Michigan Operations
May 6, 2005

The Dow Chemical Company
Midland, Michigan 48667

Mr. David Nelson
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Rockville, MD 20852

SUBJECT: Revised Radiological Health and Safety Plan for the TDCC Bay City, MI, Site

Dear Mr. Nelson,

The purpose of this letter is to provide Revision 3 of the Radiological Health and Safety (H&S) Plan for The Dow Chemical Company (TDCC) Bay City, MI, Site. The H&S Plan was revised in anticipation of beginning site sampling and excavation activities in accordance with Revision 2 of the Supplement to the Decommissioning Plan and is submitted as an attachment to Revision 2 of the Supplement. Therefore, TDCC requests that the revised H&S plan be reviewed and approved as a part of TDCC's April 13, 2005, license amendment request to approve Revision 2 of the Supplement.

Revision 3 of the H&S plan is provided in the Enclosure. The revisions are indicated in redline/strikeout format. Appendices B, C, and D were not revised and are not included in the Enclosure.

Please contact me or David Fauver if you have any questions.

Sincerely,

Ben Baker

Ben Baker
Project Manager
Michigan Operations
47 Bldg
Midland, MI 48667

ENCLOSURE

The Dow Chemical Company Thorad Project
Radiological Health and Safety Plan
Revision 3

The Dow Chemical Company

Thorad Project

RADIOLOGICAL HEALTH AND SAFETY PLAN

Prepared for:

The Dow Chemical Company
2020 Dow Center
Midland, MI 48674

Prepared by:

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and
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Revision 03~~02~~
May 2005
~~January 2001~~

Project Number 007133-8210

DISCLAIMER

The Dow Chemical Company does not guarantee the health or safety of any person entering this site. Due to the nature of the site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all potential hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior review by trained health and safety specialists.

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1.0 Approvals

By their signature the undersigned key project team members acknowledge their assignments to the named positions and certify that: (1) This revised Radiological Health & Safety Plan (RHSP) will be utilized by all team members at The Dow Chemical Company's Bay City, Michigan site; and (2) All project activities associated with sampling, remediation radiological control, and radiation measurements will be conducted in accordance with 10CFR19 and 10CFR20 (NRC, 1997).

Ben Baker
Dow Project Manager _____ _____
Signature Date

Gerard A. Sgro
Field Services Manager _____ _____
Signature Date

Gary Waugh
Field Services Superintendent _____ _____
Signature Date

David J. Richards
~~Ricardo V. Burke~~
Project Radiation Safety Officer _____ _____
Signature Date

Brandon Baker
~~Charlene Loar~~
Assistant Radiation Safety Officer _____ _____
Signature Date

Charlene Loar
~~Brandon Baker~~
2nd Assistant Radiation Safety Officer _____ _____
Signature Date

2.0 Applicability

This revised Radiological Health and Safety Plan (RHSP) will be implemented to establish safety criteria procedures for workers involved in the removal of material from The Dow Chemical Company's (Dow) Bay City, Michigan magnesium-thorium storage site.

This RHSP establishes:

- ALARA Program;
- Health and Safety organization and responsibilities;
- Site Access Control Procedures;
- Worker Training and Indoctrination;
- Environmental Monitoring Program;
- Program requirements, occupational monitoring, and personnel protection methods;
- Sample control, handling, packaging, and shipping procedures; and
- Emergency and Contingency Procedures for site emergencies (during handling and transport).

Applicable health and safety standards are specified and responsibilities in carrying out this plan are delineated. The Project Radiation Safety Officer (RSO) will have prime responsibility for carrying out the plan and will thus be responsible for on-site worker radiation health and safety, and for insuring that environmental releases do not adversely affect public health. The RSO and supporting staff will perform the combined health physics and industrial hygiene functions at the Bay City storage site. Guidance on program requirements, hazard control, and monitoring is included. The standards and procedures delineated in this plan must be understood and observed by all Dow personnel and contractors.

3.0 Site Safety Management and Organization

The following describes the health and organizational responsibilities and safety designations that will be employed during field activities at the site. Resumes of the designated staff are provided in Appendix A.

3.1 Organization

Figure 3-1 is a schematic outline of the Project Organization. As shown, lines of authority for health and safety management will be independent of those for operational management to ensure that site health and safety functions are not overridden by operational concerns. The QA/QC field and laboratory functions will also be independent of the Project Organization.

The RSO will report to the Dow Project Manager. A radiological support services staff that will perform the day-to-day monitoring of radiological on-site health and safety aspects of the Project will support the RSO.

3.2 Personnel Responsibilities

3.2.1 Project Manager

The Dow Project Manager has the overall responsibilities of implementing the health and safety procedures outlined in this RHSP and to ensure that all site work is executed in a safe manner. He is responsible for providing adequate resources to the site personnel to enable proper implementation of the provisions of this RHSP. He has the authority to sign contracts, commit project funds, and make license commitments for radiological health and safety for the project.

3.2.2 Health and Safety Officer

The Health and Safety Officer (HSO) establishes environmental health and safety policies, provides technical assistance to the RSO as required, and assures that all personnel designated to work on the site are medically qualified. The HSO is responsible for authorizing the appropriate monitoring, and safety equipment and other resources necessary to implement this RHSP.

3.2.3 Radiation Safety Officer/Radiological Support Services

The Radiation Safety Officer (RSO) will be responsible for the radiological health and safety of all workers and for ensuring that airborne and liquid effluents are below the limits in 10CFR20 Appendix B, Table2. This individual shall be provided with properly trained staff and adequate equipment as needed to ensure that all work is done safely.

The RSO has the responsibility to assist project management personnel in implementing this RHSP in accordance with the Dow Corporate Environmental, Health and Safety Standards and consistent with the health and safety requirements of the Nuclear Regulatory Commission (NRC).

The RSO will execute appropriate monitoring techniques to ensure adequate protection for site personnel and conduct on-site inspections to identify potential safety and health hazards. The RSO, with the assistance of the HSO, will investigate all accidents and incidents occurring on this site and will conduct safety briefings and site-specific training for all on-site personnel. The RSO together with appropriate Dow personnel will accompany all government agency representatives visiting the site in response to health and safety issues.

The RSO has stop-work authorization if an imminent hazard or potentially dangerous situation exists during the course of on going site activities. Authorization to again proceed with work will be verified by the HSO.

No significant work will be performed inside the Controlled Area without the on-site presence of the RSO, the Assistant Radiation Safety Officers (ARSO) or a qualified Radiological Control Technician.~~No work will be performed inside the Controlled Area without the on-site presence of the Radiation Safety Officer or one of the Assistant Radiation Safety Officers.~~ Significant work is

described as any activity that could potentially generate airborne contamination, result in the inadvertent discharge of liquid effluents or radioactive material from a controlled area, or have the potential to change existing radiological conditions. The RSO should be notified in advance of any significant work activities.

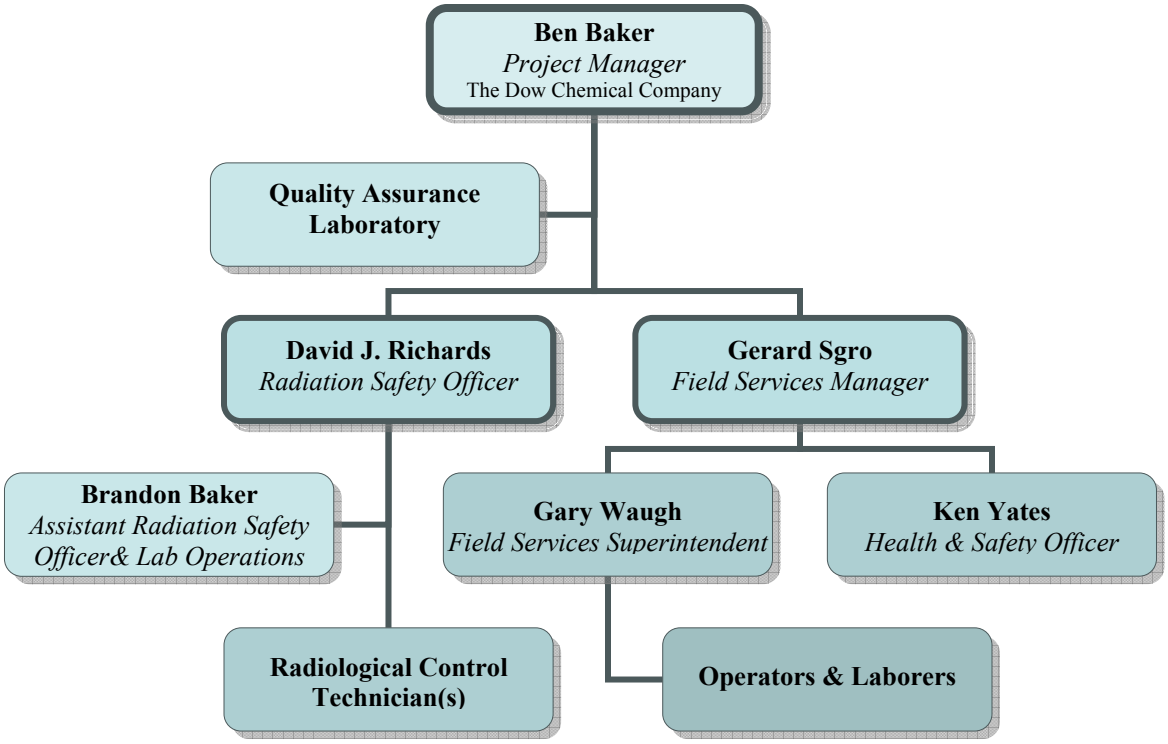
3.2.4 Assistant Radiation Safety Officers

The Assistant Radiation Safety Officers (ARSOs) will be responsible for implementing the health and safety procedures outlined in this RHSP with assistance from the RSO. In the event of an emergency, the ARSO will also implement site evacuation procedures, including the shutting down of appropriate equipment, removing equipment and coordinating emergency services on-site.

3.2.5 Site Personnel

It is the responsibility of all site personnel to report unsafe or potentially hazardous conditions to their supervisor. They should maintain knowledge of the information, instructions, and emergency response actions contained in this RHSP and will be required to read and acknowledge the requirements of this RHSP by signature. They shall also comply with rules, regulations and procedures set forth in this RHSP and revisions, which are instituted and prevent admittance of unauthorized personnel to the site

THORAD Project Organization Chart



4.0 ALARA

Dow's policy is to limit radiation exposures of workers and the general public to as low as reasonably achievable (ALARA). In all cases, the radiation exposure shall not exceed the regulatory limits specified in 10 CFR Part 20.

The ALARA policy will be implemented in the site health and safety program through site safety training, planning, meetings, Standard Operating Procedures (SOPs), radiation exposure control measures, establishing administrative control limits, issuing Radiation Work Permits (RWPs), and personal protective equipment. Implementation of this policy also requires the active participation of every member of the on-site staff and anyone entering the control area.

Personnel will be trained in radiation safety procedures and ALARA philosophies to a level commensurate with their assigned tasks. Engineering controls will be the preferred means of reducing exposures, although administrative controls or personal protective clothing and equipment may also be used. The equipment necessary to implement the ALARA policy will be dependent on the specific tasks involved. In some instances, the work will be planned so special protective equipment will not be necessary to limit exposures.

The RSO (and ARSOs) shall have sufficient delegated authority to enforce regulations and administrative practices concerning any aspect of the radiological safety program.

A management review will be performed periodically to assess the effectiveness of the ALARA program. In particular, work area and perimeter air sampling and other data results will be evaluated to ensure that personnel exposures are maintained as low as practicable.

The programs to implement these principles are described in the sections of this plan. In addition, standard safe work practices and physical hazard control constraints, which will be enforced to help assure ALARA work conditions, are summarized in Section 11.0.

4.1 ALARA Committee

An ALARA committee has been established to ensure the Dow ALARA policy is implemented to limit radiation exposures of workers and the general public to as low as reasonably achievable. The committee will

provide management review of site activities to assess the effectiveness of the ALARA program. The Dow Project Manager will assign the appropriate personnel to serve as members on the committee. The ALARA committee will meet on a quarterly basis during extended periods of significant work activity such as large-scale remediation and final status survey implementation. During periods of no significant work activity, the committee should meet annually or at a frequency determine by the Dow Project Manager. The minutes of each committee meeting shall be recorded.

4.2 Reviews and Revisions of Administrative Changes

If a change or revision to the RHSP~~, a RWP~~ or a SOP is required, the change is presented to the RSO for initial approval. It is then presented to the ALARA committee for approval and implementation. ~~The ALARA committee meets on a monthly basis during operation.~~ If a change is needed before ~~the~~ a regularly scheduled ALARA committee meeting, a special meeting will be called. Documentation of approval of the administrative change will be in the minutes of the ALARA meeting.

5.0 Background Information

5.1 Material

The radioactive material at the Bay City site consists primarily of foundry slag containing low-levels of thorium. This material was produced in the period from 1940 to 1970 as the residual from the production of magnesium-thorium alloy. This lightweight alloy was used for defense purposes, including aircraft engines and aeronautical structural components. The slag was originally stored, with plans for reclamation, on the two Dow properties. Some other thorium-contaminated material from a decommissioned third site was added to the Bay City pile in 1985.

A single license (STB-527) was originally granted by the NRC in 1973 for the Bay City and Midland sites to store up to 200,000 pounds of thorium as slag. This license expired in 1978, but has remained in effect under timely renewal. The Midland site has been verified clean and released from this license by the NRC.

The material slated for removal consists of magnesium with up to two-percent thorium. In its present state, portions of the process slag have been mixed with soil or limited amounts of construction debris (about 1% of the total volume); in addition, there has been some emplacement of the material outside the boundaries of the Bay City site. As a result of this mixing, the thorium concentrations, as determined by Dow soil sampling, vary from 2 - 7,000 pCi/g at the Bay City site. The estimated total activity of 9.7 Ci of Th-232 is distributed through approximately 60,000 cubic yards of slag, soil and construction debris.

Dow has contracted URS (formerly Radian International) to remove the thoriated material from the site

5.2 Bay City Storage Area Parameters

The Bay City site is located on property owned by Dow near the town of Bay City, Michigan about one-mile south of Saginaw Bay. Figure 5-1

shows the affected area, as defined by NUREG/CR-5849. As shown, the affected area encompasses a region beyond the original thorium pile.

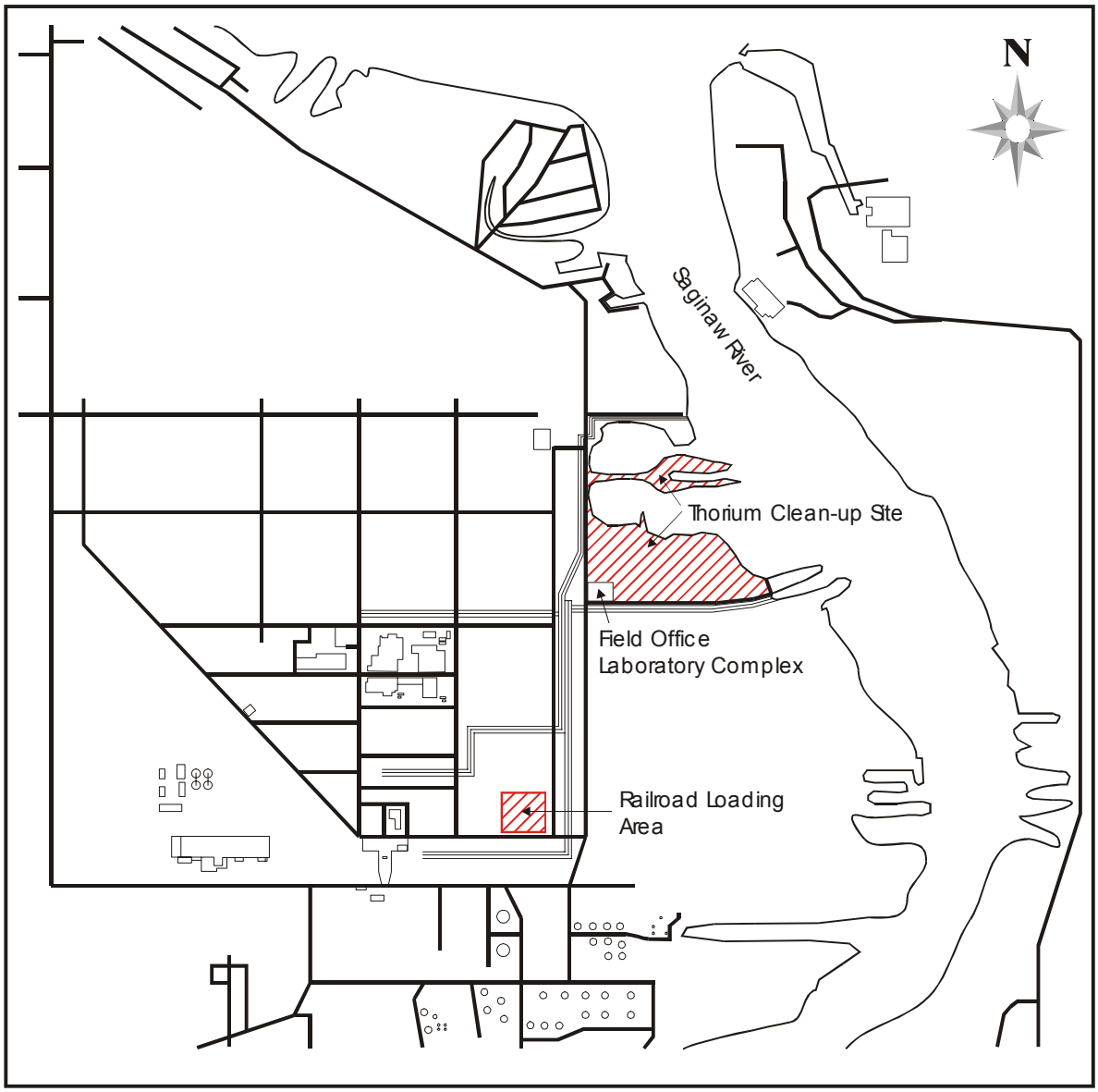
The thoriated material at Bay City is located adjacent to and north of an inlet canal, which enters the Saginaw River to the east. The Saginaw River as shown on Figure 5-1 is located to the north and east of the material.

The area surrounding the material is relatively level, with some marshy areas and ponds. Typically the material sits approximately 5 to 10 feet above the water level in the inlet canal.

The highest concentration Bay City material was partially covered with an asphaltic sealant and fenced. However, this material has since been excavated and shipped to Envirocare of Utah for disposal.

The affected area includes all areas that have potential radioactive contamination (based on operating history) or known radioactive contamination (based on radiological surveillance). Areas immediately surrounding the Bay City pile storage area are included in this classification because of the potential for inadvertent spread of contamination. The unaffected areas are not expected to contain residual radioactivity based on knowledge of site history and existing survey information. Figure 5-1 depicts the previously surveyed area.

Figure 5.1, Bay City Thoriated Material Storage Site



6.0 Site Access Control

Access to the Bay City storage site for personnel, vehicles, and equipment is restricted by fences and locked gates. All personnel requiring access to a site will be admitted by a designated safety officer at a specified gate and will sign the site access control register. An assessment will also be made as to the necessity and extent of personal monitoring in accordance with applicable procedures and regulations. A copy of the register will be maintained at the site. Access control procedures and a copy of the access control roster are contained in SOP 1.1, Access Control Procedures, included as Appendix B.

Visitors entering the site should be admitted and escorted by the RSO, ARSO, or other rad worker trained individual. The RSO or ARSO will require any person entering the potentially contaminated zone to fill out the information requested in the site Controlled Area Access Form. Visitors to the site who will remain only in the Clean Zone, or who are unlikely to receive equal to or greater than 100 mrem will not be issued dosimetry or be required to complete the Controlled Area Access Form. This assessment will be made by the RSO or ARSO.

Dosimetry will be issued, if necessary, in accordance with SOP 1.3, External Dosimetry Procedure.

All site personnel and workers who enter the potentially contaminated zone must be surveyed (frisked) prior to leaving the zone. Visitors must be frisked by their escorts.

7.0 Worker Training and Medical Requirements

7.1 Worker Training

A formal 4-hour training program will be provided by the RSO or designee to workers before they begin on-site work in potentially contaminated areas The training will be commensurate with the work hazard and will include discussions of the remediation project, industrial and radiological safety procedures (to include "Stop Work Authority"), emergency and contingency procedures. The potential for encountering hazardous materials on the sites, and emergency telephone numbers, first aid, and location of first-aid stations and hospitals will also be discussed.

The training will also include the highlights of this RHSP, detailed description of decontamination procedures, and respirator use and fit testing pursuant to 29 CFR 1910.134. Practical demonstrations will be given in self-monitoring for contamination on workers. Adequate information regarding known radioactive and physical hazards that may be encountered on-site will be provided.

A written test is given upon completion of the initial training. The new employee is assigned to work with an experienced employee until it is judged that the new employee is proficient at the task.

Annual Radiation Refresher training will be provided by the HSO, RSO or designee. It consists of a review of the topics listed in Table 7.1

The RHSP and SOPs are reviewed by the RSO annually for any changes in procedures that may be required. If a change has occurred, each employee is trained on the new procedure. That training is documented by signing the training attendance provided at the sessions. The employee is observed until it is judged that they are proficient at the new method or procedure.

Visitors will receive training on the specific hazards they may encounter. Documentation of the training of each employee will be retained and

maintained at the site for review. A representative site-specific training outline is provided in Table 7.1.

Prior to beginning work at a new location or when working conditions change, the RSO or designee will provide a briefing to workers stating the nature of hazards and the extent of contamination to be encountered that day, and an explanation of safety equipment to be used.

The RSO shall identify those individuals requiring First Aid and CPR training in order to ensure that emergency medical treatment is available during field activities. It is expected that at least two members of the field team will have First Aid and CPR training. The training will be consistent with the requirements of the American Red Cross Association.

All personnel authorized to wear personal radiation exposure monitoring devices, thermoluminescent detectors (TLD), shall submit prior occupational radiation exposure records (USNRC Form 4 or equivalent) prior to TLD issue. The RSO or designee shall review all exposure history records prior to TLD use.

All contractor personnel will comply with the site Radiological Health and Safety Plan and be responsible to the RSO or designee.

A worker under age 18 shall neither be employed in, nor be allowed to enter, controlled areas.

Visitors to the sites shall be required to comply with all health and safety restrictions provided in this document. A trained site worker will accompany visitors at all times. Visitors must sign into the access log to gain access to the sites.

7.1.1 Hazard Communication Training

Hazard Communication training covering 29 CFR 1910.1200 will be conducted as part of the site-specific training and on an as needed

basis during the life of the project. The training will include the following:

- Requirements of the standard;
- Operations involving hazardous chemicals;
- Location and availability of the written program, chemical list and MSDSs;
- Methods used to detect the presence or release of hazardous chemicals;
- Physical and health hazards of the chemicals; and
- Protective measures, work practices, and emergency procedures.

The OSHA and the NRC posters will be posted at the site in a conspicuous place (Appendix C and Appendix D).

7.2 Medical Requirements

An occupational physician shall clear all personnel performing work at the Bay City site for work. The occupational physician shall evaluate the physical condition of the site employees to ensure the employees are in good health to perform the work that is required of them.

Site personnel, except non-working supervisory personnel and visitors who are typically observing work from a distance, will participate in an annual medical monitoring program and a respirator fit test. The objective of the medical monitoring program is to determine the medical competency of employees who work while wearing respiratory protection and those who work under the heat and physical stress that may be encountered in the work place. Only those employees determined to be physically capable will be eligible for respiratory fit testing and training and/or assigned work involving physical stress pursuant to 29 CFR 1910.134.

Prior to initiating work, a work-related radiation exposure history shall be acquired and maintained for each employee working in a controlled area. At the discretion of the RSO, baseline bioassay measurements may be required of personnel prior to working in areas of potential airborne radioactivity.

Table 7.1

Site Radiation Safety Training Outline

1.0	Site-General History
2.0	Fundamentals of Radiological Health Protection 2.1 Background Radiation - Sources 2.2 Alpha Particle Radiation 2.3 Beta Particle Radiation 2.4 Gamma Radiation 2.5 Half-Life 2.6 Exposure Pathways 2.7 Instruction Concerning Prenatal Radiation Exposure 2.8 Risk 2.9 ALARA
3.0	Site Radiation Health and Safety Practices and Worker Responsibilities 3.1 General 3.2 Control Area and Potentially Contaminated Areas 3.3 Clean Areas 3.4 Postings
4.0	Personnel Hygiene Practices 4.1 Protective Clothing 4.2 Respiratory Protection 4.3 Worker Hygiene 4.4 Decontamination
5.0	Control Measures Dust Suppression 5.1 Engineering Controls 5.2 Procedural Controls
6.0	Radiological Monitoring 6.1 Airborne Particulate Monitoring - Lapel and General Area Sampling 6.2 Gamma Exposure Rate Surveys 6.3 Gamma Count Rate Surveys 6.4 Gamma Spectrometry 6.5 Bioassay 6.6 Whole Body Counting - Invivo 6.7 Personnel and Equipment Contamination Release Surveys 6.8 Personal Dosimetry - TLD
7.0	Emergency Procedures
8.0	Regulatory Authority 8.1 U.S. Nuclear Regulatory Commission (NRC) 8.2 Occupational Safety and Health Administration (OSHA)

ALARA - as low as reasonably achievable

TLD - thermoluminenscent dosimeter

8.0 Hazard Assessment

The following sections discuss the hazards, which could potentially be encountered on-site.

8.1 Radiological Hazards

The radiological constituents present in the slag and soil at the Bay City site is Thorium-232, Thorium-230, and their associated decay products. Thorium-232 is at the head of its decay series while thorium-230 is a constituent in the Uranium-238 decay series.

The radiation from the radiological constituents present at the sites could pose both external and internal radiation hazards during remedial activities. Some of the radionuclides is in these two series, during decay, emit gamma radiation which is a potential external hazard to the body.

Thorium-230 and 232 and their daughters also emit alpha radiation. Inhalation of airborne alpha activity is the primary internal exposure pathway, which could occur from breathing contaminated dust. A secondary internal pathway is ingestion of alpha contamination transferred from a worker's hands or clothing.

Monitoring programs to be conducted during remedial activities to detect elevated levels of radioactivity in the environment and contamination on surfaces are discussed in Sections 10.0 and 12.0 along with relevant action levels.

8.2 Physical Hazards

A variety of physical hazards may be present during site activities. The most common hazards are slips, trips, falls, cold and heat stress and noise effects. The weather related stress and noise effects are often not obvious, and are therefore discussed below. Other physical hazards are due to the use of hand and power tools and handling and storage of solvents and fuels.

These hazards are not unique and are generally familiar to decontamination workers. Additional specific hazards may be covered during safety briefings at the project site.

8.2.1 Heat-Related Illnesses

If site activities are conducted in the summer, there is a potential for personnel suffering from heat related illnesses. Additionally, the use of personal protective equipment increases the potential even further. Heat Stress is a significant potential hazard, associated with the use of protective equipment in hot weather environments. The following sections briefly discuss the heat-related illnesses and emergency response actions.

8.2.1.1 Heat Cramps

Heat cramps are brought about by long exposure to heat. As an individual perspires, water and salt is lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment consists of providing shade, rest and fluid replacement. Normally, the individual should recover within 30 minutes. If the individual does not recover within 30 minutes, the individual should be transported to a hospital for medical attention.

8.2.1.2 Heat Exhaustion

Heat Exhaustion usually occurs in an individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual begins to fail as blood collects near the skin in an effort to relieve the body of

excess heat. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Pale skin;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment consists of cooling the victim, elevating the feet and replacing fluids. If the individual has not recovered within 30 minutes, the individual should be transported to a hospital for medical attention.

8.2.1.3 Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **medical emergency**, requiring immediate cooling of the patient and transport to a hospital. The signs and symptoms of heat stroke are as follows:

- Dry hot red skin;
- Body temperature approaching or above 105^{o}F;
- Large (dilated) pupils; and
- Loss of consciousness - the individual will go into a coma.

First aid treatment consists of cooling the patient and transport to a hospital immediately.

Working with personal protective equipment in hot weather may produce circumstances, which will require restricted

work schedules in order to protect employees. Should work remediation activities proceed into the summer, a Wet Bulb Globe Temperature (WBGT) Index will be used to establish a work/rest cycle during hot climate.

If the measured WBGT exceeds 86°F (76°F when workers are wearing semi-impermeable or impermeable clothing), the work/rest cycle given in Table 8.1 will serve as a guideline. The use of work/rest cycle and training on signs and symptoms of heat related illnesses should prevent them from occurring.

Table 8.1
Permissible Heat Exposure Threshold Limit Values
(Values are given in °F WBGT)

Work/Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous Work	86	80	77
75% work - 25% rest, each hour	87	82	78
50% work - 50% rest, each hour	89	85	82
25% work - 75% rest, each hour	90	88	86

- When workers are wearing semi-impermeable or impermeable clothing, subtract 10°F from the WBGT value in the above table.
- Rest means minimal physical activity. Rest should be accomplished in the shade. Any activity requiring only minimal physical activity can be performed during rest periods.

8.2.2 Cold Stress

If work continues during winter months, then workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include hypothermia and frostbite, physical conditions which gradually result over time of exposure and which result often in personnel employing poor judgment and taking

short cuts, as well as involving the physical hazards of slips, trips and falls on icy surfaces.

Progressive clinical symptoms of hypothermia include:

Core Temperature (^{o}F)	Symptoms
98.6	Normal rectal temperature
96.8	Metabolic rate increases
95.0	Maximum shivering
93.2	Victim conscious and responsive
91.4	Severe hypothermia
89.6 to 87.8	Consciousness clouded, blood pressure difficult to obtain, pupils dilated but react to light, shivering ceases
86.0 to 84.2	Progressive loss of consciousness, muscular rigidity increases, pulse and blood pressure difficult to get, respiratory rate decreases
78.8	Victim seldom regains conscious
64.4	Lowest accidental hypothermia victim to recover

In order to minimize the risk of the hazards of working in cold environments, workers will be trained and periodically reinforced in the recognition of the physiologic responses of the body to cold stress. In addition, the use of insulated work clothing, warm shelters and work/warm regimens may be used to minimize the potential hazards of cold stress. Also, special attention will be paid to equipment warm-up time and freeze protection for vessels, piping, equipment, tools and walking/working surfaces.

8.2.3 Noise

During site activities, equipment will be used which may require the use of ear protection due to elevated noise levels. Disposable earplugs or other hearing protection will be required when working with or around this equipment.

8.3 Biological Hazards

During the course of the project, there is potential to come into contact with certain biological hazards including insects and plants while on-site.

8.3.1 Insects

Insects such as mosquitoes, ticks, bees and wasps may be present at the site during certain times of the year. Workers will be trained during site-specific training and as part of a daily safety briefing to recognize and to minimize contact with these insects.

Workers will be encouraged to use insect repellant when working in areas where insects may be present. If insects present a potential problem, efforts will be made to further protect workers and/or remove them.

Any worker that is allergic to bee/wasp or other insect stings must inform the RSO of the medical condition prior to starting work. The medical staff at the hospital will be informed of the condition and steps taken to prepare for this type of medical emergency.

Ticks can transmit microorganisms that can cause several diseases, including Lyme Disease and Rocky Mountain Spotted Fever. Ticks adhere tenaciously to the skin or scalp. There is some evidence that the longer an infected tick remains attached, the greater the chance it will transmit the disease.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the RSO or designee should be contacted immediately. If personnel feel sick or have signs similar to those above, they should likewise notify the RSO or designee immediately.

8.3.2 Plants

Plants such as poison ivy, poison oak and stinging nettles may be present at the site during certain times of the year. Workers will be trained during site-specific training and as part of a daily safety briefing with periodic reinforcement to recognize these plants and to minimize contact with them.

8.4 Control Measures for Physical Hazards

Control measures for the physical hazards identified in Section 8.2 are described below.

8.4.1 Drill Rig Operations

- Conduct pre-work inspections of all parts of the equipment;
- Use in accordance with the Operator's Manual/Manufacturer's Specifications;
- Remove/replace broken/damaged parts;
- Use the designated personal protective equipment for the task; and
- Ensure minimum of 10 feet of clearance from overhead power lines.

8.4.2 Hand and Power Tools

- Conduct pre-work inspections of all parts of the equipment;
- Use in accordance with the Manufacturer's Operations and Maintenance Manual'
- Remove/replace broken/damaged parts;
- Use the designated personal protective equipment for the task;
- Use the tool for its intended purpose;
- Ensure that all electrical tools are grounded; and
- Use ground fault interrupters.

8.4.3 Slips/Trips/Falls

- Pay careful attention to walking surfaces, especially when they are wet or icy;
- Clear water, ice or spills as quickly as possible off walking surfaces or in high traffic areas;
- Do not take short cuts over fences or walls;
- Do not jump over excavations;
- Any platform area higher than 4 feet will have standard guard railings and toeboard;
- Use non-slip surfaces when constructing platform, if possible; and
- Use fall protection for work higher than 6 feet of potential free-fall.

8.4.4 Lifting

- Perform limbering exercises prior to lifting loads;
- Obtain help for heavy weights and bulky objects;
- Communicate with other workers;
- Face object, plant feet at shoulder length apart, use the best hand holds, keep back straight and lift with the center of strength in the legs not in the back;
- Do not twist while handling the load; and
- Use caution when manually shoveling heavy material, move small loads and follow the proper lifting procedures.

8.4.5 Fire Protection

- No smoking in work areas;
- At least one fire extinguisher rated at least 1A, 10:BC will be located in each work area; and
- Inspect all fire extinguishers monthly by site personnel and annually by licensed personnel.

8.4.6 Motors and Pumps

- All electric motors will have ground fault interrupters (GFI) in place;
- All rotating parts, gears or chains will be properly guarded; and
- All pumps shall have pressure relief devices.

8.4.7 Electrical Equipment

Any work involving the installation of electrical equipment of the use of electrical apparatus or appliances shall comply with the provisions of NFPA 70, the National Electric Code which as been adopted by OSHA 29 CFR 1910 and 29 CFR 1926. Electric installations themselves shall meet the requirements of the authority having jurisdiction.

In general, electrical requirements to be adhered to at the site include but are not limited to the following:

- Use of GFI's on all electrical tools/equipment being used during decontamination activities;
- Use of multiple pronged (grounded) electrical power supply systems and appliances unless double insulated;
- Restrictions or limitations on the use of flexible (extension) cords;
- Clearance requirements for electrical service boxes;
- Grounding provisions for fixed equipment;
- Use of explosion-proof equipment for hazardous locations, as specified in articles 500-503 of the NEC; and
- Lock-out/Tag-out requirements on equipment being serviced.

8.4.8 Welding/Burning/Cutting

- Use of permit;
- Use of proper personal protective equipment (face shields, gloves, etc.)

- Fire protection; and
- Monitoring requirements.

8.4.9 Drum Moving

- Full drums will not be moved without mechanical assistance (e.g., a drum dolly);
- Inspect drum lids/seals for damage;
- Communicate with other personnel helping to move drums;
- Avoid pinch points;
- Ensure that pull drum lids are tightened prior to moving;
- Use pallets to provide easier means of movement; and
- Use leather workgloves while handling drums where possible.

9.0 Work Area Control

Access to the site will be controlled to protect workers from unnecessary radiation exposure and to minimize the potential for spread of contamination. These controlled areas will be conspicuously marked according to applicable posting requirements.

Each site shall be divided into the following three zones:

- Contamination (Exclusion) Zone;
- Contamination Reduction Zone; and
- Clean (Support) Zone.

Access to these zones shall be controlled for people, vehicles, and equipment by fencing and posting the area or by using other methods to prevent inadvertent exposure to contaminated material.

Smoking, drinking, eating, or other activities that would enhance the transfer of radionuclides into the human body shall be prohibited within the Contamination and Contamination Reduction Zones.

All site activities will be conducted to minimize the generation of airborne dust. Dust suppression measures, including wetting the roadways and work areas, providing sprays or mists during loading operations, and instituting vehicle speed limits, will be used at all times if any visible dust is evident. In addition, respiratory protection will be employed as described in Section 10.2.

9.1 Contamination Zone

This zone includes the actual areas of contamination (uncovered thoriated material under excavation in the designated affected area). This zone has the highest inhalation exposure potential and/or presents a high probability of skin contact. It will be clearly delineated by fencing, cones, tapes, or other means. Entry and exit point(s) to and from this zone will be strictly controlled and decontamination facilities will be set at all such points. Personnel are not allowed in this zone without ~~a buddy,~~ site-specific training,

and wearing appropriate personal protective equipment.

All points of potential access to a Contamination Zone will be conspicuously posted with signs bearing the radiation caution symbol and the words "Caution Radioactive Materials" and "RWP Required for Entry". A barrier should be used to prevent the inadvertent entry into the area. All points of exit from a Contamination Zone should have a sign posted stating "All Personnel, Tools and Equipment Must Be Frisked Prior to Exit". All work done in this zone will be performed under a Radiation Work Permit (RWP). RWP procedures are contained in SOP 1.10, Radiation Work Permit, found in Appendix B.

The surface contamination action limits in the contamination zone are 26 dpm/100cm^2 removable and 129 dpm/100cm^2 total alpha (average) for total thorium for equipment and solid debris surfaces. ~~The equivalent beta limits are 12 dpm/100cm^2 and 57 dpm/cm^2 respectively.~~

9.2 Contamination Reduction Zone

This zone includes the areas immediately surrounding the Contamination Zone, and includes the contamination reduction corridor, and personnel, vehicle and equipment decontamination stations. This zone will be used for general site entry and egress in addition to access for heavy equipment and emergency support services. It has the next highest inhalation hazard but does not have a high probability of skin contact. Contamination limits within this zone will be maintained at <26 dpm/100cm^2 removable and <129 dpm/100cm^2 total alpha ~~(or equivalent beta)~~.

9.3 Clean (Support) Zone

This zone covers all areas outside of the Contamination Reduction Zone. Adverse exposure in this zone is unlikely since it is an uncontaminated area. Field support for most operations including field team communications, sanitary facilities, and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. As areas of the sites are decontaminated, they may be fenced and also managed as clean areas.

10.0 Radiological Monitoring

This section provides information on the parameters of the site personnel and environmental monitoring programs, use of personnel protective equipment, administrative controls, and sample control procedures.

10.1 Monitoring Equipment Calibration and Maintenance

Daily, before use, radiation monitoring instruments such as alpha scintillometers and Geiger-Muller counters will be efficiency-tested using a National Institute of Standards and Technology (NIST) source or sources with known levels of radioactivity. In addition, all radiation monitoring equipment will be calibrated and serviced annually. Sealed radioactive sources are used in instrument calibration and efficiency testing. All sources have been chosen such that they are exempt quantity sources and do not require licenses. The pressurized ion chamber will be calibrated at a facility licensed to perform such work

Radioactive sources used in efficiency testing and calibration will be shipped according to relevant NRC regulations, and to Department of Transportation regulations 49 CFR 171-178 (CFR 1997).

~~The onsite laboratory consists of three Multi Channel Analyzers. The calibration and maintenance program for the gamma spectroscopy equipment employs a background sample, a spike sample taken from the site, and a Analytics traceable multi-gamma source sample. Each day prior to use, the system is checked with each of the above samples for 15 minutes. A report is printed and the counts are converted to activity and then compared to the known activity. If the relative percent difference between the known activity and the analytical results is less than 10% for the Analytics standard and less than 20% for the spike and background samples the unit is determined to be functioning properly. If the unit does not meet these criteria the sample is rerun (a maximum of 3 times) to balance statistical counting errors. If it still does not pass, the unit is re-calibrated.~~

~~One hundred percent of all verification samples and five percent of the survey samples collected & analyzed at Bay City are sent to Dow's Freeport, Texas, laboratory for quality assurance/quality control (QA/QC). Verification samples are representative dirt samples used to verify if an area is qualified for exclusion from the Controlled Area.~~

~~To calibrate, the Analytics source and a spike are counted for one hour each. Peaks and regions of interest (ROI) are marked. ScintiVision™ software is utilized at the Bay City laboratory, which allows the lab technicians to name each ROI and assign efficiencies for each peak (nuclide). The Analytics source contains three (3) different nuclides, which are listed in table 17.1. The Analytics source is decay corrected every quarter as determined by site policy. After the calibration, the unit is function checked as described above before being used.~~

~~Results from Freeport are compared to Bay City's results. If there is a discrepancy, the sample data and function checks are examined. If necessary, the sample is re-counted at both laboratories and the error is investigated internally. The same procedure is used for the QA/QC of the Freeport lab with the outside lab.~~

~~The Dow staff responsible for performing the soil analyses onsite have the training described in table 7.1 (page 7-2) and additional hands-on-training on the MCAs.~~

~~Table 17.1 Activities of Analytics Source~~

~~**Nuclide**~~	~~**Activity (microCuries)**~~
~~Ce-139~~	~~0.023~~
~~Co-60~~	~~0.020~~
~~Cs-137~~	~~0.014~~

The onsite soil sample analysis laboratory consists of three Multi Channel Analyzers. Operation, calibration, maintenance and QA for the gamma spectroscopy equipment are controlled by Standard Operating Procedures. Each day prior to use, the system is subjected to performance checks that include:

- Energy/channel alignment check and adjustment (if needed)
- Background check
- Activity analysis performance check.

The energy/channel alignment check is performed using a check source that has a prominent gamma emission, typically Cs-137. The background check is performed by counting a blank sample container. The result compared to a background baseline count that has been established for each detector. The daily background performance acceptance region is within ± three standard deviations of the baseline background count mean value.

Daily activity analysis performance checks utilize a NIST traceable Thorium standard prepared in the same sample container-geometry used for routine analysis of Thorad soil samples. A spectrum is obtained from the reference standard, analyzed for Th-232 concentration and the result compared to the baseline activity established for each detector. The acceptance region is within ± two standard deviations of the reference source mean baseline Thorium-232 concentration.

To calibrate the detectors a NIST traceable calibration standard, prepared by a qualified vendor is used. A specially designed standard in the 500 ml container geometry used for counting Thorad soil samples, is used for calibration. The calibration source contains three nuclides, with prominent gamma emissions that span the energy range used in soil sample analysis. Calibration and calibration testing are performed according to a Thorad SOP, “Calibration of the DOW Thorad Project Gamma Spectrometer”. No recalibration frequency is specified, as the need for recalibration is determined by performance. Recalibration criteria are given in the SOP for QA for the Gamma Spectroscopy Counting System.

Five percent of final status survey samples collected & analyzed at Bay City are sent to an outside laboratory for independent analysis as a quality control measure. Results from the outside laboratory are compared to the

Thorad results. Criteria in NRC Inspection Procedure IP 84526 are used as a guide to compare results between the laboratories. If there is a discrepancy, the sample data and function checks are examined. If necessary, the sample is re-counted at both laboratories and the results evaluated using IP 84526 criteria.

The Thorad Project staff responsible for performing soil analyses onsite have the training described in table 7.1 (page 7-4) and additional hands-on-training on the MCAs as described in the SOP for Quality Assurance for the Gamma Spectroscopy Counting System.

10.2 Personnel Monitoring and Protective Equipment

Personnel leaving the Contamination Zone or coming into contact with potentially contaminated material will be monitored with a portable alpha detector (see Appendix B, SOP 1.2, Total Alpha Surface Contamination Measurements). ~~A thin-window GM will also be used to measure beta contamination levels.~~ Any contaminated clothing such as gloves, boot covers, and coveralls will be removed and cleaned or placed in a designated contaminated clothing container. For any reading above background on the actual skin, personnel will be required to wash the contaminated area and have the area re-surveyed until background levels are achieved or approved by the site RSO or his designee. Based on previous experience, skin contamination is easily removed by washing.

All personnel working with licensed material, or in an area where licensed material is present, will be monitored. On-Site workers will be issued individual thermoluminescent dosimeters (TLDs) to monitor their external exposure as appropriate (see Appendix B, SOP 1.3, External Dosimetry Procedure). The TLDs will be worn under protective clothing to prevent possible contamination. All TLDs, as well as controls, will be located in the Clean Zone when not in use. A third-party vendor will read them quarterly during periods of high activity. Otherwise, they may be read semiannually.

The air-sampling program, as described herein, will follow the guidance provided in NRC Regulatory Guide 8.25, Air Sampling in the Workplace,

and 8.34, Monitoring Criteria and Methods to Calculate Occupational Radiation Doses.

Occupational general area airborne particulate sampling with RAS-1 intermediate volume air samplers, with flow rates of 60 to 80 liters per minute, will be conducted at work locations each work day according to SOP 1.6, Intermediate Volume Air Particulate Sampling. Locations of sampling stations will be determined based on the prevailing wind direction observed on-site, site activities, and source terms. Air samples will be collected at a height of 1 to 1.5 meters above ground level in locations free from unusual micrometeorological or other conditions that could result in artificially high or low concentrations. General air monitoring will be performed daily or whenever site work activities have the potential for releasing airborne radioactivity. If airborne concentrations of radioactivity in the work area exceed 10 percent of the concentration limits for insoluble Thorium 232 (1×10^{-12}) as stated in 10CFR Part 20 Appendix B Table 1, ~~then personnel will be required to don air purifying respirators and associated Level C protective equipment.~~ the RSO will evaluate the necessity to don air purifying respirators and associated Level C protective equipment. ~~Personnel performing critical jobs such as the loader operator will also work in Level C protective equipment.~~ Level C protection consists of steel toed safety shoes, boot covers, long sleeve disposable coveralls, cloth gloves, a full face air purifying respirator, hearing protective devices (as required) and a hard hat. Any personnel not properly trained, not properly fitted, or not medically certified to use respirator equipment will be required to leave the area of elevated airborne activity. The respirator fit tests will be conducted according to SOP 1.11, Respiratory Protection Program. Under work conditions where the monitoring results indicate that the thorium action level is not exceeded, personnel will use level D protection equipment (no air purifying respirator).

In addition, ~~a high volume (Hi Vol)~~ air ~~sampler~~ sampling may be used to assist in assessing the airborne particulate concentrations in ~~the~~ work areas ~~environment (see SOP 1.18, Sampling of Airborne Particulates using High Volume Air Samplers)~~.

The THORAD Project performs bioassay analysis based on routine and non-routine criteria. ~~All individuals receiving routine and non-routine in vivo analysis (whole body count) will be directed to the Big Rock Nuclear Power Plant in Charlevoix, Michigan. The analysis will be performed in accordance with their standard operating procedures, as approved by the Nuclear Regulatory Commission (NRC).~~

Routine bioassay measurement is required for the following:

1. New employees assigned to the Project should receive a baseline/entrance bioassay measurement prior to receiving a TLD unless they have never entered a Radiological Controlled Area or as otherwise determined by the RSO.
2. When an individual no longer requires access to the "Controlled Area" due to termination, an exit ~~Whole Body Count (WBC)~~ bioassay will be scheduled, unless otherwise determined by the RSO.

A non-routine bioassay is required when an individual is suspected of having received an unplanned intake of radioactive material.

All exposures, internal and external, will be documented and maintained at the site in worker radiation exposure files.

In addition, gamma exposure rate surveys, using hand-held detectors, will be conducted in the work area when significant work activities are being performed. Exposure rate surveys are performed in accordance with SOP 1.4, Beta-Gamma Radiation Measurements Using a Geiger-Muller Director or SOP 1.5, Measurement of Gamma-Ray Fields Using a Sodium Iodide (Nal) Detector.

Basic emergency and first aid equipment will be available at the Support Zone and/or the Contamination Reduction Zone. They will include one (1) standard industrial first air kit, one (1) fire extinguisher rated at least 1A,

10:ABC, one (1) portable emergency eyewash limit, and air hose (at least one).

10.3 Environmental Monitoring

The radiological constituents present in the slag and soil at the Bay City site is thorium-232, thorium-230, and their associated decay products. These radiological constituents could pose an internal radiation hazard with inhalation of airborne alpha activity being the primary exposure pathway. The airborne thorium-232, thorium-228, and thorium-230 concentrations will be controlled by a measurement of gross alpha emissions from air particulate filters, assuming that all emissions arise from the decay of thorium-232, the most restrictive isotope. At least a 72-hour decay period will be used prior to analysis to allow time for the decay of radon-222 and radon 220. For each project at the site during which 15 or more daily air samples indicate a gross alpha air concentration greater than 10% of the insoluble thorium-232 concentration in 10CFR Part 20, Table 2, the filters will be saved for an isotopic analysis. ~~upon completion of the project.~~

10.3.1 Perimeter Environmental Air Monitoring

RAS-1 intermediate volume air samplers will be stationed at various locations along the site perimeter, as determined by the RSO, to assess thorium-228 and 230 concentrations and demonstrate compliance with 10 CFR Part 20. Locations of sampling stations will be determined based on wind rose data gathered by Saginaw airport (Tri-Cities) and demographic factors. Because there are no stack emissions associated with site activities, maximum off-site concentrations from dust that may be produced are assumed to occur at ground level near the site boundary. Air samples will be collected at a height of 1 to 1.5 meters above ground level in locations free from unusual micrometeorological or other conditions that could result in artificially high or low concentrations. Locations will be selected to avoid areas where large-particle (non-respirable) fugitive dust can dominate the sample. Monitoring will be continuous for 24 hours a day. The filters are changed out weekly with isotopic analysis required for most samples or composites of samples.

Background measurements will be made prior to beginning work in order to determine the area background particulate radioactivity, as well as to assess the air quality impact of site operations at the site perimeter. Sampling will decrease only if there are no anomalous results of any trends in the increase in the background concentrations. A minimum sampling rate of 60 L/min (no more than 80 L/min) will be sufficient to determine whether off-site concentrations are exceeding the general public limit for thorium-228 and 230 of 2 x 10^{-14} uCi/ml. Sampling will be performed in accordance with SOP 1.6, Intermediate Volume Air Particulate Sampling.

10.3.2 Background Thorium-228, Radon-222, and Radon-220 Concentrations

Natural background concentrations of thorium-228, radon-222, and radon-220 will be assessed to indicate their contribution to on-site and off-site air concentrations. The control background station will be located at a suitably chosen background location in the unaffected area. SOP 1.6 will be used to measure background concentrations of long-term gross alpha, isotopic thorium, radon-222, and radon-220. Thorium control concentrations using gross alpha results will be determined on weekly basis from continuous air sampling (24 hours a day).

10.3.3 Groundwater Monitoring Program

In 1978, a research project was completed to determine the potential for release of thorium or thorium daughters form the storage site into groundwater. This research project identified the leaching properties of the magnesium/thorium slag under laboratory conditions and was completed in 1978. It was determined that under these most severe laboratory-created conditions there was a potential for a slight amount of thorium and/or it's daughter's to leach into water. Because of this potential Dow has analyzed groundwater samples from nine (9) wells

immediately around the storage site. No thorium or thorium daughter's were found at the detection limit of 2 pCi/L, based on Pb-212. Analysis of these samples by gross beta counting indicated a concentration of radioactivity ranging from 30 to 800 pCi/L in various samples. A careful crosscheck by gamma spectroscopy indicated that all of the gross beta activity could be accounted for by naturally occurring K-40.

In September 1979, the Michigan Department of Public Health, the Nuclear Regulatory Commission (Region III) and Dow sampled immediately adjacent to the thorium slag storage site. Identical soil, sediment, and groundwater samples were taken by each group and analyzed independently for Th-232. Again, the results indicated there was no significant migration of thorium from the storage site. The samples analyzed by Dow contained Th-232 at a concentration within the normal background for Th-232. Furthermore, the Nuclear Regulatory Commission (NRC) report on the September 1979 survey concluded, "…no migration of thorium residues is indicated…" from the soil and sediment samples. The report also concluded that the groundwater samples indicated "…thorium migration (if any) into ground or surface water was (and continues to be) extremely small".

However, in 1979 Dow began a semi-annual program of groundwater sampling from the nine (9) wells surrounding the slag storage site. This program was continued until mid 1996 when it became necessary to remove the wells to implement the SDMP. The NRC Region III was informed of the need to remove the wells and a copy of the most recent monitoring data was provided to them during the site visit in August 1996. The sampling events

conducted until the wells were removed indicated that the conclusion of the September 1979 NRC report was valid. ~~Based upon this information, no groundwater program is planned at the site.~~

10.4 Clean Area and Laboratory Monitoring

Administration offices and laboratory facilities will be located within the designated clean (unaffected) area. The areas outside and within the facility not used for analytical work will be maintained as clean areas. Clean areas inside the facility will be inspected daily and monitored weekly during periods of significant site activity according to SOPs 1.1 and 1.7, Sampling for Removable Alpha Contamination. The laboratory equipment used to measure removable alpha contamination (SOP 1.7) is sufficient to detect near background levels of activity. Any contractor clean areas developed at the site inside the control area will require the same inspection and monitoring frequency. All clean areas inside the control area will be posted "CLEAN AREA." Potentially contaminated clothing, tools and equipment may not be stored in clean areas.

The facilities will also include a short-term sample storage room, analytical laboratory, and general chemistry laboratory with a vented fume hood. The entryways to these areas and the fume hood will be posted "CAUTION RADIOACTIVE MATERIALS." These areas will be treated and controlled as potentially contaminated areas, but will be inspected and monitored as clean areas in order to prevent the possible spread of contamination to the clean areas inside the facility. These laboratory areas will be kept clean to minimize exposure to personnel as well as to prevent the potential spread of contamination. Smoking, drinking, chewing, and eating will be prohibited at all times in the general chemistry laboratory and sample storage room. The doors to these rooms will be kept closed during work activities.

10.5 Sample Control, Handling, Packaging and Shipping

Samples are collected in the potentially contaminated (affected) area and placed in ~~2-liter Marinelli beakers~~ 500 ml containers. The exteriors of the

~~beakers~~ containers are wiped with a clean towel to remove potential exterior contamination. For samples of slag material, the exteriors are cleaned and surveyed for total contamination (SOP 1.2) to ensure that there is not detectable external contamination present. The 500 ml containers ~~beakers~~ containing contaminated slag material will be labeled "~~CAUTION~~ RADIOACTIVE MATERIAL". No slag sample will be removed from the affected area without this label.

The samples will be brought to the on-site laboratory for analysis. The samples may be analyzed using gamma spectroscopy without additional sample handling. These samples may be stored in the sample storage room for short periods of time. However, the quantity and storage time will be limited since the presence of the samples may affect the analytical laboratory radiological background, thereby creating analytical errors.

Samples analyzed for hazardous substances may be removed from the container ~~Marinelli beaker~~ and tested using various techniques. Dry dispersible material will be handled in the vented fume hood within the general chemistry laboratory. All liquid wastes will be collected or discharged to the laboratory sink where they are routed to a holding tank. The holding tank contents will be tested prior to off-site release to ensure compliance with all environmental regulations. The radioactive assay will be compared with the criteria specified in 10 CFR 20. Upon completion of the laboratory work, any sediments having radionuclide concentrations above background will be disposed of as radioactive waste.

Any samples of radioactive material to be analyzed off-site (QC samples) will be shipped in accordance with relevant NRC and DOT regulations and SOP 1.8, Guide to the Handling, Packaging, and Shipping of Samples. SOP 1.9, Sample Control and Documentation, applies to all samples collected on-site.

11.0 General Standard Operating Procedures for Field Operations

To assure that operations associated with the remediation of the thorium contaminated storage areas are conducted at the highest level of safety and that all releases and exposures are maintained at ALARA levels, the following practices will be followed:

11.1 Standard Safe Work Practices

- A RSO or designee will be present on-site at all times during significant radiological characterization survey activities and shall provide all monitoring and health and safety support in order to ensure the adequacy of protective equipment and safety procedures.
- Knowledge of the location of safety equipment and emergency evacuation procedures will be established prior to initiation of operations. Use of designated protective clothing will be required during all activities as described in RHSP.
- ~~The buddy system and line-of-sight shall be employed at all times when in an exclusion zone.~~
- If field personnel perceive an unsafe condition or situation, the RSO or their supervisor will be notified immediately.
- All field operations should be planned and discussed with personnel prior to the beginning of start-up of site activities. A Tailgate Safety Meeting shall be conducted at the beginning of each shift and whenever new personnel arrive on the job.
- Be cognizant of slip-trip hazards present due to areas of difficult terrain.
- Practice contamination prevention both on- and off-site.
- Ignition sources in the vicinity of potentially flammable materials are prohibited.
- When working in areas where flammable vapors may be present, particular care must be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded.
- Approved and appropriate safety equipment shall be worn where required.
- Smoking is restricted to designated areas. Eating, drinking, or application of cosmetics is restricted to the Clean Zone.
- All employees shall be required to wash their faces and hands with soap and water before eating, drinking, smoking, or applying cosmetics.

- Contaminated tools and hands must be kept away from the face. Do not unnecessarily touch a contaminated surface or allow clothing, tools or other equipment to do so.
- Persons with long hair and/or loose fitting clothing that could become tangled in power equipment must take adequate precaution.
- Report the presence of open wounds to the RSO prior to work in the "Exclusion Zone" (affected area). If a wound occurs in such an area, report immediately to RSO and attend to the wound. Apply first aid immediately to any and all cuts, scratches and abrasions.
- Horseplay is prohibited in the work area.
- Follow good "housekeeping" practices to minimize the amount of material and equipment that has to be decontaminated or disposed of as contaminated wastes.
- Contaminated protective equipment shall not be removed from the contamination reduction zone until it has been cleaned and surveyed or properly packaged and labeled.
- Working under the influence of intoxicants, narcotics, or controlled substances is prohibited.
- Be alert to your own physical condition. Watch your buddy for signs of fatigue and/or exposure.
- Initiate a work/rest regimen if ambient temperatures and protective clothing create a potential heat stress situation.
- Do not proceed or continue working unless adequate lighting exists and appropriate supervision is present.
- Legible and understandable precautionary labels shall be prominently affixed to containers of raw materials, scrap, waste, debris, and contaminated clothing.
- Removal of materials from protective clothing or equipment by blowing, shaking, or any other means, which may disperse materials into the air, is prohibited.
- ~~Portable emergency shower stations shall be strategically located throughout the controlled area.~~
- Change rooms and shower facilities shall be provided for the use of employees working in the controlled area.
- Showers will be available for personnel to use at their discretion before leaving the job site.

- Walking through mud puddles, kneeling on the ground, or leaning against excavation machinery should be avoided whenever possible.
- Monitoring equipment shall not be placed on potentially contaminated surfaces.
- A flagman with roadwork vest, signs, cones, and high-level warning signs shall be provided when it is necessary to control normal vehicular traffic due to vehicles entering or leaving the site.
- Wetting agents shall be used for dust abatement when the probability of airborne contamination exits.
- Wet materials shall be dewatered prior to loading onto transport trucks to reduce the possibility of contamination run-off when in transit.
- Transport trucks shall be securely tarped when filled to prevent an inadvertent release of material.
- Prompt remedial action shall be taken whenever an inadvertent release of a hazardous material occurs.
- The OSHA poster, Job Safety and Health Protection, and NRC poster, Notice to Employees (Appendix C & D) will be posted at the Bay City site in conspicuous places.

11.2 Hazard Control

Personnel working on the remediation of sites involving chemical and radiological substances may encounter conditions that are unsafe or potentially unsafe. In addition to the danger caused by the physical, chemical, and toxicological properties of the material present or other types of hazards, e.g., electricity, water, heavy equipment, falling objects, loss of balance, or tripping, can have an adverse effect on the health and safety of personnel. This section describes the general requirements that will be implemented to minimize these potential adverse effects.

The excavation and hauling of the thoriated material requires proper handling and control measures to ensure the safety of personnel from both aspects of radiological exposure and physical/mechanical hazards.

- All trenching and excavation work must comply with all safety regulatory agency rules.

- Before any excavation work, the existence and location of underground pipe, electrical conductors, etc., must be determined.
- The walls and sides of all excavations more than 4 feet deep, which a worker may enter, shall be guarded by shoring laid back at a 1 on 1 maximum slope or some other equivalent means.
- Daily inspections of excavations shall be made. If there is evidence of possible cave-ins or slides, all work in the excavation shall cease until the necessary safeguards have been taken.
- Excavations more than 4 feet deep, which a worker will enter, shall have ladders extending not less than 3 feet above grade located no more than 25 feet from the worker's locations.
- All excavations shall be backfilled as soon as practical after work is completed and all associated equipment removed.
- All equipment shall be kept out of traffic lanes and access-ways. Equipment shall be stored so as not to endanger personnel at any time.
- All excavations shall be completely guarded on all sides. Excavated material shall be kept a minimum of 2 feet from edges of all trenches.
- Excavation guarding shall consist of wooden or metal barricades spaced no further apart than 20 feet. Such barricades shall be not less than 36 inches high when erected.
- Protection between barricades shall consist of at least 3/4 inch wide nylon tape, yellow, or yellow and black tape. The tape shall be stretched between barricades.

12.0 Decontamination

12.1 Personnel Decontamination

All personnel shall be given instruction on the proper removal of anti-contamination clothing at the control point exit from the affected area. PPE clothing and equipment shall be worn and removed in such a manner to preclude the transfer of potential contamination from external surfaces to inner clothing or skin surfaces.

All personnel, after removal of PPE at the control point, shall perform or have performed a whole body survey (called frisk) for contamination using the control point 'frisker'. ~~(typically AC ratemeter with GM pancake detector). An immediate and sustained audible increase on the frisker (typically 100cpm > background) may indicate the presence of residual contamination.~~

In the unlikely event that contamination is found on a person's underclothing or skin, the following actions are applicable:

- Note area and resurvey;
- Complete whole body frisk to determine other areas;
- Notify RSO or fellow worker; and
- Remain at control point for response by RSO or radiological control technician.

The presence of contamination on skin or clothing does not present an immediate threat to health or safety. However, decontamination of personnel, if required, shall only be performed by the RSO/RCT and properly documented.

12.2 Procedures for Handling Potentially Contaminated Property and Equipment

12.2.1 Monitoring for Unrestricted Release from the Site

Property and material to be released includes goods or equipment that have inherent value in their present physical form, such as heavy earth-moving equipment, vehicles, hand tools, piping, or any other objects that could be reused.

All heavy equipment and tools used during site remediation activities will be wiped down and/or steam cleaned or power washed (if required) prior to being scanned for residual surface contamination. The RSO and Site Manager shall select a location for this activity.

Standard Operating Procedures (SOPs) have been developed in order to meet the surface residual contamination requirements set forth in the U.S. Nuclear Regulatory Commission (NRC) the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material". The procedures include the following:

1. A survey form, on which the piece of equipment or tool shall be identified, will be created and filed accordingly. The license tag number, model or serial number, or any other available unique identifier will be recorded, when possible.

2. A complete scan of potentially contaminated areas will be performed by a RCT using an alpha probe and rate meter with the results recorded on the data form. Maximum and average total alpha levels shall be recorded.

3. A minimum of one wipe test will be conducted by RCT covering 100 cm^2 per 1 m^2 of potentially exposed area. For articles with areas less than 100 cm^2, the entire surface shall be wiped, and the results shall be reported based on an estimate of the area sampled. The wipe test shall be a biased sample from areas judged or measured (from scan) to have the highest potential for contamination and highest potential for removal of material.

4. Should results of the wipe test or surface scan for total alpha activity indicate activity approaching the limits, additional measurements may be required to ensure that the release criteria are met.

12.2.2 Monitoring of Scrap Material and Debris for On-Site Management or Disposal

Scrap material and debris at the sites consist of building material and other material potentially containing oxidized iron and steel, aluminum, concrete, bricks, cross ties, and small pieces of magnesium. Most of this material is uncontaminated and when practical, will be buried on-site (at Bay City) rather than shipped to a radioactive waste disposal site.

Experience with the scrap material and debris at the Madison, Illinois storage site containing the same thorium material showed that only a very small percentage of the pieces had measurable surface contamination, with a few exceptions where the concentrated thorium slag was embedded in rusted drums. In addition, bricks and other debris found in the concentrated slag had measurable levels. Attempts failed at decontaminating the bricks using high-pressure water. Therefore, if these items are present, they will likely be sent to the radioactive waste disposal site. Material potentially suitable for on-site burial will be selected according to the following criteria:

- Scrap iron and steel having no visible evidence of slag contamination;
- All debris found in the clean slag areas or off-pile areas;
- All debris no likely to have come into contact with the highly concentrated thorium slag material such as that currently stored at the covered pile;
- Material that can be transported to the monitoring area without fear of release of contaminated material in the clean zone (that is, no loose slag on or in the pieces);
- Pieces that do not have the potential to act as a container for contaminated slag; and
- Objects having no value for reuse.

Trained technicians (RCTs) will scan each object to be buried, according to SOP 1.2. If only background levels are found, the object will be placed in a pile for potential burial. One hundred percent of the objects will be selected for a wipe test using SOP 1.7 to check that the removable contamination

limits specified in Table 12.1 are met. If the results are background levels, the pile will be buried. If any of the samples are elevated, the pile will either be disposed of as radioactive waste or each piece will be wipe-tested to ensure that the criteria in Table 12-1 are met. For those items shown by the scan to have measurable contamination, the item will either be sent for disposal as radioactive waste or monitored using SOPs 1.2 and 1.7 to ensure compliance with the total and removable contamination limits for unrestricted release prior to burial (see Table 12.1). As a final check to ensure that no concentrated thorium-bearing material is hidden inside an object, a gamma scan will be done according to SOP 1.5. Any increase above the local gamma-ray background will be reason to send the object for radioactive waste disposal. The sensitivity of the instrumentation used in SOP 1.2 and SOP 1.7 is sufficient to measure the levels specified in Table 12.1.

The monitoring plan is based upon the following assumptions:

- The buried material will have little or no value to anyone in the future;
- It has been verified that the pieces do not contain radioactive slag material;
- All surfaces do not have any measurable total surface contamination, 100% of the pieces have been checked to ensure that there is no removable contamination; and
- If it is desirable to bury material with measurable total surface contamination, the material will be monitored to ensure that it meets the release criteria for removable surface contamination as well as total surface criteria, as presented in Table 12.1.

  This plan is considered conservative, considering our extensive experience with these materials at the Madison, Illinois site. Implementation of this plan will result in compliance with the criteria in Table 12.1. All information below has been obtained utilizing the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material".

Table 12.1
Surface Contamination Limits (Alpha)

		NRC Guideline *
I	Removable Contamination:[a] ($dpm/100cm^2$) A. Average over any surface[b]	26[c]
II	Total Contamination[d] ($dpm/100\ Cm^2$)	
	A. Average over any surface[e]	129
	B. Maximum on any surface[f]	387

Reference: NRC 1987

* The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with a dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination is detected on objects with surface area less than 100 cm^2, the activity per unit area should be based on the actual area and the entire surface should be wiped. These numbers are maximum amounts. [b]Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object. The maximum contamination level applies to an area of not more than 100 cm^2. [d]Total contamination indicates fixed plus removable. [d]Total contamination indicates fixed plus removable.

The values have been calculated using the average thorium-230 to thorium-232 ratio of 3 to 1, the limits for pure alpha emitting radionuclides for thorium-230, the limits for natural thorium-232 in equilibrium with its progeny for thorium-232, and the use of the formula below.

$$\sum_{I-1}^{n} \frac{Af_1}{g_1} \_ 1$$

where:

f_i = fraction of the total activity on a surface due to the i_{th} radionuclides
A is the total activity on the surface
g_i = the applicable guideline for the i_{th} radionuclides

[a] Per the U.S. Nuclear Regulatory Commission (NRC) Guideline "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."

[b] The NRC Guideline does not specify an average removable contamination level.

[c] These values were determined by taking the ratios of Th-232 and Th-230 at the site and applying them to the values from NRC Guideline Table 1.

[d] Total contamination indicates fixed plus removable.

[e] Per the NRC Guideline, "Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object."

[f] Per the NRC Guideline, "The maximum contamination level applies to an area of not more than 100 cm^2."

12.2.3 Waste Disposal Procedures

All discarded waste materials such as PPE consumables, etc., shall be handled in such a way as to exclude the potential for the spread of contamination, creating a sanitary hazard or causing litter to be left on-site. All potentially contaminated disposable wastes, e.g., boots, gloves, coveralls, will be scanned to determine if they are radiologically contaminated. If contaminated, they will be bagged and/or drummed, labeled and segregated in a designated and secured area on-site for disposal. All contaminated waste materials shall be disposed of in accordance with applicable regulations. All non-contaminated materials shall be collected and bagged for proper disposal as normal domestic waste.

All other disposable protective clothing: gloves, boot covers, contaminated coveralls, will be tightly bagged and stored appropriately on-site in drums or other adequate containers following completion of each day's work. All drums/containers used for storage of such waste will be clearly labeled as "PPE".

All non-disposable contaminated personal protective equipment that will not decontaminate adequately will also be discarded and disposed of as above and replaced with new or uncontaminated equipment as needed. Steel-toed field boots or shoes will be decontaminated thoroughly. If this procedure does not adequately remove all contaminated materials, they will also be disposed of as described above.

13.0 Contingency Plan

The contingency plan outlined in this section, will be known by all field personnel involved in site activities and will be covered during the initial worker health and safety training. The contingency plan will be available for use at all times during site work.

Various individual site characteristics will determine preliminary actions taken to assure that this contingency plan is successfully implemented in the event of a site emergency. It should be noted that drills are not conducted on site based on the low levels of radioactive material present at the Bay City site, the Radiation Protection Management has deemed it unnecessary and impracticable.

The emergency coordinator, the Field Operations Leader, shall make contact with the Dow personnel at the site prior to beginning of work on-site. Prior to start-up of site operations, the emergency coordinator shall also contact the local emergency services regarding the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The emergency coordinator will make necessary arrangements to be prepared for any emergencies that could occur.

The emergency coordinator will implement the emergency plan whenever conditions at the site warrant such action. The emergency coordinator will be responsible for coordination of the evacuation, emergency treatment, and emergency transport of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

13.1 Material Release

The potential for release of contaminated material from the site will be minimized. The primary potential release mechanism from the Bay City site is through the air. When significant quantities of material from the thorium storage pile are exposed, special precautions will be taken, including applying water or stopping work will be implemented to reduce air emissions from the site.

13.2 Evacuation

In the event of an emergency situation such as fire, an air horn or other appropriate device will be sounded in 10 second intervals indicating the initiation of evaluation procedures. All personnel will evacuate and assemble at a pre-designated location. The location shall be upwind of the site where possible. For efficient and safe site

evacuation and assessment of the emergency situation, the emergency coordinator will have authority to initiate action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed in the area once the emergency signal has been given. The RSO or designee will see that access for emergency equipment is provided and that all equipment have been shut down and secured once the alarm has sounded. Once the safety of all personnel is established, the emergency response groups, as necessary, will be notified by telephone of the emergency.

13.3 Personal Injury

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted; monitoring will not be performed. The site RSO or designee (health physicist) shall accompany contaminated victims to the medical facility in accordance with SOP 1.12, Emergency Procedures for Handling Services Injuries with Potential Radiological Contamination. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel or the person is suffering from heat stroke. For minor medical problems or injuries, personnel will be monitored and decontaminated, if necessary, prior to administering first aid. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and first aid begun immediately.

In an emergency situation, an ambulance shall be contacted for transportation to the hospital as necessary. Only in non-emergency situations shall an injured person be

transported to the hospital by means other than an ambulance. The hospital routes are identified in Section 13.

13.4 Fire/Explosion

Fire extinguishers will be available to support local fire fighting. They will be placed in all buildings and near all construction activity and will be checked monthly or after each use. The proper use of the extinguishers will be incorporated in the site health and safety training.

In the event of a fire or explosion, immediate evacuation of the site (air horn will sound in 10 second intervals) shall be initiated by the emergency coordinator. The local fire and police department and other appropriate emergency response groups will be notified immediately if an actual fire or explosion takes place.

13.5 Chemical Exposure

In the event project personnel are exposed to toxic chemicals, the following guidelines will be followed:

Skin Contact: Apply copious amounts of soap and water. Wash/rinse affected area thoroughly and provide appropriate medical attention. Emergency eyewash is located in the Support or the Contamination Reduction Zone. Eyes should be rinsed for a minimum of 15 minutes upon chemical exposure.

Inhalation: Move to fresh air and area, if necessary, decontaminate/transport to medical facility.

Ingestion: Decontaminate and transport to medical facility.

Puncture: Decontaminate and transport to medical facility.

Wound/Lacerations: Decontaminate and transport to medical facility.

13.6 Adverse Weather Conditions

In the event of adverse weather conditions, the RSO or designee will determine if work can continue without compromising the health and safety of field personnel. Some of the items to be considered prior to determining if work should continue are the following:

- Potential for heat stress and heat-related illnesses;
- Potential for cold stress and cold-related illnesses;
- Treacherous weather-related working conditions; and
- Potential for an electric storm.

13.7 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by the RSO or designee via telephone:

1. ~~Maria Sandow~~ Charlene Loar, HSO	(989) 671-1642	(Work)
	(989) 737-0941	(Mobile)
2. Ben Baker, Project Manager:	(989) 636-0787	(Work)
	(989) 737-0973	(Mobile)

3. The employer of any injured worker, if not Dow employee.

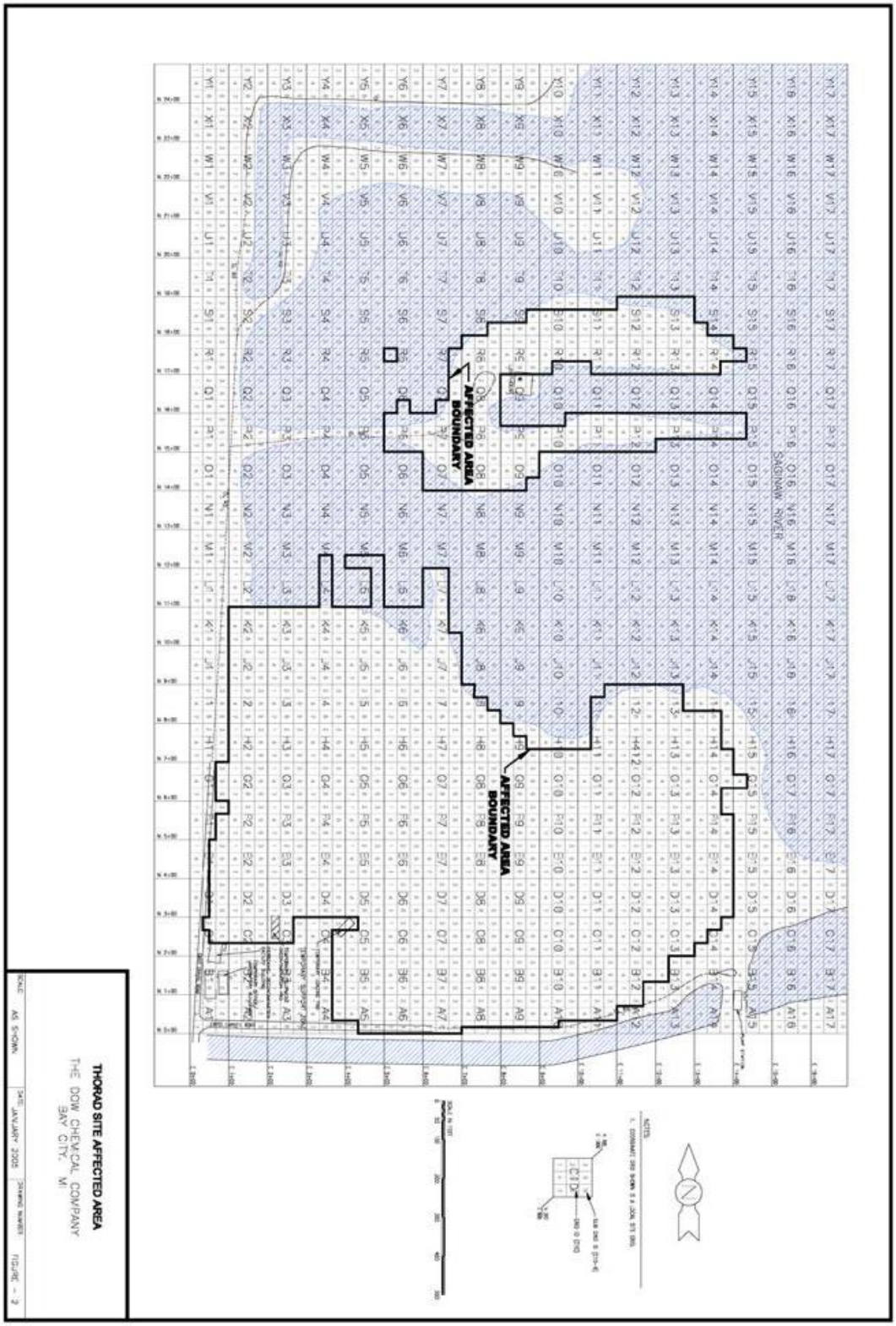
Written confirmation of verbal reports are to be submitted within 24 hours by the RSO or designee. An Accident Incident Report form is to be used for this purpose. All personnel contacted by telephone are to receive a copy of this report. If the employee involved is not Dow employee, his employer will receive a copy of this report. For reporting purposes, the term accident refers to fatalities, lost time injuries, OSHA recordable injuries, spill or exposure to hazardous materials (radioactive, toxic, explosive, flammable or corrosive), fire, explosion, damage to property, or potential occurrence of the above.

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information, which is released by patient consent, is to be filed in the individual's medical records and treated as confidential.

Emergency Resources for the Bay City Thorad Site Project Number 007133				
Emergency Information		Name	Telephone Number from a Dow Phone	Telephone Number from a non-Dow phone
Local Resources	Dow Chemical Project Manager	Ben Baker	Office 6-0787 Mobile Phone (9) 989-737-0973	989-636-0787 989-737-0973
	Dow Chemical Owner's Rep	~~Bob Reiss~~ Ben Baker	Office 6-0787 Mobile Phone (9) 989-737-0973	989-636-0787 989-737-0973
Emergency Resources	**Ambulance**	**Dispatch**	**(9) 9-1-1**	**9-1-1**
	Hospital (Bay Medical)	**Dispatch**	**(9) 9-1-1**	**9-1-1**
	Police	**Dispatch**	**(9) 9-1-1**	**9-1-1**
	Fire Department	**Dispatch**	**(9) 9-1-1**	**9-1-1**
	Poison Control		**(9) 800-764-7661**	**800-764-7661**
Non Emergency Medical Resources	WorkCare	Dr. ~~Chan~~ Greaney	(9) 800-455-6155	800-455-6155
	Occupational and Preventative Medicine Associates	Dr. on Call	(9) 517-790-5990	517-790-5990
~~Radian Resources~~ URS Corporation	Field Services Manager	Gerard Sgro	Office – (9) 989-671-1641 Mobile – (9) 989-737-2555	Office – 989-671-1641 Mobile – 989-737-2555
	Field Services Superintendent	Gary Waugh	Office - (9) 989-671-1630 Mobile – (9) 989-737-3374	Office - 989-671-1630 Mobile – 989-737-3374
	Construction and Remediation Health and Safety Manager	~~Gary Beswick~~ Stephanie Taylor	(9) 512-419-5313	512-419-5313
	Regional Health and Safety Manager	Ken Yates	Office – (9) 979-238-7490 Mobile – (9) 979-482-0247	Office – 979-238-7490 Mobile – 979-482-0247
	Environmental Health & Safety Coordinator ~~Midland Office~~	~~Maria Sandow~~ Charlene Loar	Office – (9) 989-671-1642 Mobile – (9) 989-737-0941	Office – (9) 989-671-1642 Mobile – (9) 989-737-0941

13.8 Directions to the Hospitals

Figure 13-1 shows the route from the Dow Bay City site to the Bay Medical Center at 1900 Columbus Avenue in Bay City.


AFFECTED AREA BOUNDARY
AFFECTED AREA BOUNDARY
SAGINAW RIVER
THORAD SITE AFFECTED AREA
THE DOW CHEMICAL COMPANY
BAY CITY, MI

13.9 OSHA Form 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the project sites. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the HSO for maintenance. Subcontractor employees must also meet the requirements of maintaining an OSHA 200 Form. The accident/incident report to be employed will meet the requirements of the OSHA Form 101 (Supplemental Record), which must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

14.0 References

"Code of Federal Regulations, Title 49." U.S. Department of Transportation, Washington, D.C. October 1, 1997.

"Code of Federal Regulations, Title 29." Occupational Safety and Health Standards, Sections 1910 and 1926, Washington, D.C., October 1, 1997.

NRC. 1974. "Termination of Operating Licenses for Nuclear Reactors." Regulatory Guide 1.86. U.S. Nuclear Regulatory Commission, Washington, D.C.

"Standards for Protection Against Radiation", 10CFR Part 20, U.S. Nuclear Regulatory Commission, Washington, D.C., January 1, 1998.

~~Appendix A~~

~~Resumes~~

Appendix ~~B~~A

- **SOP 1.1 Access Control Procedures**
- **SOP 1.2 Total Alpha Surface Contamination Measurements**
- **SOP 1.3 External Dosimetry Procedure**
- **SOP 1.4 Beta-Gamma Radiation Measurements using a Geiger-Muller Detector**
- **SOP 1.5 Measurement of Gamma-Ray Fields using a Sodium Iodide (Nal) Detector**
- **SOP 1.6 Intermediate Volume Air Particulate Sampling**
- **SOP 1.7 Sampling for Removable Alpha Contamination**
- **SOP 1.8 Guide to the Handling, Packaging and Shipping of Samples**
- **SOP 1.9 Sample Control and Documentation**
- **SOP 1.10 Radiation Work Permit**
- **SOP 1.11 Respiratory Protection Program**
- **SOP 1.12 Emergency Procedure for Handling Serious Injuries with Potential Radiological Contamination at the Bay City Site**
- ~~**SOP 1.18 Sampling of Airborne Particulates using High Volume Air Samplers**~~
- **SOP 1.21 Soil Sample Counting and Gamma Spectrometry Analysis**
- **SOP 1.22 Calibration of the DOW Thorad Project Gamma Spectrometer**
- **SOP 1.23 Quality Assurance for Gamma Spectroscopy Counting System**

Appendix ~~C~~B
OSHA Poster, Job Safety and Health Protection

Appendix ~~D~~C
NRC Poster, Notice to Employees

Appendix ~~E~~D
List of Field and Laboratory Instrumentation