Materials Area

A *Radioactive Materials Area* is an area that contains radioactive materials in amounts exceeding 10 times the 10 CFR 20, Appendix C. Each Radioactive Materials Area (RMA) must be posted with signs meeting applicable standards, including the radiation symbol, and the words "CAUTION - RADIOACTIVE MATERIALS AREA" or "DANGER - RADIOACTIVE MATERIALS."

7.3 Radiation Area

Radiation Area means any area, accessible to personnel, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mRem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Entrance to Radiation Areas will be conspicuously posted with "CAUTION - RADIATION AREA" signs.

7.4 Contaminated Area

A contamination area is an area which contains radioactive material which can spread. The amount of contamination is measured in disintegrations per minute per 100 cm^2. Contamination above the lowest radionuclide specific limits in Table 7-1 will constitute a contamination area. The area will be isolated and posted. The posting will read "CAUTION - CONTAMINATED AREA".

7.5 Airborne Radioactivity

Areas accessible to personnel, such as a room, enclosure, or area will be posted as *Airborne Radioactivity Areas* if airborne radioactivity composed wholly or partly of licensed material exists in concentrations:

(1) In excess of the derived air concentrations (DACs) specified in Appendix B of 10 CFR 20.

(2) To such a degree that an individual present in an area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC hours.

Each Airborne Radioactivity Area must be posted with signs meeting applicable standards,including the radiation symbol, and the words "CAUTION - AIRBORNE RADIOACTIVITY AREA".

Additional instructions or requirements such as "RWP required"," TLD required," "Contact Health Physics Prior to Entry," as appropriate, may be attached as inserts to each of the above specified postings.

TABLE 7-1
RADIOLOGICAL CONTAMINATION LIMITS AND SELECTION OF PERSONNEL PROTECTIVE EQUIPMENT

PPE	DIRECT RADIATION LEVELS	RADIOACTIVITY	
		LOOSE SURFACE CONTAMINATION	AIRBORNE
None	<0.01 mR/hr	<1,000 dpm/100 cm^2 β-γ <20 dpm/100 cm^2 α soil contamination of $\leq$ radionuclide specific concentration limit	10% of 10 CFR 20, Appendix B, Table 1 Limit
TLD	>0.01 mR/hr above background	<1,000 dpm/100 cm^2 β-γ <20 dpm/100 cm^2 α soil contamination of $\leq$ radionuclide specific concentration limit	--
TLD, shoecovers, gloves, coveralls and head covering	>0.01 mR/hr above background	$\geq$1,000 dpm/100 cm^2 β-γ $\geq$20 dpm/100 cm^2 α to 10,000 dpm/100 cm^2 β-γ 200 dpm/100 cm^2 α or soil contamination of > radionuclide specific concentration limit	10% of 10 CFR 20, Appendix B, Table 1 Limit
TLD, double shoe, double gloves, coveralls, head covering, hood, half face respirator	--	>10,000 dpm/100 cm^2 β-γ >200 dpm/100 cm^2 α soil contamination of > radionuclide specific concentration limit	10 CFR 20, Appendix B, Table 1 Limit
TLD, double shoecovers, double gloves, double coveralls, head cover, hood, full face respirator	--	>100,000 dpm/100 cm^2 β-γ >2,000 dpm/100 cm^2 α or soil contamination of > radionuclide specific concentration limit	10 times 10 CFR 20, Appendix B, Table 1 Limit
TLD, double shoecovers, double gloves, double coveralls, head cover, hood, airline respirator or SCBA	--	soil contamination of > radionuclide specific concentration limit	50 times 10 CFR 20, Appendix B, Table 1 Limit

8.0 RADIATION WORK PERMITS

8.1 Introduction

The Radiation Work Permit (RWP) is a administrative tool used to control work occurring inside the radiologically restricted area and to make all of the personnel involved with the work aware of specific hazards and precautions in the specific work area. Additionally, the RWP will instruct the workers as to what protective equipment may be needed and what monitoring will be required.

An RWP will be required for any of the following conditions:

- Entering a radiation area.
- Entering a contaminated area.
- Entering an airborne radioactivity area.
- Unknown radiological conditions in an area to be entered or equipment to be opened.

8.2 Work Control

All work will be administratively controlled via RWPs. RWPs will be issued daily or weekly, depending on the length of the work task, and reviewed daily by the PRSO or his designee. The RWP will list the following information:

(1) Task(s) to be performed.

(2) Location of Task(s).

(3) Radiological Hazards Involved with Task(s).

(4) Most Recent Radiation Survey Results.

(5) Required Personnel Protective Equipment.

(6) Special Units or Restraints.

(7) Signature of the RSO or his designee.

(8) Signature(s) of the individual(s) performing the required work

A daily safety meeting will be conducted with all workers to review safety and radiological conditions and/or changes to the RWP as appropriate.

An RWP will be issued at the start of remediation operations and daily or weekly thereafter. The RWP will be terminated at the end of 24-hour or 7 days or when conditions change.

9.0 EXTERNAL RADIATION EXPOSURE LIMITS AND CONTROL

9.1 Introduction

Control of exposure to ionizing radiation is based on the assumption that any dose received as a result of exposure involves some incremental risk; however, exposure within acceptable limits represents a very small increase in risk compared to the normal hazards of life. Therefore, it is the objective of the B. Koh & Associates, Inc. Radiological Protection and Control Plan not only to maintain exposures within the limits established by Federal and State law, but also to minimize exposures to individuals, the total work force and the general population in accordance with the as low as reasonably achievable (ALARA) principle.

Site operations will be controlled such that no member of the public and no worker will exceed any 10 CFR 20 non-occupational and occupational limit (NRC, January 1994) respectively and the total of all workers' exposures will be limited to the lowest reasonably achievable. To ensure worker exposures will be limited to the lowest reasonably achievable, at any time during the project activities the radiation level exceeds 1 mR/hour, site work will be immediately stopped. An evaluation of the safety and health effects due to the abnormal radiation level will be performed and documented. Further remediation activities may proceed with the approval of the Project Radiological Safety Officer, after the evaluation is completed.

In addition, remediation activities will be controlled such that there will be no release to the environment of airborne radioactivity greater than the concentration limit of 10 CFR 20, Appendix B, Table 2, Column 1 or no release to surrounding water of radioactive liquids greater than 10 CFR 20, Appendix B, Table 2, Column 2 limits.

9.1.1 Control of Personnel Exposure

9.1.1.1 Exposure to Radiation Workers

9.1.1.1.1 Occupational Radiation Exposure Limits

Radiation exposure limits are used for controlling personnel exposure to radiation (excluding medical and dental exposures) to levels which are believed to pose no significant risk even if the employee was exposed to these levels throughout his/her entire working life. These limits are based on those promulgated by Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation." Personnel should endeavor to maintain their own exposures as low as reasonably achievable and below these limits.

The occupational exposure limits (10 CFR 20.1201(a)) and the B. Koh & Associates, Inc. administrative exposure limits for radiation workers to external radiation are given in Table 9-1. It will be the goal of the B. Koh & Associates, Inc. to maintain individual radiation exposure to less than 1 Rem per year.

As stated previously, Table 9-1 lists the B. Koh & Associates, Inc. administrative limits for occupational radiation exposure. These limits are less than or equal to those specified in 10 CFR 20. These administrative limits will be the operating limitations for exposure to all personnel. No employee will

exceed these limits without receipt of a formal written extension of allowable exposure by the Project Radiation Safety Officer (PRSO) or his designee.

9.1.1.1.2 Occupational Radiation Exposure Controls

To maintain personnel radiation exposures as low as reasonably achievable (ALARA), B. Koh & Associates, Inc. may choose to have more restrictive radiation exposure limits.

The three most important methods to minimize exposure in fulfillment of ALARA objectives are the proper use of time, distance, and shielding. Each of these items is discussed below.

- Time. The less time an individual spends in a radiation area, the less exposure to radiation he/she will receive. To fully utilize the time that is spent in radiation areas, all jobs should be preplanned. Such preplanning should include:

  1. Making sure all the tools and equipment required for the job are obtained prior to entering the area.

  2. Being familiar with the equipment and work plans prior to entering the area.

  3. Knowing the radiation levels as well as component location prior to entering the area.

- Distance. Exposure to radiation can be significantly reduced by keeping as much distance between the individual worker and source as possible.

- Shielding. The third method of controlling/minimizing radiation exposure is by means of shielding. B. Koh & Associates, Inc. will utilize shielding as necessary to limit exposure to personnel.

9.1.1.1.3 Personnel Monitoring for External Radiation

The purpose of personnel monitoring for external radiation is to provide an indication of the level of external radiation to which an individual has been exposed.

Upon the initial site visit by each radiation worker, a USNRC Form 4 (or equivalent) will be completed and signed. Exposures to the worker during the course of the project activities will be documented on a USNRC Form 5 (or equivalent).

9.1.1.2 Exposure to Minors

The annual occupational dose limits for minors specified in 10 CFR 20.1207 is 10 percent of the annual dose limits specified for adult workers.

However, to minimize exposures to minors, individuals under the age of 18 are not permitted to enter any restricted area or any radiation area at the B. Koh & Associates, Inc. Project sites without the authorization of the PRSO.

9.1.1.3 Exposure to Unborn Child

Because of the high radiosensitivity of newly formed and fast growing cells, female employees who work in controlled areas and their supervisors will be advised of the National Council on Radiation Protection and Measurement recommendations to keep radiation exposure to an embryo or fetus to the very lowest practical level during the entire gestation period and to limit the dose to the unborn child to a maximum 500 mrem or less during the entire period of pregnancy as specified in 10 CFR 20.1208 (a).

The dose to an embryo will be taken as the sum of the deep dose equivalent to the declared pregnant woman and the dose to the embryo/fetus from radionuclides in the declared pregnant woman.

The B. Koh & Associates, Inc. policies regarding exposure to an embryo or fetus are derived from those of Regulatory Guide 8.13 and 8.36 and are very strict in limiting the exposure of fertile females.

These policies are in place to protect the unborn child.

- As stated in 10 CFR 20.1003, a "declared pregnant woman" is a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

- Upon declaration of pregnancy, it is the responsibility of B. Koh & Associates, Inc. management to insure that all proper precautions are taken to minimize exposure to the unborn child of the female employee.

As part of the radiation safety training (and reverification training) and prior to issuance of TLDs, all personnel authorized to receive radiation exposure will be given specific instruction about prenatal exposure risks to a developing embryo and fetus. This instruction will include both orally and in writing, the applicable information contained in the Appendix to U.S. Nuclear Commission Guide 8.13 (see Figure 9-1).

The signed statements will be kept with the training records and will be retained by B. Koh & Associates, Inc. as part of the Project Files.

9.1.1.4 Exposure to Visitors

B. Koh & Associates, Inc. will control the exposure of visitors to its worksites to levels as low as reasonably achievable (ALARA). For exposure control purposes a "visitor" is defined as any person not qualified as a "radiation worker" and who requires access to restricted areas.

Entry by a visitor to a control area will require the following:

(1) Assignment of a temporary TLD badge or self-reading dosimeter;

(2) Escort by a qualified radiation worker at all times while in the restricted area

(3) Documentation of the following information:

(a) Name

(b) Social Security Number

(c) Date of Visit

Visitors are not allowed access to any area where there is a significant risk of internal deposition of radioactive material.

If repeated entries to restricted areas are required by a visitor, over periods exceeding two weeks, a temporary TLD can be issued if the visitor meets the appropriate requirements for a radiation worker.

9.2 Personnel External Exposure Monitoring

9.2.1 Equipment

As stated previously, the purpose of personnel monitoring for external radiation is to provide an indication of the level of external radiation to which an individual has been exposed. Monitoring for external radiation exposure will be accomplished with the use of primary dosimetry and radiation survey dose rate meters. The primary dosimeter for this project will be the thermoluminescent dosimetry badge (TLD) capable of measuring the worker's whole-body (deep and shallow dose equivalent) exposure.

Other devices that will be available for exposure control are self reading dosimeters and dose rate survey meters. The self reading dosimeters will be used by visitors to the site and as directed by the PRSO.

The radiation survey dose rate meter for this project will have a minimum detection rate of 2 μR/hr, an accuracy of $\pm$ 10%, and a response time of 15 seconds. Radiation and/or contamination instrumentation and specifications are presented in Section 13.0.

9.2.2 Calibration

Portable dose rate survey instrumentation used to evaluate personnel exposure will be calibrated semi-annually by a qualified vendor in accordance with ANSI N42.17A-1989 guidance for each type of radiation of concern at the site. Portable instrumentation will be source checked each day the instrument is in use. All calibrations will be performed using standards traceable to the National Institute of Standards and Technology (NIST).

Self reading dosimeters will be tested semi-annually by a qualified vendor in accordance with ANSI N13.5-1972 (R 1989) guidance. TLD badges do not require field calibration, but must meet the performance criteria found in ANSI N13.15-1985.

9.2.3 Survey and Dosimetry Requirements

9.2.3.1 Surveys

Surveys for radiation levels and/or contamination levels will be performed using appropriate portable radiation survey dose rate meters prior to working on known or materials suspected of being contaminated to assess the level of hazards and aid in the establishment of appropriate radiological controls.

These surveys will be performed by qualified individuals using calibrated instruments and in accordance with approved procedures.

9.2.3.2 Dosimetry

Consistent with 10 CFR 20.1502, all personnel who are likely to receive, in one year from sources external to the body, a dose in excess of 10 percent of the limits specified in 10 CFR 20.1201(a) will be monitored by dosimeters. While it is unlikely that any worker will receive a dose in excess of 10 percent of the specified limits, the following personnel will be monitored with dosimeters:

(1) Personnel entering an area posted as a radiation area.

(2) Personnel who routinely remain in spaces immediately adjacent to radiation areas. Even though the general area radiation levels in the space are less than one mRem per hour, personnel will be monitored.

(3) Personnel who directly handle or touch radioactive material, or personnel in a controlled surface contamination area, even though they do not enter a radiation area. However, it is permissible for personnel to handle radiation survey instruments containing check sources without being monitored with dosimeters.

9.2.3.2.1 Thermoluminescent Dosimeter (TLD)

B. Koh & Associates, Inc. will use TLD badges to measure personnel radiation exposure for permanent record purposes. This TLD measures ionizing radiation by emitting a measurable amount of visible light which is directly proportional to the amount of incident radiation. This TLD measures both beta and gamma exposure. Extremity TLDs will be made available by B. Koh & Associates, Inc. if the need arises. Extremity TLDs will be TLD finger rings or TLDs oriented toward the source of radiation as much as practical without causing damage to the devices during use.

The results of the TLD badge measurements are the basis of the legal record of an employee's exposure. Therefore, any deliberate action by an employee which invalidates the TLD measurements is cause for disciplinary action.

An individual's permanent TLD badge will be worn on the front of the body between the waist and neck, facing away from the body. TLD badges are to be placed in the special onsite storage rack when not being used. TLD badges are not to be taken offsite (i.e., home, car).

All personnel required to regularly enter and work in the radiologically restricted area will be provided with a primary dosimeter (TLD). This dosimeter will be worn daily throughout the duration of the project. Dosimetry will be analyzed quarterly or at the time of employee termination (whichever is earlier) to determine radiation exposure of the individual. Visitors will be assigned a temporary dosimeter (TLD) or a self-reading dosimeter (SRD).

9.2.3.2.1.1 Issuance

Workers will not be issued a TLD until the worker has:

- Provided evidence of the physical fit for duty and fit for respirator use (when required)
- Successfully passed the Radiation Workers Training course (score of 80% or higher)
- Completed NRC Form 4
- Provided a urine sample for baseline bioassay

All employees upon permanent departure from the project will turn in dosimetry and provide a urine sample for closeout bioassay.

9.2.3.2.1.2 Loss or Damage of TLDs

Each instance of a lost or damaged personnel TLD will be reported promptly to radiological control personnel.

Individuals who lose or damage their TLD while in a restricted area will immediately exit the area and report the condition to the RCT. The individual will be restricted from entering restricted areas until an exposure estimate has been completed and a new TLD issued.

9.2.3.2.1.3 Estimate of Dose

All exposures indicated by the TLD will be considered to have been received by the individual unless it can be clearly demonstrated to be erroneous.

If an exposure measurement result from a TLD is lost or proven erroneous, an estimate of the dose received by the individual during the period in question will be established by the RCS and documented as part of the employee's exposure record. An example of a Dose Evaluation Report is provided as Figure 9-2.

Estimates of dose received will consider at least the following:

(1) Dose rates in the individual's work area.

(2) Actions taken by the individual during the time for which dose information is desired. This review should include consideration of work position, time in restricted areas, etc.

(3) Doses received by other personnel doing similar work in the area.

9.2.3.2.1.4 Wearing TLDs

The wearing of TLDs will be strictly enforced. TLDs will be worn on the front of the body between the waist and neck, facing away from the body. Any deliberate action by an employee which invalidates the TLD measurements is cause for disciplinary action.

9.2.3.2.1.5 Tracking Radiation Exposure

Prior to personnel performing work at a B. Koh & Associates, Inc. Project site, NRC Form 4, "Occupational External Radiation Exposure History," will be completed to determine personnel lifetime exposure. NRC Form 5, "Current Occupational External Radiation Exposure," will be completed to determine personnel exposure for the current year.

9.2.3.2.2 Self-Reading Pocket Dosimeters

Self-reading pocket dosimeters (SRPD) may be issued to individuals who enter controlled areas. These dosimeters, if used, will be utilized as required and will be returned to the Radiological Control Technician (RCT) for processing. If the SRPD is worn with a TLD, the SRPD will be worn next to the permanent TLD.

Pocket dosimeters, whether low or high range types, will be read by the wearer prior to entering radiation or high radiation areas and periodically thereafter to control his own radiation exposure while in these areas. To prevent offscale reading, low range dosimeters will be recharged whenever the reading exceeds 150 mRem.

9.2.4 Analysis

Dosimetry will be provided, processed and evaluated by an offsite dosimetry processor that:

(1) Holds current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NAVLAP) of the National Institute of Standards and Technology (NIST); and

(2) Approved for the type of radiation (gamma and high energy beta from depleted uranium) that most closely approximates the type of radiation for which the individual wearing the dosimeter is monitored.

Dosimeters will be processed on a quarterly basis or at the time of employee termination, whichever is earlier.

9.2.5 Recordkeeping

9.2.5.1 Dosimetry

When self reading dosimeters are used, the daily exposure will be recorded and tracked on a separate form for visitors and as a portion of the Radiation Work Permit (RWP) for radiation workers. Copies of TLD results (NRC Form 5) as they relate to a named employee will be maintained on site and available for inspection. Personnel monitoring reports will be maintained with guidance from NRC Regulatory Guide 8.7, Rev. 1, 1992.

Copies of individual exposure results (NRC Form 5) will be transmitted to each employee at the end of each year. Copies of NRC Form 4 (see Section 9.1.1.1) and Form 5 for individual workers will be maintained as part of the B. Koh & Associates, Inc. Project Files for the duration of the Project and until termination of the license.

9.2.5.2 Radiation and Contamination Surveys

Records of radiation and contamination surveys will include:

(1) Date and time of survey.
(2) Type(s) of instrument(s) used, including the model numbers and calibration information.
(3) Sketch and description of survey area.
(4) Contact and general exposure rates and/or contamination levels.
(5) Location of any boundaries and step-off pads.
(6) Name of survey performing individual and reviewing supervision.

A form that includes the information presented above will be developed for each project.

Records of all surveys will be maintained by B. Koh & Associates, Inc. for the duration of the Project and until termination of the license, if appropriate.

TABLE 9-1
RADIATION EXPOSURE LIMITS

WHOLE BODY	OCCUPATIONAL EXPOSURE LIMIT	B. KOH & ASSOCIATES, INC. ADMINISTRATIVE LIMITS
Total Effective Dose Equivalent	5 rem/yr	1 rem/yr
Sum of deep dose equivalent plus committed dose equivalent to any individual organ or tissue	50 rem/yr	5 rem/yr
Lens of eye, skin and extremities	15 rem/yr	1.5 rem/yr
Shallow dose	50 rem/yr	5 rem/yr
Minor	10% of occupational dose limits	10% of Administrative Dose Limits However, no minors are permitted to enter a restricted area*
Embryo/fetus	0.5 rem/gestation period	0.5 rem/gestation period
General public	0.1 rem/yr	0.1 rem/yr

*No minors are permitted to enter a restricted area without the authorization of the PRSO

FIGURE 9-1

PRENATAL EXPOSURE INSTRUCTIONS FORM

I, _____, acknowledge and understand the recommendation of the National Council on Radiation Protection and Measurements to limit radiation exposure to the unborn child to the very lowest practical level, not to exceed 0.5 Rem during the entire period of pregnancy, as contained in "Instructions Concerning Prenatal Radiation Exposure" Regulatory Guide 8.13.

_____
Signed

_____
Printed

_____
Social Security Number

_____
Witness

FIGURE 9-2

DOSE EVALUATION REPORT	Sheet _____ of _____ Rev _____ Date _____

Name _____ Social Security No. _____

Date of Birth _____ Company or Craft _____

Lost TLD ☐ No. _____ Neutron Dose Evaluation ☐

Lost Film Badge ☐ No. _____ Lost Dosimeter ☐ No. _____

Damaged ☐ (Describe) _____

DESCRIPTION OF OCCURRENCE

(Use additional sheets, if necessary, and check here if used ☐)

Summary of Available Records of Exposure (Give Survey Numbers, RWP Numbers, Dosimeter Readings, etc.)

(Use additional sheets, if necessary, and check here if used ☐)

ESTIMATED EXPOSURE

Evaluate above data and estimate Occupational External Radiation Exposure. Describe evaluation below and attach additional sheets, if necessary. Check here ☐ if used.

_____ Rem	_____ Rem	_____ Rem
Whole Body	Skin	Extremeties
_____	_____	_____
Employee	Supervisor	Investigator

ACTION

Personnel Monitoring Records Adjusted

Date _____

By _____

File This Report with Applicable Dosimetry Records for Period

10.0 INTERNAL RADIATION LIMITS AND EXPOSURE CONTROL

10.1 Introduction

It is the policy of B. Koh & Associates, Inc. to maintain the internal exposure of radioactive materials to ALARA. The use of engineering controls to the maximum extent possible will be employed. If engineering controls are not adequate, as demonstrated by work area air sampling, then respiratory protection will be considered to control internal exposures to radioactive materials. The effectiveness of the internal exposure control program will be confirmed through the use of air sampling surveys and bioassay.

Operations will be controlled such that no member of the public and no worker will exceed any 10 CFR 20 (NRC, January 1994) non-occupational and occupational limit, respectively, and the total of all workers' internal exposures will be limited to the lowest reasonably achievable.

10.2 Engineering Controls

Engineering controls will be utilized to the maximum extent possible to control the production of dusts during the remediation project. Engineering controls may be, but are not limited to using tarps or coverings, water misting or dust control additives.

10.3 Monitoring of Airborne Radioactivity

To demonstrate compliance with the limits specified in 10 CFR 20, Appendix B, Table 1, air sampling of the work areas will be performed daily during excavation, transfer or hauling solidification and placement activities. The frequency and location of sampling equipment will be dictated by the remediation activities that occur each day. An adequate number of samples will be collected to be representative of the air in the work area.

Representative samples will be collected daily in the general work areas, at the breathing zone (within 18") of workers and downwind of the work area at the restricted area boundary. If work involves the use of heavy equipment air samples will be collected in the operator's cabs daily or as directed by the PRSO. Work area air sample volumes will be a minimum of 36 cubic feet and collected using high volume, low volume or lapel air samplers as directed by the PRSO.

If work involves activities outside the operator cab or when deemed appropriate by the PRSO, representative samples will be collected daily in the general work area as close to the workers as practical.

If air sampling determines the possibility of an airborne release, then the PRSO will evaluate the possibility of an uptake. Evaluation will include, but not be limited to nasal smears and bioassay methods to determine exposures due to an uptake of the specific radionuclides.

To demonstrate compliance with the limits specified in 10 CFR 20, Appendix B, Table 2 during excavation, transfer or hauling solidification and placement operations site perimeter air samples will be

collected and analyzed daily. The sampler(s) will be positioned at appropriate locations downwind of the site to collect potential releases from the site.

One background sample will be collected daily from the upwind location to the remediation site. At a minimum, one sample will be collected downwind to the remediation site. The site perimeter air samplers will collect a minimum of 36 cubic feet using a low volume sampler. Downwind perimeter air samples will be collected during periods of site activities to verify that radionuclides above the established limits in 10 CFR 20, Appendix B, Table 2, Column 1 are not released from the site.

Air sample collection and analysis will be performed with qualified personnel using calibrated equipment/instrumentation and in accordance with approved procedures.

10.4 Equipment

Air sampling equipment will be calibrated in accordance with ANSI N13.1-1969 (R/1982) within six months of the start of the project and every six months thereafter. Flow rates for the air samplers will be variable from 0.5 to 20 CFM. The analysis of air samples will be performed with equipment capable of a minimum detectable activity of the radionuclide of concern. The analysis equipment will be calibrated in accordance with ANSI N42.17A-1989 guidance.

10.5 Analysis

Results of air samples will be compared with the limits given in Table 10-1. If the air sample results are above 10% of the 10 CFR 20, Appendix B limit, then the PRSO or PM will be notified.

10.6 Respiratory Protective Equipment

10.6.1 Selection

To maintain the internal exposure of radioactive materials to ALARA, engineering controls will be used to the maximum extent possible. If engineering controls are not adequate, as demonstrated by work area air sampling, then respiratory protection will be considered to control internal exposures to radioactive materials.

All respiratory protective equipment (RPE) will be recommended by the Project Radiation Safety Officer (PRSO) or his designee prior to the initiation of each new task or operation.

RPE will always be selected on the basis of hazard or presumed hazard. Whenever the degree of hazard can not be determined prior to task initiation, a conservative approach for protecting personnel will be assumed.

Respiratory equipment may be used to limit the potential for intake of radioactive materials. Protection factors as specified in 10 CFR 20, Appendix A will not be applied and potential exposures will be based upon measured volumes of contamination in the air. If B. Koh & Associates, Inc. determines a need to

take credit for the use of respiratory protection equipment (apply protection factors), it will notify Region III of the NRC in writing 30 days prior to using respiratory protection equipment for that purpose.

10.6.2 RPE Use

Consistent with the applicable portion of 10 CFR 20.1703, the following requirements will apply to the use of RPE at this project:

(1) RPE will only be used by those persons who have been examined by a licensed physician and found medically qualified to wear the prescribed equipment.

(2) Project personnel will use the prescribed RPE in accordance with their training and the requirements of the work permit.

(3) Only equipment recommended by the PRSO will be permitted.

(4) Only equipment that has been selected, maintained, and inspected prior to commencement of work will be permitted.

(5) Personnel will only be permitted to use equipment for which they have been adequately trained and fitted.

(6) Only equipment that has been properly fitted in accordance with the acceptable methods contained in NUREG-0041 will be permitted for use.

(7) Only equipment that has been adequately decontaminated will be permitted to be reused.

(8) Only approved RPE will be allowed for use during the remediation project.

(9) Only NIOSH and MSHA-approved respiratory equipment will be used.

(10) Communications (voice, visual, or signal line) will be maintained between all individuals present. Planning will be such that one individual, unaffected by any likely incident, will have the necessary resources to assist the others in case of any emergency.

(11) Respiratory protective equipment will not be worn when conditions exist that prevent a good face-to-facepiece seal.

(12) Cartridges and filters used in conjunction with air-purifying respirators will be changed daily, or upon increased breathing resistance; whichever comes first.

(13) No contact lenses will be permitted when wearing respiratory protection.

Additional requirements may be identified as work progresses.

10.6.3 Maintenance and Repair

All RPE will be maintained and repaired in accordance with the manufacturer's recommendations, using only manufacturer-approved replacement parts, by personnel who are knowledgeable in the maintenance/repair procedure to be performed. Some procedures may be performed by the user while other procedures must be performed by the manufacturer, or an authorized service center. The following subsections describe the maintenance procedures anticipated for this project.

10.6.3.1 Maintenance/Repair by the User

All personnel who have been issued RPE will be responsible for:

(1) Daily cleaning or disposal of assigned equipment.

(2) Cartridge/filter replacement.

(3) Proper storage of assigned equipment.

(4) Possession of assigned equipment.

(5) Requesting maintenance/repair as needed.

(6) Proper use/handling.

(7) Breathing-air replenishment.

(8) Periodic frisking for radioactive contamination.

10.6.3.2 Survey of Cleaned RPE

All RPE coming into contact with the skin will be surveyed for radioactive contamination prior to use by a qualified Radiation Controls Technician.

10.6.3.3 Maintenance/Repair by the Manufacturer

All equipment that cannot be maintained, serviced, or repaired by the user will be sent to the manufacturer or authorized service center for service. Some of the procedures that are not anticipated to be handled in-house include:

(1) High-pressure regulator maintenance/repair.

(2) Cylinder maintenance/repair.

(3) High-pressure hose maintenance/repair.

Prior to returning RPE to a manufacturer for repair, the equipment will be surveyed for radioactive contamination, decontaminated if necessary, and resurveyed for unrestricted release.

10.6.3.4 Inspection

All RPE will be inspected prior to each use and during cleanings/reassembly. In the case of respiratory protection, the content of inspections will be as prescribed by the manufacturer. In addition, all respirators will be periodically monitored for radioactive contamination. If airborne radioactivity is indicated by the airborne sampling program (Section 10.3), then respirators will be monitored for radioactive contamination after each use. This will be accomplished by direct surveying and swipe testing for loose contamination. Contaminated respirators will be decontaminated immediately and retested, prior to being used again. Decontamination will be in accordance with contamination limits presented in Chapter 11.0 (Table 11-1).

10.7 Training and Instructions

As part of the radiation worker training, individuals will be instructed in the proper donning and doffing of respirators. They will also be fit tested and instructed on the proper field test to be used to insure an adequate fit.

In addition, individuals will be instructed on the proper maintenance and cleaning of respirator.

The worker will also be advised that the worker may leave the work area any time for relief from respirator use in the event of respirator failure, physical/psychological distress or other emergency situations.

10.8 Bioassay

While it is not expected that internal exposures due to inhalation or ingestion (uptake) of U^{238} would exceed the limits specified in 10 CFR 20, Appendix B, Table 2, Columns 1, 2 and 3, bioassay methodology will be implemented to demonstrate compliance. This bioassay methodology will be consistent with the applicable portions of Regulatory Guide 8.9.

10.8.1 In-Vitro Bioassay

Urine samples will be collected from each radiation worker prior to start of work to establish a baseline measurement of radioactive material (if any) within the individual body. Urine samples may also be taken more frequently (e.g., annually) from B. Koh & Associates, Inc. radiation workers and other contractor remediation workers as designated by the PRSO to monitor possible intake. A final urine sample will be collected from each worker a the time of termination to demonstrate compliance with the specified limits and to ensure that any unknown intakes are quantified. A urine sample will also be collected any time there is a suspect ingestion or inhalation of contaminated material.

10.8.2 In-Vivo Bioassay

In-vivo (lung/whole body) counting will be performed by a qualified vendor or facility, if urinalysis is not possible or sufficient.

Results of each worker pre employment and past employment bioassays will be maintained as part of the Project files and will be available for the worker to review.

10.8.3 Special Internal Dosimetry Evaluation

Personnel who are involved in radiological work will have internal dosimetry evaluations when internal contamination is confirmed or suspected, in accordance with the following criteria:

A urinalysis or lung count will be required in the following circumstances:

(1) Whenever personnel are exposed to airborne radioactivity above the limits in 10 CFR 20, Appendix B.

(2) Whenever personnel are exposed to high airborne concentrations exceeding protection provided by respiratory equipment being worn.

(3) Whenever nasal swabs or personnel frisking indicates detectable counts of alpha or beta-gamma activity.

(4) Whenever the Project Radiation Safety Officer or his designee feels that internal monitoring is needed.

When in-vivo examinations are required as a result of internal contamination, the involved personnel will be transported directly to the whole body counter facility as soon as practicable after the incident. Additionally, in-vitro fecal sampling may be required if the urinalysis or in-vivo examination indicates internal contamination.

10.8.4 Dose Commitment

When an internal deposition is detected, the employee's committed effective dose equivalent (CEDE) will be estimated by methods using metabolic modeling consistent with reports 26, 30 and 54 of the International Commission on Radiological Protection (ICRP) and Regulatory Guide 8.9. The calculated CEDE will be reported to the employee and will become a part of his/her exposure history file (NRC Form 5).

10.9 Work Restriction

An employee may have his radiation work activities altered or limited as a result of:

(1) Approaching the control levels specified in Section 9.1.1 and 10.1.

(2) Unknown exposure status.

(3) Increased potential for internal deposition, such as an open skin break.

(4) Repeated violations of radiological or general safety requirements.

The RCS is responsible for implementing work restrictions, when necessary. The employee's supervisor will be notified in writing that a work restriction has been imposed within hours of determining the need for a restriction. Copies of work restrictions will be maintained in the employee's dosimetry record.

No person will exceed the administrative control levels of Section 9.1 without prior written approval of the RCS and the SS.

An employee whose exposure status is unknown (e.g., lost dosimeter) will not enter a controlled area until his/her current exposure status is determined by the RCS.

When an employee has an internal deposition of a radioisotope induced for medical diagnostic purposes, he/she will be restricted from wearing a TLD until the medical isotope is eliminated from the body. This is done to avoid including exposure from the medical isotope to that exposure received from this contact with radioactive material.

Employees who work with radioactive materials will report any skin breaks which they may have to their immediate supervisor and radiological controls personnel. Skin breaks include unhealed wounds, open cracks from chapping, injuries such as lacerations, abrasions, punctures, and blisters or burns. A clearly open wound will be sufficient reason to prohibit entry to a controlled area, irrespective of protective clothing or medical dressings.

Safeguards will be maintained by supervision to minimize the likelihood of accidental introduction of radioactive materials beneath the skin. If the skin is broken while working with radioactive materials, the employee will immediately report to his immediate supervisor who will have the skin break surveyed by an RCT. The RCS will determine if additional followup action is required.

Contaminated personnel will be decontaminated in accordance with the approved procedures listed in Chapter 11.0 (Table 11-2).

TABLE 10-1
AIR MONITORING/SAMPLING ACTION LEVELS

TYPE OF MEASUREMENT	READING	ACTION
TLD - Personnel	>50 mrem/qtr	• Investigate exposure source(s), evaluate tasks/operations involving potential for exposure, establish ALARA controls to reduce exposures as appropriate. • Notify PM and RSO.
TLD - Project Site Perimeter	2 times background	• Determine source and evaluate impact on public. • Notify PM and RSO.
Work Area Air Samples for Particulate Radioactivity	Administrative Limit (50% of 10 CFR 20 limit) (1×10^{-11} μCi/ml)	• Investigate additional engineering. methods to reduce exposure to airborne materials. • Notify PM and RSO. • Increase frequency of work site air sampling.
Work Area Air Samples for Particulate Radioactivity	0.10 to 0.25 of 10 CFR 20 limit (2×10^{-12} μCi/ml to 5×10^{-12} μCi/ml)	• Investigate the need for respiratory protection. • Notify PM and RSO.
Perimeter sampling for Particulate Radioactivity	>0.5 of 10 CFR 20 limit (3×10^{-14} μCi/ml)	• Notify PM and RSO. • Evaluate controls of off-site emissions and modify as appropriate.

11.0 CONTAMINATION CONTROL

11.1 Introduction

Control of radioactive materials is needed to minimize the spread of contamination. When radioactive contamination is spread, the potential for an individuals exposure to radiation will increase. In the event that radioactive contamination is spread, then decontamination efforts will be implemented.

Decontamination may be required whenever personnel and equipment exit potentially or known contaminated areas of the project site. Proper decontamination will be necessary to minimize the potential for transfer of contaminants to previously unaffected areas, and for personal protection. The subsections below present the personal and equipment decontamination requirements applicable to this project.

11.2 Contamination Control

To the maximum extent possible, all radioactive contamination will be kept to a minimum. Spills of radioactive materials will be isolated and cleaned up as quickly as possible. All equipment and personnel exiting the radiologically restricted area will be monitored for contamination. Limits for contamination and associated personnel protective equipment are given in Table 11-1.

11.3 Equipment Decontamination

11.3.1 General

All equipment used on site will be thoroughly decontaminated prior to being cleared for release from the project site. This requirement will apply to all equipment, including (but not limited to) the following:

(1) Vehicles and heavy equipment.

(2) Contaminated materials transport equipment (conveyors, hoppers, piping, containers, etc.).

(3) Air monitoring instruments.

(4) Sampling apparatuses.

(5) Hand tools.

The degree of decontamination necessary will vary on the type of equipment involved, and on its uses relative to the amount of contamination that may have occurred.

11.3.2 Requirements

Small items of equipment (i.e., hand-held items such as hand tools and air monitoring instruments) will be taken to the personnel decontamination area and decontaminated by the user(s) upon entry into the Personal Decontamination Pad. Larger items such as vehicles will be taken to the Equipment Decontamination Pad.

Small items will be protected from contacting contamination to the extent possible through practices such as bagging instruments or taping (if applicable/possible), and avoidance of setting items on potentially-contaminated surfaces. Decontamination of small items will typically involve a soap and water wash and a clean water rinse, followed by instrument frisking/screening.

Exceptions to these requirements may include:

(1) Items made of absorbent materials (i.e., wooden handles on tools, etc.) may be discarded and not subjected to decontamination efforts after reasonable effort is made to decontaminate. Absorbent materials in the contamination area should be kept to a minimum.

(2) Items that require special decontamination procedures, such as samples and/or sampling apparatus.

Large items of equipment (i.e., site vehicles, bulldozers, backhoes, etc.) will undergo decontamination at the Equipment Decontamination Pad. The procedures utilized at this location will include high-pressure steam cleaning of all exterior surfaces. Pre- and post-instrument screening/frisking will be performed to identify potential "hot" spots from a radiological standpoint. These measurements will be taken on both exterior and accessible interior surfaces.

Additional guidance regarding personnel decontamination is contained in the B. Koh & Associates, Inc. Surface Contamination Procedure.

11.3.3 Contaminated Release Limits

Guidance for specific radionuclide contamination limits for materials and equipment are specified in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Materials" *(NRC, August 1987)*. (See Table 11-1 for guidance on contamination limits.)

11.4 Personnel Decontamination

11.4.1 General

It is not expected that personnel exiting the radiological control zones will be contaminated after removal of the outer layer of protective clothing. However, if personnel are determined to be contaminated then personnel decontamination procedures will be performed (see Table 11-2).

The only exception to this requirement would be in the event of an extreme emergency when the urgency of the situation outweighs the need for decontamination. An example of this is a medical emergency where medical attention requires priority treatment.

11.4.2 Procedures

Personnel decontamination protocol will be comprised of removing items of personal protective equipment and clothing (tyvek and outer boots), followed by surveying for radioactive contamination. Radiological survey instrumentation and specifications are presented in Section 13.0. Personnel contaminated above the limits specified in Table 11-1 will be decontaminated using the procedures specified in Table 11-2.

All personnel will receive training in proper decontamination procedures and sequences as part of the site-specific training for this project.

11.4.3 Facilities

Personal decontamination facilities will consist of as a minimum, a bermed area lined with plastic. The decontamination facility will have provisions for containers containing soapy water, rinse water and receptacles for waste, water and trash. All materials will be tested for radioactive contamination prior to release from the decontamination facility.

11.5 Reuse of Personal Protective Equipment (PPE)

Reuse of items of personal protective equipment (PPE) will be permitted, provided that such items are successfully decontaminated, and that they satisfactorily pass the instrument screening/frisking process. Examples of PPE items that may be reused include:

(1) Hardhats.

(2) Respirators (exception: air-purifying respirator cartridges).

(3) Work boots.

(4) Boot covers.

(5) Eye and face protection.

(6) Ear protection (exception: disposable ear plugs).

(7) Cloth coveralls and/or Tyvek.

(8) Work gloves.

Items that cannot be properly decontaminated will be handled as waste products, containerized, and will be disposed of in accordance with B. Koh & Associates, Inc. requirements for disposal of radioactive waste.

11.6 Confiscation of Contaminated Articles

All site personnel will be made aware, as part of site-specific training that any item brought on site may be confiscated if it becomes radioactively contaminated and cannot be successfully decontaminated. In this regard, site personnel will be informed that personal articles should not be brought on site.

11.7 PPE Requirements for Decontamination Areas

Personnel working in decontamination areas during decontamination operations will need to utilize items of PPE to protect themselves from the contaminants that may be present on the surfaces that are being decontaminated. PPE requirements for personnel working in the personnel decontamination areas will generally be consistent with the items of PPE worn by the workers being decontaminated. For those workers assigned to the equipment decontamination pad, an increased potential for contact with liquids exists due to the use of a high-pressure steam generator. Therefore, minimum PPE requirements for workers in this area will typically involve:

(1) Hooded coveralls, made of moisture-repellant material or rain suits.

(2) Full-face shield.

(3) Boot covers.

(4) Moisture-resistant gloves.

These PPE requirements may be modified based on project site conditions including the use of full-face air-purifying respirators as conditions warrant.

11.8 Personal Hygiene

Due to the nature of operations and contaminants involved at this site, practicing sound personal hygiene will be emphasized to all site workers both initially during site training, and on an on-going basis.

Eating, drinking, chewing gum or tobacco, and smoking will be prohibited in the contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists.

11.9 Personal Contamination (Frisking and Decontamination)

As part of Radiation Worker Training, all personnel will be instructed in the proper method of removing outer clothing/tyveks and boot covers and monitoring for personal contamination as part of the formal

radiation safety training program. Friskers (personal contamination monitors) will be available at each exit from a controlled area. Instructions will be provided at each personal frisking station. Instrumentation/specification of instruments used to monitor for personal contamination are presented in Section 13.0.

In the event that personnel contamination is suspected or found, the RCT will be notified and appropriate action as directed by the PRSO be taken. Table 11-1 gives contamination levels for personnel contamination. Table 11-2 provides guidance for skin decontamination methods.

11.10 Waste Minimization

As a result of carrying out the project activities at the B. Koh and Associates Inc., site, radioactive waste in the form of protective clothing, rags, gloves, wipes, tools and equipment will be generated.

It is B. Koh & Associates, Inc. policy to minimize the amount of radioactive waste to the extent practical. To achieve this objective, the following guidance is offered:

- Radwaste receptacles are for contaminated trash only. Do not throw clean trash into these containers.

- Take only the amount of material (bags, wipes, rags, etc.) that you need to perform the immediate job. Avoid taking bulk volumes of material into the contaminated area.

- Bag or tape tools or equipment to minimize the potential for the article to become contaminated.

- Reuse to the extent possible tools and equipment that is already contaminated. Reuse of contaminated tools and equipment will reduce the amount of radioactive material contaminated.

- All tools and equipment removed from contaminated areas must be surveyed by Radiological Control personnel prior to removal to determine if they are contaminated. Contaminated tools and equipment should be stored for future use and contaminated trash should be disposed of as radwaste. Tools, equipment, and trash that are frisked "clean" may be stored or discarded as everyday non-radioactive material.

- If cleaning solutions are to be used for decontamination purposes, make sure that the solution is not a hazardous chemical that will generate a "mixed waste" if it becomes contaminated with radioactivity and has been declared waste. A water based decontamination solution is the preferred option.

TABLE 11-1
RADIOACTIVE CONTAMINATION LIMITS

NUCLIDES[a]	AVERAGE[b, d, f]	MAXIMUM[b, d, f]	REMOVABLE[b, e, f]
Equipment: U-nat, U-235, U-238 and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2
Personnel	200 dpm $\beta\gamma$ 20 dpm α		

[a] *Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.*

[b] *As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.*

[c] *Measurements of average contaminant should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each such object.*

[d] *The maximum contamination level applies to an area of not more than 100 cm^2.*

[e] *The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.*

[f] *The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.*

TABLE 11-2
TABLE OF SKIN DECONTAMINATION METHODS

METHOD	ADMINISTRATING PERSON	EFFECTIVE FOR	INSTRUCTIONS
Masking Tape	RC Technician	Visible Particulate	Apply tape to skin by light patting. Remove carefully.
Waterless Hand Cleaner	RC Technician	All Skin Contamination	Apply to affected area and allow it to melt onto skin. Remove with cotton or soft disposable towel.
Soap and Tepid Water	RC Technician	All Skin Contamination	Wash area with low alkaline, non-abrasive soap and tepid water. Repeat until further attempts do not reduce the level. A surgical hand brush may be used with moderate pressure.
Cornmeal Detergent Paste	RC Technician	All Skin Contamination	Mix cornmeal and powder detergent in equal parts with enough water to form a paste. Put onto affected area for five (5) minutes. Remove with cotton or disposable towel. Rinse skin.
Shampoo	RC Technician	Hair Contamination	Wash hair and rinse. Repeat as necessary. Remove any hair that cannot be decontaminated. DO NOT SHAVE HAIR. Cut hair as close to the skin as possible with scissors.
Nose Blowing	Individual	Nasal Contamination	Blow nose into a rag, tissue, kim wipe, etc. Monitor tissue after attempt. Stop when no increase in activity is noted.

TABLE 11-2 (continued)
TABLE OF SKIN DECONTAMINATION METHODS

METHOD	ADMINISTRATING PERSON	EFFECTIVE FOR	INSTRUCTIONS
Titanium Dioxide Paste	Medical Personnel	Fission Product Contamination	Form a paste of Titanium Dioxide powder and water. Apply small amounts of water to paste to keep it moist whole massaging it onto area. Continue massage for five (5) minutes. Remove paste with cotton. Rinse thoroughly with lukewarm water followed by a wash with soap and water.
EDTA Cream*	Medical Personnel	Fission Product Contamination	Mix a cream consisting of 1% EDTA, 3% powdered detergent, 8% Carboxy-Methyl-Cellulose, and 8% distilled water. Scrub area with cream. Remove with cotton.
Potassium	Medical	Alpha	Mix an equal volume of a saturated solution of Potassium Permanganate (6.4 grams) $KMnO_4$/100 ml water) with 1% Sulfuric Acid solution (0.2N). Pour this solution over WET contaminated areas. Rub lightly for several minutes with surgical hand brush. Rinse with tepid water to remove the resulting brown stain. Pour a freshly prepared 5% Sodium Bisulfite solution (10 g $NaHSO_3$/200 ml water). Rinse with tepid water and scrub lightly for several minutes. This procedure may be repeated several times without harm. Limit washing to 2 minutes each.

* *Note: Do not use EDTA on halogens such as I^{131} contamination*

12.0 RADIATION SURVEYS

12.1 Introduction

In order to adequately determine the extent of the radiation hazard for the B. Koh & Associates, Inc. Projects and to ensure that personnel do not exceed the 10 CFR 20.1201(a) limits or unnecessary exposure to radiation, routine and non-routine radiation surveys will be performed. These surveys will consist of direct radiation surveys, total and loose contamination surveys and airborne radiation surveys.

Specific procedures will be developed to perform each of the surveys needed to provide adequate information to determine the true extent of the radiation hazard at the B. Koh & Associates, Inc. Project sites and to minimize personnel exposure to as low as reasonably achievable (ALARA). The routine and non-routine radiation surveys will be performed by qualified individuals using calibrated equipment/instruments and in accordance with approved procedures.

The radiation survey program is designed to provide the following;

(1) Provide a means for analyzing trends of the site radiological conditions.

(2) Informs the workers of existing radiological hazards at the site and in their work area.

(3) Verifies that the radioactive material is being adequately controlled and not spreading to uncontrolled areas.

(4) Verifies the effectiveness of contamination controls.

(5) Verifies the effectiveness of engineering controls and/or respiratory protection.

12.2 General Requirements and Standards

(1) Surveys will only be conducted by individuals specifically trained in the use of radiation monitoring equipment.

(2) Surveys are classified as routine and non-routine surveys. Routine surveys are surveys performed on a regular basis while non-routine surveys are performed as necessary to support remediation activities. A schedule of routine surveys will be developed by the PRSO.

(3) Surveys will be performed with instruments calibrated for the type and energy of the radiation being monitored.

(4) A sufficient number of survey points will be taken in order to adequately assess the radiological status of the area being surveyed.

(5) Radiological postings and other control measures should be reviewed for adequacy following surveying. The posting will be updated as needed or at the direction of the PRSO.

(6) All radiological surveys will be recorded on standard forms. The forms will contain spaces for the following information:

(7) Date and time.

(8) Name of survey and surveyor.

(9) Space for sketches or drawings of material or areas to be surveyed.

(10) Space for survey results.

(11) Space for the instrument(s) being used, serial numbers, calibration date(s), background(s) and efficiencies.

Continuation sheets can be used to complete survey information, however continuation sheets will contain enough information to tie it to the cover sheet.

12.3 Radiation Surveys

Radiation surveys will be performed at predetermined points in active work areas and adjacent areas whenever operations are performed that have the potential for changing radiation or contamination levels.

12.3.1 Survey Frequencies

Radiation surveys are performed as necessary to ensure personnel do not exceed radiation exposure limits and to meet requirements for posting radiation areas. These surveys are performed to determine whether abnormal radiation levels exist and to determine the extent and magnitude of radiation levels. The following surveys will be the minimum performed.

12.3.1.1 Facilities Containing Radioactive Material

Radiation surveys will be performed to control radiation exposure whenever operations are performed that might be expected to change existing radiation levels. Examples of such operations include accumulation of waste and relocation of highly radioactive materials.

Temporary boundaries (e.g., rope boundaries) of radiation areas will be surveyed weekly to ensure controlled areas do not extend beyond posted boundaries.

Gamma surveys and contamination control surveys will be performed at least weekly in occupied posted radiation areas, in all occupied areas of radiological facilities, and in radioactive material short-term storage areas. Long-term storage areas will be surveyed at least monthly.

Other surveys will be performed as necessary to control personnel exposure to gamma, beta and alpha radiation.

12.3.1.2 During Casualties

Radiation surveys will be performed as necessary to access the extent and magnitude of a radiation condition in the event of an accident which might cause abnormal radiation levels.

12.3.1.3 Records

Records of radiation surveys will be retained until the end of the job and submitted to B. Koh & Associates, Inc. The survey information will be recorded on a standard form, if specified, or on locally prepared forms which contain at least the following information:

- Date and time of survey.
- Reason for survey and type of radiation measured (e.g., weekly gamma).
- Type and identifying number of instruments used.
- Instrument calibration due dates.
- Location (will be shown on a survey map or listed in a table).
- Radiation level measured.
- Remarks.
- Signature of surveyor.
- Signature of persons reviewing results (e.g., Radiological Control Supervisor).

12.3.2 Safety Precautions

The following safety precautions will be observed by personnel using portable radiation monitoring equipment.

(1) Only personnel trained in the use of portable radiation monitoring equipment will be allowed to use this equipment. As a minimum, training will consist of a lecture on the use of the instrument, the meaning of its measurements, a demonstration of its proper handling, and a period of supervised use.

(2) Damage to or loss of radioactive source can result in spreading, inhaling, or ingesting contamination. Therefore, radioactive sources require careful handling and accountability control. If a source is lost, immediate steps will be taken to recover the source and minimize radiation exposure to or contamination of personnel as a result of the lost source.

(3) Except for sources which are permanently attached to monitoring instruments, check sources which are not in use will be kept in a locked cabinet. The number of keys will be kept at a minimum. Combination locks are permitted and, when used, the number of personnel having the combination will be kept to a minimum.

12.3.3 Calibration and Maintenance of Survey Instruments

Radiological control supervisory personnel will ensure that the appropriate survey instruments are available, functional, and calibrated using accepted standards for performing radiation surveys.

The types and uses of specific radiation monitoring devices recommended for use are listed in Section 13.2.

12.4 Airborne Radioactivity Surveys

Airborne radioactivity surveys (monitoring/sampling) provide assurance that airborne radioactivity is adequately controlled. The airborne survey consists of drawing a known volume of air through a 0.5 micron, 47 mm diameter (or equivalent) air filter and analyzing the air filter for appropriate radionuclides. Additionally, the airborne survey can act as a guide in the selection of the appropriate respiratory protection equipment.

12.5 Final Verification Survey

Final verification surveys of the surface impoundments, buildings, and solid waste management unit(s) and other related areas will be conducted consistent with the Draft NUREG/CR 5849, Manual for Conducting Radiological Surveys in Support of License Termination, as appropriate.

13.0 INSTRUMENTATION

13.1 Introduction

Direct radiation and contamination monitoring using portable or laboratory measurements will be performed using instrumentation and techniques necessary to detect 200 dpm/probe area (15 cm^2) total and 100 dpm/100 cm^2 removable beta/gamma contamination. Instruments will be calibrated with radiation sources traceable to the National Institute of Standards and Technology (NIST) and having consistent energy spectrum with the radionuclides being measured. If alpha contamination is suspected, appropriate surveys and/or laboratory measurements capable of detecting 20 dpm/100 cm^2 removable alpha activity will be performed.

13.2 Equipment Specifications

Portable Contamination Monitor (Beta/Gamma)

Range	-	0 TO 500,000 counts per minute
Accuracy	-	±10% of reading between 10% and 100% of full scale on any range
Response Time	-	20 seconds (slow response)
Instrument	-	Ludlum model 3 with Ludlum model 44-9 probe (or equivalent)

Direct Radiation Exposure Meter (Beta/Gamma)

Range	-	0 TO 5 R/hr auto scaling
Accuracy	-	±10% of reading between 10% and 100% of full scale on any range
Response Time	-	2 to 8 seconds (slow response)
Energy Spectrum	-	beta above 100 KeV and gamma above 15 KeV
Instrument	-	Victorian 450 (or equivalent)

Portable Alpha Survey Monitor

Range	-	0 TO 200,000 counts per minute
Accuracy	-	±15% of reading between 10% and 100% of full scale on any range
Response Time	-	5 seconds (slow response)
Efficiency for Pu239	-	16%
Instrument	-	Ludlum Model 3 with Ludlum 43-1 zinc sulfide probe (or equivalent)

Direct Radiation (Gamma)

MicroRem Meter

Range	-	0 to 200,000 μRem/hr scales
Response Time	-	5 seconds
Instrument	-	Bicron microRem

Micro R Meter

Range	-	0 to 5,000 μRem/hr scales
Response Time	-	22 seconds (slow response)
Instrument	-	Ludlum 19

Scaler (Alpha and Beta/Gamma)

Range	-	0 to 500,000 counts
Accuracy	-	±10% of reading between 10% and 100% of full scale on any range
Response Time	-	2 to 8 seconds (slow response)
Energy Response	-	1 to 1 energy response above 80 KeV
Instrument	-	Ludlum 2200 singular channel analyzer (or equivalent)

Air Samplers

Flow Rate	-	0.5 to 20 cubic feet per minute
Instrument	-	Radeco 809V variable flow rate air sampler (or equivalent)

Dosimetry

Personnel Dosimetry, Record	-	Landauer TLD Equipment (or equivalent)
Personnel Dosimetry, Self-Reading	-	Atomic Products #019-100, 200 (or

The above identified radiation survey instruments will be calibrated every 6 months.

Instrument calibration records and daily source check records will be maintained by the PRSO and available at the site field office for inspection.

14.0 MEDICAL SURVEILLANCE

14.1 Introduction

This section describes the medical surveillance program applicable to personnel who will work within the Radiologically Controlled Areas at the B. Koh & Associates, Inc. Project sites. The purpose of the medical surveillance program is to determine site personnel fitness for duty. The data obtained from the medical surveillance program, in conjunction with information generated via employee exposure monitoring, will be utilized to evaluate the health status of site personnel.

The B. Koh & Associates, Inc. Medical Surveillance Program consists of the following elements:

(1) Administration of the program by B. Koh & Associates, Inc.

(2) Initial, annual and termination medical examinations for all personnel engaged in field work.

(3) A standard protocol for medical examinations, modified as necessary to reflect site-specific concerns not addressed by the standard protocol.

(4) Maintenance and retention of medical records.

14.2 Medical Examinations

The B. Koh & Associates, Inc. Project Medical Surveillance Program requires that all personnel engaged in field work involving potential exposure to health, safety, and/or radiological hazards participate in the program. An initial examination is performed on the employee prior to assignment to field work. At least annually, thereafter, the employee is provided with an additional examination. All B. Koh & Associates, Inc. employees assigned to this project will be active participants in the medical surveillance program. All project personnel will have had a medical examination meeting the requirements of the program within the past 12 months.

B. Koh & Associates, Inc. contractors and subcontractors must demonstrate that their employees are participants in a medical surveillance program that is at least as comprehensive as the B. Koh & Associates, Inc. program by providing B. Koh & Associates, Inc. with a written description of their program and the name and telephone number of their examining physician or medical consultant. The B. Koh & Associates, Inc. Project Manager (PM) may contact the subcontractor's physician or medical consultant to discuss the specifics of this project and the content of the subcontractors program.

14.3 Physician's Written Opinion

Physicians performing examinations of B. Koh & Associates, Inc. employees are provided with the following information:

(1) A description of the employee's duties as they relate to the employee's exposures.

(2) The employee's exposure levels or anticipated exposure levels.

(3) A description of any personal protective equipment to be used, including the potential use of air-supplied or negative pressure, air-purifying respirators.

(4) Any information from previous medical examinations in the possession of B. Koh & Associates, Inc. or the Contractor which is not readily available to the examining physician.

This information, and the results of the examination, are used as the basis of the physician's written opinion regarding the medical status of the employee.

Upon completion of an initial or annual medical examination of a B. Koh & Associates, Inc. contractor employee, the examining physician is required to provide medical clearance prior to the employee engaging in on-site work activities.

14.4 Recordkeeping

The clinics or physicians utilized by B. Koh & Associates, Inc. to perform medical examinations will maintain records of all examinations. B. Koh & Associates, Inc. will maintain a medical surveillance file on all current employees as well as terminated employees.

15.0 RECORDS AND REPORTS

15.1 General

All records and reports related to the Radiation Control and Protection Program will be maintained by B. Koh & Associates, Inc. until the Project is complete and the NRC terminates the license, if appropriate. Employee exposure records will be retained by B. Koh & Associates, Inc. indefinitely.

15.2 Exposure Records and Reports

The PRSO will assure that records are maintained to permit a ready accounting of an employee's accumulated radiation exposure. This occupational exposure record will include:

(1) Any known prior employment occupational exposure history (NRC Form 4 or equivalent) (see Figure 15-1).

(2) External and internal exposure received occupationally, including that received at other installations (NRC Form 5 or equivalent) (see Figure 15-2).

(3) Special dose evaluations and work restrictions (see Figure 15-3).

(4) Reports of unusual exposure, such as overexposure or incidents with potential for internal disposition. The incident forms will be supplied by B. Koh & Associates, Inc.

Each employee will be informed of the results of all record dosimetry evaluations. Each employee will be provided a copy of his/her occupational exposure at the end of each year.

15.3 Forms and Records

Specific forms or records will be developed and used for the following items:

(1) Direct and contamination surveys.

(2) Personnel contamination survey.

(3) Airborne survey (monitoring/sampling) calculation data sheets.

(4) Daily instrument operational check and calibration sheets.

(5) Daily report of work and surveys completed.

(6) Radiation Work Permits.

(7) NRC Form 4 or equivalent and Form 5 (or equivalent will be used to track individual worker exposure).

(8) Self Reading dosimeter usage.

(9) Incidents and accidents.

15.4 Record Maintenance

B. Koh & Associates, Inc. will maintain records consistent with 10 CFR 19 and 20 requirements as applicable and will make such records available to individual workers for inspection. The following is a general listing of the records that will be maintained by B. Koh & Associates, Inc. for the Project.

(1) The provisions of the Radiation Protection and Control Program.

(2) Audits and other reviews of the Radiation Protection and Control Program content and implementations.

(3) Results of surveys and calibrations required by 10 CFR 20.1501 and 10 CFR 20.1906(b).

(4) Records of the results of surveys to determine the dose from external sources and used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents.

(5) Records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose.

(6) Records showing the results of air sampling, surveys, and bioassays.

(7) Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment.

(8) Records of doses received by all individuals for whom monitoring was required pursuant to 10 CFR 20.1502. These records must include, when applicable:

(a) The deep-dose equivalent to the whole body, eye dose equivalent, shallow-dose equivalent to the skin, and shallow-dose equivalent to the extremities;

(b) The estimated intake or body burden of radionuclides;

(c) The committed effective dose equivalent assigned to the intake or body burden or radionuclides;

(d) The specific information used to calculate the committed effective dose equivalent pursuant to 10 CFR 20.1204(c);

(e) The total effective dose equivalent when required by 10 CFR 20.1202; and

(f) The total of the deep-dose equivalent and the committed dose to the organ receiving the highest total dose.

(9) B. Koh & Associates, Inc. will maintain the records specified on NRC Form 5, in accordance with the instructions for NRC Form 5, or in clear and legible records containing all the information required by NRC Form 5.

(10) Records sufficient to demonstrate compliance with the dose limit for individual members of the public.

(11) Records of the disposal of licensed materials made under 10 CFR 20.2002 and 10 CFR 20.2003.

(12) B. Koh & Associates, Inc. will maintain the records of dose to an embryo/fetus with the records of dose to the declared pregnant woman.

(13) Records sufficient to demonstrate compliance with the dose limit for individual members of the public.

(14) Records of the disposal of licensed materials made under 10 CFR 20.2002.

(15) Incident reports, as required by 10 CFR 20, Subpart M.

FIGURE 15-1

NRC Form 4
10 CFR 20

U.S. NUCLEAR REGULATORY COMMISSION

Approved by OMB
3150-0005

OCCUPATIONAL EXTERNAL RADIATION EXPOSURE HISTORY

See instructions on the back

IDENTIFICATION

1. NAME (PRINT - LAST, FIRST, AND MIDDLE)	2. SOCIAL SECURITY NO.
3. DATE OF BIRTH (MONTH, DAY, YEAR)	4. AGE IN FULL YEARS (IN)

OCCUPATIONAL EXPOSURE - PREVIOUS HISTORY

5. PREVIOUS EMPLOYMENTS INVOLVING RADIATION EXPOSURE - LIST NAME AND ADDRESS OF EMPLOYER	6. DATES OF EMPLOYMENT FROM TO	7. PERIODS OF EXPOSURE	8. WHOLE BODY (REM)	9. RECORD OR CALCULATED (INSERT ONE)

10. REMARKS	11. ACCUMULATED OCCUPATIONAL DOSE - TOTAL

10. CALCULATIONS - PERMISSIBLE DOSE WHOLE BODY:

(A) PERMISSIBLE ACCUMULATED DOSE = 5(N-18) . _____ REM

(B) TOTAL EXPOSURE TO DATE (FROM ITEM 11) . _____ REM

(C) UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (A-B) . _____ REM

12. CERTIFICATION. I CERTIFY THAT THE EXPOSURE HISTORY LISTED IN COLUMNS 5, 6, AND 7 IS CORRECT AND COMPLETE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

EMPLOYEE'S SIGNATURE DATE

14. NAME OF LICENSEE

FIGURE 15-2

NRC Form 5
(10-83)
10 CFR 19

U. S. NUCLEAR REGULATORY COMMISSION

Approved by OMB
3150-0044

CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See instructions on Back

IDENTIFICATION

1 NAME (PRINT - Last, First, and Middle)	2 SOCIAL SECURITY NO
3 DATE OF BIRTH (Month, Day, Year)	4 NAME OF LICENSEE

5 DOSE RECORDED FOR (Specify: whole body, skin or whole body, or names and forearms, feet and ankles)	6 WHOLE BODY DOSE STATUS (rem)	7 METHOD OF MONITORING (e.g. Film Badge - FB, Pocket Chamber - PC, Calculations - Calc.) X OR GAMMA _____ BETA _____ NEUTRONS _____

8 PERIOD OF EXPOSURE From - To	DOSE FOR THE PERIOD (rem)				13 RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9 X OR GAMMA	10 BETA	11 NEUTRON	12 TOTAL	

LIFETIME ACCUMULATED DOSE

14 PREVIOUS TOTAL (rem)	15 TOTAL CALENDAR QUARTER DOSE (rem)	16 TOTAL ACCUMULATED DOSE (rem)	17 FORM NCC. DOSE (rem)	18 UNUSED PART OF PREVIOUSLY ACCUMULATED DOSE (rem)

FIGURE 15-3

DOSE EVALUATION REPORT

Sheet _____ of _____
Rev _____
Date _____

Name _____ Social Security No. _____

Date of Birth _____ Company or Craft _____

Lost TLD ☐ No. _____ Neutron Dose Evaluation ☐

Lost Film Badge ☐ No. _____ Lost Dosimeter ☐ No. _____

Damaged ☐ (Describe) _____

DESCRIPTION OF OCCURRENCE

(Use additional sheets, if necessary, and check here if used ☐)

Summary of Available Records of Exposure (Give Survey Numbers, RWP Numbers, Dosimeter Readings, etc.)

(Use additional sheets, if necessary, and check here if used ☐)

ESTIMATED EXPOSURE

Evaluate above data and estimate Occupational External Radiation Exposure. Describe evaluation below and attach additional sheets, if necessary. Check here ☐ if used.

_____ Rem Whole Body _____ Rem Skin _____ Rem Extremeties

_____ Employee _____ Supervisor _____ Investigator

ACTION

Personnel Monitoring Records Adjusted

Date _____

By _____

File This Report with Applicable Dosimetry Records for Period

16.0 EMERGENCY ACTIONS

Accidents, industrial events, and medical emergencies that occur at the B. Koh & Associates, Inc. sites will be handled in accordance with the site specific Health and Safety Procedures and Emergency Action Procedures.

Onsite first aid emergency response will be supported by the local emergency response (fire and medical) organizations. Radiation awareness training will be provided to transport and treatment personnel.

The emergency response protocol for various accidents and emergencies are summarized in the subsequent sections. B. Koh & Associates, Inc. will notify the NRC of any accident or emergency consistent with the applicable requirements in 10 CFR 20.2202.

16.1 Accidental Spillage of Radioactive Materials

Should radioactive or contaminated materials be accidentally released from their container, the following actions should be taken. B. Koh & Associates, Inc. personnel are to follow the instructions below which have been developed using the SWIMS acronym:

S	=	Stop the spill
W	=	Warn other personnel
I	=	Isolate the spill area
M	=	Minimize personnel exposure
S	=	Secure the appropriate equipment

Stop the spill. If the spill has occurred from a source which may or is continuing to add material to the spill, take such measures as necessary to stop the spill, such as closing a valve or blocking the path of the fluid with absorbent material. A balance of risk to the individual must be weighed for potential personnel risk in these actions versus the potential safety and economic cost if limited actions are taken. If mechanical action is needed, such as closing a valve or disabling a pump, knowledge of the effect on the total system or machinery involved is required prior to such actions.

Warn other personnel. Others in the immediate area and those entering the area must be told of the event to enable all personnel to take the appropriate response actions. Health physics personnel must be notified as soon as possible.

Isolate the spill area. Non-vital personnel will be kept out of the immediate vicinity, if necessary, by having someone posted at the entrance to the area. Personnel who have been contaminated will remain in the immediate vicinity to prevent the spread of contaminants until health physics personnel release them. An exception to this is when the ambient radiation levels are high or of a traumatic injury requiring leaving the area has occurred.

Minimize personnel exposure. The event may include both a radiological and a chemical hazard. Personnel will remain in the immediate vicinity until health physics personnel arrive both to assist in spill control and to be available for surveying of exposed individuals. The nature of the spill, both chemical and radiological, and the need to monitor the spill will dictate how close personnel should remain.

Secure the appropriate equipment. Ventilation or other operating equipment may be selected for shut-down due to the nature of the spill and to prevent further occurrence. Knowledge of the system and equipment involved is necessary prior to taking such action.

16.2 Fire in a Restricted Area

Areas will be evacuated by all non-emergency personnel when a fire, heavy smoke, or similar fumes occur in a controlled area. Health physics, operational and/or fire response personnel will be immediately notified. This is true for all fire events, including those where personnel in the immediate vicinity have extinguished a minor event, such as a wastebasket fire.

- When possible, the fire will be extinguished by personnel in the immediate vicinity rather than allowing it to grow into larger proportions while designated personnel are on their way.
- If a fire cannot be rapidly extinguished, the local fire department will be summoned for fire detail:
  - fire detail will wear self-contained respiratory equipment, protective clothing, and any other items deemed necessary by the lead health physics individual
  - the primary function of the fire detail will be to evacuate personnel from the fire area
  - the secondary function of the fire detail will be to save equipment and property without endangering their own or other lives
  - the tertiary function of the fire detail is to minimize the spread of contamination outside the controlled area
- Fire extinguishing agents, such as CO_2, foam, or dry chemicals, are preferred as this minimizes the volume of potentially contaminated liquids.
- All firefighting personnel will be surveyed prior to exiting the event area except for those in need of immediate medical assistance outside the controlled area. Minimization of the spread of contamination will be kept in mind at all times.

16.3 Contaminated Injury

Medical emergencies or accidents can be divided into two categories. The first category is non-life-threatening and the second being considered as life-threatening.

16.3.1 Non-Life-Threatening Incidents

Non-threatening medical emergency victims will be given first aid on the B. Koh & Associates, Inc. site. Prior to the victims leaving the site the victim will be monitored for radioactive contamination. If the individual is contaminated decontamination procedures will be followed unless it is determined that the emergency is life-threatening.

Specific emergency actions include:

- Wash minor wounds immediately under running water, spreading the edges of the gash. If at all practical, collect and retain cotton sponges, fluids, etc., for analyses.
- Report all radiation accidents involving personnel wounds, ingestion or inhalation to the RCS as soon as possible.
- Call, at once, a physician qualified to treat radiation injuries and to collect additional bioassay samples.
- Permit no person involved in a radiation injury to return to work without the approval of the attending physician and the RCS.
- Prepare a complete history of the accident and subsequent activity related thereto for the RCS.

16.3.2 Life-Threatening Incidents

In the event that a life-threatening accident or injury occurs, the victims life takes prominence over any radiation or contamination controls at the B. Koh & Associates, Inc. site. The victim will be treated and transported to the local medical center as soon as possible. Attempts will be made to minimize the spread of contamination and the medical center will be notified of the potentially radioactively contaminated victim being transported to the facility.

In emergency situations where an individual is seriously injured in a contaminated area, the first priority is to treat the injury.

Other actions include:

- Contact the RCS.
- Call or have someone call an ambulance.

- Notify the nearest hospital qualified to treat contaminated injuries that a potentially contaminated injured person would soon arrive.

A Health Physics Technician equipped with appropriate survey instruments will accompany the contaminated, injured individual to the hospital.

Once at the hospital, the Technician will survey the emergency transport vehicle and paramedic crew. The Technician will support the medical staff treating the patient regarding survey results, accident history, etc.

No contaminated injured individual may return to work without written approval of the attending physician and the RCS.

16.3.3 Medical Facility and Transportation

Arrangements will be made with the local medical center and emergency response and transportation services to transport, receive and treat potentially contaminated injury victims. If requested, training will be provided to the medical center and ambulance transportation organization personnel for the treatment of radioactively contaminated victims.

Additionally, emergency kits will be available to minimize the spread of radioactive contamination and collect radioactive wastes in the Medical Center and the ambulance service.

16.4 High Airborne Radioactivity

Particulate radioactivity above the 10 CFR 20 Appendix B limits in occupied radiological areas:

NOTE: High airborne contamination is not expected in ground moving tasks. However, cutting, grinding or burning of other material may be performed in containment, thus warranting these precautions.

Immediate Action: Notify Radiological Controls Supervisor.

(1) Evacuate personnel from affected areas. Don respiratory equipment in accordance with the Airborne Radioactivity Procedure for personnel who must return to the affected area.

(2) Verify that the high airborne results (i.e., from air sampling or elevated instrument readings) are correct.

(3) Stop operations which might be causing high airborne radioactivity until adequate control of airborne radioactivity is established.

(4) Secure air moving equipment (e.g., fans, window air conditioners, and unit heaters) in the affected spaces.

(5) Determine the extent of the airborne radioactivity by sampling the affected area and adjacent areas which might be affected using portable air samplers.

16.4.1 Special Emergency Signals

Each project site may pose additional hazards to the worker performing radiological work. Individuals will be instructed on the alarms and evacuation system implemented by the project site as part of their radiation worker training.

16.4.2 Supplementary Action

(1) Attempt to identify the radionuclide causing the airborne radioactivity. For example, by promptly measuring the sample for alpha radioactivity and determining the half life.

(2) Measure and control surface contamination in areas affected by high airborne radioactivity.

(3) Perform alpha and beta/gamma surveys of ventilation filters and ducts and measure surface contamination in the vicinity of the ventilation exhaust discharge point.

(4) When resuming operations, take a portable air sample to verify that the cause of high airborne radioactivity is corrected.

(5) Check personnel exposed to high particulate radioactivity for internal radioactivity.

16.4.3 Followup Action

A report of any incident involving high airborne radioactivity, other than fallout or natural background, in areas occupied by personnel not wearing or wearing inappropriate respiratory equipment, will be sent to B. Koh & Associates, Inc. The report will include results of internal monitoring and be submitted within ten working days.

16.5 Loss of Radioactive Material

If radioactive material is lost, the following procedures will be followed:

- B. Koh & Associates, Inc. or B. Koh & Associates, Inc. contractor personnel will immediately conduct a search. The primary reason for this is to ascertain that no persons will receive inadvertent internal or external exposure from the material.

- If the material cannot be located before the end of the work day, B. Koh & Associates, Inc. will prepare an incident report in accordance with 10 CFR 20.2201 and notify the NRC, as appropriate.

ATTACHMENT 1

THEODORE G. ADAMS

TITLE

Vice President
Radiological and Site Restoration Services
B. Koh & Associates, Inc.

EXPERTISE

Quality Assurance
Radiation and Environmental Protection
Radioactive Waste Management
Decontamination and Decommissioning

EXPERIENCE

13 Years

1993 - Present - B. Koh & Associates

Technical Radiological Consultant for the Northeast Ohio Regional Sewer District Ash Lagoon Removal Project.

- Provide radiological consultant support to the NEORSD management. Managed preparation of the Radiological Control Plan, Site Operation Plan and Conceptual Remediation Plan. Established environmental monitoring program for the Southerly Sewage Treatment Plant.

1990 - 1993 - Dames & Moore

Dames & Moore Project Manager for Chemetron Corporation McGean Remediation Project, Newburgh Heights, Ohio

- Responsible for the planning and execution of site characterization and remediation activities estimated at $7 million, including design of disposal closure cells for industrial sites contaminated with depleted uranium and hazardous chemicals (1.5 million ft^3), in accordance with NRC release criteria and EPA RFI and RI/FS Guidelines. Provided oversight of radiological contractor activities. Provided management, technical, and quality assurance direction to the project and represented client before the NRC, Ohio EPA, and local public officials.

- With respect to interaction with the NRC, assisted the client and their legal counsel in preparation of license renewal under 10 CFR Part 40. This effort included direct involvement in preparation of the License Renewal Application and associated backup information, Health & Safety Plans, the Decommissioning Funding Plan and the Financial Assurance Plan for Decommissioning. Efforts also include meeting with the NRC HQ licensing personnel to ensure smooth and timely issuance of the license renewal.

Dames & Moore Senior Radiological Manager for Confidential Client, Midwestern USA

- Responsible for the planning and execution of radiological activities estimated at $200K required to support remediation of industrial surface impoundments contaminated with depleted uranium and hazardous waste (mixed waste) in accordance with NRC and state cleanup criteria. These activities included review of site characterization plans, performance of radiological pathway analyses, closure cell design, development of radiological sampling and analysis plan, and preparation of safety analysis reports and client health and safety plans and procedures. Also provided technical expertise to the remediation contractor responsible for removing and stabilizing the mixed waste in a RCRA designed closure cell.

- Provided technical direction to the client regarding radiological protection/control matters and represented the client before the NRC. Specific interaction with the NRC includes direct oversight of the preparation of License Termination Application (10 CFR Part 40), preparation of Safety Analysis Reports, preparation of Health and Safety Plans and performance of dose assessment/pathway analysis for project activities.

1989 - 1990

Quality Assurance Manager for New York State LLRW Siting Commission.

- Provided technical and programmatic interface between Siting Commission, county officials, technical consultants and general public.

- Developed and implemented quality assurance program estimated at $1.5 million for the Commission for site and method selection activities.

1983 - 1989

Safety Manager for DOE West Valley Demonstration Project (WVDP).

- Provided technical and programmatic administration in the areas of environment, safety and health including radiological protection for operation of new facilities constructed on-site (HLW vitrification facility, LLW treatment facility, LLW storage facility) and decontamination/decommissioning of main processing plant. Participation in readiness review for new systems startup.

- Oversight of WVDP D&D operations of main plant and associated support facilities. Special D&D activity included removal/remediation of waste previously disposed of in burial grounds.

- Served as lead WVDP interface with various federal and state agencies (EPA, NRC, DOT, OSHA, NYSDEC, NYSDOH, NYSDOT), as well as National Laboratories, public officials and concerned private groups on ES&H/QA, Waste Management and D&D matters.

- As lead interface, successfully obtained all State and Federal permits, NRC approvals and DOE approvals required to support the startup of the liquid high-level radioactive Supernatant Treatment System and related systems. This effort included obtaining: state permits for surface water discharges, EPA NESHAPS permit for radiological air emissions, NRC approvals of Safety Analysis and DOE concurrence on required environmental review documentation, safety analysis, and related environmental, Health & Safety documentation.

1981 - 1983

Waste Management Specialist for DOE Chicago, Argonne, Illinois.

- Served as the technical and programmatic specialist in the areas of D&D and hazardous and radioactive waste management. Conducted Waste Management appraisals of contractor facilities to identify potential ES&H problems associated with waste management and D&D operations and evaluate regulatory compliance.

- Served as DOE Project Manager for D&D of New Brunswick Laboratory, New Brunswick, N.J.; BNL Glovebox Facility; & Zero Gradient Synchrotron at ANL.

1980 - 1981

Health Protection Specialist for DOE Chicago, Argonne, Illinois.

- Served as Technical Specialist in the areas of environmental protection, industrial hygiene/occupational Health & Safety and Health Physics.

- Conducted ES&H appraisals of DOE contractors.

- Participated in development and review of Environmental Assessments and Environmental Impact Statements.

ACADEMIC BACKGROUND

B.S., Biology, Minor: Chemistry, University of Pittsburgh, 1975.
M.S., Health Physics, Purdue University, 1978.
Ph.D., Environmental Assessment, Purdue University-completed all course work.
Various professional courses in DOE Project Management, Public Speaking/Media Training, Human Factors Operational Readiness, MORT and Risk Assessment, Nuclear Criticality Radiation Worker Training, Certified Lead Auditor (NQA-1), DOE Certified Accident Investigator.

PROFESSIONAL AFFILIATION

Health Physics Society
Sigma XI

PUBLICATIONS

Adams, T.G., "Industrial Mixed Waste Management," invited paper presented at the Mixed Waste Regulation Conference, Washington, D.C., November 27-28, 1990.

Englert, J.P., Picazo, E.D., Adams, T.G., and Wilcox, D.P., "Environmental Monitoring Program Interaction Between the West Valley Demonstration Project and New York State Agencies," presented at the 5th Annual DOE Environmental Protection Information Meeting, Albuquerque, New Mexico, November 6-16, 1984.

Several papers on trace metals in biological indicator organisms and environmental monitoring at West Valley Demonstration Project.