

ACCELERATOR DIVISION ES&H PROCEDURE

ADSP-10-0202

CONTROL AND RELEASE OF RADIOACTIVE MATERIALS FROM  
RADIOLOGICAL AREAS TO CONTROLLED AREAS

RESPONSIBLE DEPARTMENT AD ES&H

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## 1.0 APPLICABILITY

- 1.1 This procedure applies to the release of radioactive materials from radiological areas to controlled areas. For purposes of this procedure, radioactive material is any material, equipment, or system component potentially made radioactive or contaminated by exposure to particle beams or rendered contaminated by contact with other contaminated material. This procedure does not apply to radioactive sealed and unsealed sources.

## 2.0 PURPOSE OF THIS PROCEDURE

- 2.1 The purpose of this procedure is to provide instructions to qualified personnel for the release of radioactive material from radiological areas to controlled areas and is intended to meet the requirements of the Fermilab Radiological Control Manual Article 421.

- 2.2 Proper labeling and storage of radioactive material is necessary to maintain control of radioactive material and to prevent Fermilab personnel from receiving unnecessary radiation exposure. This procedure provides instructions for that purpose.

- 2.3 This procedure documents the controls which have been established to ensure loose surface contamination is not inadvertently transferred to uncontaminated areas by the movement of people or objects.

- a. Contamination areas are those areas where contamination is found or suspected of being present at levels greater than  $0.45 \text{ nCi}/100 \text{ cm}^2$ .

- i. The levels may be averaged over 1 square meter provided the maximum surface activity in any area of  $100 \text{ cm}^2$  is less than three times the value specified.

- ii. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if:

1. from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value;
2. or it is determined that the sum of the activity of all isolated spots/particles in any  $100 \text{ cm}^2$  area exceeds 3 times the applicable value.

## 3.0 TRAINING/QUALIFICATION

- 3.1 Personnel who have completed Radiological Worker training are qualified to release radioactive materials from radiological areas known to be free of loose surface contamination.

- 3.2 Non-AD ES&H Radiation Safety Group personnel who have completed Radiological Worker training are not qualified to release materials from areas known or suspected of being contaminated.

- 3.3 AD ES&H Radiation Safety Group personnel are qualified to release radioactive material from all areas, regardless of the contamination status of the area.

- 3.4 General Employee Radiation Training (GERT) alone is insufficient for persons to perform any portion of this procedure.

#### 4.0 RESPONSIBILITIES

4.1 All qualified personnel (including lab employees, users, contractors, and visiting scientists) are responsible for:

- a. proper labeling and storage of any radioactive material that they remove or cause to be removed from beam enclosures or radioactive material that comes into their possession as part of their assigned work responsibilities;
- b. proper labeling and storage of radioactive parts and components that result from the disassembly of items that are radioactive; and
- c. contacting the AD ES&H Department Radiation Safety Group before commencing work in or removing material from areas known or suspected to be contaminated.

4.2 The AD ES&H Department Radiation Safety Group is responsible for:

- a. determining the contamination status prior to any work being conducted in areas suspected to be contaminated;
- b. decontaminating known to be contaminated materials prior to the work, or providing Job Coverage or ALARA plan for decontamination activities by Radiological Worker trained personnel as directed by the AD RSO or his designee;
- c. determining the disposition and storage of contaminated materials removed from radiological areas to controlled areas;
- d. providing Job Coverage or an ALARA plan for work on contaminated materials either at the work location or another location as approved by AD RSO or his designee;
- e. taking possession or otherwise control contaminated items as necessary for storage or pending determination of the disposition of the items;
- f. labeling items as potentially contaminated or as contaminated.

#### 5.0 INSTRUCTIONS

5.1 The Release of Materials Flow Chart (Appendix 1) provides the instructions to be used to comply with release of materials requirements. Specific additional requirements for the release of materials follow in sections are as follows:

- a. Materials which are to be released from radiological areas and which are known or suspected to be contaminated are required to be surveyed prior to release by AD Radiation Safety.
- b. In general, grinding, drilling, machining and similar processes performed on Class 1 and Class 2 radioactive material do not produce measurable radioactive contamination as described in section 6.0 below.
- c. However, such processes performed on higher radioactive class objects may create contamination or airborne radioactivity areas.

- d. All work on radioactive materials must be reviewed and approved by the AD Radiation Safety Officer (RSO) or designee prior to commencement of the work regardless of the radioactivity class of the material.
- e. The AD RSO or designee is responsible to evaluate the scope of all such work and prescribe containment controls, contamination area boundaries, monitoring requirements, personnel protective equipment, and cleanup requirements commensurate with the scope of work.

## 6.0 TECHNICAL BASIS FOR WORK LIMITATIONS IN POTENTIALLY CONTAMINATED AREAS OF ENCLOSURES

6.1 Characterization studies, Initial Entry surveys, and previous experience are used to define contaminated and potentially contaminated areas within AD beam enclosures. The basis for the instructions for the release of materials from potentially contaminated areas is as follows:

- a. Historically, the previous survey data shows that significant contamination ( $>0.45$  nCi/100 cm<sup>2</sup>) is not found on beam enclosure surfaces other than beam line interfaces until dose rates exceed 50 mrem/hr at one foot, however for conservatism the dose rate has traditionally been taken to be 20 mrem/hr at one foot before significant contamination is detected.
- b. Historically, wipes have been collected when dose rates exceed 20 mrem/hr at one foot for conservatism and tend to support the conclusion in (a) above.
- c. After extended running periods, contamination levels in high intensity machines such as the Main Injector and Booster may eventually build up on beam pipe surfaces and similar locations such as magnet interfaces with no correlation to the dose rates at one foot.
- d. Contamination levels have not been observed to build up in low intensity or low loss machines such as the lower energy Linac.
- e. Contamination found during initial entry surveys is normally removed or posted by the survey team as directed by the AD RSO prior to allowing Supervised Access.
- f. Contamination should be controlled at the source and should not be permitted to spread away from the immediate area in which it is created.
- g. Areas known or suspected to be free of contamination should not be allowed to become contaminated by the movement or use of contaminated material within them unless specific planning is done to minimize the impact.

## 7.0 SUPERVISED ACCESS CONDITIONS

7.1 Initial conditions are as follows:

7.2 An Initial Entry survey has been completed;

- a. all areas greater than 20 mrem/hr have been checked for removable contamination as directed by the AD RSO or designee;
- b. at the discretion of the AD RSO, all contaminated areas have been either decontaminated, resurveyed, and found to be free of contamination or left as is and posted as a contamination area; and

- c. a general Radiation Work Permit (RWP) has been prepared which indicates that cutting, drilling, or grinding work in posted contamination and/or High Radiation areas and at magnet interfaces or other beam pipe surfaces is not permitted until surveyed and approved by the AD RSO or designee.

7.3 Work may proceed as follows:

- a. All workers review general RWP and determine whether the intended work is covered by the RWP.
- b. If work is covered by the RWP, workers should sign in on the RWP and may then proceed.
- c. If work to be done is in an area not covered by the RWP, workers must notify the AD RSO or designee of work to be done and wait for RSO approval before proceeding. RSO may request survey and decontamination of known contamination areas or may require work to be performed under supervision of a Radiological Control Technician (RCT) as Job Coverage or under an ALARA plan. Workers may proceed upon notification by RSO and in accordance with instructions provided by the RSO.
- d. In the event it is impracticable to decontaminate the area, an RCT will be assigned to cover the job or an ALARA plan will be written, and the RCT will perform the necessary surveys. All materials removed from the work location will be surveyed for contamination prior to removal.
- e. In the event it is impractical to decontaminate equipment or material removed from contamination areas, the material or equipment may be securely wrapped in plastic or otherwise protected to contain the contamination and properly labeled as potentially contaminated or contaminated. Items properly labeled, wrapped or otherwise protected may remain in the radiological area such as an enclosure pending determination of the disposition of the equipment or material. RSO review and approval is required prior to removal of contaminated material from radiological areas. AD Radiation Safety will determine the appropriate storage location.

7.4 Initial Entry surveys that are performed to establish the contamination status of a beam enclosure or work location will be documented.

8.0 CONTROLLED ACCESS CONDITIONS

8.1 Initial conditions are as follows:

- a. Initial Entry survey by the Radiation Safety Group has not been performed.
- b. For certain enclosures such as portions of Linac, radiation dose rates are very low and contamination levels are well below established release criteria based upon knowledge of beam energy, intensity, loss patterns, and previous operating experience.
- c. Other enclosures such as Main Injector, Booster, and Switchyard may have elevated radiation dose rates. Contamination above the release criteria may exist under various conditions:
  - i. contamination does not normally occur on beam enclosure surfaces such as floors, magnets, support equipment, walls, etc. when dose rates are less than 20 mrem/hr at one foot from such objects; and
  - ii. contamination may be present on beam enclosure surfaces such as magnets which exceed 20 mrem/hr, on small diameter beam tubes (less than 6 inches), or at magnet interfaces regardless of dose rates. Generally, contamination levels do not exist above release criteria on floors if dose rates are less than 100 mrem/hr at one foot from nearby components.

- d. A general RWP for Controlled Access has been prepared in which:
    - i. work is permitted in all areas where dose rates are less than 20 mrem/hr except for magnet interfaces.
    - ii. work in areas greater than 100 mrem/hr at one foot or at magnet interfaces is prohibited pending review and approval by the RSO or designee;
    - iii. AD RSO or designee guidance is required prior to removal of materials from magnet interfaces or at areas in which the dose rate exceeds 20 mrem/hr; and
    - iv. RSO or designee review and approval is required prior to commencement of work in high radiation areas.
- 8.2 Work under Controlled Access conditions may proceed as follows:
- a. work to be performed at magnet interfaces may not begin until the Radiation Safety Group has conducted a contamination survey to determine the contamination status;
  - b. work in areas where dose rates exceed 20 mrem/hr at one foot may not be performed until a contamination survey has been performed; and
  - c. work in areas in which the dose rates are less than 20 mrem/hr, other than magnet interfaces, can proceed in accordance with RWP requirements.
- 8.3 If the survey shows that contamination is present, the AD ES&H Radiation Safety Group will either provide coverage and permit the work to proceed, or decontaminate the area and declare the area free of removable contamination based on the results of follow-up surveys.
- 8.4 In the event it is impractical to decontaminate equipment or materials removed from contamination areas, the material or equipment may be securely wrapped in plastic or otherwise protected to contain the contamination under AD Radiation Safety coverage. RSO or designee review and approval is required prior to removal of contaminated materials from radiological areas. AD Radiation Safety will determine the disposition and storage of contaminated material.
- 9.0 RELEASE OF MATERIALS KNOWN TO BE FREE OF REMOVABLE SURFACE CONTAMINATION
- 9.1 Areas are declared as free of removable surface contamination during Supervised Access except for magnet interfaces which have not been surveyed and for any areas which are posted as contamination areas.
- 9.2 Items that are free of removable external surface contamination, but could potentially contain removable contamination on internal surfaces should only be removed with AD ES&H Radiation Safety Group consultation.
- 9.3 Upon exiting a radiological area with material known to be free of removable surface contamination, perform the following steps:
- a. determine if the item(s) are radioactive with the frisker as per Appendix 2, "Frisker Procedure for Material Surveys;"
  - b. if the material is radioactive, determine the radioactivity class using the wallflower as per Appendix 3, "Wallflower Procedure for Radioactivity Class Determination;"

- c. if the item is radioactive, select the appropriate radioactivity class tape (Class tape 1, 2, and 3 is available at all enclosure access points) and fill out the blank lines on the class tape, which include the dose rate in mrem/hr at one foot, the date of the survey, and the name or ID number of the person performing the survey.
- d. If the item is determined to be Class 2 or higher, contact AD RSO before attempting to move the item from the frisker and wallflower area. The AD RSO will determine proper handling, movement, and storage of the item.

## 10.0 STORAGE OF RADIOACTIVE MATERIAL IN CONTROLLED AREAS

### 10.1 General Requirements

- a. Class tape is used to designate that the material to which it is affixed is radioactive.
- b. "Caution, Radioactive Materials" signs are used to designate radioactive material storage areas.
- c. The usage of Class tape and "Caution, Radioactive Material" are not interchangeable.
- d. Cabinets that are used for storing radioactive material are required to be labeled with "Caution, Radioactive Material."
- e. Labeled radioactive items may be stored on shelves or other open areas in designated radioactive material storage areas.
- f. In general, radioactive materials must be stored separately from non-radioactive materials.
- g. When locked cabinets are used for radioactive material storage, it is recommended that radioactive and non-radioactive components be segregated.
- h. Designated radioactive material storage cabinets must be locked or attended whenever unlabeled radioactive materials are stored inside.
- i. Radioactive items are not to be stored in offices.
- j. Radioactive items that are free of removable contamination may be stored in Controlled Areas if labeled with class tape. Items with removable contamination must be stored in Radiological Areas as determined by the AD RSO.
- k. Radioactive items are not to be stored on or in workbenches. Radioactive items may be present on work benches temporarily to perform work on them. Radioactive items that are not part of work in progress are to be stored in a designated radioactive material storage area.

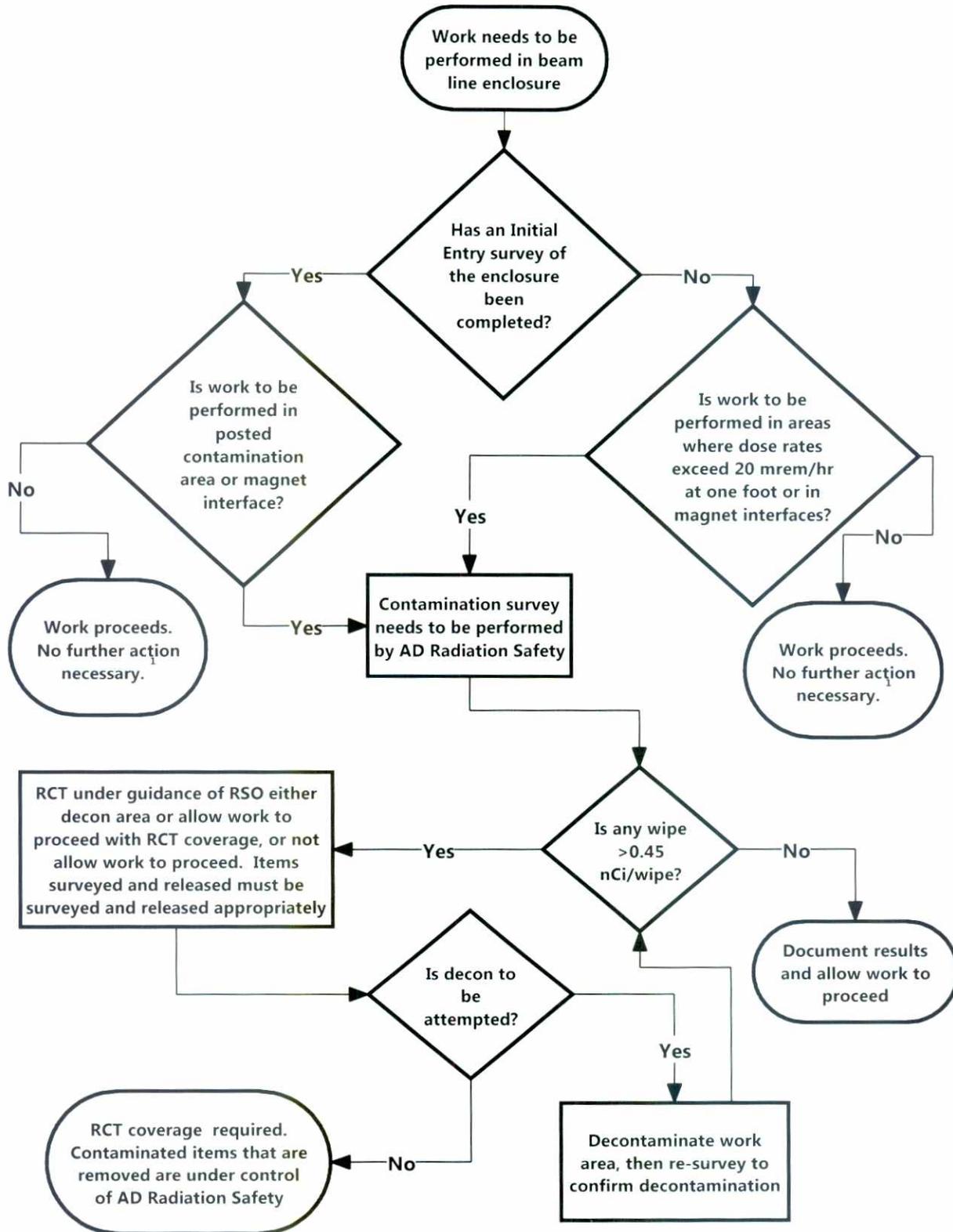
## 11.0 UNLABELED RADIOACTIVE MATERIAL

- 11.1 In general, all components that are removed from other radioactive items are to be checked for radioactivity and labeled accordingly. Some radioactive components cannot be labeled because the adhesive from the tape would compromise the component surfaces. Other radioactive components are too small and numerous for labeling to be practical. In these cases the components need not be labeled with class tape. Unlabeled radioactive items are to be controlled under the provisions of this section.
- 11.2 Unlabeled radioactive materials may be stored together in containers that have been labeled with the appropriate class tape. Such containers are acceptable provided that they are either continuously attended, or

are locked up in a designated radioactive material storage cabinet that is labeled "Caution, Radioactive Material."

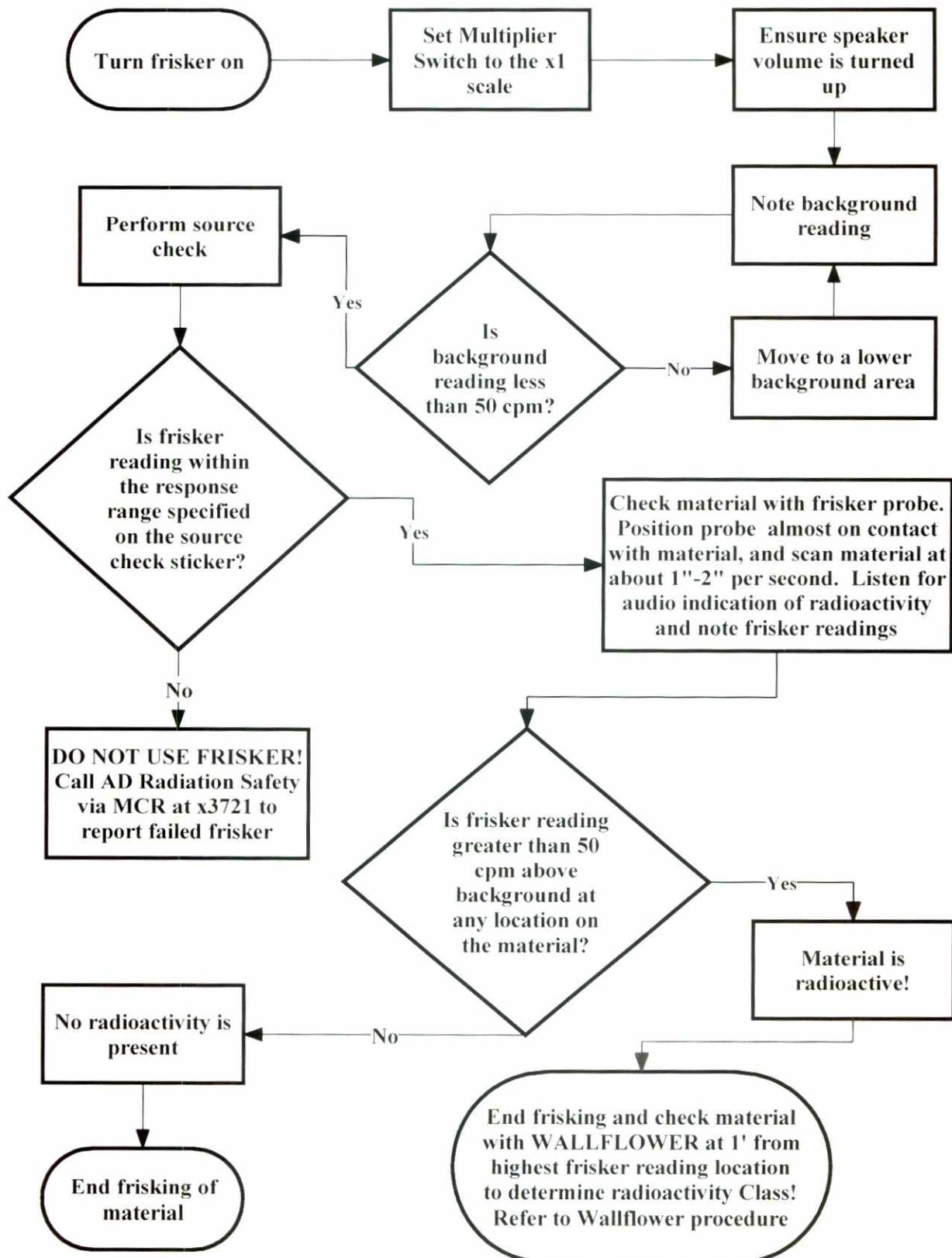
- 11.3 Containers which are lockable and locked are equivalent to storage cabinets and should be labeled "Caution, Radioactive Material."
- 11.4 Unlabeled disassembled radioactive components are not to be left unattended. Unlabeled items in active continuously attended work areas approved by the AD RSO that are locked after hours may be temporarily stored in yellow radioactive material bags or containers labeled "radioactive materials" if the items are actively part of ongoing work and it is impractical to individually label each item. Unlabeled items that are no longer needed must be labeled with class tape and controlled as per 10.1, or be timely disposed of as radioactive waste.
- 11.5 Under no circumstances is unlabeled radioactive material to be left unattended in areas where work is not active and ongoing. Unlabeled radioactive material must be secured in designated radioactive material labeled cabinets or designated locked storage areas, and signage indicating "Unlabeled radioactive material" is placed on the container.
- 12.0 EXEMPTIONS
- 12.1 Exemptions to the requirements of this procedure may be authorized only by the AD RSO or designee.

# Release of Materials Flow Chart



<sup>1</sup> --That is, action related to release of materials from a contamination area. All remaining applicable requirements must be observed.

## Frisker Procedure for Material Monitoring



## Wallflower Procedure for Radioactivity Class Determination

