



# **MKM ENGINEERS**

*Radiation Safety Procedures*

*Book 2*

**"SAFETY IS THE FIRST & MOST IMPORTANT  
ASPECT OF ANY JOB"**

MKM ENGINEERS - 1999

A/3

Radiation Safety Procedures

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**MKMP-011**  
**CONTAINMENT DEVICES**

**MKMP-012**  
**PORTABLE HEPA & VACUUMS**



## Radiation Safety Procedure

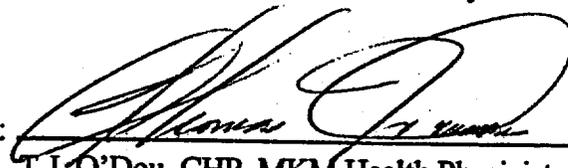
for

### Portable HEPA Sytems and Vacuum Cleaners

**MKMP-012**

Revision 0

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



## MKMP-012

Portable HEPA Systems and Vacuum Cleaners**1.0 Purpose and Scope**

- 1.1 The purpose of this procedure is to provide guidance and requirements for use and control of portable high-efficiency particulate air filtered (HEPA) ventilation systems and vacuum cleaners that are used to accomplish radiological work. This procedure specifies the radiological controls and the requirements for safe operation, maintenance, and storage involved with portable HEPA ventilation systems and vacuum cleaners used for radiological work. Installed or permanent ventilation systems are not within the scope of this procedure. Vacuum cleaners used solely for purposes or hazards other than radiological, such as asbestos, are also not covered by this procedure.

**2.0 General****2.1 Precautions**

- 2.1.1 Exercise caution when handling energized portable HEPA ventilation equipment, being aware of rotating fan blades that could be accessible through the outlet connection.

**CAUTION: Do not operate portable HEPA ventilation systems and vacuum cleaners in explosive atmospheres.**

- 2.1.2 Operate portable HEPA ventilation units in the position designated by the specific component technical manual. Any other position of operation may cause failure of the blower assembly resulting in severe personnel injury, or may retard operating efficiencies
- 2.1.3 Improper use of portable ventilation systems and vacuum cleaners can result in the spread of loose surface contamination, the generation of airborne radioactivity, or high dose rates.
- 2.1.4 Change-out of HEPA filters and vacuum cleaner emptying operations have a high potential to spread loose surface contamination and generate airborne radioactivity.
- 2.1.5 Generally portable HEPA ventilation systems or vacuum cleaners should not be used for work where tritium is the major radiological concern. Notify the RSO prior to the use of HEPA ventilation or vacuum cleaners in situations involving tritium
- 2.1.6 Do not use portable HEPA ventilation systems or vacuum cleaners without a current dioctyl phthalate (DOP) test inspection sticker for radiological work. A DOP test is valid for 12 months provided integrity of the unit is maintained.
- 2.1.7 If the particle size of the contaminant has the possibility to be  $\leq 0.3 \mu\text{m}$ , the use of portable HEPA ventilation systems or vacuum cleaners should be referred to the RSO for evaluation. DOP testing media for HEPA filters uses particles with an average size of  $0.3 \mu\text{m}$ .

MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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2.1.8 Notify the RSM prior to the use of a HEPA vacuum cleaner for fissile materials to the use of a HEPA vacuum cleaner for fissile materials.

3.0 References, Records and Equipment

3.1 References

MKMP-007 Air Sampling and Sample Analysis  
MKMP-008 Radiation and Contamination Surveys

3.2 Records

Survey records are generated during the performance of this procedure. The original of the records is the record copy for the project file. The record copy is given to the RSO for processing, including arrangement and filing. Copies of the records may be made for information purposes.

These records are used by the Radiation Safety Program to document radiological surveys.

3.3 Equipment

HEPA ventilation unit and HEPA filtered vacuum cleaner

4.0 Responsibilities

4.1 The Radiation Safety Officer has responsibilities for:

- The overall radiological control of portable HEPA ventilation systems and vacuum cleaners.
- The use of portable HEPA ventilation systems and vacuum cleaners by radiation safety personnel.
- Implementation of this procedure.
- Ensuring that Health Physics Technicians (HPTs) are qualified to perform this procedure and are documented as such.
- Providing oversight and guidance in the performance of this procedure.
- Ensuring that training on this procedure is developed, kept up-to-date, and offered to radiation safety personnel needing it.
- Documentation of training completion.

4.2 The HPTs are responsible for:

- The direct radiological control of portable HEPA ventilation systems and vacuum cleaners used by all facility organizations.
- Properly operating portable HEPA ventilation systems and vacuum cleaners. In addition, if for any reason an HPT is unable to follow this procedure, the HPT shall immediately stop and notify the RSO.

## MKMP-012

Portable HEPA Systems and Vacuum Cleaners5.0 Procedure

5.1 Prior to use, inspect the equipment for:

- Any physical damage.
- Properly made hose connections.
- Electrical connections and cables in good condition.
- A DOP test inspection sticker, if required, certifying the test has been performed within the last 12 months.
- Differential pressure (d/p) gauge reads zero, if installed.
- Integrity of tamper seal on unit.

5.2 Ensure that the d/p across the HEPA filter in portable ventilation units equipped with d/p gauges is less than 3 in. wg (inches of water, gauge; clean filter d/p is 1 in. wg) when operating. Pressures greater than 3 in. wg indicate the possible need for HEPA filter replacement.

5.3 Ensure that portable ventilation system exhaust is directed away from contamination or airborne areas.

5.4 Contain suction hose end(s) when portable ventilation systems are secured to prevent the spread of loose surface contamination.

5.5 Use of HEPA Vacuum Cleaners

5.5.1 Prior to use, inspect the equipment for:

- Any physical damage.
- Properly made hose connections.
- Electrical connections and cables in good condition.
- A DOP test inspection sticker, if required, certifying the test has been performed within the last 12 months.
- Integrity of tamper seal on unit.

5.5.2 Ensure that vacuum cleaner exhaust is directed away from loose surface contamination.

5.5.3 Contain suction hose end(s) when vacuum cleaners are secured to prevent the spread of loose surface contamination

5.6 Control and Storage of HEPA Ventilation Systems and Vacuum Cleaners of HEPA Ventilation Systems and Vacuum Cleaners ?

5.6.1 Portable HEPA ventilation systems and vacuum cleaners used for radiological work shall be positively controlled to prevent unauthorized use (e.g. locked storage room, locked to a structure at the storage or work area, etc.).

5.6.2 Maintain an inventory log using Attachment -1 or equivalent for all portable HEPA ventilation systems and vacuum cleaners used for radiological work within the area of responsibility.

MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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5.7 Maintenance of Equipment

- 5.7.1 Any work performed on portable HEPA ventilation systems and vacuum cleaners such as filter replacement, repairs, or emptying operations shall be accomplished under a separate RWP
- 5.7.2 Perform any maintenance or replacements on portable HEPA ventilation systems and vacuum cleaners in accordance with the specific equipment technical manual(s)
- 5.7.3 Stage all replacement parts (prefilters, filters, etc.) prior to the disassembly of any equipment.
- 5.7.4 Place an Out Of Service tag on any equipment whose HEPA filter has been replaced, integrity violated, or is in question until a DOP test is performed satisfactorily.
- 5.7.5 Upon completion of DOP testing, prior to placing unit in service, place Radiation Safety Tamper Seal Tape on unit to provide indication of unit integrity.

5.8 Radiological Controls

- 5.8.1 Provide specific instructions within the RWP or technical work document detailing the work step(s) requiring the use of portable HEPA ventilation systems or vacuum cleaners.
- 5.8.2 Monitor portable HEPA ventilation system exhaust by grab sample in accordance with procedures specified in the RWP.
- 5.8.3 Monitor for airborne radioactivity when HEPA vacuum cleaners are used in High Contamination Areas using breathing zone sampling in accordance with MKMP-007 and as specified in the RWP.
- 5.8.4 Obtain radiation and contamination measurements in accordance with MKMP-008 at least daily on HEPA vacuum cleaners during the performance of radiological work to detect any changes in vacuum cleaner and work area dose rates or contamination levels. The frequency of radiation surveys will depend on the evolution(s) during which the vacuum cleaner is used and shall be specified in the RWP.
- 5.8.5 Portable HEPA ventilation systems and vacuum cleaners used for radiological work shall be controlled and labeled as Radioactive Material, Internal Contamination when in use or when stored after use unless released in accordance with MKMP-025.

6.0 Attachments

MKMP Form 12-1      Portable HEPA Ventilation System and Vacuum Cleaner Inventory Log



**MKMP-013**  
**STEP-OFF PADS**

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**Radiation Safety Procedure**

for

**Step-Off Pads**

**MKMP-013**

**Revision 0**

Reviewed By: *D.J. Wells* 8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By: *T.J. O'Dou* 8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-013**  
**Step-Off Pads**

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**1.0 Purpose and Scope**

This Procedure instructs MKM field personnel project personnel in the proper use of step-off pads. This procedure applies to all MKM Radiological Remediation Projects or operations that use step-off pads for radiological contamination control.

**2.0 General****2.1 Precautions**

These pads should always be placed in the Radiological Buffer area just outside the contamination area as a control to prevent the spread of contamination.

**3.0 References, Records and Equipment****3.1 References**

RSM	Radiation Safety Manual
MKMP - 008	Radiation and Contamination Surveys
MKMP - 009	Routine Radiological Surveys
MKMP - 025	Release of Materials from Radiological Control

**3.2 Records**

All records generated by this procedure are used in the Radiation Safety Program to document contamination levels of work areas and materials onsite.

**3.3 Equipment**

Step off pads

**4.0 Responsibilities****4.1 The Radiation Safety Officer (RSO) is responsible for:**

- Ensuring that Health Physics Technicians (HPTs) are qualified to perform this procedure.
- Reviewing, approving, and transmitting documentation generated during the performance of this procedure.
- Maintaining knowledge of contents of operating procedures affecting the conduct of contamination surveys and communicating pertinent requirements to HPTs performing this procedure.

**4.2 HPTs are responsible for:**

- Performing contamination swipe analysis in accordance with this procedure.
- Discussing specific project contamination survey requirements with the RSM.

**MKMP-013**  
**Step-Off Pads**

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- If a Radiation Protection Technologist (RPT) is unable to perform this procedure due to errors, extenuating circumstances, or any other reason, the RPT shall immediately stop and notify the Radiation Safety Manager (RSM). All changes in sampling and survey protocol must be documented in field logbooks and on appropriate survey forms.

**5.0 Procedure****5.1 Location of Step-Off Pads**

**5.1.1** Radiation safety personnel will specify the placement of step-off pads based on the requirements listed below

- A single step-off pad should be installed at exit points to areas where loose surface contamination levels exceed 1000 dpm/100cm<sup>2</sup>
- Two step-off pads, separated by a covered area where possible, should be installed at exit points to areas where contamination levels exceed 100,000 dpm/100cm<sup>2</sup>.

**5.1.2** Consideration must be given to other radiological conditions and general safety precautions when installing step-off pads:

- Step-off pads should be positioned at personnel control points in such a manner that they do not cause individuals to remain in significant radiation fields while removing protective clothing. In these cases, the step-off pad should be separated from the actual point of exit, by a covered area.
- Step-off pads should be placed in such a manner that they do not constitute a safety hazard. For example, step-off pads should not be placed on steep ground, slippery surfaces, etc.
- Step-off pads should not be placed at Emergency Exits or at Equipment Entrances/Exits.

**5.2 Use of Step-Off Pads**

**5.2.1** Step-off pads shall be considered uncontaminated surfaces in the case of a single step-off pad; or as surfaces of lower contamination than the contaminated area, in the case of first of two step-off pads (when exiting the posted area). The step-off pad needs to be surveyed periodically in accordance with MKMP-009.

**5.2.2** Before stepping out of the Contamination Area or Airborne Radioactivity Area to the step-off pad, the worker should:

- Remove exposed tape.
- Remove rubber overshoes.
- Remove outer pair of gloves.
- Remove hood from front to rear.
- Remove respiratory protection, as applicable.
- Remove coveralls, inside out, touching the inside only.
- Take down barrier closure, as applicable.
- Remove tape or fastener from inner shoe cover.

**MKMP-013  
Step-Off Pads**

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- Remove each shoe cover, place the shoe cover into the container for contaminated shoes, and step onto clean step-off pad.
- Remove cloth glove liners.
- Replace barrier closure, as applicable.
- Commence whole body frisking.
- Monitor badge and dosimeter.

The sequence for the removal of primary and supplemental dosimetry is dependent upon where the dosimetry was worn and the potential for contamination.

**5.2.3 Use of Multiple Step-off Pads**

- Multiple step-off pads should be used to control exit from high surface contamination areas. These pads define interim control measures within the posted area to limit the spread of contamination. The following controls apply:
- The inner step-off pad should be located immediately outside the highly contaminated work area, but still within the posted area.
- The worker should remove highly contaminated outer clothing prior to stepping on the inner step-off pad.
- Additional secondary step-off pads, still within the posted area, may be used as necessary to restrict the spread of contamination out of the immediate area.
- The final or outer step-off pad should be located immediately outside the contamination area.

**6.0 Attachments**

None

MKMP-014  
RADIOLOGICALLY RESTRICTED AREAS



## Radiation Safety Procedure

for

## Radiologically Restricted Areas

**MKMP-014**

**Revision 0**

Reviewed By: *D.J. Wells* 8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By: *T.J. O'Dou* 8/27/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-014**  
**Radiologically Restricted Areas**

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**1.0 Purpose and Scope**

- 1.1 This procedure provides the methods MKM uses to control radioactive materials. Adherence to this procedure will provide reasonable assurance that personnel will remain free of contamination, contamination will not spread beyond the designated contamination area, and personnel exposures will be maintained As Low As Reasonably Achievable (ALARA).
- 1.2 This procedure will be used by MKM personnel to control and contain radioactive materials. The following are types of control methods that will be employed;
- Posting requirements for radioactive materials.
  - Establishing and posting radiation areas.
  - Establishing and posting contaminated areas.
  - Establishing and posting airborne radioactivity areas.

**2.0 General****2.1 Definitions**

- 2.1.1 Restricted Area - An area containing radioactive materials to which access is controlled to protect individuals from exposure to ionizing radiation.
- 2.1.2 Radioactive materials - Materials containing or capable of emitting alpha particles, beta particles, gamma rays, X rays, neutrons and/or other ionizing radiations.
- 2.1.3 Radiation area - Any area accessible to personnel in which there exists ionizing radiation at dose-rate levels such that an individual could receive a deep dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.
- 2.1.4 Contaminated Area - A restricted area that has radioactive materials above the limits specified in the Radiation Safety manual in the form of dusts, particulates, and sorbed contaminants that could adhere to personnel clothing and skin while working in the area.
- 2.1.5 Airborne radioactivity area - A room, enclosure or area in which radioactive material is dispersed in the form of dusts, fumes, particulates, mists, vapors, or gases and the concentration of the dispersed radioactive materials is in excess of:
- a) The derived air concentrations (DAC's) specified in Table 1, Column 3 of Appendix B, Title 10 Part 20 of the Code of Federal Regulations.
  - b) Concentrations such that an individual present in the area without respiratory protective equipment could exceed, during the hours the individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI).
- 2.1.6 ALARA - An approach to radiation exposure control to maintain personnel exposures as far below the federal limits as technical, economical and practical considerations permit.

**MKMP-014**  
**Radiologically Restricted Areas**

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**2.2 Quality Control**

Instrumentation used in the surveys will be checked with standards daily and verified to have current valid calibration.

**3.0 References, Records and Equipment****3.1 References**

10 CFR 20	<i>Standards for Protection Against Radiation</i>
RSM	Radiation Safety Manual
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-004	Operation of Ionization Chambers
MKMP-007	Air Sampling and Sample Analysis
MKMP-008	Radiation and Contamination Surveys

**3.2 Records**

3.2.1 Record any radioactive materials postings made in the project log book. Include the date, location, and all information posted.

3.2.2 Record the date and location of any radiation areas established in the project log book. Include a sketch of the area and radiation area boundary on survey forms.

3.2.3 Record the date and location of any contaminated areas established in the project log book. Include a sketch of the area and contaminated area boundary on survey forms.

3.2.4 Record the date and location of any airborne radioactivity areas established in the project log book. Include a sketch of the area on survey forms. Indicate time and date of any notifications required by this procedure.

**3.3 Equipment**

None Required

**4.0 Responsibilities**

4.1 Program Manager - The Program Manager is responsible for insuring that all personnel assigned the tasks of establishing and posting restricted areas are familiar with this procedure, adequately trained in the use of protective clothing, and have access to a copy of this procedure.

4.2 Radiation Safety Officer - The Radiation Safety Officer is responsible for training personnel in the procedures for establishing and posting restricted areas.

4.3 Technicians - Technicians establishing and posting restricted areas are responsible for complying with provisions of this procedure.

**MKMP-014**  
**Radiologically Restricted Areas**

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**5.0 Procedure****5.1 Posting requirements for radioactive materials**

- 5.1.1 Any area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in Appendix C, Title 10 Part 20 of the Code of Federal Regulations shall be posted with a sign or signs "CAUTION, RADIOACTIVE MATERIALS AREA" or "DANGER, RADIOACTIVE MATERIALS AREA".
- 5.1.2 When posting a room as required in step one, a sign should be placed on each entrance door to the room. If the area to be posted is not a room, the area containing the licensed material shall be bounded by a yellow and magenta/black rope or ribbon securely fastened to stanchions, posts or other durable devices and signs shall be displayed in all accessible directions.
- 5.1.3 Any container which contains licensed material in quantities equal to or greater than the quantities listed in Appendix C, Title 10 Part 20 of the Code of Federal Regulations shall be posted with a sign or label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIALS" or "DANGER, RADIOACTIVE MATERIALS".
- 5.1.4 When posting a container as required by step three, the label should also state the radionuclide present in the container, the activity in the container, the date at which the activity was determined, the radiation levels emanating from the unshielded radioactive source, and the radiation levels from the container holding the radioactive source. The label shall also state the mass enrichment if different from natural enrichment and the kind of material (Encapsulated source, liquid, powder, etc.).
- 5.1.5 Posting of containers is not required if containers are in transport and packaged and labeled in accordance with the regulations of the Department of Transportation (See Title 49 Parts 172 and 173 of the Code of Federal Regulations). Containers which are awaiting shipment at a facility are subject to posting requirements as specified in step one.

**5.2 Establishing and posting radiation areas.**

- 5.2.1 Any area accessible to personnel in which there exists ionizing radiation at dose-rate levels such that an individual could receive a deep dose equivalent in excess of 5 mrems in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates shall be identified and posted with a sign "CAUTION, RADIATION AREA".
- 5.2.2 A Micro-R-Meter or other calibrated dose rate meter is used to identify the boundary location of the 5 mrem/hr dose rate.
- 5.2.3 If an entire room or most of the room is at or above the 5 mrem/hr level, a sign should be placed on each entrance door to the room. If the area to be posted is not a room, the area at or above the 5 mrem/hr level shall be bounded by a yellow and magenta/black

## MKMP-014

**Radiologically Restricted Areas**

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rope or ribbon securely fastened to stanchions, posts or other durable devices and signs shall be displayed in all accessible directions.

5.2.4 An exemption to this posting requirement is allowed in areas or rooms containing radioactive materials for periods of less than 8 hours, if each of the following conditions is met:

- a. The materials are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure to radiation or radioactive materials in excess of the limits specified in the Radiation Safety Manual; and
- b. The area or room are subject to the licensee's control.

For example, the area around a truck loading radioactive waste does not require posting if the above conditions are met.

5.2.5 If dose rates above 100 mrem/hr are encountered control access to the area and contact the Radiation Protection Supervisor or RSO for posting instructions.

5.3 Establishing and posting contaminated areas.

5.3.1 A restricted area that has fixed and removable radioactive materials in the form of dusts, particulates, and sorbed contaminants which are above the limits specified in the Radiation Safety Manual shall be identified and posted with a "CONTAMINATED AREA" sign.

5.3.2 Contamination levels are determined using procedure MKMP-008 (Radiation and Contamination Surveys) and the results of the survey measurements compared to the contamination limits specified in the Radiation Safety Manual.

5.3.3 If an entire room or most of the room is at or above the contamination criteria, a sign should be placed on each entrance door to the room. If the area to be posted is not a room, the area above the contamination criteria shall be bounded by a yellow and magenta/black rope or ribbon securely fastened to stanchions, posts or other durable device and signs displayed in all accessible directions.

5.3.4 A single entry point shall be established to access the contaminated area. A step off pad is placed at the entry point which provides a defined boundary between contaminated and unrestricted areas.

5.3.5 Receptacles for protective clothing and waste materials shall be placed just inside the entry point to collect protective clothing from personnel exiting the area.

5.3.6 If work activities in the area are likely to generate significant dusts containing radioactive materials, the area should be enclosed within a containment to prevent the spread of contamination beyond the identified contaminated area.

## MKMP-014

Radiologically Restricted Areas

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**5.4 Establishing and posting airborne radioactivity areas.**

5.4.1 MKM's policy is to minimize (and protect, if practical) the amount of radioactive materials taken into a workers body. In order to accomplish this, Airborne Radioactivity Areas are posted at 10% DAC, as specified in Table 1, Column 3 of appendix B of 10 CFR Part 20. Maintaining the airborne activity below these limits will eliminate any posting requirements.

5.4.2 To verify that these limits are not exceeded, an air sample is taken during each work activity which could create an airborne radioactivity hazard. The results of these samples are compared with the above limits to verify the limits are not exceeded. If the limits are exceeded, immediately contact the Radiation Protection Supervisor at the site or the RSO.

5.4.3 A room, enclosure or area shall be posted with a "CAUTION, AIRBORNE RADIOACTIVITY AREA" or "DANGER, AIRBORNE RADIOACTIVITY AREA" if radioactive material is dispersed in the form of dusts, fumes, particulates, mists, vapors, or gases and the concentration of the dispersed radioactive materials is in excess of:

- a. The derived air concentrations (DAC) specified in Table 1, column 3 of Appendix B, Title 10 Part 20 of the Code of Federal Regulations.
- b. Concentrations such that an individual present in the area without respiratory protective equipment could exceed, during the hours the individual is present in a week, an intake of 0.6 percent of the Annual Limit on Intake (ALI).

5.4.4 If an room, enclosure, or area requires posting as specified in step 3, immediately stop work activities and contact the Radiation Protection Supervisor at the site or the RSO for instructions.

**6.0 Attachments**

None



**MKMP-013  
Step-Off Pads**

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**1.0 Purpose and Scope**

This Procedure instructs MKM field personnel project personnel in the proper use of step-off pads. This procedure applies to all MKM Radiological Remediation Projects or operations that use step-off pads for radiological contamination control.

**2.0 General****2.1 Precautions**

These pads should always be placed in the Radiological Buffer area just outside the contamination area as a control to prevent the spread of contamination.

**3.0 References, Records and Equipment****3.1 References**

RSM	Radiation Safety Manual
MKMP - 008	Radiation and Contamination Surveys
MKMP - 009	Routine Radiological Surveys
MKMP - 025	Release of Materials from Radiological Control

**3.2 Records**

All records generated by this procedure are used in the Radiation Safety Program to document contamination levels of work areas and materials onsite.

**3.3 Equipment**

Step off pads

**4.0 Responsibilities****4.1 The Radiation Safety Officer (RSO) is responsible for:**

- Ensuring that Health Physics Technicians (HPTs) are qualified to perform this procedure.
- Reviewing, approving, and transmitting documentation generated during the performance of this procedure.
- Maintaining knowledge of contents of operating procedures affecting the conduct of contamination surveys and communicating pertinent requirements to HPTs performing this procedure.

**4.2 HPTs are responsible for:**

- Performing contamination swipe analysis in accordance with this procedure.
- Discussing specific project contamination survey requirements with the RSM.

**MKMP-013**  
**Step-Off Pads**

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- If a Radiation Protection Technologist (RPT) is unable to perform this procedure due to errors, extenuating circumstances, or any other reason, the RPT shall immediately stop and notify the Radiation Safety Manager (RSM). All changes in sampling and survey protocol must be documented in field logbooks and on appropriate survey forms.

**5.0 Procedure****5.1 Location of Step-Off Pads****5.1.1 Radiation safety personnel will specify the placement of step-off pads based on the requirements listed below**

- A single step-off pad should be installed at exit points to areas where loose surface contamination levels exceed 1000 dpm/100cm<sup>2</sup>
- Two step-off pads, separated by a covered area where possible, should be installed at exit points to areas where contamination levels exceed 100,000 dpm/100cm<sup>2</sup>.

**5.1.2 Consideration must be given to other radiological conditions and general safety precautions when installing step-off pads:**

- Step-off pads should be positioned at personnel control points in such a manner that they do not cause individuals to remain in significant radiation fields while removing protective clothing. In these cases, the step-off pad should be separated from the actual point of exit, by a covered area.
- Step-off pads should be placed in such a manner that they do not constitute a safety hazard. For example, step-off pads should not be placed on steep ground, slippery surfaces, etc.
- Step-off pads should not be placed at Emergency Exits or at Equipment Entrances/Exits.

**5.2 Use of Step-Off Pads****5.2.1 Step-off pads shall be considered uncontaminated surfaces in the case of a single step-off pad; or as surfaces of lower contamination than the contaminated area, in the case of first of two step-off pads (when exiting the posted area). The step-off pad needs to be surveyed periodically in accordance with MKMP-009.****5.2.2 Before stepping out of the Contamination Area or Airborne Radioactivity Area to the step-off pad, the worker should:**

- Remove exposed tape.
- Remove rubber overshoes.
- Remove outer pair of gloves.
- Remove hood from front to rear.
- Remove respiratory protection, as applicable.
- Remove coveralls, inside out, touching the inside only.
- Take down barrier closure, as applicable.
- Remove tape or fastener from inner shoe cover.

**MKMP-013**  
**Step-Off Pads**

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- Remove each shoe cover, place the shoe cover into the container for contaminated shoes, and step onto clean step-off pad.
- Remove cloth glove liners.
- Replace barrier closure, as applicable.
- Commence whole body frisking.
- Monitor badge and dosimeter.

The sequence for the removal of primary and supplemental dosimetry is dependent upon where the dosimetry was worn and the potential for contamination.

**5.2.3 Use of Multiple Step-off Pads**

- Multiple step-off pads should be used to control exit from high surface contamination areas. These pads define interim control measures within the posted area to limit the spread of contamination. The following controls apply:
- The inner step-off pad should be located immediately outside the highly contaminated work area, but still within the posted area.
- The worker should remove highly contaminated outer clothing prior to stepping on the inner step-off pad.
- Additional secondary step-off pads, still within the posted area, may be used as necessary to restrict the spread of contamination out of the immediate area.
- The final or outer step-off pad should be located immediately outside the contamination area.

**6.0 Attachments**

None



## MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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**1.0 Purpose and Scope**

- 1.1 The purpose of this procedure is to provide guidance and requirements for use and control of portable high-efficiency particulate air filtered (HEPA) ventilation systems and vacuum cleaners that are used to accomplish radiological work. This procedure specifies the radiological controls and the requirements for safe operation, maintenance, and storage involved with portable HEPA ventilation systems and vacuum cleaners used for radiological work. Installed or permanent ventilation systems are not within the scope of this procedure. Vacuum cleaners used solely for purposes or hazards other than radiological, such as asbestos, are also not covered by this procedure.

**2.0 General****2.1 Precautions**

- 2.1.1 Exercise caution when handling energized portable HEPA ventilation equipment, being aware of rotating fan blades that could be accessible through the outlet connection.

**CAUTION:** Do not operate portable HEPA ventilation systems and vacuum cleaners in explosive atmospheres.

- 2.1.2 Operate portable HEPA ventilation units in the position designated by the specific component technical manual. Any other position of operation may cause failure of the blower assembly resulting in severe personnel injury, or may retard operating efficiencies
- 2.1.3 Improper use of portable ventilation systems and vacuum cleaners can result in the spread of loose surface contamination, the generation of airborne radioactivity, or high dose rates.
- 2.1.4 Change-out of HEPA filters and vacuum cleaner emptying operations have a high potential to spread loose surface contamination and generate airborne radioactivity.
- 2.1.5 Generally portable HEPA ventilation systems or vacuum cleaners should not be used for work where tritium is the major radiological concern. Notify the RSO prior to the use of HEPA ventilation or vacuum cleaners in situations involving tritium
- 2.1.6 Do not use portable HEPA ventilation systems or vacuum cleaners without a current dioctyl phthalate (DOP) test inspection sticker for radiological work. A DOP test is valid for 12 months provided integrity of the unit is maintained.
- 2.1.7 If the particle size of the contaminant has the possibility to be  $\leq 0.3 \mu\text{m}$ , the use of portable HEPA ventilation systems or vacuum cleaners should be referred to the RSO for evaluation. DOP testing media for HEPA filters uses particles with an average size of  $0.3 \mu\text{m}$ .

## MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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2.1.8 Notify the RSM prior to the use of a HEPA vacuum cleaner for fissile materials. to the use of a HEPA vacuum cleaner for fissile materials.

**3.0 References, Records and Equipment****3.1 References**

MKMP-007      Air Sampling and Sample Analysis  
MKMP-008      Radiation and Contamination Surveys

**3.2 Records**

Survey records are generated during the performance of this procedure. The original of the records is the record copy for the project file. The record copy is given to the RSO for processing, including arrangement and filing. Copies of the records may be made for information purposes.

These records are used by the Radiation Safety Program to document radiological surveys.

**3.3 Equipment**

HEPA ventilation unit and HEPA filtered vacuum cleaner

**4.0 Responsibilities****4.1 The Radiation Safety Officer has responsibilities for:**

- The overall radiological control of portable HEPA ventilation systems and vacuum cleaners.
- The use of portable HEPA ventilation systems and vacuum cleaners by radiation safety personnel.
- Implementation of this procedure.
- Ensuring that Health Physics Technicians (HPTs) are qualified to perform this procedure and are documented as such.
- Providing oversight and guidance in the performance of this procedure.
- Ensuring that training on this procedure is developed, kept up-to-date, and offered to radiation safety personnel needing it.
- Documentation of training completion.

**4.2 The HPTs are responsible for:**

- The direct radiological control of portable HEPA ventilation systems and vacuum cleaners used by all facility organizations.
- Properly operating portable HEPA ventilation systems and vacuum cleaners. In addition, if for any reason an HPT is unable to follow this procedure, the HPT shall immediately stop and notify the RSO.

## MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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5.0 Procedure

## 5.1 Prior to use, inspect the equipment for:

- Any physical damage.
- Properly made hose connections.
- Electrical connections and cables in good condition.
- A DOP test inspection sticker, if required, certifying the test has been performed within the last 12 months.
- Differential pressure (d/p) gauge reads zero, if installed.
- Integrity of tamper seal on unit.

5.2 Ensure that the d/p across the HEPA filter in portable ventilation units equipped with d/p gauges is less than 3 in. wg (inches of water, gauge; clean filter d/p is 1 in. wg) when operating. Pressures greater than 3 in. wg indicate the possible need for HEPA filter replacement.

5.3 Ensure that portable ventilation system exhaust is directed away from contamination or airborne areas.

5.4 Contain suction hose end(s) when portable ventilation systems are secured to prevent the spread of loose surface contamination.

5.5 Use of HEPA Vacuum Cleaners

## 5.5.1 Prior to use, inspect the equipment for:

- Any physical damage.
- Properly made hose connections.
- Electrical connections and cables in good condition.
- A DOP test inspection sticker, if required, certifying the test has been performed within the last 12 months.
- Integrity of tamper seal on unit.

5.5.2 Ensure that vacuum cleaner exhaust is directed away from loose surface contamination.

5.5.3 Contain suction hose end(s) when vacuum cleaners are secured to prevent the spread of loose surface contamination

5.6 Control and Storage of HEPA Ventilation Systems and Vacuum Cleaners of HEPA Ventilation Systems and Vacuum Cleaners

5.6.1 Portable HEPA ventilation systems and vacuum cleaners used for radiological work shall be positively controlled to prevent unauthorized use (e.g. locked storage room, locked to a structure at the storage or work area, etc.).

5.6.2 Maintain an inventory log using Attachment -1 or equivalent for all portable HEPA ventilation systems and vacuum cleaners used for radiological work within the area of responsibility.

## MKMP-012

Portable HEPA Systems and Vacuum Cleaners

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**5.7 Maintenance of Equipment**

- 5.7.1 Any work performed on portable HEPA ventilation systems and vacuum cleaners such as filter replacement, repairs, or emptying operations shall be accomplished under a separate RWP
- 5.7.2 Perform any maintenance or replacements on portable HEPA ventilation systems and vacuum cleaners in accordance with the specific equipment technical manual(s)
- 5.7.3 Stage all replacement parts (prefilters, filters, etc.) prior to the disassembly of any equipment.
- 5.7.4 Place an Out Of Service tag on any equipment whose HEPA filter has been replaced, integrity violated, or is in question until a DOP test is performed satisfactorily.
- 5.7.5 Upon completion of DOP testing, prior to placing unit in service, place Radiation Safety Tamper Seal Tape on unit to provide indication of unit integrity.

**5.8 Radiological Controls**

- 5.8.1 Provide specific instructions within the RWP or technical work document detailing the work step(s) requiring the use of portable HEPA ventilation systems or vacuum cleaners.
- 5.8.2 Monitor portable HEPA ventilation system exhaust by grab sample in accordance with procedures specified in the RWP.
- 5.8.3 Monitor for airborne radioactivity when HEPA vacuum cleaners are used in High Contamination Areas using breathing zone sampling in accordance with MKMP-007 and as specified in the RWP.
- 5.8.4 Obtain radiation and contamination measurements in accordance with MKMP-008 at least daily on HEPA vacuum cleaners during the performance of radiological work to detect any changes in vacuum cleaner and work area dose rates or contamination levels. The frequency of radiation surveys will depend on the evolution(s) during which the vacuum cleaner is used and shall be specified in the RWP.
- 5.8.5 Portable HEPA ventilation systems and vacuum cleaners used for radiological work shall be controlled and labeled as Radioactive Material, Internal Contamination when in use or when stored after use unless released in accordance with MKMP-025.

**6.0 Attachments**

MKMP Form 12-1      Portable HEPA Ventilation System and Vacuum Cleaner Inventory Log



**MKMP-015**  
**PERSONNEL PROTECTIVE EQUIPMENT (PPE)**



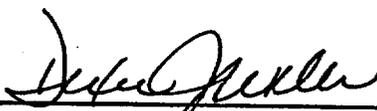
## Radiation Safety Procedure

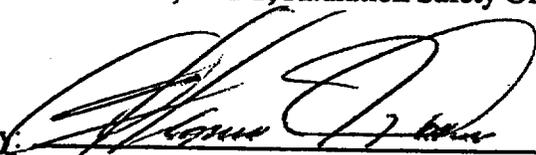
for

## Personnel Protective Equipment (PPE)

**MKMP-015**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-015**  
**Personnel Protective Equipment (PPE)**

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1.0 Purpose and Scope

- 1.1 This procedure provides the methods MKM uses to wear and remove protective clothing while working in and exiting from contaminated areas. Adherence to this procedure will provide reasonable assurance that personnel will remain free of contamination and contamination will not be spread beyond the designated contaminated area.
- 1.2 This procedure will be used by MKM personnel to enter, work in and exit from areas contaminated with radioactive materials.

Description of procedures and requirements for using protective clothing in contaminated areas.

- 1.2.1 Selection requirements and procedural methods for wearing protective clothing in contaminated areas.
- 1.2.2 Procedures for preventing personnel contamination during work in contaminated areas.
- 1.2.3 Procedures for the removal of protective clothing and personnel surveys required when exiting contaminated areas.

2.0 General

2.1 Definitions

- 2.1.1 Restricted Area - An area containing radioactive materials to which access is controlled to protect individuals from exposure to ionizing radiation.
- 2.1.2 Contaminated Area - A restricted area that has radioactive materials above the limits specified in the Radiation Safety manual in the form of dusts, particulates, and sorbed contaminants that could adhere to personnel clothing and skin while personnel are working in the area.
- 2.1.3 Personnel Survey - A survey with radiation detection instruments that measures the amount of radioactive materials on personnel clothing or skin surfaces.

3.0 References, Records, and Equipment

3.1 References

RSM	Radiation Safety Manual
MKMP-001	Contamination Survey
MKMP-008	Radiation and Contamination Surveys

3.2 Records

Record results of equipment surveys on survey forms. If contamination is found on personnel following exiting contaminated area, record levels found before and after decontamination on the personal contamination worksheet.

**MKMP-015**  
**Personnel Protective Equipment (PPE)**

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**3.3 Equipment**

As required by the job.

**4.0 Responsibilities**

- 4.1 Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of working in contaminated areas are familiar with this procedure, adequately trained in the use of protective clothing, and have access to a copy of this procedure.
- 4.2 Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel in the selection, use, and removal of protective clothing. The RSO is also responsible to train personnel in proper personnel survey techniques when exiting a contaminated area.
- 4.3 Technicians** - Technicians using protective clothing are responsible for complying with provisions of this procedure.

**5.0 Procedure****5.1 Selection and methods of dressing in protective clothing**

**NOTE:** Dress/undress instructions are based on the assumption of using zippered or buttoned protective clothing.

- 5.1.1** Protective clothing is selected to provide a barrier between personnel clothing/skin and radioactive materials that exist in a contaminated area as defined in the Radiation Safety Manual.
- 5.1.2** Boots or overshoes are used to prevent contamination from adhering to shoes and tracking contamination beyond the designated contamination area.
- 5.1.3** Cloth or vinyl coveralls are used to intercept contamination before contacting personnel clothing and skin.
- 5.1.4** Cotton, vinyl, or latex gloves are used to prevent contamination from adhering to hands while handling contaminated surfaces and items in a contaminated area.
- 5.1.5** Cloth or vinyl caps or hoods are worn to prevent contamination from overhead surfaces from contaminating hair and exposed skin while working in contaminated areas.
- 5.1.6** Plan all work activities before putting on protective clothing and obtain all necessary supplies, instruments, and tools to be used in work activities. This equipment is placed at the entrance to the contaminated area so it can be taken into the area when entry is made. Instrumentation should be placed at the exit or be available for personnel surveys when exiting the area.
- 5.1.7** All protective clothing is selected and put on before entering the contaminated area.

## MKMP-015

**Personnel Protective Equipment (PPE)**

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- 5.1.8 First put on coveralls and close flaps provided on the coveralls. If specified on the Radiation Work Permit (RWP), place a strip of 2 inch masking tape over pocket openings and front zipper or button flaps. Fold over the tape at one end to provide a tab for easier removal of the tape when exiting the area.
- 5.1.9 Put cloth or plastic booties on over personal shoes, overshoes over booties and place coverall pant legs over the overshoe tops. Tape the overall pant legs to the bootie tops leaving a tape tab for later removal.
- 5.1.10 Place cloth cap or hood on head. If using a hood tape hood flap to outside of coveralls. If wearing a respirator, ensure hood is taped to respirator.
- 5.1.11 Put on gloves with coverall sleeves over the gloves. Tape coverall cuffs to gloves to provide a seal at the joint. Leave tab at the end of the tape for easy removal. If high levels of contamination are anticipated, a second pair of gloves may be worn under the taped pair.
- 5.1.12 After entering the contaminated area, a complete survey of clothing must be made as described in section 5.3 before exiting the area.
- 5.1.13 If light work activities (such as surveys) are performed in the contaminated area, taping coverall sleeves, cuffs, and flaps is not required.
- 5.2 Work techniques and contamination area hygiene.
- 5.2.1 All surfaces and items contacted in a contaminated area are considered contaminated and contact with surfaces and items will transfer contamination to protective clothing. While working in a contaminated area, minimize contact to the extent possible with surfaces and items.
- 5.2.2 While in the contaminated area, do not touch face, glasses or exposed skin with gloves or other protective clothing.
- 5.2.3 If clothing becomes torn or ripped during work activities, tape opening with 2 inch masking tape to prevent contamination from further penetrating the protective clothing.
- 5.2.4 Avoid work activities to the extent possible which will create airborne activity.
- 5.2.5 Workers shall not eat, drink, chew or smoke while wearing protective clothing and working in a contaminated area.
- 5.3 Procedures for exiting a contaminated area.
- 5.3.1 Tools and equipment used in a contaminated area shall be surveyed and decontaminated as necessary before release to unrestricted areas.
- 5.3.2 Protective clothing is removed when exiting a contaminated area in such a manner as to control contamination from spreading beyond the designated boundary of the contaminated area.

**MKMP-015**  
**Personnel Protective Equipment (PPE)**

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- 5.3.3 If a second set of gloves is used, the outer set of gloves are removed before starting the unsuiting procedure.
- 5.3.4 Remove tape from hood, coverall cuffs, and coverall pant legs if used.
- 5.3.5 Remove hood or cap by handling external surfaces and place in a protective clothing receptacle.
- 5.3.6 Remove overshoes by handling external surfaces and place in a protective clothing receptacle. With the overshoes removed, retain plastic booties and remain inside the area to continue removing protective clothing.
- 5.3.7 Undo the coveralls flap and remove by handling external surfaces of the coveralls. Slip coverall pant legs over booties and place in a protective clothing receptacle.
- 5.3.8 With your back toward the step-off pad, remove the plastic booties and step onto step-off pad with personal shoes.
- 5.3.9 While standing on the step-off pad remove gloves by handling external surfaces and deposit in a protective clothing receptacle.
- 5.3.10 Perform personnel survey by first surveying hands with an alpha and/or beta survey meter. After determining hands are free of contamination, pick up instrument and survey shoes, personal clothing, face, and hair with a survey meter to determine no surfaces are contaminated. If contamination is found above limits in the Radiation Safety Manual, contact RSO or Radiation Protection Supervisor at the site for decontamination instruction.

6.0 Attachments

None

MKMP-016  
RADIOACTIVE MATERIALS BROKERING



**Radiation Safety Procedure**

for

**Radioactive Materials Brokering**

**MKMP-016**

**Revision 0**

Reviewed By: *D.J. Wells* 8/28/99  
D.J. Wells, KRPT, Radiation Safety Officer Date

Approved By: *T.J. O'Dou* 8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date

**MKM Engineers, Inc.**

**Procedure MKMP 016  
Radioactive Materials Brokering**

**LIST OF EFFECTIVE PAGES  
(Revision Level 0 = Original Document)**

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**MKMP-016**  
**Radioactive Materials Brokering**

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**1.0 Purpose and Scope**

- 1.1 This procedure provides the methods and procedures MKM utilizes in shipping radioactive materials. Adherence to this procedure will provide reasonable assurance that radioactive materials will be shipped in accordance with applicable regulations.
- 1.2 This procedure will be used by MKM to prepare required shipping papers, secure loads, and ship radioactive materials.
- 1.3 Types of radioactive material shipments covered by this procedure.
  - 1.3.1 Shipment of Limited Quantities of radioactive materials.
  - 1.3.2 Shipments of Low Specific Activity (LSA) radioactive materials.
  - 1.3.3 Shipment of Surface Contaminated objects (SCO).
  - 1.3.4 Shipment of radioactive materials in Type A and Type B packages.
  - 1.3.5 Shipment of Highway Route Controlled Quantities of radioactive materials.
  - 1.3.6 Shipment of empty packages

**2.0 General****2.1 Definitions.**

- 2.1.1 *A<sub>1</sub> Activity* - The maximum activity of special form Class 7 (radioactive) materials permitted in a Type A package.
- 2.1.2 *A<sub>2</sub> Activity* - The maximum activity of Class 7 (radioactive) materials, other than special form, LSA or SCO permitted in a Type A package.
- 2.1.3 *Carrier* - Any individual or organization engaged in the transportation of passengers or property.
- 2.1.4 *Closed Transport Vehicle* - A transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transport restricts the access of unauthorized persons to the cargo space containing Class 7 (radioactive) materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the "see-through" type, and must limit access from top, sides and bottom.
- 2.1.5 *Consignee* - Any individual or organization that receives material from a carrier.
- 2.1.6 *Consignor* - Any individual or organization that furnishes material to a carrier for transportation.

**MKMP-016**  
**Radioactive Materials Brokering**

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- 2.1.7 *Depleted Uranium* - Uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.
- 2.1.8 *Exclusive Use* - The sole use of a conveyance by a single consignor and for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. Any loading or unloading must be performed by personnel having radiological training and resources appropriate for safe handling of the consignment. Specific instructions for maintenance of exclusive use shipment controls must be issued in writing and included with the shipping paper information provided to the carrier by the consignor. Also referred to as *Sole Use* or *Full Load*.
- 2.1.9 *Fissile Material* - Any material consisting of or containing one or more fissile radionuclides. Fissile radionuclides are plutonium-238, plutonium-239, plutonium-241, uranium-233, and uranium-235. Neither natural nor depleted uranium are fissile material. Fissile materials are classified according to the controls needed to provide nuclear criticality safety during transportation, as provided in 49 CFR 173.455.
- 2.1.10 *Freight Container* - A reusable container having a volume of 1.81 cubic meters (64 cubic feet) or more, designed and constructed to permit being lifted with its contents intact and intended primarily for containment of packages in unit form during transport. A small freight container is one which has either one outer dimension less than 1.5 meters (4.9 feet) or an internal volume of not more than 3.0 cubic meters (106 cubic feet). All other are designated as large freight containers.
- 2.1.11 *Highway route controlled quantity (HRCQ)* - The quantity of radioactive material within a single package which exceeds the following:
- a. The quantity of radioactive material is 3,000 times the  $A_1$  value of the radionuclides for special form Class 7 (radioactive) material;
  - b. The quantity of radioactive material is 3,000 times the  $A_2$  value for normal form Class 7 (radioactive) material;
  - c. The quantity of radioactive material is equal to or exceeds 27,000 Curies, whichever is least.
- 2.1.12 *Limited Quantity of Class 7 (Radioactive) Material (LQ)* - A quantity of Class 7 (radioactive) material not exceeding the materials package limits specified in 49 CFR 173.425 and which conform with requirements specified in 49 CFR 173.421.
- 2.1.13 *Low Specific Activity Materials (LSA)* - LSA materia means Class 7 (radioactive) material with limited specific activity which satisfies the descriptions and limits set forth below. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents. LSA material must be in one of the three groups:

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*LSA-I*

- a. Ores containing only naturally occurring radionuclides (e.g., uranium and thorium) and uranium and thorium concentrates of such ores; or
- b. Solid unirradiated natural or depleted uranium or natural thorium .
- c. Class 7 (radioactive) material, other than fissile material, for which the  $A_2$  value is unlimited; or
- d. Mill tailings, contaminated earth, concrete, rubble, other debris, and activated material in which the Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed  $10^{-6}A_2/g$ .

*LSA-II*

- a. Water with tritium concentration up to 20 curies per liter; or
- b. Material in which the Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed  $10^{-4}A_2/g$  for solids and gases, and  $10^{-3}A_2/g$  for liquids.

*LSA-III* Solids (e.g., consolidated wastes, activated materials) that meet the requirements of 49 CFR 173.468 and which:

- a. The Class 7 (radioactive) material is essentially uniformly distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.); and
- b. The Class 7 (radioactive) material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that, even under loss of packaging, the loss of Class 7 (radioactive) materials per package by leaching when placed in water for seven days would not exceed  $0.1 A_2$ ; and
- c. The average specific activity of the solid does not exceed  $2 \times 10^{-3}A_2/g$ .

2.1.14 *Non-Fixed Radioactive Contamination* - Radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in 49 CFR 173.443 and in table A, section 5.2 of this procedure.

2.1.15 *Normal Form Radioactive Material* - Radioactive material which has not been demonstrated to qualify as special form radioactive material.

2.1.16 *N.O.S.* - Abbreviation denoting "Not Otherwise Specified" which is used on shipping papers to generic describe radioactive materials.

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**Radioactive Materials Brokering**

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- 2.1.17 *Radioactive Material* - Materials having a specific activity greater than 0.002 microcuries per gram (uCi/g).
- 2.1.18 *Special Form Radioactive Material* - Radioactive material which satisfies the following conditions:
- a. It is either a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;
  - b. The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inches); and
  - c. It satisfies the test requirements of 49 CFR 173.469. (Also see special requirements in 49 CFR 173.389)
- 2.1.19 *Specific Activity* - The activity of the radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the activity per unit mass of the material.
- 2.1.20 *Surface Contaminated Object (SCO)* - A SCO means a solid object which is not itself radioactive but which has Class 7 (radioactive) materials distributed on any of its surfaces. SCO must be in one of two groups with surface activity not exceeding the following limits:
- SCO-I.* A solid object on which:
- a. The non-fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 10<sup>-4</sup> microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 10<sup>-3</sup> microcurie/cm<sup>2</sup> for alpha emitters;
  - b. The fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 1.0 microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 0.1 microcurie/cm<sup>2</sup> for all other alpha emitters; and
  - c. The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 1.0 microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 0.1 microcurie/cm<sup>2</sup> for all other alpha emitters.
- SCO-II.* A solid object on which the limits for SCO-I are exceeded and on which:
- a. The non-fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 10<sup>-2</sup> microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 10<sup>-3</sup> microcurie/cm<sup>2</sup> for alpha emitters;

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- b. The fixed contamination on the accessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 20 microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 2 microcurie/cm<sup>2</sup> for all other alpha emitters; and
  - c. The non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>) does not exceed 20 microcurie/cm<sup>2</sup> for beta and gamma and low toxicity alpha emitters, or 2 microcurie/cm<sup>2</sup> for all other alpha emitters.
- 2.1.21 **Transport Index** - A dimensionless number (rounded up to the first decimal place) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is determined as following:
- a. The number expressing the maximum radiation level in millirem per hour at one meter (3.3 feet) from the external surface of the package; or
  - b. For Fissile Class packages, the number expressing the maximum radiation level at one meter (3.3 feet) from the external surface of the package, or the number obtained by dividing 50 by the allowable number of packages which may be transported together, whichever is larger.
- 2.1.22 **Type A Package** - A Type A packaging that, together with its radioactive contents limited to A<sub>1</sub> or A<sub>2</sub> as appropriate, meets the requirements of 49 CFR 173.410 and 173.412 and is designed to retain the integrity of containment and shielding required by this part under normal conditions of transport as demonstrated by test set forth in 49 CFR 173.465 and 173.466, as appropriate. A Type A package does not require competent authority approval.
- 2.1.23 **Type B Package** - A Type B packaging together with its radioactive contents, is designed to retain the integrity of containment and shielding required by this part when subjected to the normal transport and hypothetical accident test conditions set forth in 10 CFR Part 71.
- Type B(U) package* - Means a Type B packaging that, together with its radioactive contents, for international shipments requires unilateral approval only of the package design and of any stowage provisions that may be necessary for heat dissipation.
- Type B(M) Package* - Means Type B packaging, together with its radioactive contents, that for international shipments requires multilateral approval of the package design, and may require approval of the conditions of shipment.
- 2.1.24 **Type A Quantities** - A quantity of Class 7 (radioactive) material, the aggregate radioactivity which does not exceed A<sub>1</sub> for special form Class 7 (radioactive) material, or A<sub>2</sub> for normal form Class 7 (radioactive) material.

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**Radioactive Materials Brokering**

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2.1.25 *Type B Quantities* - Means a quantity of material greater than a Type A quantity.

**2.2 Quality Control**

Instrumentation used in the surveys will be checked with standards daily and verified to have current valid calibration.

**3.0 Reference, Records, and Equipment**

**3.1 References**

49 CFR Parts 172 to 178.	DOT Transportation Regulations
10 CFR Part 71.	NRC Packaging and Transportation of Radioactive Materials.
RSM	Radiation Safety Manual
MKMP-001	Contamination Survey Meters
MKMP-002	Alpha/beta sample counters
MKMP-003	Micro-R Meters
MKMP-008	Radiation and contamination surveys
MKMP-015	Personnel Protective Clothing

**3.2 Records**

A copy of all radiation surveys, contamination surveys and shipping documents will be retained in shipment specific files. The basic records which would be included in a shipping file include:

MKMP Form 8-1	Radiological Survey Report
MKMP Form 8-2	Radiation and Contamination Survey
MKMP Form 8-3	Radiation and Contamination Survey Results
MKMP Form 16-1	Shipping Report
Shipment Manifest	Carriers bill of lading

**3.3 Equipment**

None Required

**4.0 Responsibilities**

- 4.1 **Program Manager** - The Program Manager is responsible for insuring that all personnel assigned the tasks of shipping radioactive materials are familiar with this procedure, adequately trained in the appropriate regulations, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer is responsible for training of personnel in the shipment of radioactive materials.
- 4.3 **Waste Broker** - The Waste Broker is responsible for waste characterization, negotiations with carriers, packaging of waste, and negotiations with disposal facilities.

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4.4 Technicians - Technicians shipping radioactive materials are responsible to comply with provisions of this procedure.

5.0 Procedure

5.1 Determining the Type of Shipment

5.1.1 Determine the radionuclide(s) and quantity of activity to be shipped.

5.1.2 Determine the radiation level which will be present at the external surface of the package. (See MKMP-008 for survey procedures)

5.1.3 Determine if material is special or normal form (see definitions in section 2.1 of this procedure).

5.1.4 Determine the  $A_1$  or  $A_2$  values for the radionuclides to be shipped. A partial list of  $A_1$  and  $A_2$  values commonly encountered is presented in table 1 of the appendix to this procedure. If the radionuclide is not found in table 1, refer to 49 CFR 173.434 to obtain values. If there is a mixture of radionuclides use the formulas presented in 49 CFR 173.433 to determine the  $A_1$  and  $A_2$  values.

5.1.5 Use figures 1 through 4 found in the appendix of this procedure to determine the type of shipment required for the material being shipped.

5.1.6 Transportation of radioactive materials by passenger carrying aircraft is not allowed.

5.2 Shipping Limited Quantity Radioactive Materials

5.2.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.

5.2.2 Materials must be packaged in a strong, tight package that will not leak any of the radioactive materials during conditions normally incident to transportation.

5.2.3 The radiation level at any point on the external surface of the package must be less than or equal to 0.5 millirem per hour.

5.2.4 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in Table A. (See MKMP-008 for survey procedure) and/or in accordance with 49 CFR 173.443 (1996):

(a) ...The level of non-fixed radioactive contamination...must be determined by either:

(1) Wiping an area of 300 square centimeters of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements must be taken...when averaged over the surface wiped, may not exceed the limits...at any time during transport; or

(2) Using other methods of assessment of equal or greater efficiency, in which case the efficiency of the method used must be taken into account...

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Table A

**Maximum Permissible Surface Contamination**

Contaminant	Maximum Permissible Limits			
	Bq/cm <sup>2</sup>	μCi/cm <sup>2</sup>	dpm/cm <sup>2</sup>	dpm/100cm <sup>2</sup>
Beta and gamma emitters and low toxicity alpha emitters (all radionuclides with half-lives less than ten days: natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228; and thorium-230; when contained in ores or physical concentrates).	0.4	10 <sup>-5</sup>	22	2200
All other alpha emitting radionuclides.	0.04	10 <sup>-6</sup>	2.2	220

5.2.5 The outside of the inner packaging or if there is no inner packaging the outside of the packaging itself must bear the marking "RADIOACTIVE".

5.2.6 The package must contain less than 15 grams of uranium-235 unless it is an excepted article or instrument containing natural uranium.

5.2.7 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.

5.2.8 Packages which contain liquid radioactive materials with a liquid volume not to exceed 50 cubic centimeters, must include a plastic or leak resistant inner container and be surrounded by sufficient absorbent material to adsorb at least twice the volume of liquid containing the radioactive material. The absorbent material shall be compatible with the package contents.

5.2.9 Verify all closure devices (including gaskets) are properly installed and free of defects.

5.2.10 Complete the "SHIPPING REPORT" (MKM form 16-1), if necessary, and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the home office files.

5.2.11 Complete the "LIMITED QUANTITY CERTIFICATION" (MKM form 16-2), if required, and enclose the form with the packing papers of the shipment. Retain a copy of the "LIMITED QUANTITY CERTIFICATION" for the home office files.

**5.3 Shipping Low Specific Activity Materials and Surface Contaminated Objects as Mixed Lading by Common Carrier.**

5.3.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.

5.3.2 Materials must be packaged in a DOT Specification 7A Type A package. NRC regulated LSA-II, LSA-III and SCO-II must be packaged in a "Type B" package.

*Who's shipping?  
Verify material*

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- 5.3.3 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP 008 for survey procedure)
- 5.3.4 The radiation level at any point on the external surface of the package and at a distance of one meter must conform with the radiation level requirements shown in Table B. The table also specifies the labeling requirements for packages. Each package must have two labels attached to opposite sides of the package. The shipping label is completed by entering the name of radionuclide(s), the quantity of activity and the transport index on the label using a durable weather resistant means of marking.

Table B

Radiation Levels and Labeling requirements for LSA-I, LSA-II, LSA-III, SCO-I AND SCO-II shipments by common carrier.

<u>Radiation Levels</u>	<u>Label Requirements</u>
Radiation levels are $\leq 0.5$ mrem/hr anywhere on external surface of package	Radioactive (White) - I
Radiation levels are $> 0.5$ mrem/hr but are $\leq 50$ mrem/hr anywhere on external surface of package, and are $\leq 1.0$ mrem/hr at one meter from the external surface of the package.	Radioactive (Yellow) - II
Radiation levels are $> 50$ mrem/hr but are $\leq 200$ mrem/hr anywhere on external surface of package, and are $\leq 10$ mrem/hr at one meter from the external surface of the package.	Radioactive (Yellow) - III
Radiation Levels are $> 200$ mrem/hr.	Not Allowed

- 5.3.5 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.
- 5.3.6 Each package must be marked with the Consignee's name and address.
- 5.3.7 Verify all closure devices (including gaskets) are properly installed and free of defects.
- 5.3.8 Complete the "SHIPPING REPORT" (MKM form 16-1), if necessary, and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the home office files.
- 5.3.9 Complete the transport carriers bill of lading. Retain a copy of the bill of lading for the Las Vegas office files.
- 5.3.10 The sum of the transport index from the individual packages must be less than 50 for a single carrier.

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5.3.11 The transport vehicle must be posted with a 'RADIOACTIVE' placard if the shipment contains Radioactive (Yellow) - III labeled packages.

5.4 Shipping Low Specific Activity Materials and Surface Contaminated Objects in Exclusive Use Vehicles.

5.4.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.

5.4.2 Materials must be packaged in strong tight packages such that there will be no leakage of radioactive contents under normal conditions of transport. Typical containers include B-6 boxes, B-12 boxes and 55 gallon drums. For bulk shipments the freight container can be the package. NRC regulated LSA-II, LSA-III and SCO-II must be packaged in a "Type A" package.

5.4.3 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP-008 for survey procedure)

5.4.4 The radiation level at any point on the external surface of the package, the transport vehicle, and at a specified distances must conform with the radiation level requirements shown in Table C. The table also specifies the labeling requirements for packages.

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Table C

**Radiation Levels and Labeling requirements for LSA shipments by Exclusive Use Vehicles**

Radiation Levels on Packages	Radiation levels on/in transport vehicle	Type of Shipment	Package Label Requirements
Radiation levels are $\leq 200$ mrems/hr anywhere on external surface of package, and are $\leq 10$ mrems/hr at one meter from the external surface of the package.	$\leq 10$ mrems/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 2$ mrems/hr in any normally occupied position in the transport vehicle.	Package Shipment in Open Transport Vehicle	Radioactive LSA or Radioactive SCO
Radiation levels are $\leq 1000$ mrems/hr anywhere on external surface of package. (SEE NOTE 1 BELOW)	$\leq 10$ mrems/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 200$ mrems/hr at any point on the outer surface of the vehicle. $\leq 2$ mrems/hr in any normally occupied position in the transport vehicle.	Package Shipment in Closed Transport Vehicle	Radioactive LSA or Radioactive SCO
Radiation levels are $\leq 200$ mrems/hr anywhere on external surface of package.	$\leq 10$ mrems/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 200$ mrems/hr at any point on the outer surface of the vehicle. $\leq 2$ mrems/hr in any normally occupied position in the transport vehicle.	Bulk Shipments in Closed Transport Vehicle	Radioactive LSA or Radioactive SCO on transport container
Note 1. The package must be secured so its position remains fixed during transport. There will be no loading or unloading operations between the beginning and end of the transport.			

- 5.4.5 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.
- 5.4.6 Packages, with a capacity of 110 gallons or less, that contain a hazardous substance, must be stenciled or otherwise marked with the letters "RQ" in addition to the "Radioactive LSA" or "Radioactive SCO" label.
- 5.4.7 The shipment must be braced so as to prevent shifting of lading under conditions normally incident to transportation. Shipments of 55 gallon drums are secured by nailing 2" by 4" by 8' lumber to the floor of the vehicle bed between each row of drums. B-12 and B-6 boxes are secured with 2" by 4" by 8' lumber nailed to the vehicle floor and come-along over the boxes.
- 5.4.8 Shipments must be loaded by consignor and unloaded by consignee from the conveyance or freight contained in which originally loaded.
- 5.4.9 Verify all closure devices (including gaskets) are properly installed and free of defects.
- 5.4.10 Complete the "SHIPPING REPORT" (MKM form 16-1), if necessary, and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the home office files.

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- 5.4.11 Complete the carriers bill of lading. Retain a copy of the bill of lading for the home office files.
- 5.4.12 Complete the "DRIVER INSTRUCTIONS" (MKM form 16-3) and "SPECIFIC INSTRUCTIONS FOR MAINTENANCE OF EXCLUSIVE USE SHIPMENTS" (MKM form 16-4). Explain the conditions on the forms to the driver and enclose these forms with the packing papers of the shipment. Retain a copy of the forms for the home office files.
- 5.4.13 The transport vehicle must be posted with a "RADIOACTIVE" placard. (Shipments of unconcentrated uranium or thorium ores are exempt from the "Radioactive" placard requirement.)
- 5.5 Shipping Type A and Type B Packaged Radioactive Materials as Mixed Lading by Common Carrier.
- 5.5.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.
- 5.5.2 Materials must be packaged in a DOT Specification 7A Type A package. If the quantities of activity requires a Type A package, each package shall not contain a quantity of radioactivity greater than  $A_1$  for special form radioactive materials and greater than  $A_2$  for normal form radioactive materials. If the quantity of radioactivity exceeds the  $A_1$  or  $A_2$  quantities a Type B package is required. The exterior of the packages which conform to the requirements for Type A and Type B packaging must be marked (using at least  $\frac{1}{2}$ " high lettering) "Type A" or "Type B".
- 5.5.3 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP-008 for survey procedure)
- 5.5.4 The radiation level at any point on the external surface of the package and at a distance of one meter must conform with the radiation level requirements shown in Table D. The table also specifies the labeling requirements for packages. Each package must have two labels attached to opposite sides of the package. The shipping label is completed by entering the name of radionuclide(s), the quantity of activity and the transport index on the label using a durable weather resistant means of marking.

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Table D

Radiation Levels and Labeling requirements for Type A and Type B package shipments by common carrier

<u>Radiation Levels</u>	<u>Fissile Class Restrictions</u>	<u>Label Requirements</u>
Radiation levels are $\leq 0.5$ mrem/hr anywhere on external surface of package	Package does not contain Fissile Class II or III materials. Packages can contain Fissile Class I materials.	Radioactive (White) - I
Radiation levels are $> 0.5$ mrem/hr but are $\leq 50$ mrem/hr anywhere on external surface of package, and are $\leq 1.0$ mrem/hr at one meter from the external surface of the package.	Package does not contain Fissile Class III materials. Packages can contain Fissile Class I or II materials having a transport index of 1.0 or less.	Radioactive (Yellow) - II
Radiation levels are $> 50$ mrem/hr but are $\leq 200$ mrem/hr anywhere on external surface of package, and are $\leq 10$ mrem/hr at one meter from the external surface of the package.	Packages can contain Fissile Class II or III materials having a transport index $> 1.0$ , but $\leq 10$ .	Radioactive (Yellow) - III

5.5.5 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.

5.5.6 Each package must be marked with the Consignee's name and address.

5.5.7 Verify all closure devices (including gaskets) are properly installed and free of defects.

5.5.8 Complete the "SHIPPING REPORT" (MKM Form 16-1) and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the home office files.

5.5.9 Complete the transport carriers bill of lading. Retain a copy of the bill of lading for the home office files.

5.5.10 The sum of the transport index from the individual packages must be less than 50 for a single carrier (See additional restrictions in 10 CFR 173.417 for Fissile Class shipments).

5.5.11 The transport vehicle must be posted with a "RADIOACTIVE" placard if the shipment contains Radioactive (Yellow) - III labeled packages.

**5.6 Shipping Type A and Type B Packaged Radioactive Materials by Exclusive Use Vehicle.**

5.6.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.

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- 5.6.2 Materials must be packaged in a DOT Specification 7A Type A package. If the quantities of activity requires a Type A package, each package shall not contain a quantity of radioactivity greater than  $A_1$  for special form radioactive materials and greater than  $A_2$  for normal form radioactive materials. If the quantity of radioactivity exceeds the  $A_1$  or  $A_2$  quantities a Type B package is required. The exterior of the packages which conform to the requirements for Type A and Type B packaging must be marked (using at least 1/2" high lettering) "Type A" or "Type B".
- 5.6.3 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP-008 for survey procedure)
- 5.6.4 The radiation level at any point on the external surface of the package, the transport vehicle, and at a specified distances must conform with the radiation level requirements shown in Table E. The table also specifies the labeling requirements for packages.

Table E

Radiation Levels and Labeling requirements for Type A and Type B Packages in Exclusive Use Shipments.

<u>Radiation Levels on Packages</u>	<u>Radiation levels on/in transport vehicle</u>	<u>Type of Shipment</u>	<u>Package Label Requirements</u>
Radiation levels are $\leq 0.5$ mrem/hr anywhere on external surface of package.	$\leq 10$ mrem/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 2$ mrem/hr in any normally occupied position in the transport vehicle.	Package Shipment in Open Transport Vehicle	Radioactive I
Radiation levels are $\leq 50$ mrem/hr anywhere on external surface of package, and are $\leq 1.0$ mrem/hr at one meter from the external surface of the package.	$\leq 10$ mrem/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 2$ mrem/hr in any normally occupied position in the transport vehicle.	Package Shipment in Open Transport Vehicle	Radioactive II
Radiation levels are $\leq 200$ mrem/hr anywhere on external surface of package, and are $\leq 10$ mrem/hr at one meter from the external surface of the package.	$\leq 10$ mrem/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 2$ mrem/hr in any normally occupied position in the transport vehicle.	Package Shipment in Open Transport Vehicle	Radioactive III
Radiation levels are $\leq 1000$ mrem/hr anywhere on external surface of package. (SEE NOTE 1 BELOW)	$\leq 10$ mrem/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 200$ mrem/hr at any point on the outer surface of the vehicle. $\leq 2$ mrem/hr in any normally occupied position in the transport vehicle.	Package Shipment in Closed Transport Vehicle	Radioactive III
Note 1. The package must be secured so its position remains fixed during transport. There will be no loading or unloading operations between the beginning and end of the transport.			

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- 5.6.5 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.
- 5.6.6 Verify all closure devices (including gaskets) are properly installed and free of defects.
- 5.6.7 The shipment must be braced so as to prevent shifting of lading under conditions normally incident to transportation.
- 5.6.8 Shipments must be loaded by consignor and unloaded by consignee from the conveyance or freight contained in which originally loaded.
- 5.6.9 Complete the "SHIPPING REPORT" (MKM form 16-1), if necessary, and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the Las Vegas office files.
- 5.6.10 Complete the carriers bill of lading. Retain a copy of the bill if lading for the Las Vegas office files.
- 5.6.11 Complete the "DRIVER INSTRUCTIONS" and "SPECIFIC INSTRUCTIONS FOR MAINTENANCE OF EXCLUSIVE USE SHIPMENTS" (Appendix F). Explain the conditions on the forms to the driver and enclose these forms with the packing papers of the shipment. Retain a copy of the forms for the home office files.
- 5.6.12 The transport vehicle must be posted with a 'RADIOACTIVE' placard if the shipment contains Radioactive (Yellow) - III labeled packages.
- 5.7 Highway Route Controlled Quantity shipment.
- 5.7.1 Prior to consigning radioactive material for transport, have the RSO or Waste Broker verify that the receiver possesses a license issued by the NRC or licensing agency of an agreement state to take possession of the type, form, and quantity of material to be transferred. Written confirmation shall be received by the RSO or Waste Broker prior to shipment.
- 5.7.2 If the quantity of radioactive material within a single package exceeds 3,000 times the  $A_1$  or  $A_2$  value of the radionuclides for special form Class 7 (radioactive) material or the quantity of radioactive material is equal to or exceeds 27,000 Curies, whichever is least, the material must be shipped as a Highway Route Controlled Quantity. Materials must be packaged in a DOT Specification Type B package. The exterior of the packages which conform to the requirements for Type B packaging must be marked (using at least  $\frac{1}{2}$ " high lettering) "Type B".
- 5.7.3 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP-008 for survey procedure)

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5.7.4 The radiation level at any point on the external surface of the package, the transport vehicle, and at a specified distances must conform with the radiation level requirements shown in Table F. The table also specifies the labeling requirements for packages.

Table F

**Radiation Levels and Labeling requirements for  
Highway Route Controlled Quantity shipments (exclusive use vehicle)**

<u>Radiation Levels on Packages</u>	<u>Radiation levels on/in transport vehicle</u>	<u>Type of Shipment</u>	<u>Package Label Requirements</u>
Radiation levels are $\leq 1000$ mrem/hr anywhere on external surface of package. (SEE NOTE 1 BELOW)	$\leq 10$ mrem/hr at 2 meters from the vertical planes projected from outer edges of transport vehicle. $\leq 200$ mrem/hr at any point on the outer surface of the vehicle. $\leq 2$ mrem/hr in any normally occupied position in the transport vehicle.	Package Shipment in exclusive use Vehicle	Radioactive III
Note 1. The package must be secured so its position remains fixed during transport. There will be no loading or unloading operations between the beginning and end of the transport.			

- 5.7.5 Any package which has a gross weight in excess of 110 pounds shall be plainly marked with the package weight.
- 5.7.6 Verify all closure devices (including gaskets) are properly installed and free of defects.
- 5.7.7 The shipment must be braced so as to prevent shifting of lading under conditions normally incident to transportation.
- 5.7.8 Shipments must be loaded by consignor and unloaded by consignee from the conveyance or freight contained in which originally loaded.
- 5.7.9 Complete the "SHIPPING REPORT" (MKM Form 16-1), if necessary, and enclose the report with the packing papers of the shipment. The shipping report must be marked with "HIGHWAY ROUTE CONTROLLED QUANTITY". Retain a copy of the "SHIPPING REPORT" for the home office files.
- 5.7.10 Complete the carriers bill of lading. Retain a copy of the bill if lading for the Las Vegas office files.
- 5.7.11 Complete the "DRIVER INSTRUCTIONS" and "SPECIFIC INSTRUCTIONS FOR MAINTENANCE OF EXCLUSIVE USE SHIPMENTS". Explain the conditions on the forms to the driver and enclose these forms with the packing papers of the shipment. Retain a copy of the forms for the home office files.
- 5.7.12 The transport vehicle must be posted with a 'RADIOACTIVE' placard on a SQUARE BACKGROUND as specified in 49 CFR 172.527.

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**5.8 Shipping Empty Packages.**

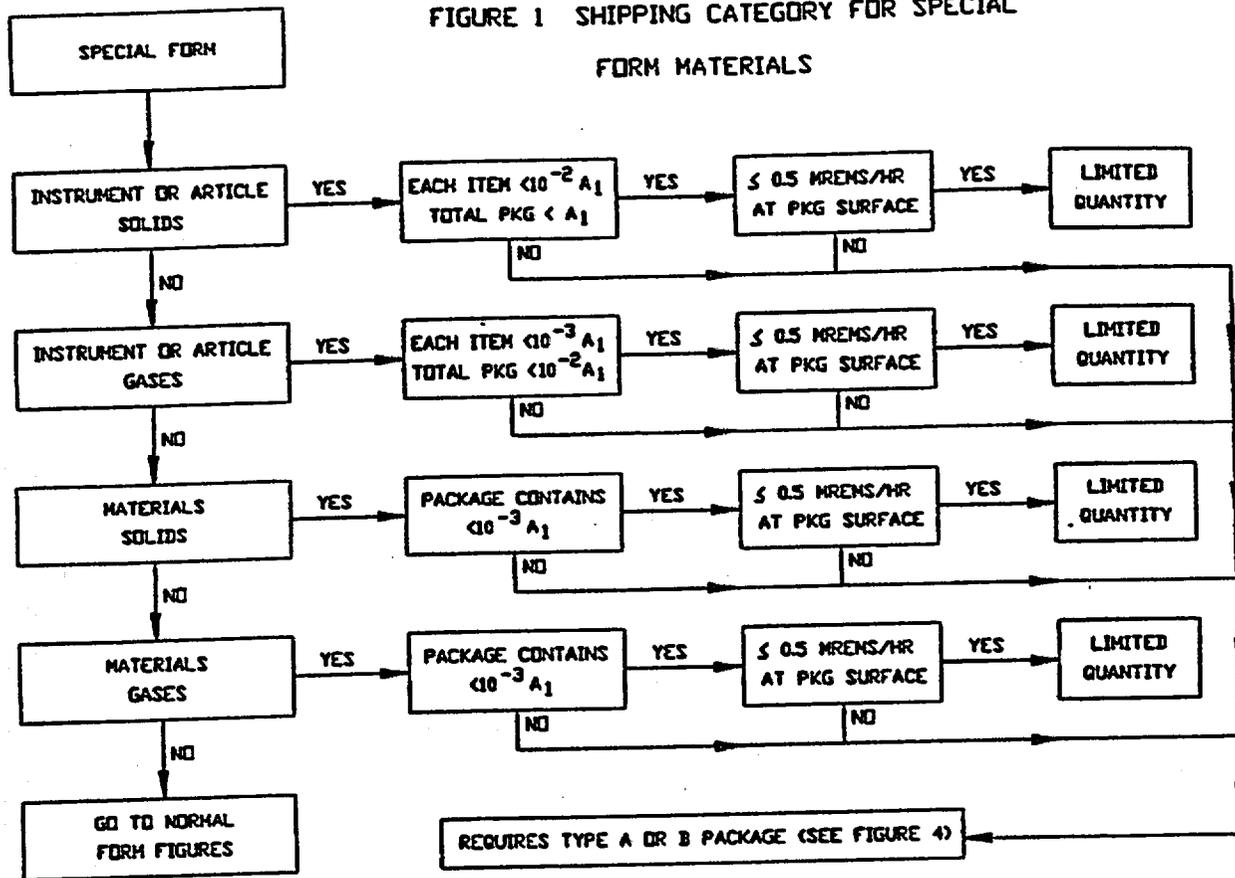
- 5.8.1 Prior to transport, any packaging, container or accessory which has been used for shipment of radioactive materials and contains residual amounts of material must be adequately sealed to prevent leakage of radioactive material during transport.
- 5.8.2 The non-fixed (removable) radioactive surface contamination on the external surface of the package shall not exceed the limits specified in table A of section 5.2. (See MKMP-008 for survey procedure)
- 5.8.3 The radiation level on the external surface of the package must be equal to or less than 0.5 mrem/hr.
- 5.8.4 The residual amounts of radioactive materials must not exceed 100 times the limits specified in table A of section 5.2.
- 5.8.5 Remove, obliterate or cover any labels previously applied and apply an "EMPTY" label.
- 5.8.6 The outside of the inner packaging or if there is no inner packaging, the outside of the packaging itself must bear the marking "RADIOACTIVE".
- 5.8.7 Complete the "SHIPPING REPORT" (MKM Form 16-1), if necessary, and enclose the report with the packing papers of the shipment. Retain a copy of the "SHIPPING REPORT" for the home office files.

**6.0 Attachments**

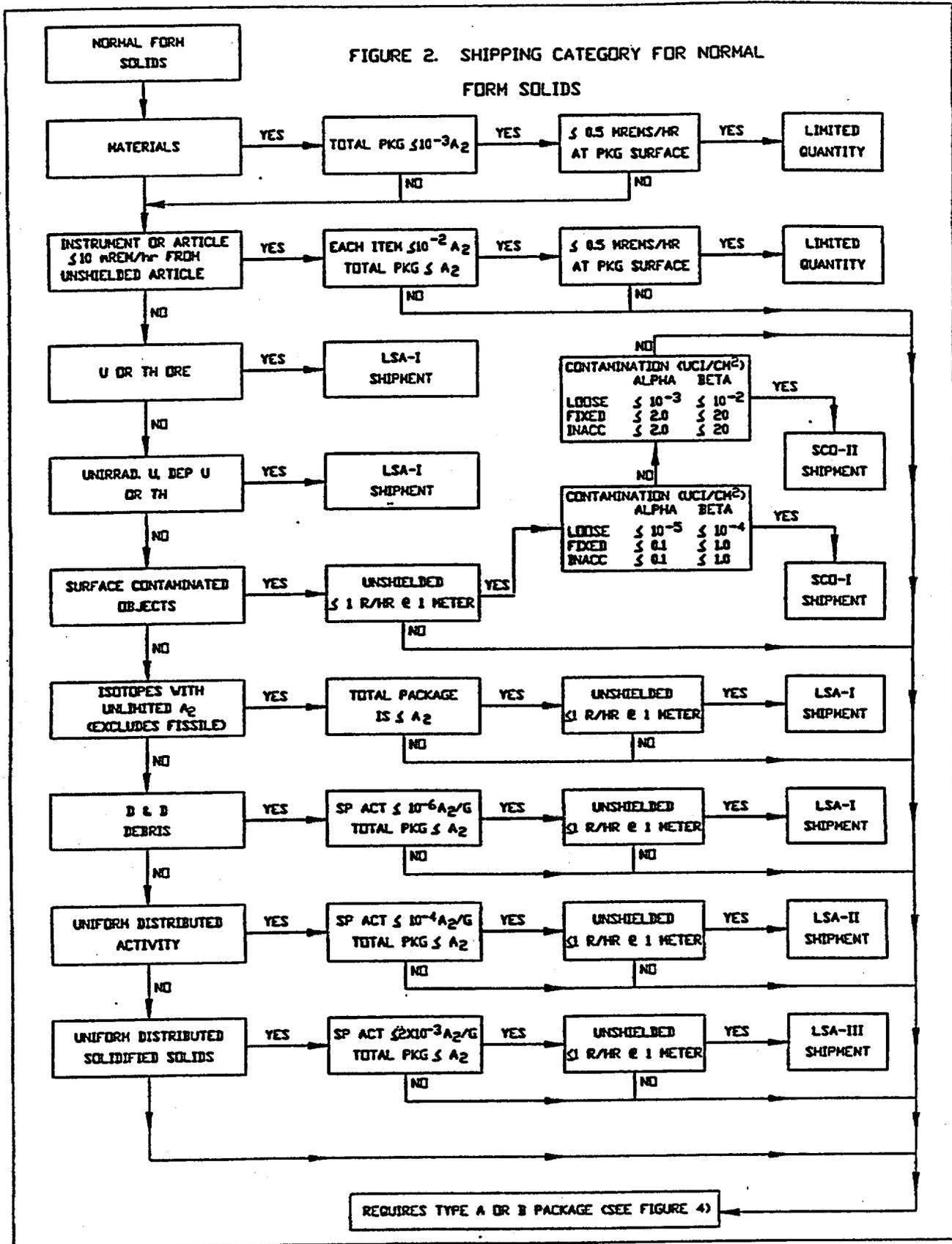
Figure 1.	Shipping category for special form materials
Figure 2	Shipping category for normal form solids
Figure 3	Shipping category for normal form liquid and gases
Figure 4	Type A and Type B shipments
Appendix A	Specific Shipping Requirements/Barnwell
Appendix B	Specific Shipping Requirements/Hanford
Appendix C	Specific Shipping Requirements/EnviroCare
Appendix D	Copy of Distribution Checklists
Appendix E	CWB Work Forms
Appendix F	Shipping Papers and Supporting Documents
Appendix G	Packaging Pyrophoric Materials
Appendix H	Packaging Biological Waste
Appendix I	Packaging Scintillation Liquids
Appendix J	Absorption of Small Volumes of Liquids
Appendix K	Encapsulation of Sources
MKMP 16-1	Shipping Report

MKMP Figure 1

FIGURE 1 SHIPPING CATEGORY FOR SPECIAL FORM MATERIALS

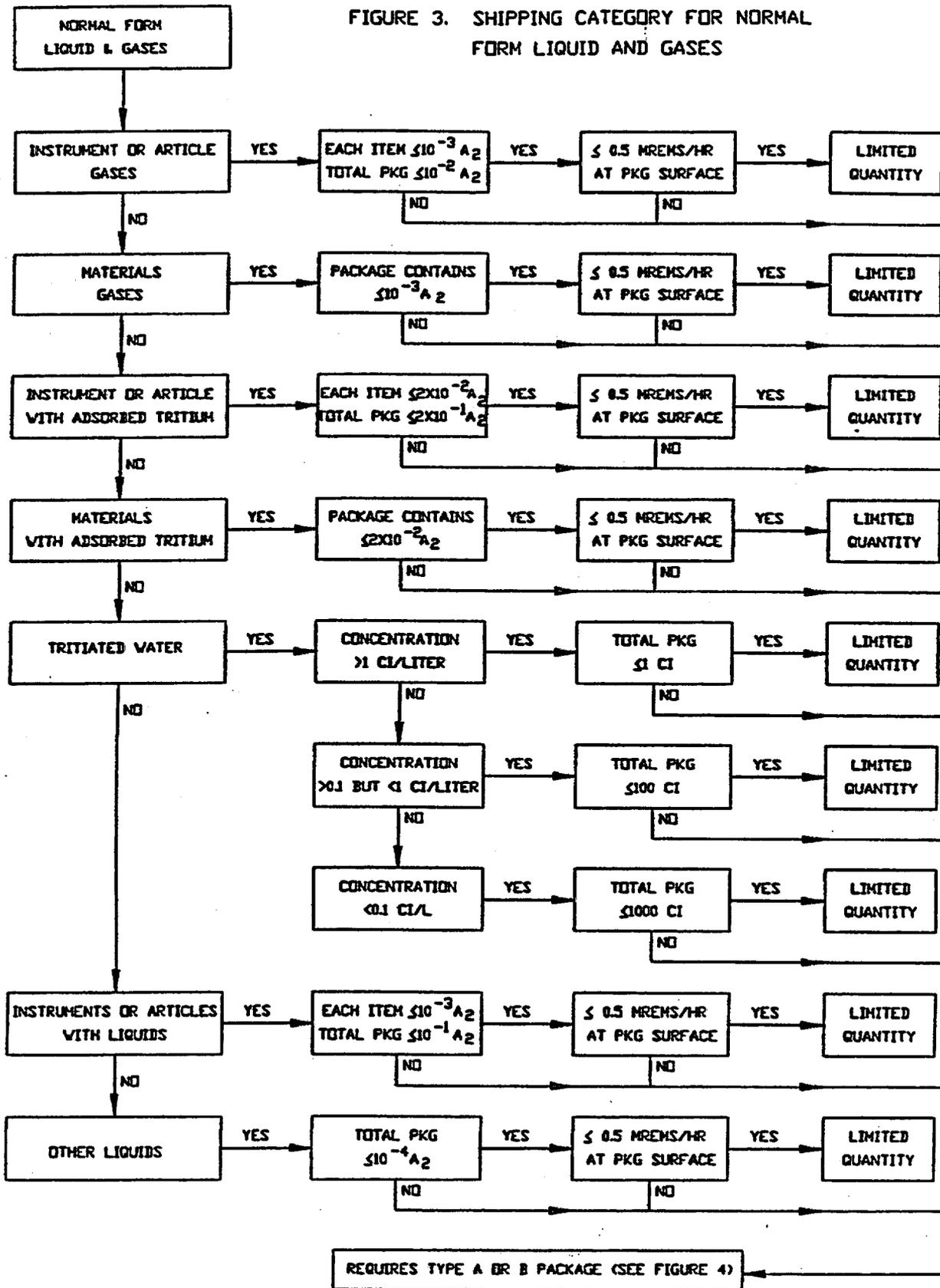


MKMP Figure 2



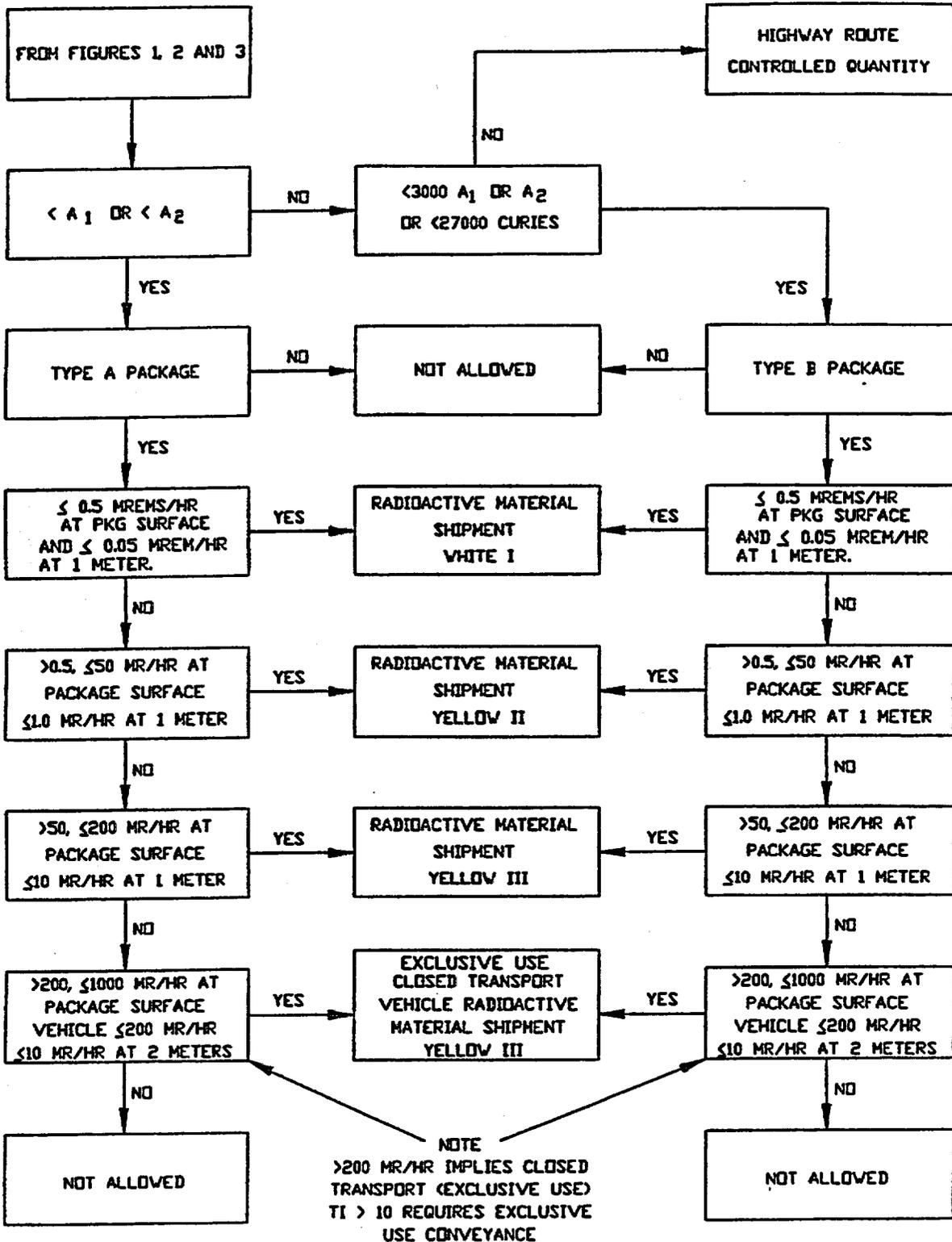
MKMP Figure 3

FIGURE 3. SHIPPING CATEGORY FOR NORMAL FORM LIQUID AND GASES



MKMP Figure 4

FIGURE 4 TYPE A, TYPE B AND HIGHWAY ROUTE CONTROLLED QUANTITY SHIPMENT



## APPENDIX A

### SPECIFIC SHIPPING REQUIREMENTS BARNWELL WASTE MANAGEMENT

- 1.0 SCDHEC transportation permits must be renewed by the first of January of each year. Ensure that these permits are current.
- 2.0 Weight and volume dilution of the activity concentration is not acceptable for aqueous filters and sources that have been encapsulated.
- 3.0 Encapsulation for stability requires a minimum specific thickness (4 inches) of cement all around the item being encapsulated. Consult Barnwell's acceptance criteria or the Materials Management Supervisor.
- 4.0 Absorbed fluids are not acceptable.
- 5.0 SCDHEC 802, Prior Notification Form, is not required if the activity in the shipment is less than one (1) Curie and the volume is less than 75 cubic feet.
- 6.0 A shipment ID# must be obtained by the 10<sup>th</sup> of the month from the Barnwell WSSP/PNP department for every shipment being sent to Barnwell "overpacks" are prepared.
- 7.0 Generators must provide a documented Radwaste Program certification as included in the Barnwell manifest and manifest coversheet.

**NOTE: CNSI has been granted an exemption by the USDOT to use their manifest as shipping papers. For generators/brokers to use the exemption number, it must be written on all pages of the manifest and other shipping papers.**

- 8.0 Generators must provide a P.O., contract or written letter of authority to CNSI marketing prior to shipment.
- 9.0 The SCDHEC 802, Prior Notification Form, must be faxed to CNSI/NSSI/PNP and SCDHEC in Columbia, at least 72 hours in advance of shipment.

## APPENDIX B

### SPECIFIC SHIPPING REQUIREMENTS HANFORD NORM/LLRW SITE

- 1.0 The disposal Site User's Permit is valid, not expired, and will not expire prior to the shipments arrival at the disposal site.
- 2.0 The Broker Site Users Permit is valid, not expired, and will not expire prior to the shipment's arrival at the disposal site.
- 3.0 Solidified oil must be segregated by ten (10) feet in the disposal trench and the segregation volume may be reflected in the disposal charges. Stabilized oil does not have to be segregated.
- 4.0 The Hanford LLRW RSM will be used, however, some handwritten changes must be made prior to use.
- 5.0 Concrete for the encapsulation of sources must be cured for 28 days and must achieve a minimum compressive strength of 2500 psi.
- 6.0 ALL Radium waste is considered NORM, however prior to burial, the Washington Department of Health (WDOH) must document an official *Norm Determination Letter* (certification). This documentation must be received and ready for inspection prior to presenting the NORM for burial.
- 7.0 Consumer products (including smoke detectors) require a specific exception or proof the original manufacturer has been licensed by the NRC or an Agreement State agency to manufacture the product as a consumer product and the consumer does not have or need a specific license to possess the product. This proof must accompany the shipping papers.
- 8.0 Lead may be permitted, as shielding on a case-by-case basis, in waste packages destined for Hanford.
- 9.0 Properly sorbed liquids are accepted for burial. The acceptable sorbents are listed in the Hanford Site License.

## APPENDIX C

### SPECIFIC SHIPPING REQUIREMENTS ENVIROCare

- 1.0 The waste forms and radionuclides must be homogeneous except in the case of structural debris superficially contaminated with licensed materials.
- 2.0 No sealed sources are acceptable.
- 3.0 Free standing liquid shall in no case exceed 1.0% by volume per container.
- 4.0 The authorized forms of materials are volumetric bulky materials or structural debris. The use of bulk closed transport vehicles is encouraged.
- 5.0 Structural debris is limited to <12 inches in at least one direction, and not greater than 8 feet in any one direction.
- 6.0 The waste is required to be characterized through a wide battery of analyses. Consult with EnviroCare's Radiation Safety Officer (RSO) and/or the Material Management Supervisor (MMS)/Waste Management Supervisor (WMS).
- 7.0 Intensive preliminary sampling per EnviroCare guidance is required prior to issuance of the notification to ship. These samples' results will be presented to EnviroCare, if requested, prior to issuance of the notification.

**APPENDIX D**

**COPY DISTRIBUTION CHECKLIST  
BARNWELL WASTE MANAGEMENT**

	Disposal Site	Shipper	Carrier	M.M.S.	CWB	Mail Copy
RSM	original	2 <sup>nd</sup> original	3 <sup>rd</sup> original	copy	copy	copy
Bill of Lading	copy	copy	original	copy	copy	N/A
DHEC 802	original	copy	copy	copy	copy	N/A
DHEC 803	original	copy	copy	copy	copy	N/A
*Driver Instruction Exclusive Use	copy	copy	original	copy	copy	N/A
Waste Inventory Sheet	N/A	copy	N/A	copy	copy	N/A
Truck Survey	copy	copy	copy	copy	copy	N/A
Administrative Info	N/A	N/A	N/A	copy	copy	N/A
*HIC Certification	copy	copy	N/A	copy	copy	N/A
*NRC Form 741	original	copy	N/A	copy	copy	N/A
*Isotopic Analysis	copy	copy	N/A	copy	copy	N/A
Class C Certification	original	copy	N/A	copy	copy	N/A
*Compact Export Certification	original	copy	N/A	copy	copy	N/A
*Variance Letter	copy	copy	N/A	copy	copy	N/A
Radwaste Program Certification	original	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	original	copy	copy	N/A

\* Only if applicable

**APPENDIX D**

**COPY DISTRIBUTION CHECKLIST  
HANFORD NORM/LLRW SITE**

	Disposal Site	Shipper	Carrier	M.M.S.	CWB	Mail Copy
RSM	original & 3 <sup>rd</sup> original	4 <sup>th</sup> original	5 <sup>th</sup> original	copy	copy	2 <sup>nd</sup> original
Bill of Lading	copy	copy	original	copy	copy	N/A
WA Certification (DHS-RHF-31B)	original	copy	copy	copy	copy	N/A
Prior Notification Call Sheet	copy	copy	copy	copy	original	N/A
*Driver Instruction Exclusive Use	copy	copy	original	copy	copy	N/A
Waste Inventory Sheet	N/A	copy	N/A	copy	original	N/A
Truck Survey	copy	copy	copy	copy	original	N/A
Administrative Info	N/A	N/A	N/A	copy	original	N/A
*Compact Export Certification	original	copy	N/A	copy	copy	N/A
*Variance Letter	original	copy	N/A	copy	copy	N/A
*NRC Certification	original	copy	N/A	copy	copy	N/A
*Port of Entry (CVSA)	original	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	original	copy	copy	copy

\* Only if applicable

**APPENDIX D**

**COPY DISTRIBUTION CHECKLIST  
ENVIRO CARE OF UTAH**

	Disposal Site	Shipper	Carrier	M.M.S.	CWB	Mail Copy
RSM	original	copy	copy	copy	copy	copy
Bill of Lading	copy	copy	original	copy	copy	N/A
*Driver Instruction Exclusive Use	copy	copy	original	copy	copy	N/A
Waste Inventory Sheet	N/A	copy	N/A	copy	original	N/A
Truck Survey	copy	copy	copy	copy	original	N/A
Administrative Info	N/A	N/A	N/A	copy	original	N/A
*NRC Form 741	original	copy	N/A	copy	copy	N/A
LDR Notification	original	copy	N/A	copy	copy	N/A
Emergency Action	copy	copy	original	copy	copy	copy

\* Only if applicable

## APPENDIX D

### COPY DISTRIBUTION CHECKLIST NON-WASTE SHIPMENTS

	Disposal Site	Shipper	Carrier	M.M.S.	CWB
RSR	original	copy	copy	copy	copy
Bill of Lading	copy	copy	original	copy	copy
*Driver Instruction Exclusive Use	copy	copy	original	copy	copy
Waste Inventory Sheet	N/A	copy	N/A	copy	original
Truck Survey	copy	copy	copy	copy	original
Administrative Info	N/A	N/A	N/A	copy	original
*NRC Form 741	original	copy	N/A	copy	copy
Emergency Action	copy	copy	original	copy	copy

\* Only if applicable

**APPENDIX E**

**CWB WORK FORMS  
CWB PRE-DEPARTURE GUIDE**

- I. Initial contact with generator (Ph#) \_\_\_\_\_
  - A. Description of material \_\_\_\_\_
  - B. Amount - Volume \_\_\_\_\_
  - C. Activity \_\_\_\_\_
  - D. Tentative dates \_\_\_\_\_
  - E. Permit number(s) \_\_\_\_\_
  - F. Directions to site \_\_\_\_\_
- 

G. Handling equipment available, if required \_\_\_\_\_

II. Office Workup

- A. Planning Job
  - 1. Classification of material
  - 2. How will it be shipped
  - 3. Waste category
  - 4. Man hours and equipment needed
  - 5. Shipping arrangements (materials)
  - 6. Shipping ID#/Generator number \_\_\_\_\_
  - 7. Permission or Permit to Export/Import to Compact
  - 8. Submit DHEC 802, if required
  - 9. Submit DHEC 803, if required
  - 10. Transportation arrangements
- B. Re-contact Generator
  - 1. Changes since last contact - additional information \_\_\_\_\_  
\_\_\_\_\_
  - 2. Shipping dates \_\_\_\_\_
  - 3. Materials to be supplied by customer
  - 4.

III. Material Needed for Job

- A. Instruments
  - 1. Dose rate w/suitable range for job
  - 2.  $\beta$  -  $\gamma$  "frisker" w/suitable range for job
  - 3.  $\alpha$  "frisker" w/suitable range for job
  - 4. Additional instruments as necessary
- B. Markings
  - 1. Specification
    - a. Proper shipping name and ID #
    - b. Consignor/consignee name and address
    - c. Item number/weight
    - d. Container specification
    - e. Reportable Quantity - RQ
    - f. Bulk package IAW 49 CFR 172.302 & 172.332

## APPENDIX E

### CWB WORK FORMS CWB PRE-DEPARTURE GUIDE (continued)

2. Non-specification
  - a. Radioactive
  - b. Radioactive LSA (exclusive use vehicle)
  - c. Waste Class: A \_\_\_\_\_ B \_\_\_\_\_ C \_\_\_\_\_
  - d. Stable \_\_\_\_\_ Unstable \_\_\_\_\_
  - e. Dry Solid
  - f. Absorbed liquids
  - g. Biological
  - h. Certification Statement (limited quantity)
  - i. *This End Up*
  - j. Overpack Statement
- D. Paperwork Required
  1. Barnwell Site
    - a. RSM and continuation pages
    - b. Completed DHEC 802
    - c. Blank DHEC 803
    - d. Broker/Processor forms, as applicable
  2. Hanford Site
    - a. RSM, continuation and compact tabulation pages
    - b. Washington State Certification, commercial
    - c. Washington State Certification, government
    - d. Broker/Processor forms, as applicable
  3. EnviroCare of Utah
    - a. RSM and continuation pages
  4. Non-Disposal Shipments
    - a. RSR and continuation pages
  5. Bill of Lading and Continuation Sheets
  6. CWB Packages
  7. Extra CWB Surveys
  8. HIC Operating Procedures
  9. Stabilization/Encapsulation/Solidification process procedures
  10. Export Permission, if applicable
  11. Packaging Certification
- E. Other Materials Needed
  1. Tools
  2. Office supplies
  3. RP Forms
  4. Instrumentation
  5. Batteries
  6. Placards
  7. Timesheets and expense reports
- F. Travel Arrangements
  1. Confirm flight reservations
  2. Confirm hotel reservations
  3. Confirm car reservations
  4. Passport and/or Visa

**APPENDIX E**

**CWB WORK FORMS  
ADMINISTRATIVE INFORMATION**

Shipper:			
Facility:			
Address:			
Phone #s			
CWB:			
RW Supv/Generator			
Gen Shipment #:		Carrier Control #:	
Carrier:			
Driver(s):			
Tractor #(s):			
Trailer #(s):			
Material Desc:			
Container #/Type	Container #/Type	Container #/Type	Container #/Type
Comments:			
Departure Date:			
Est Arrival Date:			
Name: (Print/Sign		/	Date:





**CWB WORK FORMS  
POST CHECKLIST OF BROKER'S WORK**

Check or N/A, as applicable

**A. Container Inspection**

- 1. Integrity satisfactory
- 2. Clean, contents inspected, no free-standing liquid
- 3. Solidified drums tapped
- 4. Wooden boxes banded (wooden boxes to Hanford not acceptable)
- 5. Metal boxes clipped and sealing surfaces caulked
- 6. Caulking visible on boxes
- 7. Drum lids sealed
- 8. Lock nuts tight
- 9. Tamper seal (if required to be placed on package)
- 10. Survey container
- 11. Dose rate recorded on container
- 12. Item/weight label completed
- 13. Waste classification/stability
- 14. Proper shipping name and I.D. number marking
- 15. Specification labels (both sides)
- 16. Other (list): \_\_\_\_\_

**B. Loading**

- 1. Conduct and record initial survey of trailer
- 2. Hot containers shielded from exterior
- 3. Drums weighing greater than 1000 lbs. palletized
- 4. Check with driver about weight placement
- 5. Load properly braced and secured
- 6. Truck placarded (as applicable)
- 7. Conduct and record final truck survey
- 8. Seal doors on trailer

**C. Cask Inspection**

- 1. Tie downs
  - a. Tightness (no slack)
  - b. Turnbuckles/ratchet binders (handles secure)
  - c. Cable clamps properly installed
  - d. No sharp objects to damage cable or chains
  - e. Tie-down attachment welds (no cracks)
  - f. Cable/chain conditions (do not touch)
- 2. Liner
  - a. Type \_\_\_\_\_ ; Serial No. \_\_\_\_\_
  - b. Barrel top covers (pipe caps in place)
  - c. QA inspection sticker (on liner)
  - d. Liner properly marked for Class (A, B, C)
- 3. Cask Cover/Lid
  - a. Nuts/bolts/washer (condition, lubricated, torqued)
  - b. Lids bolted/cask seal affixed
  - c. Rain cover installed
  - d. Lid lifting shackles/rings, lugs properly covered
  - e. Lid top surface clean

**CWB WORK FORMS  
POST CHECKLIST OF BROKER'S WORK  
(CONTINUED)**

4. General
- \_\_\_\_\_ a. Cask trailer base retainer plates in place
- \_\_\_\_\_ b. Cask in proper location on trailer
- \_\_\_\_\_ c. Paint appearance/nameplate/cleanliness of cask
- D. Shipping Papers
- \_\_\_\_\_ 1. RSM continuation sheets completed
- \_\_\_\_\_ 2. Cover Sheet
- \_\_\_\_\_ a. Driver's signature
- \_\_\_\_\_ b. Both release signature
- \_\_\_\_\_ c. Check for entries in every block
- \_\_\_\_\_ d. Verify totals
- \_\_\_\_\_ e. Ensure generator's state & compact is identified appropriately
- \_\_\_\_\_ f. Ensure Emergency Response information is entered
- \_\_\_\_\_ 3. Complete the CWB administrative sheet
- \_\_\_\_\_ 4. Bill of Lading
- \_\_\_\_\_ a. Number of packages
- \_\_\_\_\_ b. Hazardous material column
- \_\_\_\_\_ c. Proper shipping name, hazard class, and I.D. number
- \_\_\_\_\_ d. RQ entered
- \_\_\_\_\_ e. Fissile excepted, as applicable
- \_\_\_\_\_ f. Weight
- \_\_\_\_\_ g. Description
- \_\_\_\_\_ h. Radionuclides
- \_\_\_\_\_ i. Total activity
- \_\_\_\_\_ j. Physical Form
- \_\_\_\_\_ k. Chemical Form
- \_\_\_\_\_ l. Specification label or non-specification marking
- \_\_\_\_\_ m. T. I.
- \_\_\_\_\_ n. Container Type
- \_\_\_\_\_ o. Limited Quantity/Instruments & Articles certification statement
- \_\_\_\_\_ p. Time/date - Arrived/departed
- \_\_\_\_\_ q. Exclusive use statement
- \_\_\_\_\_ r. Page numbers if continuation used
- \_\_\_\_\_ s. Driver's signature
- \_\_\_\_\_ t. Shipper's signature
- \_\_\_\_\_ 5. Complete radioactive waste shipment certification
- \_\_\_\_\_ a. Shipper's signature
- \_\_\_\_\_ b. Driver's signature
- \_\_\_\_\_ c. CWB's signature (Hanford)
- \_\_\_\_\_ 6. Complete Driver's Instructions for exclusive use shipments. Check driver's signature
- \_\_\_\_\_ 7. Corrections to DHEC 802 — FAX corrections
- \_\_\_\_\_ 8. Shipping papers and copies legible

**APPENDIX E**

**CWB WORK FORMS  
POST CHECKLIST OF BROKER'S WORK  
(CONTINUED)**

9. Reproduce copies:

- \_\_\_\_\_ a. Shipper's copy
- \_\_\_\_\_ b. Carrier's copy
- \_\_\_\_\_ c. Site copy
- \_\_\_\_\_ d. CWB's copy
- \_\_\_\_\_ e. MMS/WMS copy
- \_\_\_\_\_ f. Mail (RSM cover sheet to disposal site)
- \_\_\_\_\_ g. EnviroCare (Fax RSM to 801/537-7345)

10 Prior notifications calls

- \_\_\_\_\_ a. Hanford - 509/377-2411
- \_\_\_\_\_ b. Barnwell - 803/259-1781
- \_\_\_\_\_ c. DHEC - 803/896-4247/4240
- \_\_\_\_\_ d. CWB - 702/869-6888

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Signature (Print/Sign)

Date

**APPENDIX E**

**CWB WORK FORMS  
VEHICLE INSPECTION SHEET**

MKM Shipment # \_\_\_\_\_ Disposal Shipment # \_\_\_\_\_ Customer Shipment # \_\_\_\_\_  
 Carrier Name/Address \_\_\_\_\_ Tractor # \_\_\_\_\_  
 \_\_\_\_\_ Trailer # \_\_\_\_\_

Driver: \_\_\_\_\_ State of Residence: \_\_\_\_\_

1	Operator's License	( ) Sat	( ) UnSat	Driver possesses valid commercial driver's license, with appropriate vehicle/hazardous materials endorsement.
2	Windshield, Side Glass & Mirror	( ) Sat	( ) UnSat	No cracked or broken glass that would affect the driver's vision. Mirror(s) in place and usable.
3	Wipers	( ) Sat	( ) UnSat	Wipers operate and are in good condition.
4	Horn	( ) Sat	( ) UnSat	Air/electric horn works.
5	Suspension	( ) Sat	( ) UnSat	Visually check for loose, broken, or damaged spring leaves, "U" bolts, shackles, pads, torque arms, and locking pins.
6	Brake Lines	( ) Sat	( ) UnSat	Brake lines and connectors do not have cracks, crimps, restrictions, or evidence of damage or audible air leaks.
7	Brake Pots & Cans	( ) Sat	( ) UnSat	Brake pots are in good physical condition and mechanical linkages are intact and in good condition.
8	Exhaust System	( ) Sat	( ) UnSat	No loose or broken brackets and no evidence of leaks which would affect driving/sleeping compartment.
9	Fuel System	( ) Sat	( ) UnSat	No damage affecting fuel tank integrity, no visible leaks, no loose or broken mounting brackets, no evidence of damage to vents, and fuel cap is securely in place.
10	Structure & Welds	( ) Sat	( ) UnSat	No cracks in load bearing welds or assemblies.
11	Frame	( ) Sat	( ) UnSat	No cracked, loose, sagging, or broken frame.
12	Van/Trailer Floor	( ) Sat	( ) UnSat	No holes or projecting nails, capable of bearing weight of load and fork truck (if used).
13	Van Walls, Ceiling	( ) Sat	( ) UnSat	No holes, severe dents, or buckling.
14	Van Doors	( ) Sat	( ) UnSat	Can be closed and secured properly.
15	Rims	( ) Sat	( ) UnSat	Rims are not bent or cracked, and stud nuts are in.
16	Tires	( ) Sat	( ) UnSat	Tires appear properly inflated, tread depths appear greater than minimum.
17	Hubs	( ) Sat	( ) UnSat	Oil level visible, no visible oil leakage from seals.
18	Head Lights	( ) Sat	( ) UnSat	Both low beams working.
19	Running Lights	( ) Sat	( ) UnSat	All affixed running lights operable.
20	Turn Signals	( ) Sat	( ) UnSat	Front and back working.
21	Brake Lights	( ) Sat	( ) UnSat	Must work on tractor and trailer.
22	Bracing	( ) Sat	( ) UnSat	Bracing/shoring must be sufficient to prevent shifting of lading during conditions normally incident to transportation.
23	Tractor & Trailer	( ) are	( ) are not	acceptable for use.

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE - LOW LEVEL RADIATION

PAGE 1 OF 6

#### HEALTH

- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.
- LOW-LEVEL RADIOACTIVE MATERIAL; VERY LOW RADIATION HAZARD TO PEOPLE. QUANTITY OF MATERIAL PRESENTS LOW RADIATION HAZARD IF RELEASED FROM PACKAGE DURING ACCIDENT.
- SOME RADIOACTIVE MATERIALS CANNOT BE DETECTED BY COMMONLY AVAILABLE INSTRUMENTS.
- PACKAGES DO NOT HAVE RADIOACTIVE I, II, OR III LABELS; WHILE SOME MAY HAVE EMPTY LABELS AND/OR THE WORD "RADIOACTIVE: IN THE PACKAGE MARKING.
- IF ANY RADIOACTIVE CONTAMINATION OCCURS, IT WILL BE EXTREMELY LOW LEVEL.

---

#### FIRE OR EXPLOSION

- SOME OF THESE MATERIALS MAY BURN, BUT MOST DO NOT IGNITE READILY.
- RADIOACTIVITY DOES NOT CHANGE FLAMMABILITY OR OTHER PROPERTIES OF THE MATERIALS.

---

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DETAIN OR ISOLATE UNINJURED PERSONS OR EQUIPMENT SUSPECTED TO BE CONTAMINATED; DELAY DECONTAMINATION AND CLEANING UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

---

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

---

#### EMERGENCY ACTION

##### FIRE

- PRESENCE OF RADIOACTIVE MATERIAL WILL NOT CHANGE EFFECTIVENESS OF FIRE CONTROL TECHNIQUES.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>, WATER SPRAY. OR REGULAR FOAM.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS).

---

#### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL.

##### LIQUID SPILLS

- COVER WITH SAND, EARTH OR OTHER NONCOMBUSTIBLE ABSORBENT MATERIAL.
- COVER POWDER SPILL WITH PLASTIC SHEET OR TARP TO MINIMIZE SPREADING.

---

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY.
- DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- IN CASE OF CONTACT WITH SUBSTANCE, IMMEDIATELY FLUSH SKIN OR EYES WITH RUNNING WATER FOR AT LEAST 20 MINUTES.
- ENSURE THAT MEDICAL PERSONNEL ARE AWARE OF THE MATERIAL(S) INVOLVED, AND TAKE PRECAUTIONS TO PROTECT THEMSELVES.

---

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - ARTICLES MANUFACTURED FROM NATURAL OR DEPLETED URANIUM OR NATURAL THORIUM
- UN2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - EMPTY PACKAGING
- UN2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - INSTRUMENTS OR ARTICLES
- UN2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - LIMITED QUANTITY OF MATERIAL

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE - LOW TO MODERATE LEVEL RADIATION

PAGE 2 OF 6

#### HEALTH

- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.
- UNDAMAGED PACKAGES ARE SAFE; CONTENTS OF DAMAGED PACKAGES MAY CAUSE EXTERNAL AND/OR INTERNAL RADIATION EXPOSURE.
- LOW RADIATION HAZARD WHEN MATERIAL IS INSIDE CONTAINER. IF MATERIAL IS RELEASED FROM PACKAGE OR BULK CONTAINER, HAZARD WILL VARY FROM LOW TO MODERATE. LEVEL OF HAZARD WILL DEPEND ON THE TYPE AND AMOUNT OF RADIOACTIVITY, THE KIND OF MATERIAL IT IS IN, AND/OR THE SURFACE IT IS ON.
- SOME MATERIAL MAY BE RELEASED FROM PACKAGES DURING ACCIDENTS OF MODERATE SEVERITY. THIS POSES LITTLE RISK TO PEOPLE.
- RELEASED RADIOACTIVE MATERIALS OR CONTAMINATED OBJECTS USUALLY WILL BE VISIBLE IF PACKAGING FAILS.
- SOME RADIOACTIVE MATERIALS CANNOT BE DETECTED BY COMMONLY AVAILABLE INSTRUMENTS.
- SOME EXCLUSIVE USE SHIPMENTS OF BULK AND PACKAGED MATERIALS WILL NOT HAVE "RADIOACTIVE" LABELS. PLACARDS, MARKINGS, AND SHIPPING PAPERS PROVIDE IDENTIFICATION. SOME PACKAGES MAY HAVE A "RADIOACTIVE" LABEL AND A SECOND HAZARD LABEL. THE SECOND HAZARD IS USUALLY GREATER THAN THE RADIATION HAZARD; SO FOLLOW THIS GUIDE AS WELL AS A RESPONSE GUIDE FOR THE SECOND LABEL.
- RUNOFF FROM CONTROL OF CARGO FIRE MAY CAUSE LOW-LEVEL POLLUTION.

#### FIRE OR EXPLOSION

- SOME OF THESE MATERIALS MAY BURN, BUT MOST DO NOT IGNITE READILY.
- URANIUM AND THORIUM METAL CUTTINGS OR GRANULES MAY IGNITE SPONTANEOUSLY IF EXPOSED TO AIR.
- NITRATES ARE OXIDIZERS AND MAY IGNITE OTHER COMBUSTIBLES.

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DETAIN OR ISOLATE UNINJURED PERSONS OR EQUIPMENT SUSPECTED TO BE CONTAMINATED; DELAY DECONTAMINATION AND CLEANING UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

#### EMERGENCY ACTION

##### FIRE

- PRESENCE OF RADIOACTIVE MATERIAL WILL NOT CHANGE EFFECTIVENESS OF FIRE CONTROL TECHNIQUES.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>, WATER SPRAY. OR REGULAR FOAM.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS), DIKE FIRE-CONTROL WATER FOR LATER DISPOSAL.

##### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL.

##### LIQUID SPILLS

- COVER WITH SAND, EARTH OR OTHER NONCOMBUSTIBLE ABSORBENT MATERIAL.
- DIKES TO COLLECT LARGE SPILLS.
- COVER POWDER SPILL WITH PLASTIC SHEET OR TARP TO MINIMIZE SPREADING.

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY.
- DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- IN CASE OF CONTACT WITH SUBSTANCE, WIPE FROM SKIN IMMEDIATELY, FLUSH SKIN OR EYES WITH RUNNING WATER FOR AT LEAST 20 MINUTES.
- INJURED PERSONS WHO CONTACTED RELEASED MATERIAL MAY BE A MINOR CONTAMINATION PROBLEM TO CONTACTED PERSONS, EQUIPMENT, AND FACILITIES.
- ENSURE THAT MEDICAL PERSONNEL ARE AWARE OF THE MATERIAL(S) INVOLVED, AND TAKE PRECAUTIONS TO PROTECT THEMSELVES.

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2912 RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE - LOW TO HIGH LEVEL RADIATION

PAGE 3 OF 6

#### HEALTH

- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.
- UNDAMAGED PACKAGES ARE SAFE; CONTENTS OF DAMAGED PACKAGES MAY CAUSE EXTERNAL AND/OR INTERNAL RADIATION EXPOSURE.
- TYPE A PACKAGES (CARTONS, BOXES, DRUMS, ARTICLES, ETC.) IDENTIFIED AS "TYPE A" BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN NON-LIFE ENDANGERING AMOUNTS. PARTIAL RELEASES MIGHT BE EXPECTED IF "TYPE A" PACKAGES ARE DAMAGED IN MODERATELY SEVERE ACCIDENTS.
- TYPE B PACKAGES (LARGE AND SMALL, USUALLY METAL) IDENTIFIED AS "TYPE B" BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN POTENTIALLY LIFE ENDANGERING AMOUNTS. BECAUSE OF DESIGN, EVALUATION, AND TESTING OF PACKAGES, LIFE ENDANGERING RELEASES ARE NOT EXPECTED IN ACCIDENTS INVOLVING "TYPE B" PACKAGES, EXCEPT THOSE OF UTMOST SEVERITY.
- RADIOACTIVE WHITE-I LABELS INDICATE RADIATION LEVELS OUTSIDE UNDAMAGED PACKAGES ARE VERY LOW (LESS THAN 0.005 mSv/h (0.5 MR/h)).
- RADIOACTIVE YELLOW-II OR YELLOW-III LABELED PACKAGES HAVE HIGHER RADIATION LEVELS. THE TRANSPORT INDEX (TI) ON THE LABEL IDENTIFIES THE MAXIMUM RADIATION LEVEL IN mrem/h @ 1 METER FROM THE PACKAGE.
- SOME RADIOACTIVE MATERIALS CANNOT BE DETECTED BY COMMONLY AVAILABLE INSTRUMENTS.
- RUNOFF FROM CONTROL OF CARGO FIRE MAY CAUSE LOW-LEVEL POLLUTION.

#### FIRE OR EXPLOSION

- SOME OF THESE MATERIALS MAY BURN, BUT MOST DO NOT IGNITE READILY.
- RADIOACTIVITY DOES NOT CHANGE FLAMMABILITY OR OTHER PROPERTIES OF MATERIALS.
- TYPE B PACKAGES ARE DESIGNED AND EVALUATED TO WITHSTAND TOTAL ENGULFMENT IN FLAMES AT TEMPERATURES OF 800°C (1475°F) FOR A PERIOD OF 30 MINUTES.

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DETAIN OR ISOLATE UNINJURED PERSONS OR EQUIPMENT SUSPECTED TO BE CONTAMINATED; DELAY DECONTAMINATION AND CLEANING UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

#### EMERGENCY ACTION

##### FIRE

- PRESENCE OF RADIOACTIVE MATERIAL WILL NOT CHANGE EFFECTIVENESS OF FIRE CONTROL TECHNIQUES.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>, WATER SPRAY. OR REGULAR FOAM.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS), DIKE FIRE-CONTROL WATER FOR LATER DISPOSAL.

##### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL.

##### LIQUID SPILLS

- COVER WITH SAND, EARTH OR OTHER NONCOMBUSTIBLE ABSORBENT MATERIAL.

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY.
- DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- INJURED PERSONS WHO CONTACTED RELEASED MATERIAL MAY BE A MINOR CONTAMINATION PROBLEM TO CONTACTED PERSONS, EQUIPMENT, AND FACILITIES.
- ENSURE THAT MEDICAL PERSONNEL ARE AWARE OF THE MATERIAL(S) INVOLVED, AND TAKE PRECAUTIONS TO PROTECT THEMSELVES.

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2918 RADIOACTIVE MATERIAL, FISSILE, N.O.S.
- UN2974 RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S.
- UN2982 RADIOACTIVE MATERIAL, N.O.S.

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE - SPECIAL FORM/LOW TO HIGH LEVEL RADIATION

PAGE 4 OF 6

#### HEALTH

- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.
- UNDAMAGED PACKAGES ARE SAFE; CONTENTS OF DAMAGED PACKAGES MAY CAUSE EXTERNAL AND/OR INTERNAL RADIATION EXPOSURE.
- CONTAMINATION AND INTERNAL RADIATION HAZARDS ARE NOT EXPECTED, BUT NOT IMPOSSIBLE.
- TYPE A PACKAGES (CARTONS, BOXES, DRUMS, ARTICLES, ETC.) IDENTIFIED AS "TYPE A" BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN NON-LIFE ENDANGERING AMOUNTS. PARTIAL RELEASES MIGHT BE EXPECTED IF "TYPE A" PACKAGES ARE DAMAGED IN MODERATELY SEVERE ACCIDENTS.
- TYPE B PACKAGES (LARGE AND SMALL, USUALLY METAL) IDENTIFIED AS "TYPE B" BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN POTENTIALLY LIFE ENDANGERING AMOUNTS. BECAUSE OF DESIGN, EVALUATION, AND TESTING OF PACKAGES, LIFE ENDANGERING RELEASES ARE NOT EXPECTED IN ACCIDENTS INVOLVING "TYPE B" PACKAGES, EXCEPT THOSE OF UTMOST SEVERITY.
- RADIOACTIVE WHITE-I LABELS INDICATE RADIATION LEVELS OUTSIDE UNDAMAGED PACKAGES ARE VERY LOW (LESS THAN 0.005 mSv/h (0.5 mR/h)).
- RADIOACTIVE YELLOW-II OR YELLOW-III LABELED PACKAGES HAVE HIGHER RADIATION LEVELS. THE TRANSPORT INDEX (TI) ON THE LABEL IDENTIFIES THE MAXIMUM RADIATION LEVEL IN mREM/h @ 1 METER FROM THE PACKAGE.
- COMMONLY AVAILABLE INSTRUMENTS CAN DETECT MOST OF THESE MATERIALS.
- RUNOFF FROM CONTROL OF CARGO FIRE MAY CAUSE LOW-LEVEL POLLUTION.

#### FIRE OR EXPLOSION

- PACKAGING CAN BURN COMPLETELY WITHOUT RISK OF CONTENT LOSS FROM SEALED SOURCE CAPSULE.
- RADIOACTIVITY DOES NOT CHANGE FLAMMABILITY OR OTHER PROPERTIES OF MATERIALS.
- RADIOACTIVE SOURCE CAPSULES AND TYPE B PACKAGES ARE DESIGNED AND EVALUATED TO WITHSTAND TOTAL ENGULFMENT IN FLAMES AT TEMPERATURES OF 800°C (1475°F) FOR A PERIOD OF 30 MINUTES.

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DELAY FINAL CLEANUP UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

#### EMERGENCY ACTION

##### FIRE

- PRESENCE OF RADIOACTIVE MATERIAL WILL NOT CHANGE EFFECTIVENESS OF FIRE CONTROL TECHNIQUES.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>, WATER SPRAY. OR REGULAR FOAM.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS).

##### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL. SLIGHTLY DAMAGED OR DAMP OUTER SURFACES SELDOM INDICATE FAILURE OF PACKAGING SINCE MOST HAVE AN INNER CONTAINER.
- IF SOURCE IS IDENTIFIED AS BEING OUT OF PACKAGE; STAY AWAY AND AWAIT ADVICE OF RADIATION AUTHORITY.

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY. DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- INJURED PERSONS WHO CONTACTED RELEASED MATERIAL MAY BE A MINOR CONTAMINATION PROBLEM TO CONTACTED PERSONS, EQUIPMENT, AND FACILITIES.
- PERSONS EXPOSED TO SPECIAL FORM SOURCES ARE NOT LIKELY TO BE CONTAMINATED WITH RADIOACTIVE MATERIAL.

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2981 URANYL NITRATE, SOLID
- UN2980 URANYL NITRATE HEXAHYDRATE SOLUTION
- UN2976 THORIUM NITRATE, SOLID

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE - FISSILE/LOW TO HIGH LEVEL RADIATION

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#### HEALTH

- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.
- UNDAMAGED PACKAGES ARE SAFE; CONTENTS OF DAMAGED PACKAGES MAY CAUSE EXTERNAL AND/OR INTERNAL RADIATION EXPOSURE.
- PACKAGES (DRUMS OR BOXES) IDENTIFIED AS TYPE AF OR IF BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN MATERIALS THAT ARE NOT LIFE ENDANGERING IF RELEASED. EXTERNAL RADIATION LEVELS ARE LOW AND PACKAGES ARE DESIGNED, EVALUATED, AND TESTED TO CONTROL RELEASES AND TO PRESENT A FISSION CHAIN REACTION UNDER SEVERE TRANSPORT ACCIDENT CONDITIONS.
- PACKAGES (METAL AND USUALLY VERY HEAVY) IDENTIFIED AS TYPE B (U) F OR B (U) F BY MARKING ON PACKAGES OR BY SHIPPING PAPERS CONTAIN POTENTIALLY LIFE ENDANGERING AMOUNTS. BECAUSE OF DESIGN, EVALUATION, AND TESTING OF PACKAGES, FISSION CHAIN REACTIONS ARE PREVENTED AND RELEASES ARE NOT EXPECTED TO BE LIFE ENDANGERING FOR ALL ACCIDENTS, EXCEPT THOSE OF UTMOST SEVERITY.
- THE TRANSPORT INDEX (TI) ON THE LABELS OR SHIPPING PAPERS MIGHT NOT INDICATE THE RADIATION LEVEL @ 1 METER FROM THE PACKAGE, INSTEAD, IT MAY INDICATE CONTROLS NEEDED DURING TRANSPORT BECAUSE OF THE FISSILE PROPERTIES OF THE MATERIALS.
- SOME RADIOACTIVE MATERIALS CANNOT BE DETECTED BY COMMONLY AVAILABLE INSTRUMENTS.
- RUNOFF FROM CONTROL OF CARGO FIRE MAY CAUSE LOW-LEVEL POLLUTION.

#### FIRE OR EXPLOSION

- THESE MATERIALS ARE NOT FLAMMABLE AND PACKAGINGS ARE DESIGNED TO WITHSTAND FIRES WITHOUT DAMAGE TO CONTENTS.
- RADIOACTIVITY DOES NOT CHANGE FLAMMABILITY OR OTHER PROPERTIES OF MATERIALS.
- TYPE AF, TYPE IF, AND TYPE B PACKAGES ARE DESIGNED AND EVALUATED TO WITHSTAND TOTAL ENGULFMENT IN FLAMES AT TEMPERATURES OF 800°C (1475°F) FOR A PERIOD OF 30 MINUTES.

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DETAIN OR ISOLATE UNINJURED PERSONS OR EQUIPMENT SUSPECTED TO BE CONTAMINATED; DELAY DECONTAMINATION AND CLEANING UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

#### EMERGENCY ACTION

##### FIRE

- PRESENCE OF RADIOACTIVE MATERIAL WILL NOT CHANGE EFFECTIVENESS OF FIRE CONTROL TECHNIQUES.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>, WATER SPRAY. OR REGULAR FOAM.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS).

#### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL. SLIGHTLY DAMAGED OR DAMP OUTER SURFACES SELDOM INDICATE FAILURE OF PACKAGING SINCE MOST HAVE AN INNER CONTAINER.

#### LIQUID SPILLS

- PACKAGE CONTENTS ARE SELDOM LIQUID. IF ANY RADIOACTIVE CONTAMINATION RESULTING FROM A LIQUID RELEASE IS PRESENT, IT PROBABLY WILL BE LOW-LEVEL.

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY. DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- INJURED PERSONS WHO CONTACTED RELEASED MATERIAL MAY BE A MINOR CONTAMINATION PROBLEM TO CONTACTED PERSONS, EQUIPMENT, AND FACILITIES.
- ENSURE THAT MEDICAL PERSONNEL ARE AWARE OF THE MATERIAL(S) INVOLVED, AND TAKE PRECAUTIONS TO PROTECT THEMSELVES.

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2975 THORIUM METAL, PYROPHORIC
- UN2979 URANIUM METAL, PYROPHORIC

## APPENDIX F

### SHIPPING PAPERS AND SUPPORT DOCUMENTS RADIOACTIVE MATERIALS GUIDE-CORROSIVE - URANIUM HEXAFLUORIDE/WATER SENSITIVE

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#### HEALTH

- CHEMICAL HAZARD GREATLY EXCEEDS RADIATION HAZARD.
- SUBSTANCE REACTS WITH WATER AND WATER VAPOR IN AIR TO FORM TOXIC AND CORROSIVE HYDROGEN FLUORIDE GAS AND AN EXTREMELY IRRITATING AND CORROSIVE, WHITE-COLORED, WATER-SOLUBLE RESIDUE. IF INHALED, MAY BE FATAL. DIRECT CONTACT CAUSES CHEMICAL BURNS TO SKIN, EYES, AND RESPIRATORY TRACT.
- LOW-LEVEL RADIOACTIVE MATERIAL; VERY LOW RADIATION HAZARD TO PEOPLE.
- RUNOFF FROM CONTROL OF CARGO FIRE MAY CAUSE LOW-LEVEL POLLUTION.
- RADIATION PRESENTS MINIMAL RISK TO TRANSPORT WORKERS, EMERGENCY RESPONSE PERSONNEL, AND THE PUBLIC DURING TRANSPORTATION ACCIDENTS. PACKAGING DURABILITY IS RELATED TO POTENTIAL HAZARDS OF MATERIAL.

#### FIRE OR EXPLOSION

- SUBSTANCE DOES NOT BURN.
- CONTAINERS IN PROTECTIVE OVERPACKS (HORIZONTAL CYLINDRICAL SHAPE WITH SHORT LEGS FOR TIE-DOWNS), ALSO IDENTIFIED AS TYPE AF OR B (U) F ON SHIPPING PAPERS OR BY MARKING ON THE OVERPACK, ARE DESIGNED AND EVALUATED TO WITHSTAND SEVERE ACCIDENTS INCLUDING TOTAL ENGULFMENT IN FLAMES AT TEMPERATURES OF 800°C (1475°F).
- CONTAINER MAY EXPLODE IN HEAT OF FIRE. THE MATERIAL MAY REACT VIOLENTLY WITH FUELS.
- RADIOACTIVITY DOES NOT CHANGE FLAMMABILITY OR OTHER PROPERTIES OF THE MATERIALS.

#### PUBLIC SAFETY

- CALL EMERGENCY RESPONSE TELEPHONE NUMBER ON SHIPPING PAPER FIRST. IF SHIPPING PAPER NOT AVAILABLE OR NO ANSWER, CALL CHEMTREC, 1-800-424-9300 OR FOR MILITARY SHIPMENTS, 1-800-851-8061.
- PRIORITIES FOR RESCUE, LIFE-SAVING, FIRST AID, AND CONTROL OF FIRE AND OTHER HAZARDS ARE HIGHER THAN THE PRIORITY FOR MEASURING RADIATION LEVELS.
- RADIATION AUTHORITY MUST BE NOTIFIED OF ACCIDENT CONDITIONS, AND IS USUALLY RESPONSIBLE FOR RADIOLOGICAL DECISIONS.
- ISOLATE SPILL OR LEAK AREA IMMEDIATELY FOR AT LEAST 25 OR 50 METERS (80 TO 160 FEET) IN ALL DIRECTIONS; KEEP UNAUTHORIZED PERSONNEL AWAY; STAY UPWIND.
- DETAIN OR ISOLATE UNINJURED PERSONS OR EQUIPMENT SUSPECTED TO BE CONTAMINATED; DELAY DECONTAMINATION AND CLEANING UNTIL INSTRUCTIONS ARE RECEIVED FROM RADIATION AUTHORITY.

#### EVACUATION

##### LARGE SPILL

- CONSIDER INITIAL DOWNWIND EVACUATION FOR AT LEAST 100 METERS (330 FEET).

##### FIRE

- WHEN A LARGE QUANTITY OF THIS MATERIALS IS INVOLVED IN A MAJOR FIRE, CONSIDER AN INITIAL EVACUATION DISTANCE OF 300 METERS (1000 FEET) IN ALL DIRECTIONS.

#### EMERGENCY ACTION

##### FIRE

- DO NOT USE WATER OR FOAM ON MATERIAL ITSELF.
- MOVE CONTAINERS FROM FIRE IF YOU CAN DO IT WITHOUT RISK.
- DO NOT MOVE DAMAGED CONTAINERS; MOVE UNDAMAGED CONTAINERS OUT OF FIRE ZONE.

SMALL FIRES: DRY CHEMICAL, CO<sub>2</sub>.

LARGE FIRES: WATER SPRAY, FOG (FLOODING AMOUNTS). COOL CONTAINERS WITH FLOODING QUANTITIES OF WATER UNTIL WELL AFTER FIRE IS OUT. IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN.  
ALWAYS STAY AWAY FROM THE ENDS OF TANKS.

#### SPILL OR LEAK

- DO NOT TOUCH DAMAGED CONTAINERS OR SPILLED MATERIAL.
- WITHOUT FIRE OR SMOKE, LEAK WILL BE EVIDENT BY VISIBLE AND IRRITATING VAPORS AND RESIDUE FOAMING AT THE POINT OF RELEASE. RESIDUE BUILDUP MAY SELF-SEAL SMALL LEAKS.
- DIKE FAR AHEAD OF SPILL TO COLLECT RUNOFF WATER.

#### FIRST AID

- MEDICAL PROBLEMS TAKE PRIORITY OVER RADIOLOGICAL CONCERNS; USE FIRST AID TREATMENT ACCORDING TO THE NATURE OF THE INJURY.
- DO NOT DELAY CARE AND TRANSPORT OF A SERIOUSLY INJURED PERSON.
- IN CASE OF CONTACT WITH SUBSTANCE, IMMEDIATELY FLUSH SKIN OR EYES WITH RUNNING WATER FOR AT LEAST 20 MINUTES.
- EFFECTS OF EXPOSURE (INHALATION, INGESTION, OR SKIN CONTACT) TO SUBSTANCE MAY BE DELAYED.
- INJURED PERSONS WHO CONTACTED RELEASED MATERIAL MAY BE A MINOR CONTAMINATION PROBLEM TO CONTACTED PERSONS, EQUIPMENT, AND FACILITIES.
- ENSURE THAT MEDICAL PERSONNEL ARE AWARE OF THE MATERIAL(S) INVOLVED, AND TAKE PRECAUTIONS TO PROTECT THEMSELVES.

THIS EMERGENCY RESPONSE GUIDE APPLIES TO THE FOLLOWING IDENTIFICATION NUMBERS:

- UN2977 URANIUM HEXAFLUORIDE, FISSILE
- UN2978 URANIUM HEXAFLUORIDE

**APPENDIX F  
DRIVER'S INSTRUCTIONS FOR  
EXCLUSIVE USE VEHICLES**

The Code of Federal Regulations, 49 CFR 173.403(I) and 173.441 © and e) requires that specific instructions for maintenance of exclusive use shipment controls be provided by the shipper to the carrier. These instructions must be included with the shipment documents.

The following instructions shall be complied with for all exclusive use vehicles:

- Do not move or transfer packages within the conveyance or between conveyances while en route to destination, without documented approval of shipper.
- The shipment must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.
- Shipments must be braced so as to prevent leakage or shifting of load under conditions normally incident to transportation.
- The vehicle must be placarded "Radioactive" on all four sides when applicable until shipment is loaded.
- Do not change the tractor used to pull this shipment unless specifically authorized by the MKM RSO or Certified Broker. If a tractor change is necessary, call (702) 395-9238 to report the situation.

Any deviation from these instructions is a violation of State and Federal laws and could result in carrier/driver penalty.

*I hereby acknowledge the receipt of instructions for maintaining exclusive use controls for this shipment. I also understand these instructions and realize that I must keep these instructions with the shipping manifest.*

----- / -----  
Driver/Carrier's Representative

Date

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**EMERGENCY INSTRUCTIONS**

1. Do not move packages unless necessary for personnel safety.
2. Keep unnecessary persons away from the accident area. Keep all personnel who were in the vicinity at the time of the accident or could have been contaminated in a segregated area until qualified radiation protection personnel arrive.
3. Identify and isolate the accident area. Avoid contact with immediate area of packages and areas downwind.
4. Call state and/or local police.
5. Direct traffic and personnel away from the accident area.
6. Notify CHEMTREC (800) 424-9300 for Emergency Response Information.
7. Notify MKM Las Vegas, (702) 395-9238, and report the situation to the Program Manager, Radiation Safety Officer, or Certified Broker.
8. Additional phone numbers:

MKM Corporate Office (Houston, TX):

President: Khodi Irani

281-277-5100

MKM Las Vegas

702-395-9238

Program Manager: Thomas O'Dou

702-528-0563 (cell)

Radiation Safety Officer: Dixie Wells

702-528-0564 (cell)

Certified Waste Broker: Robin Beasley

702-497-9475 (cell)

## APPENDIX G

### PACKAGING METHODOLOGY FOR PYROPHORIC MATERIALS (MgTh & DEPLETED URANIUM TURNINGS)

#### 1.0 Purpose

The purpose of this document is to suggest an effective means of packaging pyrophoric Magnesium-Thorium (MgTh) or Depleted Uranium (DU) to make inert for shipment and disposal. Other methods can be employed provided such method complies with 49 CFR 173.418 and is acceptable to the disposal site.

**NOTE: THE INERTING PROCESS SHALL BE APPROVED BY THE BARNWELL LICENSING DEPARTMENT PRIOR TO SHIPPING TO BARNWELL.**

#### 2.0 Method

2.1 Inspect the material for acceptability to the applicable disposal site criteria and the following:

2.1.1 Less than 1% unintentional oil is allowable on the material.

2.1.2 No water is acceptable (DU oxidizes rapidly with H<sub>2</sub>O to form free hydrogen).

2.1.3 If the material is oxidized by incineration, then follow conditions of applicable site regarding readily dispersible material and ash, if applicable.

2.1.4 If the material is oxidized naturally, then treat it with regard for loose contamination.

2.2 Using care to prevent the spread of contamination, mix the material in a 10:1 ratio of "DRY" sand to pyrophoric material (10 parts dry sand to 1 part MgTh/DU) and place in a DOT 7A Type A container. Leave a 4" void at the top of the container.

2.3 Add 3" of dry sand to top of drum.

2.4 Seal drum.

2.5 Prepare package for shipment in accordance with this procedure.

## APPENDIX H

### METHODOLOGY FOR PACKAGING BIOLOGICAL WASTE

#### 1.0 Purpose

The purpose of this document is to provide the methodology for consistent packaging of biological waste.

#### 2.0 Requirements

- 2.1 Verify the biological waste to be disposed of is acceptable to the applicable disposal site.
- 2.2 Biological waste considered pathogenic or infectious shall be previously treated to reduce the potential hazard from non-radiological materials, to the maximum extent possible.
- 2.3 The inner containers shall be specification DOT 7A Type A packages. The outer containers shall be a strong, tight container or 7A Type A, as appropriate.
- 2.4 Volume of outer container shall be at least 40% greater than the inner container (e.g., a 30-gallon container inside a 55-gallon container).
- 2.5 Shipments to US Ecology sites shall comply with applicable site license for approved absorbents, to be used in addition to the slaked lime.

For shipments to Barnwell, use slaked lime and agricultural grade 4 vermiculite or medium grade diatomaceous earth.

- 2.6 A refrigerated van shall be used to ship biological radwaste between April 1 and October 1, if transit time will exceed 48 hours from the time the waste is first removed from cold storage until arrival at the Barnwell site.

#### 3.0 Method

**NOTE: PLANTS, ANIMALS, AND BY-PRODUCTS THEREOF ARE CONSIDERED BIOLOGICAL MATERIAL. GLASSWARE, ETC... THAT AT ONE TIME CONTAINED THESE MATERIALS ARE ALSO CONSIDERED BIOLOGICAL. ALL BIOLOGICAL WASTE MUST BE PACKAGED IN ACCORDANCE WITH THIS SECTION.**

- 3.1 The inner container shall have a watertight liner (i.e., polyethylene or equivalent) of at least 4 mils thickness.
- 3.2 The addition of lime and absorbent to biological material should be in a ratio of one (1) part lime to ten (10) parts absorbent to thirty (30) parts biological material.
- 3.3 The biological material shall be placed in the inner container and thoroughly layered with absorbent and slaked lime.
- 3.4 Formaldehyde is strictly prohibited.
- 3.5 The watertight liner shall be hermetically (airtight) sealed by taping, tying, or heat sealing.
- 3.6 The ring-and-bolt closure device shall be closed with an appropriate wrench.

## **APPENDIX H**

### **METHODOLOGY FOR PACKAGING BIOLOGICAL WASTE**

- 3.7 The bottom of the outer container shall be covered by a minimum of four (4) inches of absorbent.**
- 3.8 Inner container shall be placed upright in the outer container.**
- 3.9 After placing the inner container in the outer container, the inner container shall be completely surrounded by absorbent (including the top). The lid will be placed on the outer container and the ring and bolt closure device secured.**
- 3.10 The outer container shall be equipped with a tamper-proof seal.**
- 3.11 Prepare the package for shipment in accordance with this procedure.**

## APPENDIX I

### METHODOLOGY FOR PACKAGING SCINTILLATION LIQUIDS

#### 1.0 Purpose

- 1.1 The purpose of this document is to provide the methodology for consistent packaging of liquid scintillation fluids.
- 1.2 This methodology applies to the packaging of scintillation fluids for shipment to Perma-Fix, Gainesville, FL; NSSI, Houston, TX; or any similar facility.

#### 2.0 Requirements

This methodology is subject to frequent change in accordance with the latest rules, regulations, and guidance from regulatory bodies and changes implemented by change in present vendor(s) procedures. Therefore, prior to shipping scintillation fluids for incineration, ALWAYS review references or other license(s) as applicable and consult with the proposed incineration facility.

#### 3.0 Method

##### 3.1 Packaging Requirements

3.1.1 Vials - The container must be at least a strong tight container in good condition; preferably either a DOT 7A Type A or an approved UN performance oriented package, as applicable.

- a. Place a 4 mil (minimum) plastic liner inside the drum.
- b. Place 5 inches of absorbent (i.e., vermiculite) in the bottom of the liner.
- c. Place another 4 mil liner inside the first liner.
- d. Make sure all the vial tops are tight and carefully place the vials in the inner liner. Fill the liner with vials, leaving enough room to seal when finished plus 6 inches of free space form the top of the drum. Seal the inner liner.
- e. Place 5 inches of absorbent on top of the liner, when seal the outer liner.
- f. Place the lid on the drum and secure the closure device appropriately.

##### 3.1.2 Bulk Liquids

- a. Place a 4 mil (minimum) plastic liner inside the outer container if smaller containers are to be placed inside the outer container.
- b. Put sufficient cushioning/absorbent material in the bottom of the liner to absorb all of the liquid present. If glass jugs are packaged inside a strong tight container, sufficient padding will be used to separate the jugs to preclude breaking of the containers.
- c. Ensure all inner container tops are tight, then place them in the drum.
- d. Seal or tie the liner before placing lid on drum.
- e. Ensure that the drum lid is firmly in place and secured.

## APPENDIX I

### METHODOLOGY FOR PACKAGING SCINTILLATION LIQUIDS

- f. Do not overfill packages. There must be space to allow expansion during handling, transporting, and storage. At least 5% volume is to be provided for expansion (49 CFR 173.116 (h)).

#### 3.2 Determining Hazard Class

**NOTE: THESE STEPS ARE MORE RESTRICTIVE THAN 40 CFR. IF, DUE TO LOGISTICS, THESE METHODS CANNOT BE MET, CONTACT THE PM/CWB OR YOUR IMMEDIATE SUPERVISOR TO INFORM THEM OF THE PROBLEM.**

##### 3.2.1 Radioactive

The material must be declared as "Radioactive-LSA" or "Radioactive" if the radionuclide concentration is 0.002  $\mu\text{Ci/g}$  or greater - of isotopes other than  $^{14}\text{C}$  and  $^3\text{H}$ . For these 2 isotopes, the limit of 0.05  $\mu\text{Ci/g}$  shall not be exceeded.

- a. Radioactive Material, LSA, n.o.s., UN2912; Exclusive Use Only
  - 1. Package requirements of 49 CFR 173.427 (b)(3) apply.
  - 2. Package vials in accordance with 3.1.1 and package the bulk fluid in accordance with 3.1.2.
- b. Radioactive Materials, n.o.s., UN2982
  - 1. Packaging: Specification US DOT 7A Type A, refer to 49 CFR 173.412 (k).
  - 2. Package vials in accordance with 3.1.1 and package the bulk fluid in accordance with 3.1.2.

##### 3.2.2 Flammable Liquids, n.o.s., UN1993

If the scintillation fluid contains less than 0.05  $\mu\text{Ci/g}$   $^3\text{H}$  or  $^{14}\text{C}$  and less than 0.002  $\mu\text{Ci/g}$  for other acceptable isotopes, then the material must be declared flammable liquid.

If the scintillation fluid is limited quantity, then the material must be declared flammable liquid with LQ as the subsidiary hazard.

Package vials in accordance with 3.1.1 and package bulk fluid in accordance with 3.1.2.

#### 3.3 Marking, Labeling, & Shipping Documents

##### 3.3.1 When packaged in accordance with Step 3.2.1.1:

- a. Mark in accordance with 49 CFR for Radioactive Material LSA, n.o.s., UN2912 [173.427(a)(1)(vi) "Radioactive LSA"; 172.312 "specification orientation marking arrows"; and 40 CFR 202.32 "Hazardous Waste"].
- b. Label in accordance with 49 CFR 172.403 "Flammable Liquid".

## APPENDIX I

### METHODOLOGY FOR PACKAGING SCINTILLATION LIQUIDS

- c. Label according to any subsidiary hazards.

#### 3.3.2 When packaged in accordance with Step 3.2.1 (b):

- a. Mark in accordance with 49 CFR for Radioactive Material, n.o.s., UN2982, Subpart D 172.402 (d), 172.406, and Hazardous Waste, 40 CFR 202.32.
- b. Label in accordance with appropriate radioactive and flammable liquids.

**NOTE:** PAY PARTICULAR ATTENTION TO MULTIPLE HAZARD LABEL REQUIREMENTS OF 40 CFR 172.404.

#### 3.3.3 When packaged in accordance with Step 3.2.2:

- a. Mark for Flammable Liquid, n.o.s., UN1993, 49 CFR 172.202 and 172.312 and 40 CFR 262.32.
- b. Label for Flammable Liquid, n.o.s., UN1993, 49 CFR 172 Subpart E - Labeling.

#### 3.3.4 Additional Manifesting for Hazardous Waste

In addition to the DOT shipping paper requirements of 49 CFR, hazardous waste must be manifested in accordance with 40 CFR 262 Subpart B.

## APPENDIX J

### METHODOLOGY FOR ABSORPTION OF SMALL VOLUMES OF CLASS A LIQUIDS

#### 1.0 Purpose

The purpose of this document is to provide the methodology to be used to prepare small amounts of Class A liquid waste for disposal. The preferred method of preparing liquids for disposal is solidification.

**NOTE: ABSORBED (SORBED) LIQUIDS ARE NOT ACCEPTED FOR BURIAL AT THE BARNWELL SITE.**

#### 2.0 Requirements

- 2.1 Except as permitted under the specific site's license(s), untreated liquids are not allowed for disposal. Liquids shall be rendered non-corrosive [  $4 < \text{pH} < 11$  ] prior to treatment. Acceptable treatments are stabilization, solidification, or absorption; depending on waste class and disposal facility.
- 2.2 Liquids treated by absorption shall be processed in such a manner as to leave zero percent (0%) free-standing liquid.
- 2.3 Use only approved "absorbents" in accordance with applicable site's license.
- 2.4 Consult the Broker Program Manager for guidance.

#### 3.0 Method

- 3.1 Package liquid volume not exceeding 50 milliliters as Radioactive LSA Exclusive Use.
  - 3.1.1 Use a container that meets US DOT 7A Type A specification package requirements.
  - 3.1.2 Line the container with a minimum of 4 mil plastic liner, except as noted in Appendix F of WA State License Number, WN-1019-2.
  - 3.1.3 Contain the liquid in enough absorbent material to absorb at least twice the volume of liquid (use a ratio of 4 to 1, absorbent to liquid).
- 3.2 Package liquid volume exceeding 50 milliliters shipped as other than Exclusive Use LSA

Packages with absorbed liquids having volume exceeding 50 milliliters shall have a containment system composed of a primary inner and a secondary outer containment, and the components designed to assure retention of the liquid contents within the secondary outer components in the event that the primary inner components leak [49 CFR 173.412 (n)].

  - 3.2.1 Assure the liquid is sealed and contained in a primary inner container consisting of at least 4 mil plastic.
  - 3.2.2 Use enough approved absorbent to absorb at least twice the volume of the liquid contained in the package (see 3.1.3).
  - 3.2.3 Assure absorbed liquid in the primary inner container is homogeneously distributed with no detectable free-standing liquid.
  - 3.2.4 The primary inner container will then be overpacked into a US DOT 7A Type A package.

## APPENDIX K

### METHODOLOGY FOR ENCAPSULATION OF SOURCES

#### 1.0 Purpose

The purpose of this document is to provide a method of in-situ encapsulation of sources.

**NOTE: FOR BURIAL IN SOUTH CAROLINA WHICH REQUIRES ENCAPSULATION, IN EVERY CASE. THE METHOD OF ENCAPSULATION MUST BE SPECIFICALLY APPROVED BY BARNWELL'S LICENSING DEPARTMENT.**

#### 2.0 Prerequisites/Precautions

- 2.1 QA approved pre-encapsulated drums or equivalent;
- 2.2 Pre-encapsulated drums can be obtained from an approved vendor.
- 2.3 Personnel using this procedure shall use all necessary means available to minimize their exposure to As Low As Reasonably Achievable (ALARA).

#### 3.0 Requirements

##### 3.1 Hanford

##### 3.1.1 General Guidelines

- a. Class A unstable - average the radionuclide concentration over the entire cement matrix - up to 55 gallon drum and less than Class A waste limit.
- b. Class B stable - average the radionuclide concentration over the entire cement matrix - up to 55 gallon drum (limited to 1000 lbs) and less than Class B waste limit.
- c. Class C stable - average the radionuclide concentration over the entire cement matrix - up to 55 gallon drum (limited to 1000 lbs) and less than Class C waste limit.

**NOTE: IF TRANSURANICS AND RADIUM ARE NOT HOMOGENEOUS OR ARE MORE THAN 10  $\eta$ Ci/g, BUT LESS THAN 100  $\eta$ Ci/g, SPECIAL APPROVAL IS REQUIRED IN EITHER OR BOTH CASES.**

##### 3.1.2 Radium Requirements

- a. 7A Type A package is required.
- b. 2500 psi structural concrete necessary.
- c. Assume all sources to be normal form ( $A_2$ ).
- d. Stabilize Radium 226 source in 2R container with structural concrete.
- e. Geometrically center 2R container in 7A Type A package and encapsulate with stable, structural concrete, per section 4.0 of this Appendix.
- f. Cure for 28 days.

## APPENDIX K

### METHODOLOGY FOR ENCAPSULATION OF SOURCES

- g. Ensure 7A Type A test documentation is available for package based on weight and configuration.
- h. Ensure waste form is free of liquids and voids.
- i. If the concentration, when averaged over concrete matrix is  $>10$ , but  $\leq 100$   $\eta\text{Ci/g}$ , special WA State approvals must be obtained for shipment as Class C stable waste.

#### 3.2 Barnwell

3.2.1 The radionuclide concentration must be averaged over the source volume, for Class A unstable, Class B, & Class C sources.

3.2.2 Greater than Class C limits require special approval.

#### 4.0 Procedure

4.1 Inspect the container for foreign materials and damage. Record the container condition in your log.

4.2 Place the source in the container in the geometric center or in such a manner to ensure 4" of cement surrounding the source in all directions; as applicable.

4.3 Fill the cavity of container to within 2" of the top with structural grade cement.

**NOTE: STRUCTURAL CEMENT WILL CONSIST OF 1 PART "PORTLAND" CEMENT TO 2 PARTS SAND; UNLESS OTHERWISE SPECIFIED BY THE WM OR DISPOSAL SITE LICENSING DEPARTMENT.**

4.4 Following a 6 to 24 hour cement cure time, verify the billet in accordance with Section 5.0, before proceeding to Section 4.5.

**NOTE: IF IT IS NECESSARY TO ADD ADDITIONAL CEMENT TO THE CONTAINER DUE TO ABSORPTION OR SHRINKAGE, AN ADDITIONAL BATCH MAY BE MIXED AND ADDED.**

4.5 After the acceptance criteria of Section 5.0 have been met, the encapsulation liner may be closed.

#### 5.0 Acceptance Criteria

Radioactive waste encapsulated in a disposal container shall be considered acceptable if the following conditions are met:

5.1 Visual inspection of the end product, normally 6 to 72 hours after process completion, shows a uniform product with no free-standing water.

5.2 The end product, after satisfactory visual inspection, resists penetration when probed with a rod approximately 1" in diameter.

#### 6.0 Records and Reports

6.1 A copy of the log and QA inspection forms shall be sent to the PM/CWB with the shipping papers.

**MKM Engineers, Inc.**

**Shipping Report**

**Consigned to:** \_\_\_\_\_ Date \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_  
 Name: \_\_\_\_\_ Address: \_\_\_\_\_ City: \_\_\_\_\_  
 State: \_\_\_\_\_ Zip: \_\_\_\_\_ Consignee License #: \_\_\_\_\_ Telephone #: \_\_\_\_\_

**Shipped by:**  
 Name: \_\_\_\_\_ Address: \_\_\_\_\_ City: \_\_\_\_\_  
 State: \_\_\_\_\_ Zip: \_\_\_\_\_ Shippers License #: \_\_\_\_\_ Telephone #: \_\_\_\_\_

**Carrier:**  
 Common Carrier  Contract Carrier  Air Carrier  Postal Service (LQ Only)  United Parcel Service (LQ Only)  
 Cargo Aircraft  
 Name: \_\_\_\_\_ Address: \_\_\_\_\_ City: \_\_\_\_\_  
 State: \_\_\_\_\_ Zip: \_\_\_\_\_ Telephone #: \_\_\_\_\_ Driver(s): \_\_\_\_\_

**Description of items:**

Total No. of Packages	Weight (LBS.)	Shipping Name & Hazard Class (Per 49 CFR 172.101)	ID Number				
		Radioactive Material, excepted package, limited quantity of material	UN2910				
		Radioactive Material, low specific activity, LSA, n.o.s.	UN2912				
		Radioactive Material, n.o.s.	UN2982				
		Radioactive Material, special form, n.o.s.	UN2974				
		Radioactive Material, excepted packaging, Instruments or articles	UN2910				
		Radioactive Material, excepted package, empty packaging	UN2910				
		Radioactive Material, fissile, n.o.s.	UN2918				
Specify Item Number → →	Item	Item	Item	Item	Item	Item	Item
Isotope							
Activity (nanoCuries, microCuries, or milliCuries)							
Chemical form							
Physical form							
Weight (lbs.)							

**MKM Engineers, Inc.**

**Shipping Report**

**Consigned to:** \_\_\_\_\_ Date \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_  
**Name:** \_\_\_\_\_ **Address:** \_\_\_\_\_ **City:** \_\_\_\_\_  
**State:** \_\_\_\_\_ **Zip:** \_\_\_\_\_ **Consignee License #:** \_\_\_\_\_ **Telephone #:** \_\_\_\_\_

**Shipped by:**  
**Name:** \_\_\_\_\_ **Address:** \_\_\_\_\_ **City:** \_\_\_\_\_  
**State:** \_\_\_\_\_ **Zip:** \_\_\_\_\_ **Shippers License #:** \_\_\_\_\_ **Telephone #:** \_\_\_\_\_

**Carrier:**  
 Common Carrier  Contract Carrier  Air Carrier  Postal Service (LQ Only)  United Parcel Service (LQ Only)  
 Cargo Aircraft  
**Name:** \_\_\_\_\_ **Address:** \_\_\_\_\_ **City:** \_\_\_\_\_  
**State:** \_\_\_\_\_ **Zip:** \_\_\_\_\_ **Telephone #:** \_\_\_\_\_ **Driver(s):** \_\_\_\_\_

**Description of items:**

Volume (Cu.Ft.)							
Container Type and /or Specification							
Source Material (kgs)							
Special Nuclear Material (grams)							
Radiation Levels at Contact (mr/hr)							
Transport Index = mr/hr at 1 Meter							
Alpha Surface Contamination (DPM/100CM <sup>2</sup> )							
Beta Surface Contamination (DPM/100CM <sup>2</sup> )							
Fissile Class (I, II, III or N/A)							
Labels/Markings (LSA, W-I, Y-II, Y-III, or N/A)							

This is to certify that the above materials are properly classified, described, packaged, marked, labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. 49CFR 172.204(a)

Authorized Signature \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

**MKMP-017**  
**EMPTY TRANSPORT VEHICLE SURVEYS**



## Radiation Safety Procedure

for

### Empty Transport Vehicle - Radiological Surveys

**MKMP-017**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, KRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



## MKMP-017

Empty Transport Vehicle Radiological Surveys

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**1.0 Purpose and Scope**

- 1.1 This procedure provides instructions for MKM personnel performing pre-loading surveys and release surveys of empty transport vehicles. Radiation and contamination surveys shall be performed on empty vehicles prior to entering the restricted area to ensure acceptance criteria are met, and prior to leaving the facility to ensure release criteria are met. Adherence to this procedure will provide reasonable assurance that transport vehicles have contamination levels below the specified limits before loading and following unloading of transport vehicles.
- 1.2 This procedure will be followed to survey all vehicles used to transport radioactive materials prior to loading and following the unloading of radioactive materials before the vehicle is released for other uses.
- 1.3 Description of procedures in Section 5
- Survey procedures for Closed Transport Vehicles.
  - Survey procedures for Open Transport Vehicles.
  - Action levels based on survey results.

**2.0 General****2.1 Definitions**

- 2.1.1 Closed Transport Vehicle - A transport vehicle or conveyance equipped with a securely attached exterior enclosure that during normal transport restricts the access of unauthorized persons to the cargo space containing Class 7 (radioactive) materials. The enclosure may be either temporary or permanent, and in the case of packaged materials may be of the "see-through" type, and must limit access from top, sides and bottom.
- 2.1.2 Non-Fixed (smearable) Radioactive Contamination - Radioactive contamination that can be readily removed from a surface by wiping with an absorbent material. Non-fixed (removable) radioactive contamination is not significant if it does not exceed the limits specified in 49 CFR 173.443 and in table A, section 5.2 of this procedure.
- 2.1.3 Open Transport Vehicle - A transport vehicle or conveyance which has no exterior enclosure around the cargo carrying area.

**2.2 Quality Control**

Instrumentation used in the surveys will be checked with standards daily and verified to have current valid calibration.

**3.0 References, Records, and Equipment****3.1 References**

49 CFR Parts 172 to 178. *Transportation*  
10 CFR Part 71 *Packaging and Transportation of Radioactive Materials.*

## MKMP-017

Empty Transport Vehicle Radiological Surveys

RG 1.86	<i>Termination of Operating Licenses for Nuclear Reactors</i>
RSM	Radiation Safety Manual
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-008	Radiation and Contamination Surveys

3.2 Records

MKMP Form 8-1	Radiological Survey Report
MKMP Form 8-2	Radiation and Contamination Survey

3.3 Equipment

Survey Meters  
Smears or wipes

4.0 Responsibilities

- 4.1 **Program Manager** - The Program Manager is responsible for insuring that all personnel assigned the tasks of surveying transportation vehicles are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel performing radiation surveys described in this procedure. The RSO ensures that Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 4.3 **Project Manager** - The Project Manager is responsible for identifying transportation vehicles needing survey.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for performing the surveys described in this procedure

5.0 Procedure5.1 Closed Transport Vehicles

5.1.1 At a minimum, the following areas should be surveyed by direct frisk for alpha and beta-gamma contamination:

- a. Inside surfaces of driver's area, particularly floorboards, pedals, steering wheel, driver's seat, door handles of cab, and dash area;
- b. All tires and tire wells;
- c. Inside surfaces of trailer walls and floor that were in contact with waste packages and exterior and interior door handles.

## MKMP-017

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Empty Transport Vehicle Radiological Surveys

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5.1.2 The areas in Section 5.1.1 above, are surveyed for removable contamination by disk smears. All smears are counted for beta-gamma and alpha contamination.

**NOTE:** Large area wipes or smears (LAS) may be used in conjunction with disc smears.

5.1.3 A dose rate survey is performed on the inside area of the trailer at 1 cm from surface area.

5.2 Open Transport Vehicles.

5.2.1 At a minimum, the following areas shall be surveyed by direct frisk for alpha and beta-gamma contamination:

- a. Inside surfaces of driver's area, particularly floorboards, pedals, steering wheel, driver's seat, door handles, and dash area;
- b. All tires and tire wells;
- c. Trailer deck surface.

5.2.2 The areas in Section 5.2.1 above, are surveyed for removable contamination by disk smear. All smears are counted for beta-gamma and alpha contamination. Note: Large area wipes may be used in conjunction with disc smears.

5.2.3 A dose rate survey is performed on the trailer at one (1) cm from the surface area.

5.3 Action levels

5.3.1 If direct frisk beta-gamma instrument readings exceed 100 cpm above background (with background less than 200 cpm) or 25 cpm alpha, those areas shall be surveyed as follows:

- Perform a smearable contamination survey using standard survey techniques and the guidance provided in 49 CFR 173.443:
  - (a) *...The level of non-fixed radioactive contamination...must be determined by either:*
    - (1) *Wiping an area of 300 square centimeters of the surface concerned with an absorbent material, using moderate pressure, and measuring the activity on the wiping material. Sufficient measurements must be taken...when averaged over the surface wiped, may not exceed the limits...at any time during transport; or*
    - (2) *Using other methods of assessment of equal or greater efficiency, in which case the efficiency of the method used must be taken into account...;*and document the average reading over 100 cm<sup>2</sup> of the affected area(s). Count the smears for beta-gamma and alpha contamination to determine if contamination is "fixed" or "removable".

5.3.2 Any vehicle with removable contamination exceeding the site limits listed below shall be brought to the attention of the Project Manager and handled appropriately.

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Empty Transport Vehicle Radiological Surveys

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5.3.3 Any vehicle with removable contamination exceeding the DOT limits listed below shall be brought to the attention of the RSO for release or acceptance approval.

- 2,200 dpm/100 cm<sup>2</sup> beta-gamma,
- 220 dpm/100 cm<sup>2</sup> alpha.

5.3.4 Dose rate surveys which exceed 0.2 mR/hr shall be brought to the attention of the RSO for release or acceptance approval.

5.3.5 Radiation levels exceeding 0.5 mR/hr at each accessible surface shall be brought to the attention of the RSO for release or acceptance approval.

5.4 Indication (manifest paperwork, truck logs, etc.) of the presence of difficult to detect radionuclides such as Tritium (<sup>3</sup>H) or Nickel (<sup>63</sup>Ni) shall be reported to the RSO for further evaluation. Detection of these isotopes may require the use of liquid scintillation counting.

5.5 The results of the survey shall be documented on survey forms (MKMP 8-1 and 8-2).

6.0 Attachments

None

**MKMP-018**  
**CLASSIFYING RADIOACTIVE WASTE**



## **Radiation Safety Procedure**

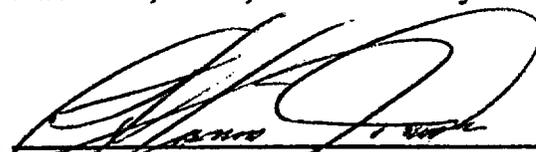
for

## **Classifying Radioactive Waste**

**MKMP-018**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-018**  
**Classifying Radioactive Waste**

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**1.0 Purpose and Scope**

**1.1** The purpose of this procedure is to establish instructions used to classify waste for disposal, complete the shipment manifests and verify waste receipt criteria. Adherence to this procedure will provide reasonable assurance that waste will be properly classified pursuant to 10 CFR 61.

**1.2** This procedure will be used to classify wastes pursuant to 10 CFR 61. Waste classification considerations for disposal at a licensed facility require:

**1.2.1** Consideration must be given to the concentration of long-lived radionuclides (and their shorter-lived precursors).

**1.2.2** Consideration must be given to the concentration of shorter-lived radionuclides for which requirements on institutional controls, waste form, and disposal methods are effective.

**1.3** Description of procedures.

**1.3.1** Use of this procedure will demonstrate the methodology for determining:

- a. If the waste is acceptable for near-surface disposal,
- b. If acceptable for near-surface disposal, whether the waste is classified as Class A, Class B, or Class C waste.

**1.3.2** Using this procedure MKM personnel will be able to determine whether the waste complies with any additional waste form, package or content requirement which may be in place at the particular disposal facility to which the waste is to be shipped.

**2.0 General**

**2.1 Definitions**

**2.1.1** Class A Waste - Class A waste is waste that is usually segregated from other waste classes at the disposal site. The physical form and waste characteristics of Class A waste must meet the minimum requirements set forth in 10 CFR 61.56(a). If Class A waste also meets the stability requirements set forth in 10 CFR 61.56(b), it is not necessary to segregate the waste for disposal.

**2.1.2** Class B Waste - Class B waste is waste that must meet more rigorous requirements on waste form to ensure stability after disposal. The physical form and characteristics of Class B waste must meet both the minimum and stability requirements set forth in 10 CFR 61.56.

**MKMP-018**  
**Classifying Radioactive Waste**

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2.1.3 **Class C Waste** - Class C waste is waste that not only must meet more rigorous requirements on waste form to ensure stability but also requires additional measures at the disposal facility to protect against inadvertent intrusion. The physical form and characteristics of Class C waste must meet both the minimum and stability requirements set forth in 10 CFR 61.56.

**2.2 Precautions and Prerequisites**

2.2.1 Minor differences may exist between individual disposal facilities and the Waste Class tables presented in this procedure. ALWAYS classify waste per the destined facilities criteria.

2.2.2 The Barnwell facility has a Class C determination form that must be completed and forwarded with the shipment.

2.2.3 US Ecology facilities has a NARM determination required to be completed before shipment.

2.2.4 Certain waste streams such as filter resins etc., also require isotopic analysis to be completed before shipment.

**2.3 Quality Control**

Instrumentation used to perform measurements required by this procedure will be checked with standards and verified to have a current calibration.

**3.0 References, Records, and Equipment**

**3.1 References**

10 CFR part 61  
CNSI Barnwell Waste Management Facility License  
US Ecology Hanford License

**3.2 Records**

3.2.1 Waste classification will be documented on MKMP Form 18-1, (may be computer generated).

3.2.2 Waste classification will be documented when shipping radioactive material to the burial site in accordance with MKMP-016.

**4.0 Responsibilities**

4.1 **Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of waste classification are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.

**MKMP-018**  
**Classifying Radioactive Waste**

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- 4.2 **Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for quality audits of waste classification performed by the Waste Broker.**
- 4.3 **Waste Broker - The Waste Broker is responsible to collect all required information about the waste and classifying the waste as outlined in this procedure.**

5.0 **Procedure**

5.1 **Procedural methods**

Methods for determination of concentration may be made by using the following individually or in combination.

- 5.1.1 **Compliance through materials accountability, a given quantity (and resulting concentration) of radioactive material may be known to be contained within a given waste or may be inferred through determining the difference between the quantity of radioactive material entering and exiting a given process.**
- 5.1.2 **Classification by source is similar to the above method of materials accountability and involves determining the radionuclide content and classification of waste through knowledge and control of the source of the waste.**
- 5.1.3 **Gross radioactivity measurements is an acceptable method for all classes of waste provided that:**
- a. **The gross radioactivity measurements are correlated on a consistent basis with the distribution of radionuclides within the particular waste stream analyzed, and**
  - b. **The radionuclide distributions are initially determined and periodically verified by direct measurement techniques.**
- 5.1.4 **Measurement of specific radionuclides may establish an inferential measurement program whereby concentrations of radioisotope which cannot be readily measured (through techniques such as gamma-spectral analysis) are projected through ratioing to concentrations of radioisotopes which can be readily measured.**
- 5.1.5 **The concentration of a radionuclide may be averaged over the volume of the waste, or weight of the waste if the units are expressed as nanocuries per gram (using NRC Branch Technical Position Paper on Waste Classification current revision). For double packaged containers, only the inner package volume may be used for classification.**

5.2 **Preferred waste classification procedure**

This algorithm for waste classification is performed using a computer when available. When using a computer, ensure data entry is accurate. Waste classification is to be performed by the Waste Broker with quality review performed by the RSO.

**MKMP-018**  
**Classifying Radioactive Waste**

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**5.2.1 Classification determined by long-lived radionuclides. If the waste contains only radionuclides listed in Table 1, classification is determined as follows:**

- a. If the concentration does not exceed 0.1 times the value in Table 1, the waste is Class A.
- b. If the concentration exceeds 0.1 times the value in Table 1, but does not exceed the value in Table 1, the waste is Class C.
- c. If the concentration exceeds the value in Table 1, the waste is not generally acceptable for near-surface disposal.
- d. For waste containing mixtures of radionuclides listed in Table 1, the total concentration shall be determined by the sum of fractions rule described in Section 4.5.
- e. Site specific variations to Tables 1 and 2 may exist. Prior to classifying waste verify that correct numbers are being used for the planned disposal facility.

**Table 1**

Radionuclide	Concentration Curies/Cubic Meter
C-14	8
C-14 in activated metal	80
Ni-59 in activated metal	220
Nb-94 in activated metal	0.2
Tc-99	3
I-129	0.08
Alpha emitting transuranic radionuclides with $T_{1/2} > 5$ years	100 <sup>1</sup>
Pu-241	3,500 <sup>1</sup>
Cm-242	20,000 <sup>1</sup>
Ra-226	100 <sup>1</sup>

<sup>1</sup>Units are nanocuries per gram, to convert to becquerels (Bq) per gram multiply by 37, to convert from curies to gigabecquerels (GBq) multiply by 37. Specific approval of SCDHEC (So Carolina) is required for disposal of these radionuclides if their concentration is greater than ten percent of the Table 1 value.

**5.2.2 Classification determined by short-lived radionuclides. If the waste does not contain any of the radionuclides listed in Table 1, classification shall be determined based on the concentrations shown in Table 2. If the radioactive waste does not contain any radionuclides listed in either Table 1 or 2, it is Class A.**

- a. If the concentration does not exceed the value of Column 1, the waste is Class A.

**MKMP-018**  
**Classifying Radioactive Waste**

- b. If the concentration value exceeds the value in Column 1, but does not exceed the value in Column 2, the waste is Class B.
- c. If the concentration exceeds the value in Column 2, but does not exceed the value in Column 3, the waste is Class C.
- d. If the concentration exceeds the value in Column 3, the waste is not generally acceptable for near-surface disposal.
- e. For wastes containing mixtures of the radionuclides listed in Table 2, the total concentration shall be determined by the sum of fractions rule described in (4.5).
- f. Site specific variations to Table 2 may exist. Prior to classifying waste verify that correct numbers are being used for the planned disposal facility.

Table 2

Radionuclide	Concentration Curies/Cubic Meter		
	Column 1	Column 2	Column 3
Total of all radionuclides with $T_{1/2} < 5$ years	700	(*)	(*)
H-3	40	(*)	(*)
Co-60	700	(*)	(*)
Ni-63	3.5	70	700
Ni-63 in activated metal	35	700	7,000
Sr-90	0.04	150	7,000
Cs-137	1	44	4,600

(\*) There are no limits established for these radionuclides in Class B or C wastes. Practical consideration such as the effects of external radiation and internal heat generation on transportation, handling, and disposal will limit the concentrations for these wastes. These wastes are Class B unless the concentration of other radionuclides in Table 2 determine the waste to be Class C independent of these radionuclides. Specific approval of SCDHEC is required prior to packaging of Class B tritium waste.

5.2.3 Classification determined by both long-lived and short-lived radionuclides. If the waste contains a mixture of radionuclides, some of which are listed in Table 1, and some of which are listed in Table 2, classification shall be determined as follows:

- a. If the concentration of a radionuclide listed in Table 1 is less than 0.1 times the value listed in Table 1 the class shall be that determined by the concentration of radionuclides listed in Table 2.
- b. If the concentration of a radionuclide listed in Table 1 exceeds 0.1 times the value listed in Table 1, the waste shall be Class C, provided the concentration of radionuclides listed in Table 2 does not exceed the value shown in Column 3 of Table 2.

**MKMP-018**  
**Classifying Radioactive Waste**

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5.2.4 Classification of waste with radionuclides other than those listed in Tables 1 and 2. If the waste does not contain any radionuclides listed in either Table 1 or 2, it is Class A.

5.2.5 The sum of fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each radionuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than or equal to 1.0 if the waste class is to be determined by that column.

EX: A waste contains Sr-90 in a concentration of 50 Ci/m<sup>3</sup> and Cs-137 in a concentration of 22 Ci/m<sup>3</sup>. Since the concentrations both exceed the values in Column 1, Table 2, they must be compared to Column 2 values. For Sr-90 fraction,  $50/150 = 0.33$ ; for Cs-137 fraction,  $22/44 = 0.5$ ; the sum of the fractions = 0.83. Since the sum is less than 1.0, the waste is Class B.

5.2.6 Determine package type in accordance with 49 CFR 173.431, 173.433 and 173.435.

5.2.7 Determine if R.Q. marking is required using 49 CFR 172.101 Appendix Table 2.

5.2.8 Verify LSA concentrations with 49 CFR 173.403 (N).

5.2.9 Any items exceeding a destination facility license shall not be shipped, refer to destination facility license. If material does not comply with license for the facility the shipment is going to, the waste will not be accepted.

6.0 Attachments

MKMP Form 18-1

Waste Classification Form

*MKM Engineers, Inc.*

**Waste Classification Worksheet**

GENERATOR: \_\_\_\_\_

CONTAINER NUMBER: \_\_\_\_\_

CONTAINER WEIGHT: \_\_\_\_\_

CONTAINER VOLUME: \_\_\_\_\_

PACKAGE TYPE: \_\_\_\_\_

TYPE A FRACTION: \_\_\_\_\_

RQ LABELING: \_\_\_\_\_

LSA CONCENTRATION: \_\_\_\_\_

TABLE 1 CLASS: \_\_\_\_\_

TABLE 2 CLASS: \_\_\_\_\_

**RADIONUCLIDE QUANTITIES IN THIS CONTAINER (mCi's)**

SAMPLE

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TOTALS: \_\_\_\_\_ WEIGHT OF WASTE = \_\_\_\_\_ LBS.

Performed By: \_\_\_\_\_ Date: \_\_\_\_\_

Page \_\_\_\_ of \_\_\_\_

**MKMP-019**  
**RADIOACTIVE MATERIAL TRACKING**

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**Radiation Safety Procedure**

for

**Radioactive Material Tracking**

**MKMP-019**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



MKMP-019  
Radioactive Material Tracking

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1.0 Purpose and Scope

- 1.1 This procedure describes the requirements associated with tracking radioactive material at MKM job sites and during any work at customer facilities where procedures for radioactive material tracking are not available in the customer's radioactive material license. Adherence to this procedure will provide reasonable assurance that personnel exposures will be below specified limits, personnel will remain free of contamination and contamination will not be spread beyond the designated contaminated area.
- 1.2 This procedure will be used to ensure tracking of radioactive material is done in accordance with State, Federal, and Licensee requirements.

2.0 General

2.1 Precautions and Prerequisites

- 2.1.1 Ensure receipt documents have been reviewed and shipments to be received have been approved by the project manager prior to initiation of unloading.
- 2.1.2 Any time the site inventory exceeds or potentially may exceed the limits in the facility license, inform the RSO.
- 2.1.3 Accurate and timely handling of all documentation including inventory updates are essential to maintaining radioactive material tracking.
- 2.1.4 No material may be placed within 10 feet of a Radiological Control Area (RCA) boundary.
- 2.1.5 Material may not be placed such that exposure rates at the restricted area boundary exceed 100  $\mu\text{R/hr}$ .
- 2.1.6 If any material is found or moved that does not have legible identification contact material controllers or the RSO immediately.
- 2.1.7 All forms and attachments may be computer files and reports.

2.2 Quality Control

- 2.2.1 Instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.
- 2.2.2 Surveillance shall be performed at least annually to verify that operations are within the guidelines of this procedure.

**MKMP-019**  
**Radioactive Material Tracking**

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**3.0 References, Records and Equipment****3.1 References**

RSM	Radiation Safety Manual
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-008	Radiation and Contamination Surveys

**3.2 Record**

- A current radionuclide inventory record shall be produced monthly.
- Record results of equipment surveys on survey forms in accordance with procedure MKMP-008.
- Maintain TRACK-1 tracking forms for at least three months after the material has been shipped from the work site.

**3.3 Equipment**

None Required

**4.0 Responsibilities**

- 4.1 **Program Manager** - The Program Manager is responsible for insuring that all personnel assigned the tasks of control and tracking of radioactive material, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for control of radioactive material.

**5.0 Tracking and Movement of Radioactive Material**

- 5.1 Anytime licensed radioactive material is moved, the person who performed the operation or directed the operation shall ensure completion of the Material Tracking Documentation, Form TRACK.1.
- 5.2 The following are requirements for Material Tracking Documentation, Form TRACK.1:
  - a. Refer any questions to the material controller or project manager;

**MKMP-019**  
**Radioactive Material Tracking**

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- b. Any item moved across a radiological contamination boundary is surveyed and the survey documented;
- c. All forms should be returned to material controllers by the end of each work day;
- d. For material transferred to another area such as another work zone or facility, a copy shall be sent to the supervisor of that area.
- e. An item generated from another item such as a large container into smaller boxes should be numbered with the original number, a dash (-), and a sequential number.
- f. Any item which can not be easily numbered shall be referred to the material controller for resolution as soon as possible;
- g. Any item for disposal or return shall be indicated in description;
- h. The inventory system should be updated within 48 hours.

5.3 This procedure shall be in effect at all MKM work sites:

- where the total activity is greater than 10 mCi,
- there are more than 5 sources of radioactive materials on-site,
- there are any licensed MKM sources of radioactive material on-site,
- or the project manager determines that tracking is needed.

5.4 Ensure that all sources of radioactive material requiring inventory in accordance with license conditions have been properly accounted for and inventoried in a timely manner, while within the confines of the MKM jobsite(s).

6.0 Attachments

MKMP Form 19-1      TRACK-1



MKDR-020  
RADIOACTIVE CHECK SOURCES



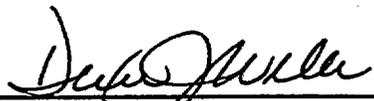
## Radiation Safety Procedure

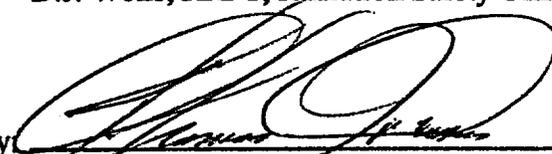
for

### Use and Control of Radioactive Check Sources

**MKMP-020**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



MKMP-020

Use and Control of Radioactive Check Sources

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1.0 Purpose and Scope

- 1.1 This procedure describes methods for control of instrument check sources used on jobs involving radioactive material. These sources are used to ensure proper radiation detection instrument operation. Adherence to this procedure will provide reasonable assurance that personnel exposures will be below specified limits, sources will not be lost or misplaced, personnel will remain free of contamination and contamination will not be spread beyond any designated contaminated area.
- 1.2 This procedure will be used to ensure proper control, use, and storage of radioactive check sources used for portable radiation detectors.

2.0 General

2.1 Precautions

- 2.1.1 Individual source quantities shall not exceed exempt quantity limits without permission of the Radiation Safety Officer.
- 2.1.2 When performing a leak test on non-exempt quantity sources, use specific license procedures.
- 2.1.3 If non-exempt quantity sources are used, the RSO will determine any additional precautions (i.e., finger rings, etc.).
- 2.1.4 Radioactive sources shall be controlled by GPI Radiation Protection personnel. \_\_\_\_\_ ?
- 2.1.5 The storage location will be approved by the Radiation Safety Officer for protection against loss, leakage, or dispersion by the effect of fire or by water.

2.2 Quality Control

The methods specified in this procedure will be audited annually to ensure compliance with the requirements to control and inventory radioactive sources.

3.0 References, Records, and Equipment

3.1 References

<i>Basic Radiation Protection Technology</i>	Gollnick, 1994
RSM	Radiation Safety Program Manual
MKMP-001	Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counters
MKMP-003	Micro-R Meters
MKMP-004	Ionization Chambers
MKMP-008	Radiation and Contamination Surveys

## MKMP-020

Use and Control of Radioactive Check Sources

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3.2 Records

MKMP Form 20-1      Sealed Source Inventory and Leak Test Form

4.0 Responsibilities

- 4.1 **Program Manager** - The Program Manager is responsible for insuring that all personnel assigned the tasks of control and leak testing of sealed sources of radioactive material, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive sources. The RSO ensures the Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations.
- 4.4 **Health Physics Technicians** - Health Physics Technicians is responsible for control and use of radioactive check sources.

5.0 Procedure

- 5.1 Only qualified Radiation Protection personnel may use or have possession of MKM radioactive check sources.
- 5.2 The Radiation Safety Officer (RSO) prepares and maintains a source file which shall, at a minimum, consist of the following:
- Procurement history of each source including copies of seller certification;
  - Status change - damage, sale or transfer, or disposal, or recalibration;
  - A completed "Sealed Source Inventory and Leak Test" MKMP Form 20-1; and
  - Any other correspondence related to the sources.
- 5.3 A physical inventory of all instrument check sources will be conducted by the RSO or designee at least once each quarter and whenever a new check source is received or an old check source is disposed. The results shall be recorded on the "Sealed Source Inventory and Leak Test" MKMP Form 20-1 and shall be retained in the source file for a period of not less than three years.
- 5.4 Although leak tests are not required for exempt quantity sealed sources, in the event a source is suspected of having a loss of encapsulation or other possible leakage, the following procedure shall be followed, wearing gloves or using tongs:
- 5.4.1 A visual inspection of the source shall be made for physical damage;
- 5.4.2 One of the following tests shall be used to determine source leakage when it is required:

## MKMP-020

**Use and Control of Radioactive Check Sources**

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**NOTE:** Any evaluation of the leakage of radioactive material from sources shall not cause violation of the source container in any way.

**CAUTION:** High activity sources have very high exposure rates on contact. Sources containing activity in excess of the exempt limits shall never be touched except with a remote means to ensure exposure is maintained As Low As Reasonably Achievable.

- a. **Dry Wipe Test** - This test will be performed on encapsulated sources or adjacent surfaces of plated or foil sources. The sources shall be wiped with dry disc smear with the application of moderate pressure. Removal of any radioactive material from the source or adjacent surfaces will be determined by counting the filter appear with appropriate instrumentation.
- b. **Wet Wipe Test** - This test will be performed on encapsulated sources only. The entire surface of the source shall be wiped with disc smear moistened with water, with the application of moderate pressure. Removal of any radioactive material from the source will be determined by counting the filter paper with an appropriate detection instrument after the filter paper has dried out.

5.4.3 When any contamination or leak test reveals the presence of 0.005  $\mu\text{Ci}$  or more of removable contamination, or activity removed is above the minimum sensitivity of the detecting instrument the source shall be retested. The source will be either repaired, if possible, or disposed of as radioactive waste if the second test is unsatisfactory. The results of the leak test for the sources are recorded on the "Sealed Source Inventory and Leak Test" MKMP Form 20-1 and shall be retained for a minimum of three years.

5.5 The on-contact radiation level exterior to the source storage locker shall be maintained at less than 2 millirem per hour on any accessible surface. A radiation survey of the storage locker shall be performed at least quarterly and immediately after the receipt of any additional check sources.

## 5.6 Action Levels

### 5.6.1 Inventory

The RPS shall be notified immediately if it has been determined that a source is missing. An immediate search shall be conducted and the Radiation Safety Officer notified.

### 5.6.2 Leakage

If a source is suspected to have lost integrity, the Radiation Safety Officer shall be notified immediately. Corrective action shall be taken to repair the source or dispose as radioactive waste.

**MKMP-020**

**Use and Control of Radioactive Check Sources**

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**5.6.3 Radiation Levels**

Radiation levels shall be maintained at less than 2 millirem per hour on contact on the source storage area.

**6.0 Attachments**

**MKMP Form 20-1 Sealed Source Inventory and Leak Test Form**



MIKMP-021

SOLIDIFICATION OF LIQUIDS/SLUDGES



## Radiation Safety Procedure

for

### Solidification of Radioactive Liquids/Sludges

**MKMP-021**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/28/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



## MKMP-021

Solidification of Radioactive Liquids/Sludges

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**1.0 Purpose and Scope**

- 1.1 This procedure provides the basic steps used to solidify aqueous based waste using Aquaset and Aquaset II solidification media, and oil based waste using Petroset and Petroset II solidification media, or combinations of the four media types. Adherence to this procedure will provide reasonable assurance that waste solidified with Aquaset and Petroset will meet waste acceptance criteria at the disposal site.
- 1.2 This procedure will be used to solidify aqueous based and oil based wastes using Aquaset and Petroset.

**2.0 General****2.1 Precautions**

- 2.1.1 Solution to be solidified must have a pH between 5 and 11 prior to testing and solidifying.
- 2.1.2 When solidifying any salt based solution with Aquaset, place a liner (at least 2 mil) in the drum prior to solidification activities.
- 2.1.3 Bench test is to be performed at similar temperature as solidification (above 60°F and below 140°F).
- 2.1.4 A 48-hour cure time at room temperature is required prior to any further testing (i.e., Freeze/Thaw and Free-Standing Solid Performance Test).
- 2.1.5 The media load rates (pounds per gallon of liquid) suggested in Tables 1 and 2 will, in most cases, produce acceptable results. However, the wide variability of waste characteristics in practice makes worthwhile the preparation of three samples as follows:
  - a. One at the recommended rate;
  - b. One at .75x the recommended rate; and
  - c. One at 1.33x the recommended rate.

This requires extra time, however, these three samples could eliminate delays due to repeat testing.

- 2.1.6 When using a combination of the solidification medias, add the materials (while mixing) in the following sequence:
  - a. Waste;
  - b. Petroset II;
  - c. Petroset;

MKMP-021

Solidification of Radioactive Liquids/Sludges

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- d. Aquaset II (then Aquaset, if needed);
- e. Alcohol Activator (if required).

2.1.7 All of the solidification agents in this procedure produce, as a final result, a slightly alkaline, inert, non-corrosive, and non-biodegradable solid matrix.

2.2 Quality control

Instrumentation used in this procedure will be checked daily with standards and verified to have a current valid calibration.

3.0 References, Records and Equipment

3.1 References

Manual .001	Fluid Tech, Inc.
RSM	Radiation Safety Manual
MKMP-014	Radiologically Restricted Areas

3.2 Records

Forms generated from this procedure will be filed in the permanent project record.

3.3 Equipment

3.3.1 Shipping container

3.3.2 4 mil Liner

3.3.3 Solidification Media (Aquaset, Aquaset II, Petroset, or Petroset II)

3.3.4 Mixer (If Needed)

3.3.5 Plastic Beaker - 400 ml

3.3.6 Scale or Balance

3.3.7 Graduated Cylinder - 100 ml or 250 ml

3.3.8 Graduated Cylinder - 10 ml

3.3.9 Spatula/Spoon - Stainless - For Stirring

3.3.10 Electric Drill with Stirring Attachment (Optional)

3.3.11 Freezer - Capable of -29°C (-20°F)

## MKMP-021

**Solidification of Radioactive Liquids/Sludges**

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3.3.12 Vernier Caliper

3.3.13 Numbered Plastic Disks

3.3.14 Modified Syringe

3.3.15 Desiccator - 250 mm/10' Diameter (i.e., Fisher Scientific Co. Number 08-615B)

3.3.16 Sample Plate

3.3.17 Cup of Water to be Used in Free-Standing Solid Performance Test

3.3.18 600 ml Beaker

3.3.19 Approved Absorbent Media

3.3.20 pH Testing Material (i.e., pH Paper)

#### 4.0 Responsibilities

- 4.1 Program Manager - The Program Manager is responsible for ensuring that all personnel assigned the tasks of solidifying waste using Aquaset and Petroset are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training personnel working with radioactive materials.
- 4.3 Project Manager - The Project Manager is responsible for identifying waste requiring solidification by this procedure and ensuring the conditions of this procedure are complied with during all project operations.
- 4.4 Health Physics Technicians - Health Physics Technicians are responsible for performing surveys and to establish contamination and radiation control areas as needed to perform this procedure.
- 4.5 Radiation Workers - Radiation workers are responsible to read, understand, and comply with the provisions of this procedure.

#### 5.0 Procedure

##### 5.1 Aquaset Bench Test

- 5.1.1 See Table 1 or Table 2 for Aquaset Applications.
- 5.1.2 Place 200 ml of well mixed, representative waste sample in a 400 ml plastic beaker.
- 5.1.3 If the pH is less than 5 or more than 11, neutralize the sample. Record the amount and type of neutralizers used.

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Solidification of Radioactive Liquids/Sludges

- 5.1.4 Place the beaker on the scale and either record the gross weight indicated or tare the scale.
- 5.1.5 Add Aquaset by scattering it uniformly across the top surface of the sample to a depth of approximately one quarter (50 ml) of the waste volume.
- 5.1.6 Wait 2 to 3 minutes and repeat step 5.1.5 to a depth of approximately one-half (100 ml) of the waste volume.
- 5.1.7 Repeat step 5.1.6 to a depth of approximately three-quarters of the waste volume (150 ml).
- 5.1.8 Repeat step 5.1.6 adding enough Aquaset to produce a dry top on the waste.
- 5.1.9 Determine and record the amount of Aquaset used by subtracting the original gross weight of the waste and beaker from the final weight, or by means of the tare/net weight shown on the scale.
- 5.1.10 Divide the weight (in grams) of Aquaset used by 24. The result is the loading rate in pounds of Aquaset to be used per gallon of original waste (assuming a 200 ml test sample).
- 5.1.11 Determine and record the final volume.

$$\text{Efficiency} = \frac{\text{Original Volume ( 200 ml )}}{\text{Final Volume}}$$

$$\text{ExpansionFactor} = \frac{\text{Final Volume}}{\text{Original Volume ( 200 ml )}}$$

- 5.1.12 Record all data on the Process Control Data Sheet, MKMP Form 21-1.
- 5.1.13 Continue to 5.2 to process waste if it has passed the bench test.

**NOTE:** If 200 ml of liquid waste cannot be solidified into a putty-like state with less than 120 grams of Aquaset (equivalent to 5 pounds per gallon), then the waste shall not be treated with Aquaset. It will require Aquaset II or a combination of Petroset and Aquaset II with power mixing.

## 5.2 Waste Solidification Using Aquaset

- 5.2.1 If the pH is less than 5 or greater than 11, neutralize the sample. Record the amount and type of neutralizers used.
- 5.2.2 Place liner inside drum.
- 5.2.3 Discard test material into 55 gallon drum (if desired, the sample may be kept for use in 5.7 and 5.8).

## MKMP-021

Solidification of Radioactive Liquids/Sludges

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**NOTE:** While this procedure is directed primarily toward the treatment of waste in 55 gallon drums, the same basic techniques are applicable to bulk, batch or continuous operations.

- 5.2.4 Add desired volume of waste to drum (it is recommended that only 2 to 10 gallons be processed at a time to ensure mixture is setting up properly).
- 5.2.5 Add approximately  $\frac{1}{3}$  of the pre-determined (from bench test) Aquaset needed for solidifying desired volume of waste.
- 5.2.6 After 5 minutes, add another  $\frac{1}{3}$  of the pre-determined Aquaset.
- 5.2.7 Add the remaining pre-determined Aquaset after another 5 minutes.
- 5.2.8 Allow the mixture to set for an additional 5 minutes and inspect the mixture to ensure it is setting up properly.

**NOTE:** The Aquaset is setting up properly if the mixture resembles a solid clay-like mass with the consistency similar to that of shortening. Small amounts of free-standing liquid on the surface of the mixture can be solidified with additional Aquaset. If there is a large amount of free-standing liquid, the Aquaset is not setting up properly and the processing must be stopped to determine what the problem is and how it is to be corrected.

- 5.2.9 Repeat steps 5.2.3 through 5.2.7 until all waste is solidified or the drum is full.
  - 5.2.10 Allow the drum to stand for 48 hours before sampling to ensure it has solidified into a free-standing solid and has no free-standing liquids.
- 5.3 Petroset and/or Aquaset II Bench Test
- 5.3.1 See Table 1 or 2 for recommended media and loading rates (pounds per gallon).
  - 5.3.2 Place 200 ml of well mixed representative waste sample in a 400 ml plastic beaker.
  - 5.3.3 If the pH is less than 5 or more than 11, neutralize the sample. Record the amount and type of neutralizers used.
  - 5.3.4 Add media while stirring vigorously. Break up clumps or clots so that uniform dispersion of the media is achieved. Stir at least one minute after the mixture has become smooth or until stirring is no longer possible. If the mixture becomes too stiff for further mixing before complete dispersion of the media is achieved, reduce the loading rate and start another sample mix.
  - 5.3.5 Divide the amount of each medium added (in grams) by 24. This will be the loading rate (pounds per gallon) of each medium.

## MKMP-021

Solidification of Radioactive Liquids/Sludges

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5.3.6 Determine and record the final volume.

$$\text{Efficiency} = \frac{\text{Original Volume ( 200 ml )}}{\text{Final Volume}}$$

$$\text{ExpansionFactor} = \frac{\text{Final Volume}}{\text{Original Volume ( 200 ml )}}$$

5.3.7 Record all data on the Process Control Data Sheet, MKMP Form 21-1.

5.3.8 Continue to 5.4 to process waste if it has passed the bench test.

5.4 Waste Solidification Using Petroset and/or Aquaset II

5.4.1 If the pH is less than 5 or greater than 11, neutralize the sample. Record the amount and type of neutralizers used.

5.4.2 Discard test material into 55 gallon drum (if desired, sample may be kept for use in 5.7 and 5.8).

**NOTE:** While this procedure is directed primarily toward the treatment of waste in 55 gallon drums, the same basic techniques are applicable to bulk, batch, or continuous operations.

5.4.3 Add desired volume of waste into drum (it is recommended that no more than 10 gallons be processed at a time to ensure mixture is setting up properly).

5.4.4 Mix vigorously enough to break up clumps and clots of solidification media desired so that uniform dispersion of the media is achieved.

5.4.5 Continue to stir at least one minute after the mixture has developed a texture similar to bench test sample; i.e., smooth.

5.4.6 If all waste was not originally placed in a drum, continue adding waste and solidification media until drum is full or all waste is mixed and has become smooth.

5.4.7 Allow drum to stand for 48 hours uncovered before sampling to ensure it has solidified into a free-standing solid and has no free-standing liquids.

5.5 Petroset II Bench Test

5.5.1 See Table 1 or Table 2 for recommended load rates (pounds per gallon).

5.5.2 Place 200 ml of a well mixed representative waste sample in a 400 ml plastic beaker.

5.5.3 If the pH is less than 5 or more than 11, neutralize the sample. Record the amount and type of neutralizers used.

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Solidification of Radioactive Liquids/Sludges

- 5.5.4 Add the recommended amount of Petroset II while stirring vigorously for at least one minute (solidification at this stage is unlikely).
- 5.5.5 If solidification is obtained, proceed to 5.5.8.
- 5.5.6 Add 10 ml (5% of the waste volume) of polar activator (any light alcohol such as methanol) and continue stirring vigorously. The waste should now be "setting up."
- 5.5.7 Continue stirring until no more polar activator can be seen.
- 5.5.8 Determine and record the final volume.

$$\text{Efficiency} = \frac{\text{Original Volume ( 200 ml )}}{\text{Final Volume}}$$

$$\text{ExpansionFactor} = \frac{\text{Final Volume}}{\text{Original Volume ( 200 ml )}}$$

- 5.5.9 Record all data on the Process Control Data Sheet, MKMP Form 21-1.

5.6 Waste Solidification Using Petroset II

- 5.6.1 If the pH is less than 5 or greater than 11, neutralize the sample. Record the amount and type of neutralizers used.
- 5.6.2 Discard test material into 55 gallon drum (if desired, sample may be kept for use in 5.7 and 5.8).

**NOTE:** While this procedure is directed primarily toward the treatment of waste in 55 gallon drums, the same basic techniques are applicable to bulk, batch, or continuous operations.

- 5.6.3 Add desired volume of waste into the drum. Mix for approximately 2 min.
- 5.6.4 Add Petroset II slowly while stirring vigorously.
- 5.6.5 Continue stirring for at least one minute after Petroset II is visually mixed into waste ( ~7 minutes).
- 5.6.6 Add polar activator, if bench test determines that this is needed, (5% of waste volume) and continue stirring vigorously.
- 5.6.7 Continue stirring until polar activator is no longer visible (~6 minutes).
- 5.6.8 Allow drum to stand for 48 hours uncovered before sampling to ensure it has solidified into a free-standing solid and has no free-standing liquids.

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Solidification of Radioactive Liquids/Sludges

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**5.7 Freeze/Thaw Testing**

- 5.7.1 If the solidified waste may be subject to freezing in storage or in shipment, the bench test procedure shall include the Freezer/Thaw portion. If not, proceed to 5.8.
- 5.7.2 Allow bench test specimens to sit at process room temperature for 48 hours.
- 5.7.3 Freeze a new sample or original bench test sample at -20°F for 24 hours.
- 5.7.4 Thaw to greater than 68°F for 48 hours.
- 5.7.5 Repeat 5.7.2 and 5.7.3 through 6 cycles.
- 5.7.6 After cycling, there shall be no free-standing liquid observable in test beaker.
- 5.7.7 Invert the beaker and verify that no free-standing liquid is present.

**5.8 Free-Standing Solid Performance Test**

- 5.8.1 See Fluid Tech manual, Test Apparatus, to show test equipment needed for this test.
- 5.8.2 Using the aforementioned equipment, take a test plug from solidified waste as needed (waste should have already set for at least 48 hours) or use the original bench test sample.
- 5.8.3 Push the sample plug forming tube through the solidified waste approximately 2 inches.
- 5.8.4 Spin the tube several times to break the sample free.
- 5.8.5 Plug the top of the sample tube to create a vacuum and pull sample tube with the sample plug.
- 5.8.6 Prepare numbered plastic disc to identify plug. See Fluid Tech Manual, Test Sample Handling.
- 5.8.7 Place the properly numbered plastic disc on top of the sample. See Fluid Tech Manual, Test Sample Handling.
- 5.8.8 Place plunger into sample tube and press the sample plug, along with the plastic disc on top, to transfer it onto the sample holding plate.
- 5.8.9 Repeat steps 5.8.2 through 5.8.8 for each of the test samples.
- 5.8.10 Using the Vernier Caliper, determine the height of each test plug to the nearest 0.01 inch and record on Test Data Chart, MKMP Form 21-2.
- 5.8.11 Place approximately 1/8 inch of tap water in the bottom of the desiccator.

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Solidification of Radioactive Liquids/Sludges

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- 5.8.12 Set the sample holding plate with the test samples in the desiccator as shown in the Test Apparatus.
- 5.8.13 Place the lid on the desiccator and wait 24 hours.
- 5.8.14 Remove lid and test samples.
- 5.8.15 Using the Vernier Caliper, determine the height of the test plugs, again using the reference dot.
- 5.8.16 Record the information and determine the percent difference in height as required on the Test Data Chart, MKMP Form 21-2.
- 5.8.17 Determine whether the height measurement differences are within 5% of the first measurement.
- 5.8.18 All sample test plugs which maintain a height difference of less than 5% over the 24 hours have passed the free-standing solid test requirement.
- 5.8.19 If any of the sample plugs show a height change over 5%, the mix is a failure. In such cases, a new mix must be done and tested using a heavier media loading rate.
- 5.8.20 After sample plugs have been removed and solidified waste has been standing for 24 hours, examine the hole where plug originated for free liquid.
- 5.8.21 Examine plugs of solidified waste for consistency and pockets of liquid.

6.0 Attachments

Attachment 1/Table 1	Recommended Media and Loading Rates
Attachment 2/Table 2	Recommended Media and Loading Rates
MKMP Form 21-1	Process Control Data Sheet
MKMP Form 21-2	Free-Standing Solid Test Data Chart

*MKM Engineers, Inc.*

**Table 1**  
**RECOMMENDED MEDIA AND LOADING RATES**  
(Pounds per Gallon)

	Aquaset	Petroset	Aquaset II	Aquaset II + Petroset	Petroset II	Petroset II + Petroset	Petroset II + Aquaset II	Reference Attachment 316-1/2
Water - With Low Levels of Dissolved Solids	5 lbs/gal	4 lbs/gal	-	-	-	-	-	(a)
Neutralized Strong Acids	7-10 lbs/gal <0.1 M	5 lbs/gal <0.1 M	5-6 lbs/gal	5 lbs/gal SO <sub>4</sub> <1.0M NO <sub>3</sub> <1.0M	-	-	-	(b)
Neutralized Weak Acids	7-10 lbs/gal <0.3M	5 lbs/gal <0.5M	5 lbs/gal	4.5 lbs/gal PO <sub>4</sub> <1.0M Ac <1.0M B <0.1M	-	-	-	(c)
Water Miscible Organics	6 lbs/gal ≤5,000 mg/l	-	5 lbs/gal	4 lbs/gal	-	-	-	(d)
Oils, Hydrocarbon	-	-	-	-	2-3 lbs/gal	-	-	(e)
Oils, Synthetic	-	-	-	-	3-4 lbs/gal	-	-	(f)
Silicone Emulsions	-	-	5 lbs/gal	-	-	-	-	(g)
Solvents	-	-	-	-	3-5 lbs/gal	-	-	(h)
Other Non-Aqueous Liquids	-	-	-	-	2-5 lbs/gal	-	-	(i)
Evaporator Concentrations BWR and PWR	-	-	4 lbs/gal	4 lbs/gal	-	-	-	(j)
Slurries - Ion Exchange Resins - Filter Precoat	-	4 lbs/gal	-	-	-	-	-	(k)
Ethylene Glycol Solutions 0% - 35% EG	-	-	5 lbs/gal	-	-	-	-	(l)
Ethylene Glycol Solutions 35% - 60% EG	-	-	5 lbs/gal	-	-	-	-	(m)
Ethylene Glycol Solutions 60% - 90% EG	-	-	6 lbs/gal	-	-	-	-	(n)

*MKM Engineers, Inc.*

**Table 2**  
**RECOMMENDED MEDIA AND LOADING RATES**

(Pounds per Gallon)

REFERENCE	LIQUID WASTE	PREFERRED MEDIA	ADDITIONAL INFORMATION
a	Water - With Low Levels of Dissolved Solids	Aquaset or Petroset	Petroset (which requires mixing) offers better volumetric efficiency than Aquaset. Some organic contaminants in very low concentrations may require the use of a combination of Petroset and Aquaset II. Bench tests will help determine the appropriate recipe.
b	Neutralized Strong Acids (Nitric, Sulfuric, Hydrochloric, etc..) and Bases	Aquaset II or a Combination of Petroset and Aquaset II	Preferred Neutralizers are: Sodium Hydroxide, Sodium Carbonate, or Phosphoric Acid
c	Neutralized Weak Acids (Boric, Phosphoric, etc..) and Bases	Aquaset II or a Combination of Petroset and Aquaset II	Preferred Neutralizers are: Sodium Hydroxide, Sodium Carbonate, or Phosphoric Acid
d	Miscible Organics	Aquaset II or a Combination of Petroset and Aquaset II	
e	Oils, Hydrocarbon	Petroset II	In some cases, activator (alcohol) is not necessary. Activator, if used, will be 5% of the volume of the oil.
f	Oils, Synthetic	Petroset II	Synthetic oils are treated in a similar fashion to Hydrocarbon oils. Synthetics tend to require heavier media loading rates than Hydrocarbon oils. Activator (alcohol) may or may not be necessary.
g	Silicone Emulsions		Some silicone fluids can be solidified with Fluid Tech, Inc. media. Emulsions (such as UCC-710) can be solidified with Aquaset II. Pure silicone fluids (polydimethylsiloxane polymers such as DOW 200 fluids) cannot.
h	Solvents	Petroset II	Most solvents can be solidified with Petroset II. Activator (alcohol) may or may not be required.
I	Other Non-Aqueous Liquids	Petroset II	Most Hydrocarbons, and many other non-water miscible organic liquids, can be solidified with Petroset II. Activator (alcohol) may or may not be required.
j	Evaporator Concentrates - BWR and PWR	Aquaset II	
k	Resin Slurries - Filter Precoat Slurries	Aquaset	These slurries can be solidified by Aquaset in 55 gallon open top drums without mixing. In this mode, the slurry and the Aquaset are fed into the drum simultaneously at rates determined by observation during the pour. Aquaset II can also be used with continuous mixing.
l, m, n	Ethylene Glycol Solutions	Aquaset II	

**MKM Engineers, Inc.**  
**Process Control Data Sheet**

**BENCH SCALE TEST DATA**

Date of Test: \_\_\_\_\_

(Raw) Waste Test Sample Volume: \_\_\_\_\_ ml Sample Weight: \_\_\_\_\_ gm

Neutralization of Sample: Raw Waste pH: \_\_\_\_\_ Neutralizer Used: \_\_\_\_\_

Quantity Used: \_\_\_\_\_ gm Final pH: \_\_\_\_\_

MEDIA: Aquaset: \_\_\_\_\_ gm Petroset: \_\_\_\_\_ gm Mixing Temperature: \_\_\_\_\_

Petroset-H: \_\_\_\_\_ gm Aquaset II: \_\_\_\_\_ gm Curing Temperature: \_\_\_\_\_

Aquaset II-H: \_\_\_\_\_ gm Petroset II: \_\_\_\_\_ gm

Other Reagent(s): \_\_\_\_\_ gm \_\_\_\_\_ gm

Activator (if required): \_\_\_\_\_ ml Added Water (if required): \_\_\_\_\_ ml

Freeze/Thaw Cycles (if required): \_\_\_\_\_ Freeze: \_\_\_\_\_ °C Thaw: \_\_\_\_\_ °C

Measured Solidified Volume: \_\_\_\_\_ ml

Hardness (if required): \_\_\_\_\_ Tons/Square Feet (Penetrometer)

<b>CERTIFICATION</b>	NO FREE-STANDING LIQUID 24 HOURS AFTER MIXING		
<b>CERTIFIED BY</b>	_____	<b>DATE</b>	_____

<b>CERTIFICATION</b>	NO FREE-STANDING LIQUID AFTER FREEZE/THAW TEST.		
<b>CERTIFIED BY</b>	_____	<b>DATE</b>	_____

<b>CERTIFICATION</b>	PHYSICAL CHARACTERISTICS HAVE BEEN MET.		
<b>CERTIFIED BY</b>	_____	<b>DATE</b>	_____

**CONVERSION OF BENCH SCALE DATA TO FULL SCALE MIXING VALUES**

$$\frac{\text{Measured Solidified Volume (ml)}}{\text{(RAW) Test Sample Volume (ml)}} = \text{Expansion Factor (XF)}$$

- OR -

$$\frac{\text{(RAW) Test Sample Volume (ml)}}{\text{Measured Solidified Volume (ml)}} = \text{Efficiency}$$



MKMP-022  
PACKAGING RADIOACTIVE MATERIAL



## **Radiation Safety Procedure**

for

## **Packaging Radioactive Material**

**MKMP-022**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer      Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist      Date



**MKMP-022**  
**Packaging Radioactive Material**

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**1.0 Purpose and Scope**

- 1.1 This procedure describes the methods used by trained MKM employees at customer facilities to package material for disposal as radioactive waste. Adherence to this procedure will provide reasonable assurance that personnel exposures will be ALARA, personnel will remain free of contamination and contamination will not be spread beyond the designated contaminated area.
- 1.2 This procedure will be used to ensure packaging of radioactive waste meets Federal, State, Customer, and Waste Site requirements.

**2.0 General****2.1 Definitions**

- 2.1.1 No detectable free-standing liquid - As little liquid as reasonably achievable, but in no case shall the liquid exceed 0.5% of the waste volume.
- 2.1.2 Sorbent Material - Sorbent material approved by applicable regulatory body for use at designated disposal site. Approved sorbents are listed in the applicable disposal facility license.
- 2.1.3 Strong Tight Container - Container capable of transporting radioactive material to the disposal facility without loss of material.
- 2.1.4 Heavy Duty Closure Ring - Closure ring for drums of 55-gallons or larger capacity secured by a bolt having a 5/8" or larger diameter.
- 2.1.5 Container - Outer package which meets strong tight criteria. Containers are most commonly steel drums of 55-gallons capacity or larger.

**2.2 Precautions**

- 2.2.1 Ensure that a Radiation Work Permit (RWP) has been issued to control the evolution. The RWP may be written to govern multiple tasks.
- 2.2.2 All personnel packaging waste shall comply with RWP requirements.
- 2.2.3 If loose surface contaminated material is to be handled, ensure the evolution is set up in an approved area AND that the ventilation system for the area is in operation, AND respiratory protection requirements have been determined and specified in the RWP.
- 2.2.4 Disposal Container Checklist, Form DCC-1, is at the packaging site to be completed as the package is assembled.

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**2.3 Quality Control**

2.3.1 Q.C. verification of packaging activities will be performed on a recurring surveillance basis and will be documented on a QA Surveillance Report.

2.3.2 Surveillance may be performed during packaging or by opening and inspecting material. All packaged containers shall be opened in accordance with MKMP-023.

2.3.3 Instrumentation used for measurements required by this procedure will be checked with standards and verified to have current calibration.

**3.0 References, Records and Equipment****3.1 References**

RSM	Radiation Safety Manual
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-004	Operation of Ionization Chambers
MKMP-006	Radiation Work Permits
MKMP-008	Radiation and Contamination Surveys
MKMP-014	Radiologically Restricted Areas
MKMP-015	Personnel Protective Equipment
MKMP-016	Radioactive Materials Brokering
MKMP-019	Radioactive Material Tracking
MKMP-023	Packaging Radioactive Material

**3.2 Records**

MKMP Form DCC-1 Disposal Container Checklist.

**3.3 Equipment**

Appropriate containers  
Packaging materials, as needed  
Tools, for securing containers

**4.0 Responsibilities**

4.1 Program Manager - The Program Manager is responsible for ensuring that all personnel assigned the tasks of packaging of radioactive material, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.

4.2 Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.

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- 4.3 Project Manager - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations.
- 4.4 Health Physics Technicians - Health Physics Technicians are responsible for control of radioactive material.

5.0 Procedure

- 5.1 The project manager will initiate a RWP describing the work to be done. The Health Physics Technician will perform all required surveys and prescribe requirements as specified in procedure MKMP-006.

5.2 Packaging Dry Material

5.2.1 Ensure container:

- a. Has a heavy closure ring which is free of defects;
- b. Exhibits no holes, damage, or deformation which renders the container non-strong tight;
- c. Gasket exhibits no apparent damage.
- d. Ensure the package meets the appropriate performance testing criteria for the material being packaged per Title 49 of the Code of Federal Regulations.

5.2.2 Place a thin layer of approved sorbent material in the bottom of the container.

5.2.3 Place pellets or other material into the container, filling as much of the volume as practical.

5.2.4 Fill void spaces within the container with dry material to the maximum extent practical.

5.2.5 Ensure the container contains no detectable free-standing liquid.

5.2.6 Install lid and fasten closure ring securely. Tap the closure ring with a hammer around the edges while tightening the closure ring bolt.

5.2.7 Ensure drainage/sample bung is closed securely, and cover bung joint with waterproof caulk.

5.2.8 Weigh the completed container.

5.2.9 Provide tracking information as required by MKMP-019.

5.2.10 Label container with following information:

- a. Radioactive Material;

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- b. Container identification number;
- c. Gross weight.

5.2.11 Complete Disposal Container Checklist, Form DCC-1.

5.2.12 Have radiation protection personnel perform a dose rate survey on completed containers.

5.2.13 Place completed container in appropriate storage area as directed by the project manager.

**5.3 Packaging Biological Material (excluding animal carcasses)**

**WARNING**

Containers with biological, pathogenic, or infectious material or equipment used in handling of such material shall be kept sealed except when an appropriate work area has been established and specific procedures are written to repackage the material.

5.3.1 Ensure that the shipper has provided certification to ensure the following:

- a. Each received container meets DOT 7A Performance Specifications or was Manufactured to DOT 17H Specifications;
- b. Each received container is lined with a sealed plastic liner, minimum 4 mil thickness.

5.3.2 Select a container with a capacity of at least:

- a. 40% greater than the received container for disposal in Washington;
- b. 50% greater than the received container for disposal in South Carolina.

5.3.3 Ensure the outer container:

- a. Meets DOT 7A Performance Specifications and test records are on file;
- b. Has a heavy duty closure ring which is free of defects;
- c. Exhibits no holes, damage or deformation which renders the container non- strong tight;
- d. Has a gasket which exhibits no damage.

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- e. Ensure the package meets the appropriate performance testing criteria for the material being packaged per Title 49 of the Code of Federal Regulations.

- 5.3.4 Place a layer of approved sorbent material in the bottom of the outer container.
- 5.3.5 Place received container into the outer container.
- 5.3.6 Fill void spaces within the container with approved sorbent material, and ensure there is no detectable free-standing liquid.
- 5.3.7 Install lid and fasten closure ring securely.
- 5.3.8 Ensure drainage/sample bung is closed securely, and cover bung joint with waterproof caulk.
- 5.3.9 Weigh the completed container.
- 5.3.10 Provide tracking information as required by MKMP-019.
- 5.3.11 Label container with the following information:
- a. Radioactive Material;
  - b. Container identification number;
  - c. Gross weight.
- 5.3.12 Complete Disposal Container Checklist, Form DCC-1.
- 5.3.13 Have radiation protection personnel perform a dose rate survey on completed containers.
- 5.3.14 Place the completed container in an appropriate storage area.

**5.4 Packaging Animal Carcasses**

**WARNING**

**Containers with animal carcasses shall not be opened at other than approved facilities. Overpacking of the inner package shall only be accomplished for burial purposes. Caution is necessary with animal carcasses as the animal may have been used for experimentation with chemicals or drugs.**

- 5.4.1 Ensure the shipper has provided certification to ensure the following:
- a. Each received container meets DOT 7A Performance Specifications or was Manufactured to DOT 17H Specifications;

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- b. The biological material within the received container is layered with absorbent and lime.
- 5.4.2 Select a container with a capacity of at least: 50% greater than the container received for disposal.
- 5.4.3 Ensure that the outer container:
- a. Meets DOT 7A Performance Specifications and test records are on file.
  - b. Has a heavy duty closure ring which is free of defects;
  - c. Exhibits no holes, damage, or deformation which renders the container non strong-tight;
  - d. Has a gasket which exhibits no apparent damage.
  - e. Ensure the package meets the appropriate performance testing criteria for the material being packaged per Title 49 of the Code of Federal Regulations.
- 5.4.4 Place a layer of approved sorbent material in the bottom of the outer container (Perlite sorbents may not be used when packaging animal carcasses in the void space between the inner and outer container).
- 5.4.5 Place the received container into the outer container.
- 5.4.6 Fill void spaces within the outer container with approved sorbent material and ensure there is no detectable free-standing liquid.
- 5.4.7 Install the lid and fasten the closure ring securely.
- 5.4.8 Ensure drainage/sample bung is closed securely, and cover bung joint with waterproof caulk.
- 5.4.9 Weigh the completed container.
- 5.4.10 Provide tracking information as required by procedure MKMP-019.
- 5.4.11 Label the container with following information:
- a. Radioactive Material;
  - b. Container identification number;
  - c. Gross weight.
- 5.4.12 Complete the Disposal Container Checklist, Form DCC-1.

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5.4.13 Have radiation protection personnel perform a dose rate survey on completed containers.

5.4.14 Place completed container in an appropriate storage area.

**5.5 Packaging Bulk Dry Materials**

**NOTE:** This section is intended for use in preparing large containers (50 ft<sup>3</sup> or more) for disposal. Items which can be placed in drums should be packaged as described in Section 5.2.

5.5.1 Inspect container to be used as a burial container to ensure:

- a. No holes, damage, or deformation which renders the container non-strong tight;
- b. Lid gasket exhibits no apparent damage;
- c. Closure devices are free of defects.
- d. Ensure the package meets the appropriate performance testing criteria for the material being packaged per Title 49 of the Code of Federal Regulations.

5.5.2 Place waste material inside the container, filling as much of the volume as practical.

5.5.3 Ensure the container has no detectable free-standing liquid.

5.5.4 Install lid and fasten securely using one or more of the following:

- a. Clips;
- b. Mechanical fasteners;
- c. Clamping rings
- d. Metal banding.

5.5.5 Ensure drainage/sample plug is closed securely, and cover drain plug with weatherproof caulk.

5.5.6 Weigh the completed container.

5.5.7 Provide tracking information as required by MKMP-019.

5.5.8 Label container with following information:

- a. Radioactive Material;

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- b. Generator(s) identification and receipt number(s);
- c. Container identification number;
- d. Gross weight.

5.5.9 Complete the Disposal Container Checklist, Form DCC-1.

5.5.10 Have radiation protection personnel perform a dose rate survey on completed containers.

5.5.11 Place completed containers in appropriate storage area designated by the project manager.

## 5.6 Packaging Solidified or Stabilized Liquid

**NOTE:** This section does not constitute a solidification or stabilization process plan. This section is provided to ensure proper packaging for disposal of liquids which have been stabilized/solidified in accordance with an approved procedure. This section may be performed concurrent with the stabilization /solidification process.

5.6.1 Review process information and maintain records to ensure:

- a. Liquid was rendered non-corrosive ( $4 \leq \text{pH} \leq 11$ );
- b. Liquid has been acceptably stabilized or solidified using material authorized in applicable disposal facility license.

5.6.2 Ensure container:

- a. Has a heavy duty closure ring which is free of defects;
- b. Exhibits no holes, damage, or deformation which renders the container non-strong tight;
- c. Gasket exhibits no apparent damage.
- d. Ensure the package meets the appropriate performance testing criteria for the material being packaged per Title 49 of the Code of Federal Regulations.

5.6.3 Fill container with material to be stabilized or solidified.

5.6.4 Fill void spaces within the container with sorbent material, and ensure there is no detectable free-standing liquid. Void space shall be less than 15% of container volume.

5.6.5 Install lid and fasten closure ring securely.

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- 5.6.6 Ensure drainage/sample bung is closed securely, and cover bung joint with waterproof caulk.
- 5.6.7 Weigh completed container.
- 5.6.8 Provide tracking information as required by MKMP-019.
- 5.6.9 Label container with following information:
  - a. Radioactive Material;
  - b. Container identification number;
  - c. Gross weight.
- 5.6.10 Complete the Disposal Container Checklist, Form DCC-1.
- 5.6.11 Have radiation protection personnel perform a dose rate survey on completed containers.
- 5.6.12 Place completed containers in an appropriate storage area designated by the project manager.

### 5.7 Packaging Sorbed Liquid

**NOTE:** This section does not constitute a sorption process plan. This section is provided to ensure proper packaging for disposal of liquids which have been sorbed in accordance with an approved procedure. This section may be performed concurrent with the sorption process. For disposal at other than the Barnwell site.

- 5.7.1 Review process information and maintain records to ensure:
  - a. Liquid was rendered non-corrosive ( $4 \leq \text{pH} \leq 11$ );
  - b. Liquid has been acceptably sorbed using material authorized in the applicable disposal facility license;
  - c. Liquid is contained in enough sorbent material to sorb at least twice the volume of the liquid content;
  - d. Volume and weight of unprocessed liquid has been recorded.
- 5.7.2 Ensure container:
  - a. Meets DOT 7A Performance specifications and test records are on file;
  - b. Has a heavy duty closure ring which is free of defects;

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c. Exhibits no holes, damage, or deformation which renders the container non-strong tight;

d. Gasket exhibits no apparent damage.

5.7.3 Line the container with a minimum 4 mil plastic liner unless liquid has been sorbed in Petroset or Aquaset.

5.7.4 Fill container with sorbed material as fully as possible.

5.7.5 Fill void spaces within the container with sorbent material and ensure there is no detectable free-standing liquid.

5.7.6 Close plastic liner.

5.7.7 Install lid and fasten closure ring securely.

5.7.8 Ensure drainage/sample bung is closed securely, and cover bung joint with waterproof caulk.

5.7.9 Weigh completed container.

5.7.10 Provide tracking information as required by GPI-14.

5.7.11 Label container with the following information:

- a. Radioactive Material;
- b. Container identification number;
- c. Gross weight.

5.7.12 Complete the Disposal Container Checklist, Form DCC-1.

5.7.13 Have radiation protection perform dose rate survey on completed container.

5.7.14 Place completed container in an appropriate storage area.

6.0 Attachments

MKMP Form 22-1 (DCC-1) Disposal Container Checklist

**MKM Engineers, Inc.**

**Disposal Container Checklist  
(DCC-1)**

CONTAINER NUMBER: \_\_\_\_\_

CONTAINER DESCRIPTION: \_\_\_\_\_

GENERATOR(S): \_\_\_\_\_

RECEIPT NO.(S): \_\_\_\_\_

- |  | SAT                      | N/A                      |
|--|--------------------------|--------------------------|
| 1) CONTAINER PROPER FOR CONTENTS                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| 2) CONTAINER HAS:  |                          |                          |
| - NO HOLES, DAMAGE, OR DEFORMATION<br>RENDERING IT NON-STRONG TIGHT. | <input type="checkbox"/> | <input type="checkbox"/> |
| - ACCEPTABLE CLOSURE EQUIPMENT                                       | <input type="checkbox"/> | <input type="checkbox"/> |
| - ACCEPTABLE CLOSURE GASKET  | <input type="checkbox"/> | <input type="checkbox"/> |
| 3) NO FREE-STANDING LIQUID   | <input type="checkbox"/> | <input type="checkbox"/> |
| 4) CONTAINER CLOSURE HARDWARE INSTALLED SECURELY                     | <input type="checkbox"/> | <input type="checkbox"/> |
| 5) CONTAINER LABELED WITH FOLLOWING:                                 |                          |                          |
| - RADIOACTIVE MATERIAL   | <input type="checkbox"/> | <input type="checkbox"/> |
| - GENERATOR IDENTIFICATIONS  | <input type="checkbox"/> | <input type="checkbox"/> |
| - CONTAINER IDENTIFICATION NUMBER                                    | <input type="checkbox"/> | <input type="checkbox"/> |
| - GROSS WEIGHT   | <input type="checkbox"/> | <input type="checkbox"/> |

ITEMS ABOVE COMPLETED: \_\_\_\_\_ / \_\_\_\_\_  
OPERATOR SIGNATURE DATE

REVIEWED BY: \_\_\_\_\_ / \_\_\_\_\_ DATE: \_\_\_\_\_  
PRINT/SIGN

Page \_\_\_ of \_\_\_

MRMB-023  
OPENING RAD MATERIAL CONTAINERS



## Radiation Safety Procedure

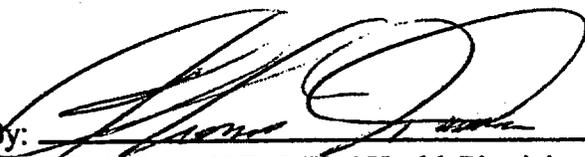
for

## Opening Radioactive Material Containers

**MKMP-023**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



## MKMP-023

Opening Radioactive Material Containers

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1.0 Purpose and Scope

- 1.1 This procedure describes the methods used by trained MKM employees at customer facilities to open packages containing radioactive material. Adherence to this procedure will provide reasonable assurance that personnel exposures will be below specified limits, remain free of contamination and contamination will not be spread beyond the designated contaminated area.
- 1.2 This procedure will be used to ensure safety in the opening of containers which require control as radioactive material. This procedure provides instructions for opening shipping containers which contain radioactive material. Containers which contain material which has been decontaminated, such that loose surface contamination has been removed, are not subject to this procedure.

2.0 General2.1 Precautions

- 2.1.1 Ensure a Radiation Work Permit (RWP) has been issued to control the evolution. The RWP may be written to govern multiple tasks (e.g., packing and loading containers).
- 2.1.2 All personnel opening containers or working in the area of container opening shall comply with RWP requirements.
- 2.1.3 If loose surface contaminated material is to be handled, ensure the evolution is set up in an approved area, per MKMP-011, AND that the ventilation system for the area is in operation, AND respiratory protection requirements have been determined. Containment to control the spread of radioactive material shall be established prior to opening a shipping container with internal loose surface contamination.
- 2.1.4 If there is any indication of hazardous or dangerous material - cease work and notify the RSO immediately.

2.2 Quality Control

Elements of this procedure will be audited during opening operations at least annually.

- 2.2.1 Q.C. verification of packaging activities will be performed on a recurring surveillance basis and will be documented on a QA Surveillance Report.
- 2.2.2 Surveillance shall be performed during opening and inspecting previously packaged material.

## MKMP-023

Opening Radioactive Material Containers

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**3.0 References, Records and Equipment****3.1 References**

MKMP-008	Radiation and Contamination Surveys
MKMP-011	Containment Devices
MKMP-016	Radioactive Material Brokering
MKMP-019	Radioactive Material Tracking

**3.2 Equipment**

- Hand Tools
- Air sampling equipment
- Survey equipment

**4.0 Responsibilities**

- 4.1 **Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of opening containers of radioactive material are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive material. The RSO ensures personnel are qualified by training and experience to perform the requirements of this procedure.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for control of radioactive material.

**5.0 Procedure****5.1 Review and Planning**

5.1.1 The Project Manager shall review the shipping papers and receipt survey data to determine which RWP will be followed while opening the container.

5.1.2 If the container is of an unusual configuration, the Project Manager will generate a plan for moving and opening the container and conduct a pre-job briefing with the crew. Pre-job briefings will be documented.

**5.2 Establish containment around the container in one of the following ways:**

5.2.1 Move the containers into a controlled building or containment;

## MKMP-023

Opening Radioactive Material Containers

---

**NOTE:** The containment boot need only limit air flow around the container. The building atmospheres must be kept negative relative to the outside air, therefore inleakage around the container is normal and desired.

5.2.2 Place the container in one of the door openings in a controlled building and establish a boot between the building and the container.

5.2.3 Establish a temporary containment which incorporates the following requirements:

- a. Wall, floor, ceiling membranes to control spread of contamination;
- b. Ventilation blower drawing on the containment and exhausting through a HEPA filter with a minimum of 99.97% efficiency;
- c. If it is believed gaseous activity is present, the blower shall be exhausted through a 99% efficient activated carbon filter in addition to HEPA filtration;
- d. Discharge of the ventilation blower shall be sampled as needed to evaluate the air released.

5.3 Open the container as follows:

**NOTE:** If an unusual situation occurs, the operation shall stop and the Project Manager will be notified.

5.3.1 Notify the Radiation Protection Supervisor on site or the RSO that the container will be opened. Radiological conditions shall be monitored while opening containers.

5.3.2 Remove fasteners from container.

5.3.3 Open container as necessary to perform airborne contamination survey on interior volume of the container.

5.3.4 Perform airborne contamination survey.

5.3.5 Open container further to perform smear surveys for removable contamination.

5.3.6 If there is any indication of hazardous or dangerous material

- a. If container can be easily and quickly secured, secure it.
- b. Warn others of the material and keep others away.
- c. Stop work and notify the RSO immediately.

5.3.7 Perform smear surveys and dose rate surveys in accordance with MKMP-008.

MKMP-023

Opening Radioactive Material Containers

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- 5.3.8 If surveys indicate contamination levels and dose rates as expected, processing may proceed as planned.
- 5.3.9 If surveys indicate contamination levels or dose rates are greater than expected, the Operations Supervisor shall review processing plans to determine if changes are required prior to start of processing.
- 5.3.10 If the container will be closed and returned to storage, a copy of the survey results should be posted on the container.

5.4 Reopening Containers

- 5.4.1 Follow Sections 5.1 and 5.2.
- 5.4.2 If a container opening survey is on file, containers may be opened and off loaded without further survey as described in Section 5.3.
- 5.4.3 If container opening survey is not on file, all requirements of Section 5.3 shall be followed.

6.0 Attachments

None

**MKMP-024**  
**DECON OF TOOLS & EQUIPMENT**



## Radiation Safety Procedure

for

## Decontamination of Equipment and Tools

**MKMP-024**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



## MKMP-024

Decontamination of Equipment and Tools

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**1.0 Purpose and Scope**

- 1.1 This procedure establishes the requirements for decontamination of equipment, material, and tools used on MKM field projects that become contaminated with radioactive material.
- 1.2 This procedure will be used to identify proper decontamination methods, provide instruction for the decontamination of equipment, material, and tools. Each decontamination operation is unique; thus, this procedure provides general, effective decontamination techniques and guidelines to be used by MKM field personnel. This document applies to all MKM personnel involved in the decontamination process.

**2.0 General****2.1 Definitions**

- 2.1.1 Decontamination - The processes whereby contamination can be safely and effectively removed from equipment, tools and materials, to levels required by Reg. Guide 1.86.
- 2.1.2 Herculite - A plastic or polyethylene floor covering and containment material used for decontamination operations. HERCULITE is a brand name.
- 2.1.3 MSDS. - Material Safety Data Sheet; Manufacturer directions, safety information and limitations for use of decontamination related solvents or cleaning solutions.
- 2.1.4 Radiation Work Permit (RWP) - A document generated by Health Physics to provide:
  - a. A description and scope of the work to be performed.
  - b. The existing radiological conditions in the work area.
  - c. The limitations placed upon the scope of work.
  - d. The maximum radiological limits allowed.
  - e. The measures to be employed to protect the worker(s).
  - f. The period of time the RWP is valid.
  - g. Special instructions to workers and HP personnel for the work.
- 2.1.5 Shall - The word "shall" as used in this procedure is to be understood as denoting a mandatory requirement.
- 2.1.6 Should - The word "should" as used in this procedure is to be understood as denoting a recommendation that is a sound safety practice; it does not denote a mandatory requirement, however, is normally done unless job conditions require other actions.

MKMP-024

Decontamination of Equipment and Tools

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2.2 Precautions

- 2.2.1 All decontamination of contaminated tools or equipment shall be performed in accordance with the direction of the Health Physics Technician providing the job coverage in accordance with this Procedure, and the RWP requirements.
- 2.2.2 Decontamination activities shall be performed within a controlled area established in accordance with the provisions of procedure MKMP-014.
- 2.2.3 Controls to contain the spread of loose contamination during the decontamination activity shall be planned and established prior to the decontamination of equipment, material, and tools.

2.3 Limitations

- 2.3.1 Protective clothing worn by the personnel involved in decontamination activities shall be determined according to the RWP.
- 2.3.2 Decontamination cleaning solvents/solutions shall only be used in accordance with the directions and limitations listed on the manufacturer supplied MSDS.
- 2.3.3 Decontamination solutions/solvents shall be approved by the Project Manager prior to use. Solvents/solutions requiring a pH adjustment shall be modified prior to use.
- 2.3.4 Respiratory protection devices required by the RWP for decontamination operations shall be selected and used in accordance with the provisions of MKMP-032.
- 2.3.5 A pre-job briefing shall be held to instruct Decontamination Technicians of the conditions of the RWP. All personnel performing work in the decontamination area shall sign the RWP prior to work.
- 2.3.6 Every effort should be made by MKM personnel to avoid re-contamination of decontaminated materials. Contamination controls shall always be observed throughout a decontamination operation.
- 2.3.7 Radiation and contamination surveys shall be performed in accordance with the provisions of procedure MKMP-008.
- 2.3.8 Release of equipment, materials, and tools from the decontamination area shall be performed in accordance with the provisions of procedure MKMP-025.

2.4 Quality Control

Instrumentation used in the surveys will be checked with standards daily and verified to have current valid calibration.

Operations conducted using this procedure shall be reviewed for compliance at least annually.

## MKMP-024

Decontamination of Equipment and Tools

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**3.0 References, Records and Equipment****3.1 References**

Reg Guide 1.86	<i>Termination of Operating Licenses For Nuclear Reactors</i>
RSM	Radiation Safety Manual
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-006	Radiation Work Permits
MKMP-008	Radiation and Contamination Surveys
MKMP-014	Radiologically Restricted Areas
MKMP-018	Classifying Radioactive Waste
MKMP-022	Packaging Radioactive Material
MKMP-025	Unconditional Release of Materials from Radiological Controls
MKMP-032	Respiratory Protection

**3.2 Records**

The records generated by the use of this procedure are documented in accordance with the provisions of referenced MKM procedures. No new records are created.

**3.3 Equipment**

None required

**4.0 Responsibilities**

- 4.1 **Program Manager** - The Manager Director is responsible for ensuring that all personnel assigned the tasks of decontamination are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel in decontamination techniques and performing radiation surveys described in this procedure. The RSO ensures the decontamination technicians are qualified by training and experience to perform the requirements of this procedure.
- 4.3 **Project Manager** - The Project Manager is responsible for supervising the decontamination technician staff and for quality assurance of the decontamination effort.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for performing the surveys of decontaminated items, and ensuring that radioactive material is not released to the public or the environment.

## MKMP-024

Decontamination of Equipment and Tools

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5.0 Procedure5.1 Pre-Decontamination Preparation

- 5.1.1 The Project Manager shall initiate decontamination instructions.
- 5.1.2 A radiological survey shall be performed by a Health Physics Technician on any object which is to be removed from a controlled area.
- 5.1.3 If radiological survey results indicate that a RWP is required for decontamination, the Health Physics Supervisor shall write the RWP in accordance with the provisions of procedure MKMP-006.
- 5.1.4 If a survey indicates that decontamination is required, the item should be bagged, wrapped, or contained under the direction of Health Physics Supervision. The Health Physics Technician shall label the item in accordance with the provisions of procedure MKMP-019.
- 5.1.5 The Project Manager shall approve or disapprove the decontamination operation based on conditions of the RWP and the cost effectiveness of the operation versus disposal costs.

5.2 Establishment of the Decontamination Area

- 5.2.1 The Project Manager and the Health Physics Supervisor shall determine a location for set-up of the decontamination area.
- 5.2.2 Once a location has been established, the decontamination area shall be constructed by the Health Physics/ Decontamination Technicians under the direction of the Project Manager and Health Physics Supervisor.
- 5.2.3 The decontamination area should consist of:
  - a. Covered (or equivalent) floor surfaces. A double layer of Herculite (or equivalent) may be laid on the floor at the Health Physics Supervisor's direction.
  - b. Covered (Herculite or equivalent) wall surfaces, if applicable.
  - c. Engineering controls (HEPA ventilation, vacuum cleaners, containment tent walls, glove bags, etc.), if applicable. Engineering controls shall be determined on the basis of the ALARA considerations section of the RWP.

**NOTE:** All possible engineering controls shall be utilized when feasible to minimize the need for respiratory protection equipment.

- d. Safe, sturdy work stations with contamination resistant surfaces. Tables that will support decontamination attempts on heavy pieces of equipment.

## MKMP-024

**Decontamination of Equipment and Tools**

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- e. Adequate supply of overhead light, adequate electrical/compressed air supply for the operation of electrical/pneumatic driven decontamination equipment.
- f. Overhead lifting equipment, if applicable.
- g. Adequate supply of MKM approved cleaning solutions and solvents; adequate supply of decontamination equipment such as:
  - i. Light duty decontamination equipment such as paper wipes, paper towels, masslinn towels, etc.
  - ii. Medium to Heavy duty decontamination equipment such as scrub pads, wire brushes, steel wool, files, sandpaper, etc.
  - iii. Fully stocked hand tool kit for disassembly of contaminated equipment.
  - iv. Power tools, such as drills, saws, needle-guns, electric screwdrivers, etc.
  - v. Radioactive material storage bags, stickers, etc.
  - vi. Buckets, barrels or drums for the storage of contaminated liquids, sludges or slurries, if applicable.
  - vii. Blotter paper or sorbent, if applicable.
  - viii. Approved absorbent material such as oil dry, etc., if applicable.
- h. Storage drums/bags for the storage of contaminated protective clothing under direction of Health Physics supervision.
  - i. Proper surveillance instruments (air monitor/sampler, contamination monitor, friskers, dose rate meter, etc.) in accordance with the RWP.
  - j. Adequate supply of personal protective clothing, gloves, respiratory equipment, etc.
  - k. Step-Off Pad or Double Step-Off Pad in accordance with the provisions of the RWP.
  - l. A designated area within the decontamination area for the segregation of radioactive waste.
- m. Fire extinguisher(s), if required.

5.2.4 Once the decontamination area has been established and stocked for operation, the bagged or wrapped contaminated or controlled equipment should be placed in the decontamination work area by Health Physics/Decontamination Technicians under the direction of the Project Manager and the Health Physics Technician. Contaminated or controlled items should always be escorted under the direction of a Health Physics Technician to the decontamination area.

## MKMP-024

Decontamination of Equipment and Tools

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5.3 Decontamination

5.3.1 After radiological posting of the decontamination area, all requirements of the RWP shall be observed.

5.3.2 The preparation for decontamination of a particular tool, material, or piece of equipment shall be performed as follows:

- a. Position the wrapped item so that the written information on the wrapping is visible.

**NOTE:** Junior Health Physics/Decontamination Technicians may operate survey instruments for decontamination monitoring purposes. Health Physics Technicians shall oversee Health Physics/Decontamination Technicians when survey instruments are in use.

**CAUTION:** Survey instruments to be used in a known or suspected contaminated area should be protected (wrapped in plastic, poly, etc.) against possible contamination before use.

- b. The Health Physics Technician shall direct the removal of the item from the wrapping in such a manner (rolling plastic wrapping inside out, etc.) to control the spread of contamination.
- c. An item that is highly contaminated with smearable contamination should be misted with an approved liquid. The water vapor will wet down the particulate contamination and help prevent the possibility of airborne contamination.
- d. Once the item has been removed from the wrapping and has been properly positioned, discard the wrapping as radioactive waste.

5.3.3 The following decontamination techniques should be considered for the decontamination of equipment, materials, and tools:

- a. Any equipment with unaccessible areas shall be dismantled so that all surfaces are accessible for decontamination and for survey.
- b. Decontamination shall be performed in a safe, effective manner.
- c. The Health Physics Technician shall be notified **IMMEDIATELY** if the job conditions change (e.g. suspected asbestos found, presence of mercury in a switch or a light bulb, a fluid leak, or any other special circumstances).
- d. A Health Physics/Decontamination Technician shall be assigned as a fire watch if any spark creating decontamination techniques (grinding, etc.) are used. There shall be a dedicated fire extinguisher located within the decontamination area.
- e. In order to secure a safe cleaning surface, the item should be positioned on the work table (if size and weight allow) and locked into a vise or secured in another way if possible.

## MKMP-024

Decontamination of Equipment and Tools

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- f. The decontamination area shall remain organized and free of debris. The Health Physics/ Decontamination Technicians shall "clean as they go."
- g. A 'HEPA' vacuum cleaner may be used during the decontamination operation.
- h. Smearable Contamination Removal

When item is properly positioned for decontamination and the pre-survey has been completed, perform the following:

- i. Moisten the surface of the item with an approved liquid (e.g. demineralized water).
  - ii. Fold a paper or cloth wipe into sections, using one surface of the wipe, gently wipe contamination off in ONE direction AWAY from the user's body. This should reduce the possibility of personnel contamination.
  - iii. Re-fold the paper or cloth wipe so that a CLEAN surface is available (this should prevent cross-contamination) and continue until item is ready for survey.
  - iv. For some materials, duct tape will effectively remove smearable contamination. Wrap the duct tape loosely around the gloved hand, ADHESIVE side OUT. Roll the tape over the contaminated area. Re-survey.
- i. Fixed Contamination Removal
- i. There are many techniques that can be used to remove fixed contamination. The general idea is to remove the material which is fixing the activity to the surface, or remove a very thin layer of the surface material. It is very important to note that fixed contamination removal methods can and do result in the creating of loose surface contamination. This creates a condition which may generate airborne radioactive materials. The activities should be controlled in such a manner that airborne activity is minimized, and air sampling should always be performed during these operations to properly evaluate any resultant airborne activity. The techniques selected for a particular decontamination operation is at the discretion of the Project Manager and the Health Physics Technician. The techniques can be divided into the following categories:
    - Light hand decontamination
    - Abrasive hand decontamination
    - Power tool decontamination
    - Machine decontamination (use of abrasive bead blasters, grit blasters, high pressure water wash systems, etc.) The specific implementation of these techniques is not included within the scope of this procedure.
    - Cleaning solutions/solvents (use of ultrasonic cleaners, acid baths, electropolishing, etc.) The specific implementation of these techniques is not included within the scope of this procedure.

## MKMP-024

**Decontamination of Equipment and Tools**

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- ii. Light hand decontamination consists of using many of the same techniques as 5.3.3 of this procedure.
- iii. Abrasive hand decontamination shall be performed in the following manner:
  - Remove as much smearable contamination as possible as indicated in Section 5.3.3 of this procedure.
  - Moisten the surface of the item(s) to contain contamination.

**CAUTION:** Abrasive measures should only be applied to surfaces which are not critical for operation of devices which must be restored to working condition. Abrasion of machined surfaces should be minimized if the device is intended to provide it's designed operation.

- Use an abrasive cleaning tool (e.g. sandpaper, steel wool, steel brush, hand grinder, etc.) to loosen fixed contamination. Clean in one direction **ONLY** and clean **AWAY** from the body to prevent personnel contamination.
  - Continue to moisten the surface of the item(s) to contain contamination.
  - Remove as much smearable contamination as possible as per Section 5.3.3 of this procedure.
  - Re-survey.
- iv. Power tool decontamination shall be performed in the following manner only under the direction of the Health Physics Technician.

**NOTE:** When using power tools, always consider the potential of injury due to the hazards involved. Power tools shall be used cautiously and in accordance with the manufacturer's recommendations

- a. Some of the electric power tools that can be used in decontamination operations are:
  - drills- used to drill out contaminated areas, to disassemble contaminated components and when used with grinding wheels or disks, may be used as an abrasive tool.
  - saws- used to separate contaminated pieces from clean pieces
  - grinders- used to grind fixed contamination from surfaces
  - electric screwdrivers- used in the disassembly of component parts
- b. Some of the air-powered tools that can be used in decontamination operations are:
  - Needle gun - a pneumatic tool which can remove contamination from concrete and/or steel surfaces
  - socket tools or impact hammer - used in disassembly of component parts
  - jackhammer/rotohammer - a pneumatic tool which can remove contamination from concrete and/or steel surfaces

## MKMP-024

**Decontamination of Equipment and Tools**

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- c. Power tool decontamination shall be performed in the following manner:
- Remove as much smearable contamination as possible as per Section 5.3.3 of this procedure.
  - Moisten the surface of the item lightly to contain contamination. Use a spray bottle for moistening.

**CAUTION:** Do not use electric power tools on a wet working surface. Keep liquids away from electric power tools.

- Whenever feasible the use of containment devices (e.g. glove box, etc.) should be used to contain the spread of contamination when using power tools for decontamination operations.
- Use the power tool to remove fixed contamination. Clean in one direction **ONLY** and clean **AWAY** from the body to prevent personnel contamination.
- Re-survey.

**5.4 Post Decontamination**

5.4.1 If the decontamination was successful, the Health Physics/ Decontamination Technician shall notify the Health Physics Technician who shall perform a release survey in accordance with MKMP-025.

- a. If the item satisfies the criteria for release as in MKMP-025, remove the item to a holding area for disposal and document results. When prepared for disposal, ensure compliance with the provisions of MKMP-018 and 022.
- b. If the item remains contaminated, attempt a second decontamination, then perform 5.4.1.
- c. If the item remains contaminated, attempt a third decontamination **ONLY** by direction of the Project Manager.

5.4.2 If an item cannot be effectively or economically decontaminated, the Project Manager may direct the MKM work crew to volume-reduce (reduce to component parts) the equipment, material, or tools as much as possible. If the item is expendable, the individual parts may be surveyed and released in accordance with Section 6.4.1.

5.4.3 If an item is volume-reduced to its component parts and decontamination is not feasible, and the item is not needed, the item parts shall be considered radioactive waste. Radioactive waste is to be segregated into similar materials for shipment purposes by the direction of the Project Manager. The Health Physics Supervisor shall direct the segregation of radioactive waste into the following categories:

- a. steels, hard metals
- b. wood

MKMP-024

**Decontamination of Equipment and Tools**

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- c. transite, fiber products
- d. paper
- e. rubber
- f. cloth (duct tape is considered a cloth)
- g. aluminum, soft metals (brass)
- h. glass
- i. concrete
- j. questionable items (e.g. light bulbs, pipe with lead solder, electronic component parts) which could be considered mixed or hazardous waste
- k. other categories, if applicable

**5.4.4** After all decontamination operations have been completed a Health Physics Technician shall perform a release survey of the decontamination area and de-post the area in accordance with procedures MKMP-008 and MKMP-014.

**6.0** Attachments

None.

MKMP-025

UNCONDITIONAL RELEASE OF MATERIALS



## Radiation Safety Procedure

for

## Unconditional Release of Materials from Radiological Controls

**MKMP-025**

**Revision 0**

Reviewed By:

A handwritten signature in black ink, appearing to read 'D.J. Wells', written over a horizontal line.

D.J. Wells, RRPT, Radiation Safety Officer

8/28/99

Date

Approved By:

A handwritten signature in black ink, appearing to read 'T.J. O'Dou', written over a horizontal line.

T.J. O'Dou, CHP, MKM Health Physicist

8/30/99

Date



## MKMP-025

**Unconditional Release of Materials from Radiological Controls**

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**1.0 Purpose and Scope**

- 1.1 This procedure sets forth the specific requirements for release of materials from controlled areas applicable to MKM field projects.
- 1.2 The purpose of this procedure is to specify requirements for releasing material from controlled areas and to minimize the potential for unintentionally releasing contaminated items to uncontrolled areas in accordance with the provisions of references in section 3.
- 1.3 This procedure provides instructions for performing release surveys of items controlled as contaminated or potentially contaminated with radioactive materials.
- 1.4 This procedure will be used to ensure by survey that all materials released from contaminated or potentially contaminated areas will meet the release criteria applicable to the license conditions, facility requirements, or as specified in regulations or guidance provided by applicable regulatory agencies of the federal or state government.

**2.0 General****2.1 Definitions**

- 2.1.1 Activity - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm), Becquerel (Bq), or micro-Curies.
- 2.1.2 Contamination - Deposition of radioactive material in any place where it is not desired, particularly where its presence may be harmful. The harm may be actual exposure to individuals or release of the material to the environment or general public. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.
- 2.1.3 Restricted Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.
- 2.1.4 Fixed Contamination - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslinn.
- 2.1.5 Minimum Detectable Activity (MDA) - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95% confidence level based upon the background count rate of the counting instrument used.
- 2.1.6 Senior Health Physics Technician - An individual designated by the Radiation Safety Officer to evaluate materials or items in accordance with Sections 5.2 and 5.3.

## MKMP-025

Unconditional Release of Materials from Radiological Controls

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2.1.7 Release for Unconditional Use - A level of radioactive material that is acceptable for use of property without restrictions. Under normal circumstances, authorized limits for residual radioactive material are set equal to, or below, the values specified in Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors*, Table 1.

2.1.8 Survey Exempt Materials - The contents of sealed containers which remain unopened while in a controlled area are exempt, the outside surfaces are not exempt.

## 2.2 Precautions

2.2.1 Instruments used to perform release surveys shall be operated in accordance with the respective operating procedure, for example:

- Ludlum Model-2929 - MKMP-002
- Ludlum Model-3 -MKMP-001

2.2.2 MDA for the Ludlum Model-2929 shall be determined in accordance with MKMP-002.

2.2.3 Large area smears may be used to augment (but not replace) the 100 cm<sup>2</sup> smear survey. Large area wipes may be counted with the Ludlum Model-3 or equivalent. Large area smears are used to obtain immediate information concerning loose contamination for the purpose of radiological protection and to minimize time spent performing disc smears on an item easily identified as contaminated.

2.2.4 A release document package, at a minimum, shall include the following forms:

- a. The Health Physics daily log.
- b. Material Release Log.
- c. Radiation and Contamination Survey Report (MKMP Forms 8-1,2, or 3) or an Unconditional Release of Equipment or Items Report (MKMP Form 25-1) and/or Sample Calculation Worksheet (MKMP Form 2-4).
- d. MKMP Form 1-1, Daily Instrument Calibration Log.

2.2.5 The release document shall include the following information:

- a. The date of the release survey.
- b. The number of the release survey.
- c. A description or identification of the item.
- d. The identity of the Health Physics Technician performing the release survey.
- e. The evaluator of the material for release.

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Unconditional Release of Materials from Radiological Controls

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f. The release approval of the Health Physics Supervisor or designee.

2.2.6 All surveys performed for the release of material shall be documented on a Radiation and Contamination Survey Report (MKMP Form 8-1, 2, or 3) and/or on a Unconditional Release of Equipment or Items Report (MKMP Form 25-1).

2.2.7 Radiation/contamination surveys shall be performed in accordance with MKMP-008.

2.2.8 Items identified as radioactive during the release survey shall be controlled in accordance with MKMP-014.

2.2.9 Personnel performing release surveys shall be logged in on a Radiation Work Permit in accordance with MKMP-006 (if applicable).

2.2.10 Audible response instruments must be used during direct scan surveys.

2.2.11 The instruments used for release surveys shall be within current calibration and shall have had a performance test check performed daily or prior to use in accordance with the instruments operating procedure.

2.2.12 Items presented for release shall be direct scanned in an area of low background.

2.3 Quality Control

Instrumentation used in the surveys will be checked with standards daily and verified to have current valid calibration.

When releasing large amounts of materials, a program shall be established to ensure by second check that no radioactive material has been released to the public or the environment.

2.4 Limitations

2.3.1 The maximum probe speed during direct scan surveys of surfaces shall be 3 cm/sec.

2.3.2 A response check shall be performed at the completion of the work day for instruments used for direct scan surveys in accordance with the instruments operating procedure.

2.3.3 The probe face shall be held within ¼ inch of the surface being surveyed for alpha radiation, and within ½ inch of the surface being surveyed for beta-gamma radiation.

2.3.4 If a instrument used to perform release surveys fails any operational check, it shall be removed from service. All data collected during the period of instrument failure must be evaluated by the Health Physics Supervisor.

2.3.5 Posting and access control of controlled areas shall be performed in accordance with MKMP-014.

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Unconditional Release of Materials from Radiological Controls

3.0 References, Records, and Equipment

3.1 References

10 CFR 20	<i>Standards for Protection Against Radiation</i>
Reg Guide 1.86	<i>Termination of Operating Licenses for Nuclear Reactors</i>
ANSI N3.1-1987	<i>Selection, Qualification and Training of Personnel for Nuclear Power Plants</i>
MKMP-001	Operation of Contamination Survey Meters
MKMP-002	Alpha-Beta Sample Counting Instrumentation
MKMP-003	Operation of Micro-R Survey Meters
MKMP-006	Radiation Work Permits
MKMP-008	Radiation and Contamination Surveys
MKMP-014	Radiological Restricted Areas
MKMP-020	Use and Control of Radioactive Check Sources

3.2 Records

MKMP Form 8-1	Radiological Survey Report
MKMP Form 8-2	Radiation and Contamination Survey
MKMP Form 8-3	Radiation and Contamination Survey Results

4.0 Responsibilities

- 4.1 Program Manager - The Program Manager is responsible for ensuring that all personnel assigned the tasks of surveying transportation vehicles are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure. *expand*
- 4.2 Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training personnel performing radiation surveys described in this procedure. The RSO ensures the Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 4.3 Project Manager - The Project Manager is responsible for identifying items requiring surveys for release.
- 4.4 Health Physics Technicians - Health Physics Technicians are responsible for performing the surveys described in this procedure.

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Unconditional Release of Materials from Radiological Controls

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5.0 Procedure

5.1 Release Limits For Gross Activity (Unknown Isotopes)

EMISSION	REMOVABLE dpm/100 cm <sup>2</sup>	TOTAL (Fixed and Removable) dpm/100 cm <sup>2</sup>
Alpha	20	100
Beta-Gamma	200	1000

**NOTE:** If all of the constituents of the contamination are known and documented on the release documents, the release limits of Table 1 of Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors* or the most current regulatory guidance, apply.

5.2 Inaccessible Surfaces

5.2.1 Items with inaccessible surfaces should be disassembled as completely as possible to facilitate release surveys. Items with inaccessible surfaces will not be unconditionally released unless evaluated by a designated evaluator who authorizes and documents the release.

5.2.2 The following guidance will be used when performing evaluations:

- A history of the item should be reviewed.
- The actual release survey shall be reviewed.
- Determination of the radiological conditions in the area the item has been used or stored shall be reviewed.
- Use of gamma radiation sensitive detectors such as NaI(Tl) or equivalent should be considered. (These detectors may indicate internal contamination that a beta sensitive detector may not detect due to the beta detector's lack of sensitivity to photon emissions).

5.3 Materials considered hazardous due to their physical or chemical nature and fragile items shall not be unconditionally released unless evaluated. For example, gases, pyrophoric materials, easily damaged electronic devices, or other easily damaged materials cannot be directly or indirectly surveyed. These materials will be evaluated on a case by case basis for release in a manner consistent with Section 5.2.2. Evaluation for release shall be performed by a designated evaluator only.

5.4 Survey Exempt Materials

5.4.1 Items such as briefcases, pens, papers, personal clothing, etc., are exempt from the Health Physics release survey requirements of this procedure if they are not causally used in the contaminated area..

5.4.2 Individuals shall survey the exempt items in the same manner as a whole body frisk when leaving a controlled area or have a Health Physics Technician perform the survey.

## MKMP-025

**Unconditional Release of Materials from Radiological Controls**

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**5.5 Survey Procedure**

**5.5.1** Upon receipt of an item presented for release, attempt to determine the history:

- Purpose of item.
- The current and past use of the item.
- The location(s) in which the item was used or stored.
- If the item was ever used for work with radioactive material or used in an area where radioactive material was used or stored.

**NOTE:** This knowledge of the item history should provide the surveyor with information helpful in performing the release survey.

**5.5.2** Using protective clothing such as gloves, perform large area smears of 100% of the accessible surfaces of the item using large area wipes (e.g. masslinn).

- a. Determine if transferrable (loose) radioactive material is present by measuring the amount of activity on the surface of the cloth.
- b. If the presence of radioactive material is indicated by a count rate above background, the item shall be treated as contaminated until the results of the disc smear survey are obtained and determination is made concerning the actual 100 cm<sup>2</sup> loose contamination levels. The material shall be controlled in accordance with MKMP-014.

**5.5.3** Perform a direct scan of 100% of all accessible areas of the item, in accordance with the instrument's operating procedure, and MKMP-008.

**NOTE:** Items presented for release shall be direct scanned in an area of low background. Preferably  $\leq 100$  CPM. The Health Physics Technician performing the release survey shall determine if the background is acceptable for direct scan of the item.

- a. If the scan indicates radioactive material on the surface of the item is less than the limits for release for total activity, proceed to (c).
- b. If the scan indicates radioactive material on the surface of the item is greater than regulatory limits for total activity, the item cannot be released.
- c. During the direct scan of the accessible surfaces of the item, a static measurement shall be taken:
  - If an increase in the audible count rate is detected.
  - After each minute of scanning.
  - When the Health Physics Technician determines that an indication of fixed activity in an area less than ten square centimeters may be present.

## MKMP-025

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**Unconditional Release of Materials from Radiological Controls**

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- d. During the static measurement, the meter probe shall be held at the proper distance from the surface being surveyed for the proper response period to allow the meter reading to stabilize, in accordance with the instrument's operating procedure.

5.5.4 Perform disc smears which are representative of 100% of the effective surface area.

- a. 100% of the effective accessible surface means performing a 100 cm<sup>2</sup> disc smear on all accessible areas of the item suspected of being contaminated.

5.5.5 Count the smears in accordance with reference MKMP-008 and/or MKMP-002 as appropriate.

- a. Record smear data on the Radiation and Contamination Survey Report (MKMP 8-2). If a Model-3 or equivalent was used, document the results on a Radiation and Contamination Survey Report (MKMP 8-2).
- b. If the smear results indicate transferrable activity below the release limits, proceed to Step 5.5.6.
- c. If the smear results indicated transferrable activity above the release limits, the item cannot be released.

5.5.6 If the item has internal or inaccessible surfaces, MKM personnel will disassemble the item and repeat Steps 5.5.2 through 5.5.5 or have the item evaluated for release by a designated evaluator.

5.5.7 If the item meets the release limits or is evaluated as meeting the unconditional release criteria, complete forms MKMP 25-1 and MKMP 8-2. Health Physics Supervision must review the release documents and approve the release prior to allowing the item to leave the controlled area.

5.5.8 Items identified as radioactive during the release survey shall be controlled in accordance with MKMP-014.

## 5.6 Action levels

5.6.1 If direct frisk beta-gamma instrument readings exceed 100 cpm above background (with background less than 200 cpm) or 25 cpm alpha, those areas shall be surveyed as follows:

- a. Perform a smearable contamination survey using 100 cm<sup>2</sup> of affected areas, and count the smears for beta-gamma and alpha contamination to determine if contamination is "fixed" or "removable".

5.6.2 Any vehicle with removable contamination exceeding the site limits listed below shall be brought to the attention of the Project Manager and handled appropriately.

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Unconditional Release of Materials from Radiological Controls

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5.6.3 Any vehicle with removable contamination exceeding the DOT limits listed below shall be brought to the attention of the RSO for release or acceptance approval.

a. 2,200 dpm/100 cm<sup>2</sup> beta-gamma.

b. 220 dpm/100 cm<sup>2</sup> alpha.

5.6.4 Dose rate surveys which exceed 0.2 mR/hr shall be brought to the attention of the RSO for release or acceptance approval.

5.7 The results of the survey shall be documented on Radiation and Contamination forms (MKMP 8-1 and MKMP 8-2).

6.0 Attachments

MKMP Form 25-1      Unconditional Release of Equipment or Items Report



MKMP-026

SOIL & SEDIMENT SAMPLING



## **Radiation Safety Procedure**

for

## **Soil and Sediment Sampling**

**MKMP-026**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RKPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-026**  
**Soil and Sediment Sampling**

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**1.0 Purpose and Scope**

- 1.1 The purpose of this procedure is to provide guidelines for collecting surface soil samples.
- 1.2 The scope of this procedure is limited to collecting samples of surface soil on MKM field projects. This procedure is applicable to all soil samples taken by MKM to fulfill a requirement for sampling. It is not intended for informal sampling, however, the techniques used should be followed even in the case of information only samples.

**2.0 General**

**2.1 Quality Control**

- 2.1.1 Instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.
- 2.1.2 Surveillance of this procedure (in use) shall be performed at least annually to verify that operations are within the guidelines of this procedure. Any time this procedure is in effect, the project manager should ensure by personal observation that samples are collected and controlled appropriately.

**3.0 References, Records and Equipment**

**3.1 References**

SHSP	Site Health and Safety Plan
SDWP	Site Detailed Work Plan
NUREG/CR-5849	<i>Manual for Conducting Radiological Surveys in Support of License Termination</i>
NUREG/CR-5512	<i>Residual Radioactive Contamination From Decommissioning</i>
MKMP - 029	Sample Chain of Custody
MKMP - 027	Water Sampling
MKMP - 028	Material Sampling

**3.2 Records**

MKMP Form 26-1	Sample Status Log
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**3.3 Equipment and Supplies**

- Digging implement: garden trowel, shovel, spoons, post-hole digger, etc.
- Special sampling apparatus (cup cutter, shelby tube, etc.) as required.
- Plastic bags, approximately 10 cm diameter x 30 cm long.
- Cardboard "ice cream" containers (1 quart size) or geology sample bags.
- Twist-ties.
- Masking or duct tape.
- Record forms.
- Labels and security seals.

**MKMP-026**  
**Soil and Sediment Sampling**

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- Indelible pen.
- Equipment cleaning supplies, as appropriate.

#### 4.0 Responsibilities

- 4.1 **Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of control and tracking of samples taken for characterization data collection, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure or provide coverage to those workers who will collect the samples.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations. He/she shall ensure by personal observation that samples are collected appropriately and chain of custody is controlled as described in this procedure.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for the control of radioactive material, coverage of radiation workers, and assurance that personnel under their cognizance observe proper precautions.
- 4.5 **Sample Collectors** - are responsible to follow the instructions of the project manager and Health Physics technicians to ensure compliance with this procedure.

#### 5.0 Procedure

Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in the upper 15 cm of soil, the usual sampling protocol described here is based on obtaining a sample of this upper 15 cm. Special situations, such as evaluating trends or airborne deposition, determining near surface contamination profiles, and measuring non-radiological contaminants, necessitate special sampling procedures. These special situations are evaluated and incorporated into site specific survey plans as the need arises.

Direct surface radiation measurements are to be performed at each location before initiating sampling. This may identify the presence of gross contamination, which may require that samples and equipment be treated as radioactive and handled in accordance with appropriate procedures.

- 5.1 Loosen the soil at the selected sampling location to a depth of approximately 15 cm, using a trowel or other digging implement.
- 5.2 Remove large rocks, vegetation, and foreign objects (these items may also be collected as separate samples, if directed.)
- 5.3 Place approximately 2 kg of this soil into a plastic bag-lined cardboard container or geology sample bag.

**MKMP-026**  
**Soil and Sediment Sampling**

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5.4 Seal the bag using a twist-tie, cap, and tape the cap in place (or tie the sample bag strings). Tape plastic bags over the seal.

5.5 Label and secure the sample container.

**NOTE:** A box shall be lined with plastic and approved absorbent material prior to placing samples inside the box if the samples are to be shipped for analysis. A load rating stamped on the bottom of the box shall be noted. This rating shall not be exceeded to prevent degradation of the box during shipping.

5.6 The container should be placed in a cardboard box (also properly labeled) for storage or shipping.

**CAUTION:** Samples must be contained within an outer protective cover (such as a second bag) to prevent (minimize) cross contamination of samples from one site to another.

5.7 Document all samples obtained on MKMP Form 26-1, Sample Status Log and in the sample log book if applicable.

5.8 Sample Chain of Custody records shall be documented in accordance MKMP 029.

**CAUTION:** DO NOT proceed to the next sample site or leave the area with any equipment until you have completed Steps 5.9 AND 5.10.

5.9 Clean sampling tools before proceeding to the next sampling location.

5.10 Survey sampling equipment to ensure no removable contamination exists which could result in cross contamination of samples.

6.0 Attachments

MKMP Form 26-1      Sample Status Log



MKMP-027  
WATER SAMPLING



## Radiation Safety Procedure

for

### Water Sampling

**MKMP-027**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, KRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-027**  
**Water Sampling**

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**1.0 Purpose and Scope**

- 1.2 The purpose of this procedure is to provide guidelines for collecting water samples.
- 1.2 The scope of this procedure is limited to collecting samples of water on MKM field projects. This procedure is applicable to all water samples taken by MKM to fulfill a requirement for sampling. It is not intended for informal sampling, however, the techniques used should be followed even in the case of "information only" samples.

**2.0 General****2.1 Quality Control**

- 2.1.1 Instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.
- 2.1.2 Surveillance of this procedure (in use) shall be performed at least annually to verify that operations are within the guidelines of this procedure. Any time this procedure is in effect, the project manager should ensure by personal observation that samples are collected and controlled appropriately.

**3.0 References, Records and Equipment****3.1 References**

SHSP	Site Health and Safety Plan
SDWP	Site Detailed Work Plan
NUREG/CR-5849	<i>Manual for Conducting Radiological Surveys in Support of License Termination</i>
NUREG/CR-5512	<i>Residual Radioactive Contamination From Decommissioning</i>
MKMP - 029	Sample Chain of Custody
MKMP - 026	Soil and Sediment Sampling
MKMP - 028	Material Sampling

**3.2 Records**

The following records will be generated and retained in the permanent project file as a result of using this procedure.

MKMP Form 26-1      Sample Status Log

**3.3 Equipment and Supplies**

- Bailing implement: cup, can, pail, etc.
- Borehole Bailer.
- Submersible pump, vacuum, or peristaltic pump with power source.
- Plastic sampling container.
- Funnel.

**MKMP-027**  
**Water Sampling**

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- Large Erlenmeyer Flask with two-hole stopper.
- Tygon tubing.
- Labels and security seals.
- Indelible pen.
- Record forms.

#### 4.0 Responsibilities

- 4.1 **Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of sampling and control and tracking of samples taken for characterization data collection, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure or provide coverage to those workers who will collect the samples.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations. He/she shall ensure by personal observation that samples are collected appropriately and chain of custody is controlled as described in this procedure.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for the control of radioactive material, coverage of radiation workers, and insurance that personnel under their cognizance observe proper precautions.
- 4.5 **Sample Collectors** - are responsible to follow the instructions of the project manager and Health Physics technicians to ensure compliance with this procedure.

#### 5.0 Procedure

##### 5.1 **Surface Sample**

- 5.1.1 Scoop water with a clean dipper carefully from the selected location, being careful to avoid collection of bottom sediment or vegetation. Remember, this is a *water* sample!
- 5.1.2 Using a clean funnel, transfer the water into a container.
- 5.1.3 Collect a required volume of water for the analysis.
- 5.1.4 Cap the container tightly to prevent sample contamination and potential loss of sample material.
- 5.1.5 Label and secure the sample.

**MKMP-027  
Water Sampling**

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**NOTE:** Line the shipping box with plastic and approved absorbent material prior to placing samples inside the box if the samples are to be shipped for analysis. The project manager shall approve packaging material and method.

**NOTE:** A load rating is stamped on the bottom of the shipping box. Do not exceed this rating when shipping materials in this box to prevent degradation of the box during shipping.

5.1.6 The container should be placed in a cardboard box (also properly labeled) for storage or shipping.

**CAUTION:** Samples must be contained within an outer protective cover to prevent cross contamination of samples..

5.1.7 Document Samples on MKMP Form 26-1, Sample Collection Log.

5.1.8 Sample Chain of Custody records shall be documented.

5.1.9 Transfer the sample to the laboratory for analysis.

**CAUTION:** DO NOT proceed to the next sample site or leave the area with any equipment until you have completed Steps 5.1.10 AND 5.1.11.

5.1.10 Clean all sampling tools before proceeding to the next sample location.

5.1.11 Survey sampling equipment to ensure no removable contamination exists which could result in cross contamination of samples.

5.2 Subsurface (well or borehole) Sample (Option 1)

5.2.1 Lower the bailer apparatus into the borehole or other below surface source of water.

5.2.2 Allow water to flow into the bailer (use care to avoid buildup of sediments on the bailer diaphragm, which could prevent the diaphragm from sealing).

5.2.3 Retrieve the bailer and empty contents through a funnel into a plastic sampling container.

5.2.3 Repeat procedure until a total volume of water has been collected.

5.2.4 Continue with steps 5.1.4 thru 5.1.11.

5.3 Subsurface Sample (Option 2)

5.3.1 Lower the pump (if submersible) until the inlet end of the tubing contacts the water surface.

**MKMP-027**  
**Water Sampling**

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5.3.2 Start pump and collect water in large flask.

5.3.3 Empty flask into a plastic sampling container as necessary.

5.3.4 Repeat procedure until a total volume of water has been collected.

5.3.5 Continue with steps 5.1.4 thru 5.1.11.

6.0 Attachments

None

MKMP-028  
MATERIAL SAMPLING



## Radiation Safety Procedure

for

### Material Sampling

**MKMP-028**

**Revision 0**

Reviewed By: *D.J. Wells* 8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By: *T.J. O'Dou* 8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-028**  
**Material Sampling**

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**1.0 Purpose and Scope**

- 1.1 The purpose of this procedure is to provide guidelines for collecting samples of material for analysis.
- 1.2 The scope of this procedure is limited to collecting samples of materials on MKM field projects. This procedure is applicable to all material samples taken by MKM to fulfill a requirement for sampling. It is not intended for soil or water sampling or for informal sampling, however, the techniques used should be followed even in the case of "information only" samples.

**2.0 General**

**2.1 Quality Control**

Instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.

Surveillance of this procedure (in use) shall be performed at least annually to verify that operations are within the guidelines of this procedure. Any time this procedure is in effect, the project manager should ensure by personal observation that samples are collected and controlled appropriately.

**3.0 References, Records and Equipment**

**3.1 References**

SHSP	Site Health and Safety Plan
SDWP	Site Detailed Work Plan
NUREG/CR-5849	<i>Manual for Conducting Radiological Surveys in Support of License Termination</i>
NUREG/CR-5512	<i>Residual Radioactive Contamination From Decommissioning</i>
MKMP - 002	Alpha/Beta Sample Counting Instrumentation
MKMP - 029	Sample Chain of Custody
MKMP - 026	Soil and Sediment Sampling
MKMP - 027	Water Sampling

**3.2 Records**

The following records will be generated and retained in the permanent project file as a result of using this procedure;

MKMP Form 26-1, Sample Status Log

**3.3 Equipment and Supplies**

Equipment is chosen based on the type of material to be sampled. The following list represents some possibilities.

**MKMP-028**  
**Material Sampling**

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- Paint sampling: heat gun, paint stripper solution, hammer and chisel.
- Drains or pipes: plumber's snake, swabs.
- Residues: towels, scoops.
- Concrete or asphalt: core bores, hammer and chisel.
- Metals: Emery cloth or scraping tool.
- Dusts: Scraping tool and plastic bags.
- Record forms, Sample Chain of Custody forms, and sample log (Form 26-1)..

#### 4.0 Responsibilities

- 4.1 **Program Manager** - The Program Manager is responsible for ensuring that all personnel assigned the tasks of sampling and control and tracking of samples taken for characterization data collection, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Radiation Safety Officer** - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure or provide coverage to those workers who will collect the samples.
- 4.3 **Project Manager** - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations. He/she shall ensure by personal observation that samples are collected appropriately and chain of custody is controlled as described in this procedure.
- 4.4 **Health Physics Technicians** - Health Physics Technicians are responsible for the control of radioactive material, coverage of radiation workers, and ensurance that personnel under their cognizance observe proper precautions.
- 4.5 **Sample Collectors** - are responsible to follow the instructions of the project manager and Health Physics technicians to ensure compliance with this procedure.

#### 5.0 Procedure

- 5.1 **Methods for collecting miscellaneous samples** should be determined based on the characteristics of the sample media. Care should be taken to limit the potential for spreading contamination during sample collection.

Sample quantities should be determined based on the following:

- Type of analyses required
- Number of analyses requested
- Detection sensitivity required of analytical result
- Estimated activity level of material

- 5.2 **Remove material to be sampled** by using the tools required and contamination control techniques to prevent loss of material from the area sampled. Label and secure all samples. Record pertinent information on Form MKMP 26-1 and in the sample log book if used.

**MKMP-028**  
**Material Sampling**

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**CAUTION: DO NOT** proceed to the next sample site or leave the area with any equipment until you have completed Steps 5.2.1 AND 5.2.2.

- 5.2.1 Clean all sampling tools before proceeding to the next sampling location.
- 5.2.2 Survey sampling equipment to ensure no removable contamination exists which could result in cross contamination of samples.
- 5.3 Samples that require gamma, beta, or alpha spectroscopy or isotopic discrimination of any type shall be sent to an approved laboratory for analysis.
- 5.4 Samples that can fit into a 1/8" x 2" planchette that require gross alpha and/or beta/gamma results may be counted in a Ludlum 2929 or equivalent.
- 5.4.1 Ensure that minimum counting system sensitivity requirements are met by calculating MDA values for alpha and beta, as applicable. Increase sample count time and background count time, or use shielding to lower background count rate as necessary to reduce MDA. If minimum MDA requirements cannot be met by these methods, forward sample to off-site laboratory for analysis.
- 5.4.2 Place the sample into a planchette with the surface of measurement up.
- 5.4.3 Count sample for an appropriate length of time..
- 5.4.4 Record count and counting time data on Form MKMP 2-4 and calculate activity estimates.
- 5.4.5 If the sample will be shipped to a laboratory for analysis, then complete steps 5.4.6 through 5.4.9. Chain of Custody records shall be documented, if applicable.
- NOTE:** Line the shipping box with plastic and approved absorbent material prior to placing samples inside the box if the samples are to be shipped for analysis. The project manager shall approve packaging material and method.
- NOTE:** A load rating is stamped on the bottom of the shipping box. Do not exceed this rating when shipping materials in this box to prevent degradation of the box during shipping.
- 5.4.6 The container should be placed in a cardboard box (also properly labeled) for storage or shipping.

**CAUTION: Samples must be contained within an outer protective cover to prevent cross contamination of samples.**

- 5.4.7 Document all samples taken on the MKMP Form 26-1, Sample Status Log.
- 5.4.8 Sample Chain of Custody records shall be documented.

**MKMP-028  
Material Sampling**

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**5.4.9 Transfer the sample(s) to the laboratory for analysis.**

**6.0 Attachments**

None

**MKMP-029**  
**SAMPLE CHAIN OF CUSTODY**



## Radiation Safety Procedure

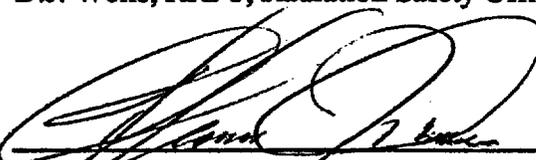
for

## Sample Chain of Custody

**MKMP-029**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-029**  
**Sample Chain of Custody**

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**1.0 Purpose and Scope**

- 1.1 The purpose of this procedure is to establish administrative controls for transfer of samples collected for characterization to a subcontractor laboratory for analysis. Adherence to this procedure will provide reasonable assurance that there will not be a disassociation between the sample taken and the documented analysis of that sample.
- 1.2 This procedure will be used at all MKM work sites which require sample analysis to facilitate collection of data to be used in the official evaluation of the radionuclide or hazardous materials content of the sample.

**2.0 General**

**2.1 Quality Control**

- 2.1.1 Instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.
- 2.1.2 Surveillance shall be performed at least annually to verify that operations are within the guidelines of this procedure. Any time this procedure is in effect, the project manager should ensure by personal observation that samples are collected and controlled appropriately.

**3.0 References, Records and Equipment**

**3.1 References**

RSM      Radiation Safety Program Manual

**3.2 Records**

Records of the following shall be maintained for each sample collected:

MKMP Form 29-1      Chain of Custody/Analysis Record  
MKMP Form 29-2      Chain of Custody and Sample Tracking Log

**3.3 Equipment**

As required for samples to be taken and analyzed.

**4.0 Responsibilities**

- 4.1 Program Manager - The Program Manager is responsible for ensuring that all personnel assigned the tasks of control and tracking of samples taken for characterization data collection, are familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.

## MKMP-029

Sample Chain of Custody

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- 4.2 **Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training of personnel working with radioactive material. The RSO ensures Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure or provide coverage to those workers who will collect the samples.**
- 4.3 **Project Manager - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations. He/she shall ensure by personal observation that samples are collected appropriately and chain of custody is controlled as described in this procedure.**
- 4.4 **Health Physics Technicians - Health Physics Technicians are responsible for the control of radioactive material, coverage of radiation workers, and to ensure that personnel under their cognizance observe proper precautions.**
- 4.5 **Sample Collectors are responsible to follow the instructions of the project manager and Health Physics technicians and to ensure compliance with this procedure.**

5.0 Procedure

- 5.1 **The sample collector must initiate a chain of custody form by filling in the requested information. Identifying data for the sample must also be entered into the sample log in accordance with the sampling/work plan for the job.**

5.1.1 **The Chain of Custody/Analysis Record must be completed in its entirety as follows:**

**Project Number - A unique number which associates the project to specific records of analysis. This is as assigned by the Program Manager.**

**Project Name - Name of the facility and the type of project. For example: "LANL - Computer Program Development".**

**Required Report Date - The date which you expect to get sample results by. Be realistic, ASAP is not appropriate here.**

**Lab Contact and Lab Phone - The number you called and the person at the laboratory you spoke with.**

**Sample ID # - The unique number recorded on the status log (Form MKMP 29-2), on the sample and on the chain of custody for a sample.**

**Sample Type - Air, Water, Soil, Oil, etc. as appropriate. Basically this answers the question, what is it a sample of?**

**Container - Describe the sample container such as; glass jar, Marinelli Beaker, Petri Dish, plastic bag, etc.**

**Volume - Record the volume and units of the volume such as; 1000 ml, 2.0 L, 5<sup>E6</sup> cc, 1 gal., etc.**

**MKMP-029**  
**Sample Chain of Custody**

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**Preservative** - Indicate the chemical name or brand name of preservative used in the sample.

**Analysis Req'd** - Indicate the desired type of analysis for the laboratory to conduct.

**Date** - The date the sample was taken.

**Notes** - Any other information for the laboratory. If there is need for a verbose note, place a circled number in this box and attach an addendum with the note written in detail prefaced with the circled number.

**Lab ID#** - A number assigned by the laboratory.

**Sample TAT Req'd** - The needed turnaround time for sample analysis. Be realistic, ASAP is not appropriate and short times may lead to increased (unnecessary) costs. Check with the Project Manager.

Check all sample characteristics that apply to this sample. For example; a sample may be Flammable, Hazardous, Liquid, and Radioactive.

- 5.1.2 Custody of samples must be maintained at all times to ensure appropriate assignment of the result to a sample. In custody tracking, the 1) Relinquished by is the person who took the sample or someone who was there when it was taken. The date and time and the person who took custody is recorded by signature along with the date and time received. These dates and times must match.
- 5.2 Proper chain of custody is maintained when the sample is controlled under the direct surveillance of an individual; in a controlled access facility, or the sample is in a tamper-proof container.
- 5.3 If the sample is to be transported by any means other than hand delivery by the custodial individual, security seals must be used. Log the seal number in the sample log and include a copy of the chain of custody form with the sample container.
- 5.4 Upon transfer of the samples to another individual, that individual shall sign as recipient. A copy of the chain of custody form will be maintained for record keeping purposes while the original will remain with the sample.
- 5.5 Upon arrival of the sample at the laboratory, the laboratory recipient shall inspect the sample for signs of tampering. If indication of tampering is noted, the laboratory shall notify site personnel who will collect another sample.
- 5.6 Once the sample is in the custody of the laboratory, it shall be maintained in accordance with the laboratory's chain of custody and quality assurance procedures.
- 5.7 Samples sent to an off site laboratory for analysis shall be returned to the site after processing for disposal if this is the condition of the laboratory contract. There may be occasions where the laboratory will hold and/or dispose of the samples.

**MKMP-029**  
**Sample Chain of Custody**

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**6.0 Attachments**

- MKMP Form 29-1      Chain of Custody/Analysis Record**
- MKMP Form 29-2      Chain of Custody and Sample Tracking Log**



MKM Engineers, Inc.

# Chain of Custody / Analysis Record

Document No \_\_\_\_\_  
Page \_\_\_ of \_\_\_

Project Number \_\_\_\_\_  
Project Name \_\_\_\_\_  
Project Manager \_\_\_\_\_  
Project Phone \_\_\_\_\_

Project Fax \_\_\_\_\_  
Req'd Report Date \_\_\_\_\_  
Lab Contact \_\_\_\_\_  
Lab Phone \_\_\_\_\_

SEND REPORT TO:

#	Sample ID #	TYPE	CONTAINER	VOLUME	PRESERVATIVE	ANALYSIS REQ'D	COLLECTION DATE	NOTES	LAB ID#
1									
2									
3									
4									
5									
6									
7									
8									

Sample TAT Req'd: \_\_\_\_\_

Notes/Comments: \_\_\_\_\_

## SAMPLE CHARACTERISTICS

Flammable       Hazardous       Gas       Liquid       BiPhase       Sp. Grav \_\_\_\_\_      Color \_\_\_\_\_  
 Corrosive       Radioactive       Solid       Sludge       TriPhase       Flash Pt. \_\_\_\_\_      Odor \_\_\_\_\_

## CUSTODY TRACKING

1) Relinquished By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_      Received By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 2) Relinquished By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_      Received By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_  
 3) Relinquished By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_      Received By: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_



MKMP-030  
DOCUMENT CONTROL



## Radiation Safety Procedure

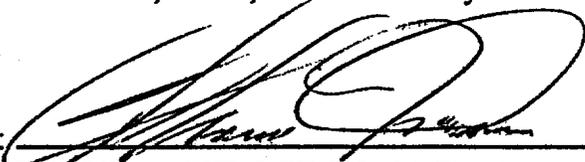
for

### Document Control

**MKMP-030**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, KRPT, Radiation Safety Officer Date

Approved By:  5/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date



**MKMP-030  
Document Control**

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**1.0 Purpose and Scope**

- 1.1 This procedure provides the methods MKM utilizes in control of documents associated with license requirements, projects, personnel, and equipment.
- 1.2 Adherence to this procedure will provide reasonable assurance that information will be retrievable.
- 1.3 This procedure is intended to ensure that authorized persons receive these documents. MKM managers are responsible to use good judgement in document recipients.
- 1.4 This procedure will be used by MKM personnel to ensure proper control of information such as procedures, reports, dose records, medical records, training records, and any records which may be required to demonstrate compliance with NRC license conditions.

**2.0 General**

**2.1 Types of Records which must be controlled**

- 1. Instrument Calibration Records
- 2. Instrument Source Check Records
- 3. Radiation Survey Forms
- 4. Contamination Survey Forms
- 5. Medical Records)
- 6. Training Records
- 7. Dosimetry Records
- 8. Decontamination Documents
- 9. Project Logs
- 10. Project Reports (MKMP-33)
- 11. Radioactive Material Transportation Records
- 12. Radioactive Material Disposal Records
- 13. Radioactive Source Transfer Receipts
- 14. Data Collection Forms (Work Procedures)

**MKMP-030**  
**Document Control**

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- 15. Sample Collection Forms
- 16. Sample Chain of Custody Records
- 17. Emergency Response Documentation
- 18. All other forms required by MKM procedures.
- 19. Document Distribution and Transmittal Forms
- 20. Respirator Issue Logs and History Records
- 21. Bioassay Records
- 22. Personnel Contamination Reports
- 23. Condition Adverse to Quality Reports

**2.2 Definitions**

- 1. Forms - Prepared documentation provided to ensure compliance with requirements. Forms have predefined fields for recording data.
- 2. Logs - Logs provide day to day documentation in a chronological fashion to identify what occurred during the execution of a project.
- 3. Reports - Reports provide a compilation of project data, the analysis of that data and the conclusions derived from the data analysis.
- 4. Quality Records - Quality Records (Records) shall be recognized as any compilation of forms, logs, or reports which pertain to a project or to regulatory compliance.
- 5. Receipts - Documentation of transfer of records from one individual or organization to another.

**2.3 Quality Control**

- 2.3.1 The project manager shall ensure by continuous supervision and surveillance that quality records are properly prepared, are accurate, neatly prepared, properly maintained during preparation, and are periodically reviewed during all project activities.
- 2.3.2 The project manager shall ensure that all records are present at the end of a project and that records are safely maintained during transfer or shipment to the location where they will be archived.
- 2.3.3 Records maintained at the project site, shall be reviewed periodically during a project by the project manager to ensure compliance with this procedure.

**MKMP-030**  
**Document Control**

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2.3.4 The Document Control Coordinator shall report the status of all controlled documents at least quarterly to the program manager.

**3.0 Records, References and Equipment**

**3.1 Records**

MKMP Form 30-1	Document Distribution Log (DDL)
MKMP Form 30-2	Document Distribution Record (DDR)
MKMP Form 30-3	Document Transmittal Record (DTR)

**3.2 References**

All MKM Procedures  
Code of Federal Regulations  
License Conditions

**3.3 Equipment**

None required

**4.0 Responsibilities**

- 4.1 **Program Manager** - The Program Manager is responsible for providing equipment to enable compliance with this procedure and for ensuring that all personnel assigned the tasks of producing, validating, transferring, or controlling information subject to this procedure is familiar with this procedure, adequately trained in the use of this procedure, and have access to a copy of this procedure.
- 4.2 **Project Manager** - The Project Manager (PM) shall ensure through continuous evaluation that all project documentation is collected and recorded in accordance with Procedures, Work Plans, Health and Safety Plans, and Quality Assurance Plans. The PM is responsible for document control of all project related quality information during a project and upon completion of the project.
- 4.3 **Radiation Safety Officer** - The RSO shall ensure all radiation safety information is recorded and evaluated to ensure adequate records exist to defend the Radiation Safety Program.
- 4.4 **Document Control Coordinator** - The Document Control Coordinator (DCC) shall ensure that documents are issued, maintained, stored, and transferred in accordance with this procedure. Any deviation from compliance will be reported immediately to the program manager.
- 4.5 **Technicians** - Technicians shall ensure documentation is recorded neatly and in accordance with procedures.

**MKMP-030**  
**Document Control**

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**5.0 Procedure****5.1 Records Control**

Each controlled document shall be stamped on the front page with the controlled document number as issued in the controlled document log.

**5.2 Records Preparations**

Records shall be prepared in dark ink and shall be neat and easily readable. Pre-prepared forms shall be used when available to collect information such as survey data or instrument analysis results. When a procedure has not defined a form for a specific purpose, the project manager may authorize creation of the method of documentation.

**5.3 Record Transfer**

Controlled records shall be transferred using the Document Distribution Log (DDL), the Document Distribution Record (DDR), and the Document Transmittal Record (DTR).

5.3.1 The DDL shall be maintained at the Records Management facility at the MKM Las Vegas office and shall be used to maintain a log of all transfers of Quality Records.

5.3.2 The DDR shall be used to provide documentation of record transmittals.

5.3.3 The DTR shall be used to ensure transfer of records by providing a receipt of record transfer.

☛ The DTR shall be returned to the Document Control Coordinator upon receipt of the document. If a DDR is not returned to the DCC, the DCC shall contact the issuee and request a letter of receipt stating that status.

☛ Control privileges do not apply to documents issued to the NRC or any agreement state regulatory agency.

**5.4 Record Review**

All Controlled records shall be reviewed by Direct Supervisors of the record creator. This review shall be indicated by full signature on the record.

**5.5 Record Correction**

Incorrect information in records shall be corrected by the document creator if possible. In cases where the creator is not available, corrections may be made by the direct supervisor or the project manager.

5.5.1 Corrections are made by drawing a single line through the error and making the correction adjacent to the error. The line out shall be initialed and dated by the corrector.

**MKMP-030**  
**Document Control**

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**5.4 Record Retention**

Records shall be retained for the duration of the project at the project site by the project manager.

5.4.1 Upon return to the location of record management, the records shall be maintained in a fashion such that they are protected from loss or damage. Record storage shall be in accordance with federal regulations or NRC license conditions. This may be dual storage, one copy at both MKM facilities, or storage in a certified fireproof container.

5.4.2 Records shall be retained for a minimum of 10 years from the date of creation, for the duration specified in the contract which caused creation of the project, or in accordance with Federal or State regulations where applicable.

**6.0 Attachments**

- |                |                                    |
|----------------|------------------------------------|
| MKMP Form 34-1 | Document Distribution Log (DDL)    |
| MKMP Form 34-2 | Document Distribution Record (DDR) |
| MKMP Form 34-3 | Document Transmittal Record (DTR)  |





**MKM Engineers Inc.**

**Document Transmittal Record**

NAME AND TITLE OF RECIPIENT:					
QTY..	DOCUMENT TITLE	DOCUMENT NUMBER	REV NO.	DESCRIPTION	CONTROL NUMBER
DOCUMENT(S) SENT BY:					
DOCUMENT(S) SENT TO:					
NAME:					
ADDRESS:					
CITY/STATE/ZIP:					
TELEPHONE:					
PLEASE CHECK ONE OF THE FOLLOWING, SIGN AND RETURN TO SENDER:					
<input type="checkbox"/> I ACKNOWLEDGE THAT I RECEIVED THE DOCUMENT(S) OR DOCUMENT(S) REVISION(S) AND THAT I HAVE UPDATED MY RECORDS.					
<input type="checkbox"/> I AM RETURNING THE DOCUMENT(S) WITH THIS TRANSMITTAL RECORD					
<input type="checkbox"/> I HAVE DESTROYED THE OLD DOCUMENT AND I AM RETURNING ONLY THE TRANSMITTAL RECORD.					
SIGNATURE:			DATE:		
DOCUMENT TRANSMITTAL RECORD COMPLETE AND APPROVED					
SIGNATURE: _____			DATE: _____		
MANAGER					

**MKMP-031**  
**PROJECT CONTROL**

**MKMP-032**  
**RESPIRATORY PROTECTION**



## Radiation Safety Procedure

for

## Respiratory Protection

**MKMP-032**

**Revision 0**

Reviewed By:  8/28/99  
D.J. Wells, RRPT, Radiation Safety Officer Date

Approved By:  8/30/99  
T.J. O'Dou, CHP, MKM Health Physicist Date

**MKM Engineers, Inc.**

**Procedure MKMP 032  
Respiratory Protection**

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(Revision Level 0 = Original Document)**

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**MKMP-032**  
**Respiratory Protection**

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**1.0 Purpose and Scope**

- 1.1 This procedure describes the requirements and MKM policies associated with respiratory protection at MKM job sites and during any work at customer facilities. Adherence to this procedure will provide reasonable assurance that personnel exposures to airborne radioactive material will be below specified limits, personnel will remain free of contamination and contamination will not be spread beyond the designated contaminated area.
- 1.2 This procedure will be used to ensure protection of personnel from internal exposure to radioactive materials.

**2.0 General****2.1 MKM Respiratory Protection Policy**

- 2.1.1 Engineering and process controls shall be used to the extent practicable to limit the concentrations of airborne radioactive materials to levels less than 10% of Derived Air Concentration (DAC) values listed in 10 CFR 20, Appendix B, Table 1, Column 1.
- 2.1.2 When it is impractical to use engineering and process controls, or while they are being implemented, other precautionary procedures such as limiting stay times, increased surveillance and/or the use of respiratory protective equipment will be used to limit the intake of airborne radioactive materials as far below 40 DAC hours, in seven (7) consecutive days, as possible. The 40 DAC-hour control measure of 10 CFR 20.1203 will be the internal exposure limit.
- 2.1.3 Respirators should not normally be used for routine repetitive tasks but may be used for non-routine tasks. No emergency situations involving potential respiratory hazards are expected under use of this program. Periods of respirator use and overall duration of use should be kept to a minimum. Respirator users shall be allowed adequate relief from use (breaks) at reasonable intervals. The variations in job assignments and in the physical and psychological capacities and attitudes of the user shall be considered. The user may leave the area at anytime for relief from respirator use in the event of equipment malfunction, physical or psychological distress, or any other condition which requires relief.
- 2.1.4 The attached procedures of the Respiratory Protection Program shall be followed as applicable for any work involving actual or potential exposure to airborne hazardous materials.

**2.2 MKM Air Sampling Program**

The air sampling program is established to provide adequate identification of all respiratory hazards present including radiological, oxygen deficient and toxic materials.

- 2.2.1 Air sample data will be used to select the proper respirator and provide estimates of worker exposure.

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**Respiratory Protection**

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2.2.2 Air samples will be representative of the air being breathed by the worker(s).

2.3 MKM Bioassay Program

Measurements of radioactive materials in the body and/or excreted from the body will be performed as necessary for timely detection and assessment of individual intakes of radioactive materials. The techniques used, (e.g. whole body counts, urine samples, etc.) will be appropriate with respect to the material exposed.

2.3.1 Baseline bioassay data shall be obtained.

2.3.2 Periodic bioassay samples will be taken to determine the adequacy of the respiratory protection program and will be used to determine actual exposures, if any.

**CAUTION:** No personnel shall be allowed to wear a respirator without written permission from a medical doctor. This is required in order to protect workers from the physical harm which may be caused to a respiratory system which cannot handle the strain of breathing through a respirator.

2.4 Qualification of Workers

Personnel will complete baseline bioassay, physical examination, and fit test prior to initial use of respirators and at least every twelve (12) months thereafter (except fit test). Requalification/testing must occur within the twelve (12) month period.

2.4.1 Physical Examinations

Personnel will be certified by a licensed physician that the individual is physically able to use respiratory protection equipment. For radioactive materials and hazardous materials (except asbestos), this qualification is annual. For asbestos, this qualification is every six months, in accordance with 29 CFR 1910.

2.4.2 Training

Personnel shall be trained in respiratory protection. Training will be given to personnel who will wear respirators and to those personnel who will direct the work. The training will be based on the hazards to be encountered and the types of respirators to be worn. The training will include the following:

- a. Discussion of the airborne contaminants against which the wearer is to be protected, including their physical properties, DAC's, physiological actions, toxicity and means of detection;
- b. Discussion of the construction, operating principles, and the limitations of the respirator and the reasons the respirator is the proper type for the particular purpose;

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**Respiratory Protection**

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- c. Discussion of the reasons for using the respirator and an explanation of why engineering or process controls are not feasible;
- d. Instruction on the proper use of the device, including performance of a pre-use inspection and negative pressure test;
- e. Instruction in how to perform a qualitative fit test;
- f. Instruction in the proper maintenance of the respirator;
- g. Discussion of the application of available cartridges and canisters;
- h. Instruction in emergency actions to be taken in the event of malfunction of the respirator;
- i. Review of radiation and contamination hazards, including the use of other protective equipment that may be used with the respirator; and
- j. Any other special training as needed.
- k. The trainee will be required to properly perform a pre-use inspection, don, wear and remove the respirator. He/she will be given ample time to wear the device in an uncontaminated atmosphere so as to become familiar with its operation.
- l. The training shall be given by personnel who have practical experience in the selection, use and maintenance of respiratory protection equipment.

#### 2.4.3 Fit Test

A qualitative or quantitative respirator fitting test will be performed to determine the ability of each individual wearer to obtain a satisfactory fit with a negative pressure respirator. The results of the fit test will be used to select types, models and sizes of respirators for each individual user.

- a. A quantitative fit test is preferred and, if performed, an overall fit factor of at least 100 shall be obtained with a full face negative pressure respirator.
- b. A qualitative fit test with a challenge atmosphere is acceptable and should be performed according to Attachment-A "Qualitative Fit Testing". If the wearer is unable to detect penetration of the challenge agent, the fit test is satisfactory.

#### 2.5 Respirator Selection

Only respiratory protection equipment approved by NIOSH/MSHA shall be used. The respiratory protection equipment shall be selected for use based on the airborne hazard identified and DAC-hr limitations.

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Respiratory Protection**

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**2.6 Respirator Maintenance**

Respirators shall be maintained to retain their original shape, effectiveness and be in the same configuration as required by its' NIOSH/MSHA approval.

2.6.1 Respirators shall be cleaned, sanitized, and surveyed to ensure each worker is provided a clean respirator at all times.

2.6.2 Respirators shall be inspected immediately prior to each use, after cleaning, and at least monthly when available for use.

2.6.3 Replacement of parts or repairs shall be performed only by persons trained/experienced in proper respirator assembly. Replacement parts will be those designed for the particular respirator and designated by the manufacturer.

2.6.4 Respirators shall be stored to protect them against dust, sunlight, heat, extreme cold, damaging chemicals or excessive moisture. Respirators shall be stored to prevent distortion of rubber or elastomer parts.

2.6.5 All new respirators shall be cleaned, sanitized, inspected and tagged with an identification number prior to use.

**2.7 Effectiveness of the Respiratory Protection Program**

Workers shall be periodically observed working in respirators to ensure proper equipment functioning and to monitor worker stress while working.

**3.0 References, Records and Equipment**

**3.1 References**

RSM	Radiation Safety Manual
MKMP-007	Air Sampling and Sample Analysis

**3.2 Records**

Records of the following shall be maintained for each individual who wears respiratory protection devices (other than dust masks) at any MKM work site:

3.2.1 Physical Qualifications

3.2.2 Fit Testing

3.2.3 Respirator Issue

3.2.4 Respirator Maintenance

3.2.5 Bioassay Data - Before and after exposure

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Respiratory Protection

3.2.6 Air Sample Results

3.3 Equipment

See individual appendices.

4.0 Responsibilities

- 4.1 Program Manager - The Program Manager is responsible for ensuring that all personnel using respirators, are familiar with this procedure, adequately trained in the use of respirators, and have access to a copy of this procedure.
- 4.2 Radiation Safety Officer - The Radiation Safety Officer (RSO) is responsible for training of personnel using respirators. The RSO ensures workers are qualified by training and experience to perform the requirements of this procedure.
- 4.3 Project Manager - The Project Manager is responsible for ensuring the conditions of this procedure are complied with during all project operations. He/she shall ensure by personal observation that respiratory protection operations are conducted as described in this procedure.
- 4.4 Health Physics ~~Technicians~~ - Health Physics Technicians are responsible for the control of radioactive material, coverage of radiation workers, and ensurance that personnel under their cognizance observe proper respiratory protection precautions.
- 4.5 All Personnel - Are responsible to ensure all respiratory protection equipment under their control is checked in accordance with the provisions of this procedure, are responsible to ensure they are currently qualified by medical examination and training before putting on a respirator, and shall ensure that all provisions of this procedure are complied with at all times.

5.0 Procedure

MKM personnel shall conduct all operations associated with respiratory protection in accordance with the following appendices to this procedure:

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- A. QUALITATIVE FIT TEST
- B. USE OF THE MSA ULTRA-VUE RESPIRATOR
- C. RESPIRATOR ISSUE & DAC-HOUR TRACKING
- D. RESPIRATOR MAINTENANCE
- E. RESPIRATORY PROTECTION ISSUE/USE LOG
- F. RESPIRATORY PROTECTION EQUIPMENT HISTORY RECORD

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Respiratory Protection

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Appendix A

QUALITATIVE FIT TESTING

1.0 PURPOSE

This procedure provides instructions for performing qualitative fit testing of respirators.

2.0 EQUIPMENT

2.1 Qualitative Fit Test Materials

2.1.1 Irritant Smoke Test

- a. Ventilation smoke tubes, stannic chloride (MSA Part# 5645 or equivalent)
- b. Aspirator bulb
- c. Tubing

2.1.2 Isoamyl Acetate Test

- a. Isoamyl acetate
- b. Tissue, cloth, swab, or brush

2.2 Respirator, full face piece, cartridge type, negative pressure, air purifying.

3.0 PRECAUTIONS AND LIMITATIONS

- 3.1. Verify that the individual has met the physical and training requirements and that the individual has no facial hair that may interfere with the proper operation of the respirator.
- 3.3 The individual administering the test should avoid breathing the test agent.
- 3.3 Exercise caution when handling irritant smoke tubes. Observe the precautions listed on the box and do not allow the crystals inside the tube to contact skin.
- 3.4 Verify that the respirator used for the fit test is in good working condition.
- 3.5 Disinfect each fit test respirator by wiping with a disinfectant cloth between each fit test.
- 3.6 Isoamyl acetate shall not be used when only HEPA cartridges are worn.
- 3.7 DO NOT direct the test material directly at filters or combination cartridges.

**MKMP-032**  
**Respiratory Protection**

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**4.0 PROCEDURE**

**4.1 Test Method (perform one of the tests below)**

4.1.1 Irritant smoke may be used when either HEPA or combination vapor and HEPA cartridges are worn.

4.1.2 Isoamyl acetate shall not be used when HEPA only cartridges are worn.

**4.2 Irritant Smoke Test**

4.2.1 The test subject will perform a pre-use inspection, don the respirator and perform a negative pressure test.

4.2.2 If NOT already done, break off the ends of the smoke tube so that a small hole results on each end.

4.2.3 Attach the smoke tube to the aspirator bulb and a piece of tubing to the end of the smoke tube to be directed at the respirator.

4.2.4 Aspirate a small amount of smoke to check that the assembly works.

4.2.5 Position test subject down wind of the tester.

4.2.6 Instruct the test subject to close their eyes.

4.2.7 Aspirate the smoke around the respirator sealing area slowly.

4.2.8 Instruct the test subject to perform the following exercises (each approximately 30 seconds) while continuing to aspirate smoke around the sealing surfaces:

- a. Normal breathing
- b. Deep breathing
- c. Move head from side to side
- d. Move head up and down
- e. Talk
- f. Frown
- g. Normal breathing

4.2.9 If no odor or irritation is detected, the test is satisfactory.

4.2.10 If leakage is detected (odor or irritation), stop the test. The individual may adjust the fit or obtain another device and repeat the test.

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4.3 Isoamyl Acetate

4.3.1 Perform step 4.2.1

4.3.2 The test should be conducted in an area with a minimum of air movement.

4.3.3 Saturate a tissue, brush or piece of cloth with isoamyl acetate.

4.3.4 Pass the material around the respirator sealing area slowly.

4.3.5 Have the individual perform the actions of B.8 above while continuing to pass the material around the respirator sealing areas.

4.3.6 If a banana odor is not detected, the test is satisfactorily completed.

4.3.7 If leakage is detected (banana odor) then go to step 4.2.10.

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**Appendix B**

**USE OF THE MSA ULTRA-VUE RESPIRATOR**

**1.0 PURPOSE**

This procedure provides guidelines for the proper use of the MSA ULTRA-VUE air purifying respirator (or equivalent).

**2.0 EQUIPMENT**

**2.1 MSA ULTRA-VUE RESPIRATOR (or equivalent)**

**2.2 Cartridges**

**2.2.1 Ultra-Vue HEPA filter cartridge (or equivalent) or;**

**2.2.2 Approved combination cartridge**

**3.0 PRECAUTIONS AND LIMITATIONS**

**3.1 When wearing this device, personnel are required, as soon as practical, to leave areas (removing the respirator, if necessary) in case of equipment malfunction, undue physical or psychological stress, procedural or communication failure, significant deterioration of operational conditions, or any other conditions that might require relief. Should such a condition occur, the individual will inform their supervisor.**

**3.2 Follow good work practices when using this device.**

**3.3 An individual may re-wear their assigned respirator during a shift provided that the interior of the face piece has no loose surface contamination above clean limits, is less than 0.1 mr/hr, and completes an additional pre-use inspection each time the device is donned.**

**3.4 DO NOT USE THIS DEVICE IN OXYGEN DEFICIENT OR IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH) ATMOSPHERES. THIS DEVICE DOES NOT PROVIDE OXYGEN.**

**3.5 Observe any limitations on the cartridge used.**

**4.0 PREREQUISITES**

**4.1 Use of the respirator is required.**

**4.2 Documentation of issue has been performed.**

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**5.0 PROCEDURE**

5.1 Obtain the respirator.

5.2 Ensure the respirator has a current inspection.

5.3 Visually inspect the device.

5.3.1 Check that the filter cartridge is correctly installed.

5.3.2 Check the tightness of connections and the condition of the face piece and head harness. Special attention is to be given to rubber or elastomer parts to ensure that they are pliable and flexible and not deteriorating.

5.4 Don the respirator.

5.4.1 Check that all head band straps are extended.

**CAUTION: IF A SURGEONS CAP OR HOOD IS USED, ENSURE IT DOES NOT PROTRUDE INTO ANY FACE PIECE SEALING AREA.**

5.4.2 Insert chin into face piece and pull head harness back over the head. This may be accomplished by either pulling the harness over the head while inserting the face or initially placing the straps over the lens, inserting the face, then pulling the harness over the head.

5.5 Adjust the straps as follows:

5.5.1 Pull the two chin straps straight back.

5.5.2 Pull the two temple straps straight back.

5.5.3 Push the head band down on the back of the head, being careful not to place it on the neck.

5.5.4 Re-tighten the chin straps as necessary.

5.5.5 Re-tighten the temple straps as necessary.

5.5.6 Tighten the forehead strap if necessary.

5.6 Conduct a negative pressure test:

5.6.1 Place fingers over the filter inlet ports. If a combination cartridge is used, place palm over the inlet port.

5.6.2 Inhale gently so the mask collapses.

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5.6.3 Hold breath for 5-10 seconds.

5.6.4 If any leakage is detected, readjust the head harness and face piece.

5.6.5 Repeat until no leakage is detected.

5.6.7 If a satisfactory seal cannot be obtained, the individual shall not wear the device and will notify their supervisor of the condition.

5.7 Note the time of work area entry and exit.

**CAUTION: DO NOT GRASP THE RESPIRATOR BY THE FILTER CARTRIDGE WHEN REMOVING IT.**

5.8 Removal

5.8.1 Remove the respirator by bending forward, grasping the snout area, and pulling the face piece out and away from the face.

5.8.2 Place the respirator into an appropriate container (bag).

5.8.3 Return the device to the storage area and complete the Respirator Issue/Use Log (MKMP Form 32-1).

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**Appendix C**

**RESPIRATOR ISSUE AND DAC-HOUR TRACKING**

**1.0 PURPOSE**

This procedure provides instruction for issuing respirators and tracking Derived Air Concentration-hours (DAC-HRS). DAC-HRS are a measure of exposure to airborne radioactive materials.

**2.0 EQUIPMENT**

MSA Ultra-Vue full face piece air purifying respirators equipped with the proper purifying filter (or equivalent).

**3.0 PRECAUTIONS AND LIMITATIONS**

- 3.1 Use of a respirator is required when airborne radioactivity concentrations cannot be maintained at less than 25% of DAC values (Table 1, Column 1, Appendix B, 10 CFR 20).
- 3.2 Personnel shall not exceed 40 DAC-hrs in any seven consecutive days.
- 3.3 Calculated DAC-hrs greater than or equal to two (2) in one day or ten (10) in any seven consecutive days shall be recorded. Exposures exceeding these guidelines will be evaluated by bioassay. If the bioassay results indicate;
- 3.3.1 a higher value, then the higher value shall be recorded.
- 3.3.2 a lower value, then the lower value MAY be recorded.
- 3.4 Periodic surveillance of individuals working in respirators will be performed to evaluate actual exposures and monitor workers stress and equipment performance. Any problems shall be reported to the job supervisor.

**CAUTION: Contact lenses shall not be worn while wearing a respirator**

**4.0 PREREQUISITES**

- 4.1 The individual has met the physical, training and fit test wearer requirements.
- 4.2 The individual has no facial hair which could interfere with the proper operation of the respirator.

**5.0 PROCEDURE**

- 5.1 Verify that the individual meets the prerequisites.
- 5.2 Verify that the respirator is required for the work the individual is to perform.

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- 5.3 Issue the respirator and complete the applicable blocks of the Respirator Issue/Use Log (MKMP Form 32-1).
- 5.4 Remind the individual to perform a pre-use inspection, negative pressure test, and to keep track of the actual time the respirator was worn.
- 5.5 At the end of each use period, or not later than the end of the shift, complete the remainder of the Respirator Issue/Use Log.
- 5.6 As soon as air sample data is available, calculate the DAC-hrs of exposure. See 5.3 above.
  - 5.6.1 If the DAC-hrs meet the record requirement, then record the calculated DAC-hrs. If not, then N/A the DAC-hrs block.
  - 5.6.2 
$$\text{DAC-hrs} = \frac{\text{time in area (hrs.)} \times \text{total DAC fraction}}{\text{respirator protection factor}}$$
  - 5.6.3 Respirator protection factor for particulate filters (HEPA or combination). Reference 10 CFR 20, Appendix A for additional information.
- 5.7 Retain all Respirator Issue/Use Logs.

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**Appendix D**

**RESPIRATOR MAINTENANCE**

**1.0 PURPOSE**

This procedure provides instruction for the inspection and maintenance of MSA Ultra-Vue (or equivalent) negative pressure air purifying respirators.

**2.0 EQUIPMENT AND SUPPLIES**

- disinfecting wipes
- plastic bags
- tape
- rags or sponges
- warm (approximately 120°F) water
- spare parts as required by the manufacturers instructions
- Clorox (or equivalent)
- MSA cleaner/sanitizer (or equivalent)
- soft bristle brush

**3.0 PRECAUTIONS AND LIMITATIONS**

- 3.1 Replace any questionable or faulty parts including rubber components that show wear or distortion. Replacement parts shall be those specified by the manufacturer.
- 3.2 Respirators will be assigned and tagged with a unique identification number. DO NOT tag the device in such a manner as to interfere with the proper operation.
- 3.3 Records will be maintained of all maintenance activities including cleaning/sanitizing, inspections and parts replacement.
- 3.4 HEPA cartridges shall not be re-used except as allowed in SOP #2 (by the same individual in the same shift after survey).
- 3.5 All respirators shall be cleaned and inspected when new, prior to initial issue and monthly at a minimum thereafter.
- 3.6 Respirator assigned to specific individuals shall be cleaned, surveyed and inspected at least at the end of each shift, prior to re-use, or more often as necessary.

**4.0 PREREQUISITES**

Personnel performing respirator inspections shall be trained in the use of this procedure. No attempt shall be made to conduct repairs beyond the scope of the manufacturer's instructions.

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**5.0 PROCEDURE****5.1 Cleaning**

**CAUTION:** Be sure to control wash water. Do not release the water to an uncontrolled drain without demonstrating by sample analysis that it meets release criteria. Do NOT soak or attempt to wash filters.

- 5.1.1 Remove the HEPA cartridge and properly dispose of as radioactive waste (if required).
- 5.1.2 Survey the respirator and cartridge to determine extent of contamination. Respirators with  $< 50,000$  DPM/100 cm<sup>2</sup> shall be soaked prior to cleaning. (**Do Not** soak filters under any circumstances.)
- 5.1.3 Fill a container with warm water. Add one package of MSA cleaner/sanitizer, or 2 fluid ounces of chlorine bleach per gallon of water used.
- 5.1.4 Gently scrub the respirator with a soft bristle brush or cloth for at least two (2) minutes.
- 5.1.5 Thoroughly rinse the respirator in warm water and allow it to air dry.
- 5.1.6 Survey the respirator after it is completely dry for loose and fixed contamination. Respirators which indicate  $< 1000$  DPM/100 cm<sup>2</sup> beta-gamma, 100 DPM/100 cm<sup>2</sup> alpha or  $< 0.1$  mr/hr fixed beta-gamma shall not be used. Repeat washing as above.
- 5.1.7 Document the survey results for each respirator.

**5.2 After-use or New Inspections**

- 5.2.1 Examine the face piece for dirt, cracks, tears or distortion.
- 5.2.2 Examine the head harness for breaks, tears, loss of elasticity or excessively worn serrations which might permit slippage. Check that the buckles are operational and free of defects.
- 5.2.3 Remove the exhalation valve cover and examine the valve for foreign material (dust, hair, dirt). Inspect the valve seat for cracks, tears, or distortion of the valve material. Check that the valve and seat are properly mounted and replace the valve covers.
- 5.2.4 Inspect the inhalation valve and seat for damage and foreign material. Inspect valve for cracks, tears or distortion. Check that the valve and seat are properly mounted and connection is tight. Check that the filter mounting coupling is not cracked and threads are in good working condition.
- 5.2.5 Examine clamps and connections and ensure they are tight and secure.
- 5.2.6 Check that there is a gasket in the inlet mounting assembly (coupling) and that it is not worn or deteriorated and is properly installed.

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- 5.2.7 Inspect the speaking diaphragm for damage or deterioration.
  - 5.2.8 Check that the lens is not cracked or badly scratched so as to impair visibility. Check that the lens position and frame are securely mounted and in good condition.
  - 5.2.9 Install a NEW HEPA filter cartridge or other cartridge as directed by supervision. Be sure to check for gasket on the cartridge when it is installed (if required).
  - 5.2.10 Check that the face piece is tagged with an identification number.
  - 5.2.11 Lightly disinfect the interior of the face piece with a disinfectant wipe.
  - 5.2.12 Place the respirator in a plastic bag and tape the bag closed.
  - 5.2.13 Record on the bag the data the respirator was cleaned, inspected and surveyed and the signature of the person performing the above.
  - 5.2.14 Record all maintenance, cleaning, inspections and repairs on the Respirator Equipment History Record, (MKMP Form 32-2), Attachment B.
- 5.3 Monthly Inspections
- 5.3.1 Check that all connections are tight including that the filter cartridge is securely attached and the mounting assembly is secure.
  - 5.3.2 Check that the filter cartridge is in good condition, no cracks and that the label is legible.
  - 5.3.3 Check that the respirator is not hardening and that rubber and elastomer parts are pliable by massaging the respirator.
  - 5.3.4 Check that the bag is securely closed and labeled including dates.
  - 5.3.5 Record the inspection on the respirator bag and on the Respirator Equipment History Record, MKMP Form 32-2.
- 5.4 Storage
- 5.4.1 Respirators will be stored with the head harness straps fully extended and on the inside of the face piece.
  - 5.4.2 Respirators are to be stored so that they are not damaged by adjacent equipment, heat, cold or chemicals or twisted out of normal configurations.
  - 5.4.3 Devices ready for use will be segregated from those not ready for use and clearly marked as such.



RESPIRATOR EQUIPMENT HISTORY RECORD

DATE: \_\_\_\_\_ RESPIRATOR TYPE: \_\_\_\_\_ IDENTIFICATION NO. \_\_\_\_\_

INSPECTION:            NEW             INITIAL USE             MONTHLY

MAINTENANCE: (Check all that apply or are performed)

- |                       |                          |                  |                          |
|-----------------------|--------------------------|------------------|--------------------------|
| SURVEY                | <input type="checkbox"/> | RINSE            | <input type="checkbox"/> |
| INSPECT RESPIRATOR    | <input type="checkbox"/> | SANITIZE         | <input type="checkbox"/> |
| REMOVE HEPA CARTRIDGE | <input type="checkbox"/> | AIR DRY/RESURVEY | <input type="checkbox"/> |
| SCRUB                 | <input type="checkbox"/> | NEW HEPA FILTER  | <input type="checkbox"/> |

INSPECTION: (Check all that apply or are performed)

- |                    |                          |                   |                          |
|--------------------|--------------------------|-------------------|--------------------------|
| EXHALATION VALVE   | <input type="checkbox"/> | INHALATION VALVE  | <input type="checkbox"/> |
| CLAMPS/CONNECTIONS | <input type="checkbox"/> | GASKET            | <input type="checkbox"/> |
| SPEAKING DIAPHRAGM | <input type="checkbox"/> | LENS              | <input type="checkbox"/> |
| FACE PIECE         | <input type="checkbox"/> | HD HARNESS/BUCKLE | <input type="checkbox"/> |
| FILTER CARTRIDGE   | <input type="checkbox"/> | RUBBER/ELASTOMER  | <input type="checkbox"/> |

BAG RESPIRATOR / LABEL

RECORD MAINTENANCE DATA

LIST ALL REPLACED RESPIRATOR PARTS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

COMMENTS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

MAINTENANCE PERFORMED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

Operator:

Print/Sign

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