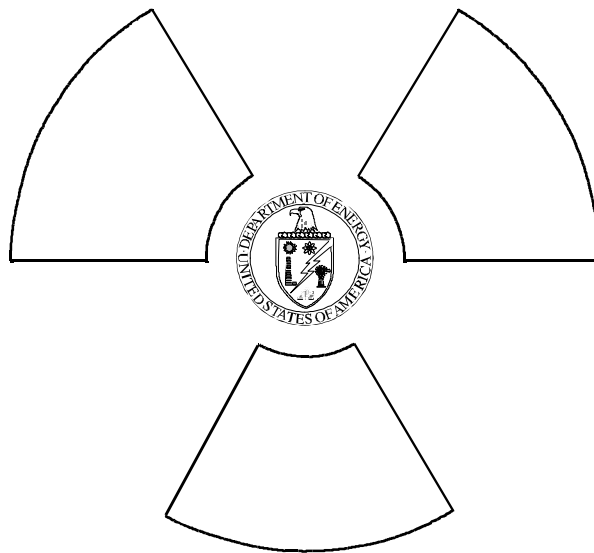


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# POSTING AND LABELING FOR RADIOLOGICAL CONTROL GUIDE

*for use with*  
**Title 10, Code of Federal Regulations, Part 835,  
Occupational Radiation Protection**



**Assistant Secretary for Environment,  
Safety and Health**

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## **ACRONYMS**

AEC	Atomic Energy Commission
ALARA	as low as is reasonably achievable
ANSI	American National Standards Institute
DOE	U.S. Department of Energy
DOE G	DOE Guide
DOE O	DOE Order
DOE-STD	DOE Standard
NCRP	National Council on Radiation Protection and Measurements
NRC	U.S. Nuclear Regulatory Commission
RCS	RADIOLOGICAL CONTROL, DOE-STD-1098-99
RCT	radiological control technician
RMA	radioactive material area

# **POSTING AND LABELING FOR RADIOLOGICAL CONTROL**

## **1. PURPOSE AND APPLICABILITY**

This Guide provides an acceptable methodology for establishing and operating a radiological hazard posting and labeling program that will comply with U.S. Department of Energy (DOE) requirements specified in Title 10 of the Code of Federal Regulations (CFR), Part 835, Occupational Radiation Protection (DOE 1998a), hereinafter referred to as 10 CFR 835. In particular, this Guide provides guidance for achieving compliance with the requirements of Subpart G of 10 CFR 835. For completeness, this Guide provides cross-references to detailed guidance provided in DOE-STD-1098-99, RADIOLOGICAL CONTROL (DOE 1999a), hereinafter referred to as the RCS. This Guide also identifies applicable recommendations contained in secondary documents (American National Standards Institute (ANSI) Standards, etc.).

This Guide amplifies the regulatory requirements of 10 CFR 835 and provides explanations and examples of the requirements for radiological hazard posting and labeling. The requirements of 10 CFR 835 are enforceable under the provisions of Sections 223(c) and 234A of the Atomic Energy Act of 1954, as amended (AEC 1954).

Except for requirements established by a regulation, a contract, or by administrative means, the provisions in this Guide are DOE's views on acceptable methods of program implementation and are not mandatory. Conformance with this Guide will, however, create an inference of compliance with the related regulatory requirements. Alternate methods that are demonstrated to provide an equivalent or better level of protection are acceptable. DOE encourages its contractors to go beyond the minimum regulatory requirements and to pursue excellence in their programs.

The word "shall" is used in this Guide to designate requirements from 10 CFR 835. Compliance with 10 CFR 835 is mandatory except to the extent an exemption has been granted pursuant to 10 CFR 820, Procedural Rules for DOE Nuclear Activities (DOE 1997). The words "should" and "may" are used to represent optional program recommendations and allowable alternatives, respectively.

This Guide is applicable to all DOE activities that are subject to the requirements of 10 CFR 835.

## 2. DEFINITIONS

Terms defined in 10 CFR 835 are used in this Guide consistent with their regulatory definitions.

**Boundary:** The line that defines the transition from one specified area to another.

**Boundary identifier:** A hazard identifier that is used to define the boundary of an area.

**Physical barrier:** A bounding physical obstruction that prevents unimpeded access to an area.

### 3. DISCUSSION

The goal of a radiological hazard posting and labeling program is to identify and effectively communicate radiological hazards to individuals, allowing them to take the appropriate protective actions. In pursuit of this goal, a radiological posting and labeling program works in concert with other hazard communication programs, including programs for radiation safety training, work authorizations, written procedures, and briefings.

10 CFR 835 requires that certain areas and items be posted or labeled to control personnel exposure to radioactive material and ionizing radiation and to prevent the spread of contamination. 10 CFR 835 also provides exceptions from the posting and labeling requirements under certain circumstances; these exceptions apply to posting or labeling requirements only. They do not apply to entry control or radiation safety training requirements.

This Guide provides references to detailed guidance provided in the RCS. The referenced guidance provides acceptable methods of achieving and maintaining compliance with related provisions of 10 CFR 835.

## 4. IMPLEMENTATION GUIDANCE

This section discusses the regulatory requirements for radiological hazard posting and labeling and provides guidance for achieving compliance with those requirements. Postings for other health and safety concerns, such as those for nuclear criticality and industrial safety concerns, should be in addition to the postings specified for radiological control.

### 4.1 GENERAL

10 CFR 835 establishes specific requirements for posting of controlled areas, radioactive material areas (RMAs), and radiological areas. Controlled areas are established to warn individuals that they are entering areas that, because of the presence of radiological areas and/or RMAs, are controlled for radiation protection purposes. RMAs and radiological areas are established within the controlled area to provide warning of specific hazards that may require individual protective action for safe entry and egress.

10 CFR 835 also establishes specific requirements for labeling of items or containers of radioactive material exceeding specified threshold activity levels. Radioactive material labels are used to provide warning to individuals of the presence of radioactive material, particularly in areas in which the radiological hazard does not warrant area posting in accordance with 10 CFR 835.

10 CFR 835.104 requires that written procedures be developed and implemented as necessary to ensure compliance, commensurate with the radiological hazards and consistent with the education, training, and skills of the exposed individuals. With regard to the radiological hazard posting and labeling program, written procedures should be developed to address the program elements addressed in this Guide. The level of detail provided in these procedures should be sufficient to provide assurance that the affected individuals can implement the program in a manner that will achieve and maintain regulatory compliance. 10 CFR 835.104 provides flexibility for a site- or facility-specific determination of the appropriate balance between individual education, training, skills, and specificity of the required written procedures. As an example, if responsibility for posting radiological hazard signs is assigned to radiological control technicians (RCTs) qualified in accordance with the RCS, then the written procedures may be relatively brief, based upon the detailed knowledge possessed by the RCTs. Conversely, if responsibility for posting radiological hazard signs is assigned to another work group in the facility whose members have a less-detailed knowledge of the regulatory requirements, then more detailed procedures should be developed and implemented, based on the cognizant individuals' presumably more rudimentary understanding of the specific requirements of 10 CFR 835.

10 CFR 835.604 and 835.606 establish specific conditions under which radiological hazard posting and radioactive material labeling are not required, generally due to the minimal hazards present in certain areas or the implementation of other controls that are sufficient to limit individual exposures to radiological hazards. Care should be exercised in implementing these posting and labeling exceptions to ensure that both the specific and general requirements of 10 CFR 835 will be met in the absence of the area postings and material labeling. For example, 10 CFR 835.604 provides a posting exception for areas in which the radioactive material consists solely of activated structures or installed components. Likewise, 10 CFR 835.606 provides a labeling exception for radioactive material having an activity less than one tenth of the 10 CFR 835 Appendix E values. However, omission of postings and labels under these conditions may affect the status of compliance with other requirements of 10 CFR 835, including the ALARA requirements of 10 CFR 835.101 and 1001, the dose limit requirements of 10 CFR 835.207 and 835.208, and the maximum controlled area dose expectation of 10 CFR 835.602(a). Compliance with these requirements is generally achieved through implementation of a comprehensive program



that includes physical design features, administrative controls, training, area posting, and material labeling. Therefore, decisions regarding omission of area postings and radioactive material labels should consider the full impact of such omissions and the ability of the remaining program elements to ensure continued compliance. Such decisions should be made on the basis of management-approved standards documented in the radiation protection program, site-specific procedures, and/or the site-specific radiological control manual.

#### **4.1.1 Design**

Postings for controlled areas may be selected by the contractor to avoid conflict with local security requirements (10 CFR 835.602(b)). To the extent practicable, controlled area postings should use the yellow and magenta radiological hazard warning color scheme, but the flexibility provided in 10 CFR 835.602(b) extends to the shape, color scheme, and content of the controlled area postings.

Postings for radiological areas and radioactive material areas and labels on radioactive items and containers of radioactive material shall include the standard radiation warning trefoil in black or magenta imposed upon a yellow background (10 CFR 835.601(a)). Magenta is the preferred color for the trefoil and any lettering on the posting. The standard radiation warning trefoil is illustrated in Appendix A of this Guide. Unless circumstances do not permit, the standard radiation warning trefoil should be oriented with one blade downward and centered on the vertical axis. The standard radiation warning trefoil should be displayed as prominently as is practicable.

Lettering should not be superimposed on the standard radiation warning trefoil (ANSI 1989). The size of lettering used on the sign should not detract from the clarity of the standard radiation warning trefoil.

The background for the entire sign or label should be yellow. The lettering and standard radiation warning trefoil should be proportional to the size of the sign or label. The color scheme used for radiological postings and labels should be consistent throughout the site and should be approved by the head of the cognizant radiation protection organization before use. The color scheme used for radiological hazard posting and labeling should be reserved for radiological hazards communication only.

Signs and labels should be constructed of materials that can endure expected environmental conditions without significant deterioration of color, legibility, strength, or other physical characteristics. Although magenta is the preferred color for both the standard radiation warning trefoil and the lettering, the magenta color tends to fade when exposed to sunlight. Therefore, special consideration should be given to the selection of signs for outdoor postings to ensure durability. If signs or labels will be used under conditions that are likely to result in significant degradation, routine surveillances should be performed as necessary to verify continued legibility. Signs and labels should not be altered or defaced in any way to change their meaning. Inserts (on signs containing insert slots) may be changed, as appropriate.

#### **4.1.2 Content**

In addition to the standard radiation warning trefoil discussed above, postings and labels required by 10 CFR 835 shall include the appropriate heading (“Caution,” “Danger,” or “Grave Danger”) and wording describing the radiological hazard (10 CFR 835 hazard designation) (10 CFR 835.603 and 835.605).

Signs required by 10 CFR 835 may include radiological protection instructions (10 CFR 835.601(b)). Supplemental wording describing additional warnings or directions should be included on the postings or labels, as appropriate. Recommended supplemental wording on potential and actual radiological conditions and specific controls is discussed in Chapters 2 and 4 of the RCS.

10 CFR 835 requires that each radiological area be posted. Therefore, if more than one radiological condition exists in an area and requires posting, each condition shall be identified (10 CFR 835.603). Multiple radiological conditions may be posted using one of two common practices:

- by posting each radiological condition on a separate sign with any appropriate supplemental wording; or
- by posting all radiological conditions on one or more signs (user-changeable signs using inserts, for example) using the most stringent heading and listing the radiological areas in decreasing order of importance. Any supplemental information should follow the radiological area designations.

The second method is preferred because it reduces clutter and is more efficient.

Very high radiation area postings should be established on an exclusive sign without other radiological area designations.

In recognition of the broad range of radiological conditions encompassed by the 10 CFR 835.2(a) definitions of the terms "airborne radioactivity area," "high contamination area," and "high radiation area," 10 CFR 835.603 allows use of either the "Caution" or "Danger" heading on the required postings. This allows the hazard in the area to be more accurately characterized. This is also an option for radioactive material labeling (see 10 CFR 835.605). Accordingly, the "Caution" heading should be used for lower hazards and "Danger" for higher hazards. With respect to radioactive material labeling, the amount, specific activity, and chemical and physical characteristics of the radioactive material should be taken into consideration. However, the use of only one heading for the entire range of conditions is also acceptable.

Chapter 2 of the RCS provides guidance for posting of additional areas, including:

- buffer areas surrounding radiological areas;
- areas where soil contamination is present;
- areas where underground radioactive materials are present; and
- access ports to enclosures having limited accessibility, such as glove bags and boxes.

While posting of these areas is not required to ensure compliance with the posting requirements of 10 CFR 835, such postings may provide an additional regulatory margin and degree of protection to affected individuals.

#### **4.1.3 Visibility**

Signs required by 10 CFR 835 shall be clearly and conspicuously posted (10 CFR 835.601(b)). Each item or container of radioactive material that requires labeling shall bear a clearly visible label (10 CFR 835.605).

When posting is required, appropriate signs should be placed intermittently along the boundary (fences, barricades, ropes, tapes, etc.). The effect upon visibility of opening of doors or other changes in configuration should be considered when posting radiological hazard warning signs. At least one sign should be on each side of an area's boundary, and a sign should be visible from any normal avenue of approach. A distance of 40 feet (12.2 m) between signs along the area's boundary is considered acceptable.

Radiological posting and labeling should be securely affixed and located such that signs and labels can be expected to remain in place when subjected to expected adverse conditions and environments.

When one radiological area is completely contained within another radiological area having similar hazards (e.g., a high contamination area inside a contamination area) or individuals must pass through one radiological area to enter another, it is not necessary to post the exits from the inner area to indicate entry into the outer area.

#### **4.1.4 Conditions**

Radiological warnings are posted based upon actual or likely radiological conditions. Actual conditions are determined through area monitoring. Likely conditions should be identified based on professional judgment or experience regarding the probability that a radiological condition will exist. When evaluating the likelihood of specified conditions, normal situations as well as unique situations which can reasonably be expected to occur should be considered.

In many operations, the likelihood that a radiological condition will exist, rather than the actual condition, will define the boundaries and posting of a radiological area. For example, opening a contaminated ventilation system in a non-contaminated area may require a contamination area to be established, or opening a radiological vacuum cleaner in a contamination area may require that an airborne radioactivity area be established. Therefore, past monitoring data, work-specific experience, and professional judgment should be included in the decision on the correct posting of each area.

Radiological postings should be completed before work begins, updated periodically when changes in radiological conditions occur or are expected, and removed as soon as is practicable when no longer required.

Radiological posting and labeling should be used or displayed only to signify the actual or likely radiological conditions. However, posting and labeling may also be used for illustrative purposes in appropriate educational or informational matter. When used for this purpose, signs and labels should be clearly marked to indicate that they are for training use only.

#### **4.1.5 Accessibility**

Radiological areas and radioactive material areas are defined based upon area accessibility. An area is considered to be accessible to individuals when it contains entrance or access points of sufficient size to permit human entry, i.e., such that any portion of the body may be exposed to the radiological hazard.

Areas with entrance or access points consisting of locked doors or other controls and interlocks (including those specified under 10 CFR 835.502), should be considered accessible to individuals. In contrast, areas with entrance or access points consisting of doors or portals, such as man hole covers, that are bolted or otherwise more permanently sealed, may be considered inaccessible, unless such doors or portals are opened on a routine basis. Likewise, areas in which the radiological hazard is located underground, such that significant soil excavation, drilling, natural forces, or other forms of intrusion would be required to gain access, may be considered inaccessible. In general, areas with entrance or access points that require the use of tools or lifting or excavation equipment to gain access may be considered inaccessible to individuals. However, for ALARA purposes, these entrance or access points should be marked indicating the radiological hazard that exists, or is likely to exist, behind the entrance or access point and a warning not to open the barrier without authorization from the radiation protection organization. In lieu of or in addition to such markings, physical controls (e.g., physical barriers, entry alarms) and/or administrative controls (e.g., procedural controls, additional training) should be implemented as necessary to prevent unauthorized or inadvertent entry to the area or exposure of the hazard. Once the entrance

point has been unsealed (or for underground hazards, the covering soil has been disturbed or penetrated) such that individuals may be exposed to the radiological hazard (whether or not such acts have been authorized), the area should be considered to be accessible.

#### **4.1.6 Boundaries and Barriers**

Controlled areas, radioactive material areas, and radiological areas should be identified by the use of a boundary identifier or a physical barrier and sufficient signs. The combination of signs and boundary identifiers should be sufficient to warn approaching individuals that they are entering an area controlled for radiation protection purposes. Boundary identifiers may consist of ropes, chains, color-coded adhesive tape, or other materials sufficient to delineate the boundary of the area. Because color-coded adhesive tape applied to floors may not be highly visible and provides no impediment to entry, its use as a boundary identifier should be limited to counter-top applications or to use in conjunction with other boundary identifiers.

Boundary identifiers and physical barriers should be clearly visible from all directions and various elevations to prevent inadvertent access to areas. For example, rope barriers should be approximately 24 to 40 inches (60 to 100 cm) in height. Area monitoring should be used to determine the adequacy of boundary placement.

Existing physical barriers, such as fences or walls, may be used as boundary identifiers if the posting is adequate to prevent inadvertent access to the area. For example, a wall that could be crossed by ladder could suffice as a boundary identifier, but would not prevent an individual from entering an area; thus posting would be required.

### **4.2 CONTROLLED AREAS**

Controlled areas are established and posted to warn individuals that they are entering areas in which radiological areas and/or RMAs exist. All radiological areas and RMAs lie within the boundaries of controlled areas (although the boundaries may be contiguous).

Each entrance or access point to a controlled area shall be posted if that area contains radioactive materials or radiation fields that require posting under 10 CFR 835.603 (10 CFR 835.602(a)). The sign should contain wording equivalent to "CONTROLLED AREA"; however, the actual wording, color scheme, and sign may be selected by the contractor to avoid conflict with local security requirements (10 CFR 835.602(b)). In the event that the boundaries of the controlled area are contiguous with those of radiological areas or RMAs, the area should be posted with both the controlled area and radiological area/RMA postings.

A controlled area may incorporate one or more radiological areas and/or radioactive material areas. Controlled area borders should not be contiguous with the site boundary.

### **4.3 POSTING FOR CONTROL OF EXPOSURE TO EXTERNAL RADIATION**

10 CFR 835 establishes requirements for three areas that shall be posted to provide warning of external radiation fields - radiation areas, high radiation areas, and very high radiation areas (10 CFR 835.603(a-c)). The need to post these areas is contingent upon two factors:

- area accessibility, as discussed in Section 4.1.5 of this Guide; and
- the radiation field intensity and duration, such that an individual's dose may exceed the specified threshold in one hour.

The posting thresholds established in 10 CFR 835 are based on the radiation field intensity measured at a specified distance from the radiation source or from any surface penetrated by the radiation (30 centimeters (cm) for radiation and high radiation areas and 100 cm for very high radiation areas). To ensure continuing compliance with the posting requirements, a degree of conservatism should be established in the local posting requirements. The desired degree of conservatism may be established by:

- posting affected areas at an exposure rate lower than that specified in 10 CFR 835 (i.e., requiring area posting when an individual is likely to exceed a specified fraction of the 10 CFR 835 posting threshold); or
- measuring the exposure rate at a distance less than that specified in 10 CFR 835; or
- both of the above.

The degree of conservatism established in the posting regimen for external radiation hazards should be adequate to address issues of monitoring equipment variability and likely variations in area radiological conditions.

#### **4.4 POSTING FOR CONTROL OF CONTAMINATION**

##### **4.4.1 Removable and Airborne Radioactive Contamination**

10 CFR 835 establishes requirements for three areas that shall be posted to provide warning of the presence of radioactive contamination - contamination area and high contamination area postings for removable surface contamination and airborne radioactivity area postings for airborne contamination (10 CFR 835.603(d-f)). The need to post contamination areas and high contamination areas is contingent upon two factors:

- area accessibility as discussed in Section 4.1.5 of this Guide; and
- the presence of removable surface contamination at levels exceeding the specified removable surface contamination values (1x the values provided in Appendix D of 10 CFR 835 for contamination areas, 100 x these values for high contamination areas).

For detailed guidance on contamination measurements and the use of the 10 CFR 835 Appendix D surface contamination values, see DOE G 441.1-9, RADIOACTIVE CONTAMINATION CONTROL GUIDE (DOE 1999b).

The need to post airborne radioactivity areas is contingent upon three factors:

- area accessibility, as discussed previously in this Guide;
- the concentration of airborne radioactive material in the area; and
- the extent to which individuals will be in the area during the area during a week.

10 CFR 835 establishes two criteria requiring posting of airborne radioactivity areas. The first criterion, based upon airborne radioactive material concentrations exceeding the derived air concentration (DAC) value(s) provided in Appendices A and C of 10 CFR 835 is absolute. That is, if the airborne radioactive material concentration exceeds or is likely to exceed the specified value(s), then the area shall be considered an airborne radioactivity area (10 CFR 835.2(a), Airborne radioactivity area). The second criterion, based upon individual exposure to airborne radioactive material, allows consideration of individual stay times. Under this criterion, an area shall be

considered to be an airborne radioactivity area if an individual could receive an intake exceeding 12 DAC-hours in a week (i.e., if an individual was present in the area for 40 hours during a week and the airborne radioactive material concentration exceeded 30% of the specified DAC value(s); 40 hours multiplied by  $>0.30$  DAC exceeds 12 DAC-hours) (10 CFR 835.2(a) Airborne radioactivity area). Note that this criterion requires consideration of individual exposures without the benefit of respiratory protective devices, whether or not such devices are required for entry. The definition of the term “week” provided in 10 CFR 835.2(a) does not specify a starting day. A starting day for the week should be selected and maintained constant, to the extent practicable. It is not necessary to track individual exposures in DAC-hours over rolling seven day periods to ensure compliance with the airborne radioactivity area posting requirements of 10 CFR 835.603(d).

To ensure continuing compliance with the posting requirements for removable and airborne radioactive contamination hazards, a degree of conservatism should be established in the local posting requirements. The desired degree of conservatism may be established by posting affected areas at surface contamination/airborne radioactivity concentrations lower than those specified (i.e., requiring area posting at a specified fraction of the applicable 10 CFR 835 Appendix value). The degree of conservatism established in the posting regimen for radioactive contamination hazards should be adequate to address issues of monitoring equipment variability, sample collection efficiency variations, and likely variations in area radiological conditions.

#### **4.4.2 Areas of Fixed Contamination**

10 CFR 835 establishes specific requirements for areas that have total contamination levels greater than the Appendix D values, but removable contamination levels less than the Appendix D values. 10 CFR 835 establishes no requirements for posting of these areas (although 10 CFR 835 does establish requirements for marking these areas, which may be satisfied through area posting, surface stenciling, or other appropriate means); however, it does establish requirements for control of these areas. These requirements are discussed in Implementation Guide DOE G 441.1-9.

### **4.5 RADIOACTIVE MATERIAL POSTING**

10 CFR 835 requires that certain areas in which radioactive material is used, handled, or stored be posted as radioactive material areas. The need to post RMAs is contingent upon two factors:

- area accessibility, as discussed in Section 4.1.5 of this Guide; and
- the presence of items or containers of radioactive material in the area in quantities exceeding the applicable Appendix E value(s).

The RMA posting exists as a means of supporting the 10 CFR 835.602(a) controlled area maximum total effective dose equivalent expectation of 0.1 rem in a year and provides an alternative to labeling of multiple radioactive items or containers of radioactive material. Therefore, 10 CFR 835.604 allows for the use of radioactive material labeling in lieu of RMA posting and 10 CFR 835.606 likewise allows for the use of the RMA posting in lieu of individual item or container labeling. The flexibility provided under these provisions permits individual DOE activities to tailor their programs to meet specific needs.

Under conditions commonly associated with DOE activities, determinations of the quantities of radioactive materials in an area are not as straightforward as determinations of radiation and contamination levels and airborne radioactive material concentrations. The process of making accurate determinations of the quantities of radioactive materials present in some areas may be relatively cumbersome and time-consuming relative to the benefits obtained. Because of the relatively low hazards present in RMAs, such a designation carries no additional

regulatory burden in terms of required entry controls. Reliable, good faith measures should be implemented to assess the quantities of radioactive material present in all areas. Such measures may include provisions for inventory tracking, exposure rate-to-activity, concentration-to-activity, or contamination level-to-activity calculations, activation analyses, or other technically-justified means for determining the activity of containers of radioactive material or radioactive items. If there is doubt about whether or not the quantity of radioactive material in an area exceeds the applicable Appendix E value(s), the area should be posted as a radioactive material area to ensure compliance.

Another difficulty that may arise in identifying RMAs is in determining the location of the RMA boundaries. While the boundaries of the radiological areas are readily identified through the conduct of area monitoring, the boundaries of a radioactive material are more nebulous. While it may be apparent that the quantity of radioactive material in a specified room or enclosure does not exceed that level defining an RMA, the sum of the quantities of radioactive material in a series of adjoining rooms or enclosures may exceed the threshold level. Such a condition will necessarily lead to questions regarding whether or not an RMA exists and, if so, regarding the logical RMA boundaries.

Two acceptable approaches to defining the boundaries of RMAs are provided in this Guide; the approach selected will be determined based predominantly on considerations of the nature of the operations taking place, the education, training, and skills of the affected individuals, and convenience. Under the first acceptable approach, the quantity of radioactive material in individually identifiable rooms or enclosures may be considered. Note that the footnote to Appendix E of 10 CFR 835 requires summing of the fractions of all radionuclides present in the designated room or area. If there are multiple radioactive items or containers, then the activity of each radionuclide present in all of the items and containers should be summed, divided by the appropriate Appendix E value and then added to the similarly determined ratios for all other radionuclides present to determine the activity-to-threshold value ratio for the designated room or area. The postings, if necessary, should be erected at the individual room or enclosure entry or access point(s) or, if there is a common access point to the rooms or enclosures, then the posting may be erected at that point. Under the second acceptable approach, the quantity of radioactive material present in a group of rooms or enclosures may be considered (using the sum-of-the-fractions rule as discussed above) and the postings, if necessary, should be erected at the common entry or access points. The decision regarding the appropriate location for the posting(s) will be based largely on considerations of convenience (i.e., the establishment of radiological hazard postings and associated entry controls at the common entrance point(s) may disrupt or impede the activities of individuals who must enter the area or create the need for additional radiation safety training for these individuals).

The use, handling, or storage of items or containers of radioactive material in outside areas may pose special challenges in identifying areas requiring posting as RMAs, particularly when the items or containers are spread over a wide area. These challenges result from the absence of identifiable rooms or enclosures, thus making the identification of the identified "area" problematic. To the extent practicable and consistent with ALARA principles, such items or containers should be consolidated in a localized area to facilitate activity determinations, posting, and control. Piles or areas of radioactive rubble or granular solids, such as soil or sand, would not normally be considered "items" or "containers." Therefore, areas in which the radioactive material consists solely of such piles or areas would not be subject to posting as an RMA. However, appropriate controls may be required to ensure compliance with other requirements of 10 CFR 835, including the ALARA requirements of 10 CFR 835.101 and 835.1001, the dose limits of 10 CFR 835.207 and 835.208, and the controlled area maximum dose expectation of 835.602(a).

#### 4.6 EXCEPTIONS FROM POSTING REQUIREMENTS

Accessible areas may be excepted from the radiological area and radioactive material area posting requirements for periods of <8 continuous hours duration when the area is placed under the observation and control of individuals who are knowledgeable of and empowered to implement required access and exposure control measures (10 CFR 835.604(a)). The observing/controlling individual(s) should be stationed to provide line of sight surveillance of the area boundaries and verbal warnings. For situations that require only simple access control measures, such as entry prevention, a minimally-trained individual would suffice. For situations that require more complicated access and exposure control measures, a radiological control technician should be used. A sufficient number of individuals should be used to provide for adequate access and exposure control.

The following accessible areas are excepted from the radioactive material area posting requirements (10 CFR 835.604(b)):

- radiological areas posted in accordance with 10 CFR 835.603(a) - (f). In this case, the radiological area posting provides adequate warning of the area hazards;
- areas in which each item or container of radioactive material is clearly and adequately labeled in accordance with Subpart G of 10 CFR 835 such that individuals entering the area are made aware of the hazard. In this case, the radioactive material labels provide adequate warning of the area hazards; and
- areas in which the radioactive material of concern consists solely of structures or installed components which have been activated (i.e., such as by being exposed to neutron radiation or particles produced in an accelerator).

Areas containing only packages received from transportation need not be posted in accordance with 10 CFR 835.603 until the packages are monitored in accordance with 10 CFR 835.405 (10 CFR 835.604(c)). For ALARA purposes, the time between package receipt and monitoring should be minimized.

Even though certain areas may be excepted from posting in accordance with the conditions provided in 10 CFR 835, appropriate controls should be established over these areas as necessary to limit exposures consistent with the ALARA controls required under 10 CFR 835.1001. Decisions regarding the omission of radiological hazard postings should be made in full consideration of the information provided in Section 4.1 of this Guide.

The exceptions discussed above apply only to radiological area and/or radioactive material area posting requirements and do not apply to the entry control requirements established in 10 CFR 835.501 and 10 CFR 835.502 or to the radiation safety training requirements established in 10 CFR 835.901. Decisions regarding omission of postings should be made in full consideration of the guidance provided in Section 4.1 of this Guide.

#### 4.7 RADIOACTIVE MATERIAL LABELING

##### 4.7.1 Radioactive Material Labeling

Each item or container of radioactive material shall be labeled (10 CFR 835.605). The label shall contain the standard radiation warning trefoil and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL" (10 CFR 835.605). The label shall also provide sufficient information to permit individuals handling or using the containers or working in the vicinity of the containers to take precautions to avoid or minimize exposures (10 CFR 835.605).



The following information should be included on the labels, as appropriate:

- radiological hazard (e.g., radiation and/or contamination levels);
- an estimate of the quantity of radioactivity;
- radioisotope(s) and activity;
- dates monitored;
- any special handling instructions necessary to permit individuals to implement appropriate protective measures;
- name of the individual performing the monitoring; and
- a description of the material, as appropriate.

If the item is too small to accommodate a label, then the label should be applied to the container or storage location.

The label shall be clearly visible on the item or container (10 CFR 835.605). If a label applied to the items will not be clearly visible, then the label should be placed on the exterior of containers holding the radioactive material.

#### **4.7.2 Exceptions from Labeling Requirements**

Containers and items are excepted from the radioactive material labeling requirements of 10 CFR 835.605 under any one of the following circumstances:

- the items or containers are used, handled, or stored in areas posted and controlled in accordance with Subpart G of 10 CFR 835 and sufficient information is provided to permit individuals to take appropriate protective actions (10 CFR 835.606(a)(1)). This information may be provided on or in conjunction with the area postings, radiation safety training, written procedures, controlling work authorization for that area, or other suitable means.
- the quantity of radioactive material is less than one tenth of the values specified in Appendix E of 10 CFR 835 (10 CFR 835.606(a)(2)). For containers that contain numerous items of radioactive material, the determination of the need for labeling should be based upon the sum of the activities of the individual items. Section 4.5 of this Guide provides guidance on determining the activity of radioactive items and containers of radioactive material and on determining the sum of the fractions of the activities of the items in question.
- the items or containers are packaged and labeled in accordance with Department of Transportation regulations or corresponding DOE Orders (10 CFR 835.606(a)(3)). When such labels are used as an alternative to the labeling required by 10 CFR 835, measures should be implemented to ensure that affected individuals are familiar with the labels and the hazards and precautions associated with the labeled materials.
- the items or containers are inaccessible or accessible only to individuals authorized to handle or use them, or to work in the vicinity (10 CFR 835.606(a)(4)). In such situations, the individuals should be trained in accordance with 10 CFR 835.901(b) and knowledgeable of the types and quantities of radioactive material

present in the area. DOE G 441.1-12, RADIATION SAFETY TRAINING GUIDE (DOE 1999c), provides guidance on developing appropriate radiation safety training programs.

- the items or containers are installed in manufacturing or process equipment, such as reactor components, piping, and tanks (10 CFR 835.606(a)(5)).
- the radioactive material consists solely of nuclear weapons or their components (10 CFR 835.606(a)(6)).

Even though items and containers of radioactive material may be exempted from labeling in accordance with the conditions provided in 10 CFR 835, appropriate controls should be established over the storage, movement, and use of unlabeled items and containers as necessary to limit exposures consistent with the ALARA controls required under 10 CFR 835.1001. Decisions regarding the omission of radioactive material labels should be made in full consideration of the information provided in Section 4.1 of this Guide.

Although 10 CFR 835.606(a)(1) provides a labeling exception for radioactive material that is used, handled, or stored in areas posted and controlled in accordance with Subpart G of 10 CFR 835, caution should be exercised in applying this exception to ensure that the radiological area posting or associated information will be sufficient to inform affected individuals of the area hazards and required protective actions. For example, a trained individual's response to a "Contamination Area" posting (i.e., protective clothing, personnel frisking) may not be sufficient to protect that individual from the hazards associated with an unlabeled radioactive item or container in the area. Similarly, a trained individual's response to a "Radiation Area" posting may not be sufficient to protect that individual from the hazards arising from the opening of a wrapped, but unlabeled, contaminated item in that area. In such cases, the exception provided in 10 CFR 835.606(a)(1) requires that sufficient information be provided to permit individuals to take appropriate protective actions. As discussed above, this information may be provided in conjunction with the area postings, radiation safety training, written procedures, controlling work authorizations or other suitable means.

## 5. REFERENCES

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ANSI (American National Standards Institute) 1989. ANSI N2.1-1971(R1989), *Radiation Symbol*. New York, New York.

DOE (U.S. Department of Energy) 1990. DOE 5400.5, RADIATION PROTECTION OF THE PUBLIC AND THE ENVIRONMENT, dated 1-7-93. Washington, D.C.

DOE 1997. 10 CFR 820, U.S. Department of Energy. Procedural Rules for DOE Nuclear Activities. 58 FR 43680, *Federal Register*, Vol. 58, No. 157, dated 10-8-97. Washington, D.C.

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DOE 1999a. DOE-STD-1098-99. RADIOLOGICAL CONTROL, under development at time of publication. Washington, D.C.

DOE 1999b. DOE G 441.1-13. RADIOACTIVE CONTAMINATION CONTROL GUIDE, under development at time of publication. Washington, D.C.

DOE 1999c. DOE G 441.1-2. RADIATION SAFETY TRAINING GUIDE, dated 3-17-99. Washington, D.C.

## 6. SUPPORTING DOCUMENTS

ANSI 1976. *Radiological Safety Standard for the Design of Radiographic and Fluoroscopic Industrial X-ray Equipment*. (ANSI N43.5-1976 (R1989). New York, New York.

NCRP (National Council on Radiation Protection and Measurements) 1964. *Safe Handling of Radioactive Materials*. (NCRP Report No. 30). Bethesda, Maryland.

NCRP 1971. *Protection Against Neutron Radiation*. (NCRP Report No. 38). Bethesda, Maryland.

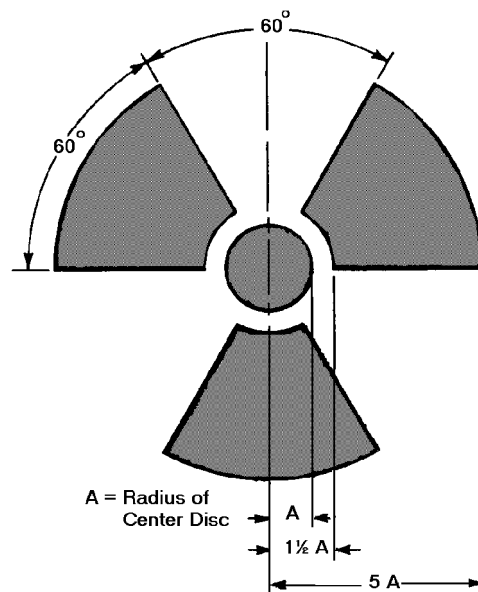
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NCRP 1987. *Radiation Alarms and Access Control Systems*. (NCRP Report No. 88). Bethesda, Maryland.

NRC 1982. *Working Safely in Gamma Radiography*. (NUREG/BR-0024). Washington, D.C.

Appendix A  
STANDARD RADIATION WARNING TREFOIL

The standard radiation warning trefoil should be proportioned as shown below (ANSI N2.1). The trefoil color shall be either magenta or black on a yellow background (10 CFR 835.601(a)).



**UNITED STATES**  
**DEPARTMENT OF ENERGY**  
Office of Worker Protection Programs and Hazards Management (EH-52/270CC)  
19901 Germantown Road, Germantown, MD 20874-1290

*Request for Changes to*  
**POSTING AND LABELING FOR**  
**RADIOLOGICAL CONTROL GUIDE**  
(Use Multiple Pages as Necessary)

Page No. _____	_____
Section No. _____	Facility Requesting Change
Paragraph No. _____	_____
	Contact Person
	_____
	Telephone Number - Fax Number

Description of Change Request:

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Suggested Specific Word Changes:

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EH-52 Technical Staff Contact: Joel L. Rabovsky (301) 903-2135	EH-52 Guidance Program Contact: Joel L. Rabovsky (301) 903-2135
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