



اوتوري تي كبغسان كسلامتن  
كصيتن. دان عالم سكيتر  
Safety, Health and Environment  
National Authority

# CLASSIFICATION OF RADIATION WORKPLACES AREA GUIDELINE

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<b>AUTHOR</b>	<b>COMPLIANCE AND INTERNATIONAL AFFAIRS DIVISION (CID)</b>
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# CONTENTS

1. INTRODUCTION .....	3
2. PURPOSE.....	3
3. SCOPE.....	3
4. DEFINITIONS.....	3
5. METHOD TO DETERMINE THE CLASSIFICATION OF AREAS IN RADIATION WORKPLACES .....	4
6. WORKING AREA MARKING .....	6
7. ADMINISTRATIVE AND SAFETY PROCEDURE AT SUPERVISED AND CONTROLLED AREA .....	7
i. SAFETY PROCEDURE OF SUPERVISED AREA .....	7
ii. SAFETY PROCEDURE OF CONTROLLED AREA .....	7
8. EFFECTIVE DATE.....	8
9. REFERENCES .....	8
APPENDIX A .....	9

## 1. INTRODUCTION

This document serves as an additional guideline for the use of Radiation Licensees or Radiation Protection Officers to determine the area classification of workplaces involving ionising radiation exposure in Brunei Darussalam.

This is also to further supplement Part 5: Monitoring Programme of the Guideline on Radiation Protection Programme (**RPP**) Requirements (Rev.1) as published on the SHENA official website.

## 2. PURPOSE

The determination of area classification of workplaces is part of the licence requirement under RPP. It aids workplaces in managing radiation risks by identifying and segregating higher risk activities from lower-risk activities and thus controls the extent of radiation exposure.

## 3. SCOPE

The scope of this guideline will address the following:

- 1.1. To define the various types of work areas that exist when dealing with ionising radiation such as clean area, supervised area, controlled area; and
- 1.2. To determine the method of classification of areas in radiation workplaces based on the risk and magnitude of radiation exposure.

## 4. DEFINITIONS

The following terms used in this guideline are defined as follows:

### i. **Clean Area**

An area where the annual dose received by a worker is not likely to exceed the dose limit for a member of the public that can cause overexposure.

### ii. **Supervised Area**

An area not designated as a controlled area but for which occupational exposure conditions are kept under review, even though specific protection measures or safety provisions are not normally needed.

### iii. **Controlled Area**

An area in or with limited access area, in which specific protection measures and safety provisions are, or could be required for controlling exposures, or preventing the spread of contamination in normal working conditions and preventing or limiting the extent of potential exposures.

## 5. METHOD TO DETERMINE THE CLASSIFICATION OF AREAS IN RADIATION WORKPLACES

The two methods described below can be used to determine whether a workplace area is a controlled area, supervised area, or clean area:

### 5.1 Direct measurement by using a calibrated survey meter.

The working area classification can be determined using a survey meter by taking direct measurements using a calibrated survey meter from the radiation source and moving away from it until the dose values for the supervise and control areas are obtained.

For instance, the Radiation Licensees or Radiation Protection Officer intends to establish a controlled area based on an annual dose limit which is 20 mSv per year, therefore the dose rate reading that must be obtained is 3.0  $\mu$ Sv/hour, based on the value of 3/10 of the annual dose limit set in the Dose Limits for Occupational Radiation Workers and Public as stated under Guidelines on Radiation Protection Programme (RPP) Requirements.

The 6 mSv/year that is derived based on the 3/10 of the annual dose limit known as dose constraints is to optimise the protection and safety of workers, from which the intended outcome is to ensure all exposures are controlled to levels that are as low as reasonably achievable (ALARA).

The mathematical formula is as follows:

#### (a) Occupational Radiation Dose Exposure for Radiation Workers

This method is suitable for all ionising radiation-based activities except for industrial radiography.

$$\begin{aligned} &= \frac{(\text{Controlled Area Dose Limit} \times \text{Annual Dose Limit})}{\text{Annual Working Hours}^*} \\ &= \frac{(3/10 \times 20 \text{ mSv/year})}{2000 \text{ hours}} \\ &= 3.0 \mu\text{Sv/hour} \end{aligned}$$

Consideration\*: 1 year = (8-hours x 5 days/week x 50 week/year) = 2000 hours

#### (b) Radiation Dose Exposure for Public

This method is used for determining the level of radiation exposure in the general population. The calculation methods are as follows:

$$= \frac{(\text{Annual Dose Limit})}{\text{Annual Working Hours}^*} = \frac{(1 \text{ mSv}/\text{year})}{2000 \text{ hours}}$$

$$= 1.0 \text{ } \mu\text{Sv}/\text{hour}$$

Consideration\*: 1 year = (8-hours x 5 days/week x 50 week/year) = 2000 hours

## 5.2 Calculation by applying the Inverse Square law to create safe distances.

The calculation method for determining the area classifications in workplaces using the Inverse Square Law formula is as follows:

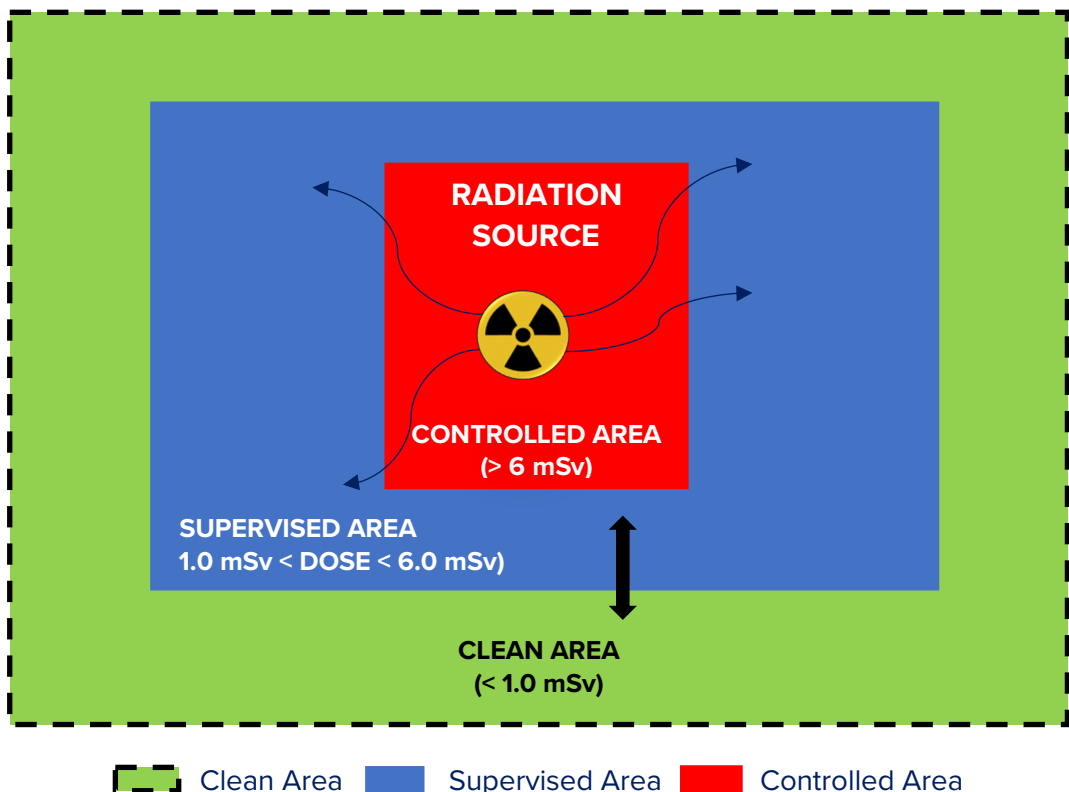
$$X_1 d_1^2 = X_2 d_2^2$$

Where:

d = Distance from radiation source

X = Dose rate


A safe distance for the radiation workers working in a controlled or supervised area can be determined by applying the formula as seen above. However, the Radiation Licensees or Radiation Protection Officer shall obtain information from the radiation detection equipment (survey meter) on the dose rate at a predetermined distance.



**Figure 1:** Border in between of Controlled, Supervised and Clean Area

## 6. WORKING AREA MARKING

The Radiation Licensees or Radiation Protection Officers are responsible for marking the controlled area with physical or other appropriate means after determining the classification of the radiation working area. The boundaries between controlled and supervised areas must be clearly defined with easy-to-read notices and warning signs that display radiation symbols with information about the radioactive material or controlled apparatus installed at appropriate locations as shown in **Figure 2**.


<b>RADIATION AREA AUTHORISED PERSONNEL ONLY</b>
1. RADIOACTIVE MATERIAL/CONTROLLED APPARATUS INFORMATION
i) ISOTOPE AND MASS NO _____ / TYPE AND MODEL _____
ii) MAXIMUM ACTIVITY _____ / MAX kVp, mA _____
2. OUTER SURFACE RADIATION LEVEL _____ mSv/h
3. EXTERNAL RADIATION LEVEL AT THE DISTANCE OF 1 METER _____ mSv/h
4. EMERGENCY CONTACT NUMBER
i) PHONE NO: _____ (Licensee)
ii) PHONE NO: _____ (Radiation Protection Officer)

**Figure 2:** Example of warning sign, radiation symbol with the minimum information on radioactive materials/controlled apparatus.

## **7. ADMINISTRATIVE AND SAFETY PROCEDURE AT SUPERVISED AND CONTROLLED AREA**

The Radiation Licensees or Radiation Protection Officers are required to impose necessary administrative measures, such as the use of administratively issued work permits, and physical barriers, such as the installation of locks or interlocks to restrict access to controlled areas. The determination of the limitation of access to the controlled area must be established by considering the magnitude and anticipation of any potential exposure. Only an authorised person who is permitted by the Radiation Licensees or Radiation Protection Officer may enter the controlled area.

Any authorised workers or personnel that have been granted access to the controlled area shall follow and comply with the instructions issued by the Radiation Licensees or Radiation Protection Officer. Protection measures, security provisions, and the boundaries of supervised and controlled areas shall all be reviewed on a regular basis when needed or as instructed by the Authority.

### **i. SAFETY PROCEDURE OF SUPERVISED AREA**

Specific protective measures and safety provisions are not required in supervised areas however, occupational exposure conditions must always be reviewed once a year by the Radiation Licensees or Radiation Protection Officer.

The Radiation Licensees or Radiation Protection Officers must consider the characteristics and level of radiation risk as well as ensure that the area's boundaries have posted visible notices that use the standard radiation warning signs (refer to [APPENDIX A](#)).

Radiation monitoring is not required in this area and the Radiation Licensees or Radiation Protection Officer must ensure that any visitor entry is adequately controlled.

The periodic medical examinations in this area are not required. Working in a supervised area is not permitted for anyone under the age of 16 years old.

### **ii. SAFETY PROCEDURE OF CONTROLLED AREA**

For controlled areas, individual occupational radiation exposure is likely to exceed 6 mSv in a calendar year. A standard operating procedure should be posted, and access control shall be restricted to only authorised persons. The Radiation Licensees or Radiation Protection Officer must, if necessary, accommodate a suitable working condition to ensure the safety of the female worker in a controlled area that has confirmed her pregnancy.

A person over the age of 16 years old but under the age of 18 years old is allowed to work in a controlled area for the purpose of training only. However, they must be supervised by an authorised and experienced employee in the field of radiation protection.

Any visitors who are interested in visiting these controlled areas must be accompanied by authorised and experienced employees in the field of radiation protection. The visitor must be given adequate information and instructions before entering a controlled area. The Radiation Licensees or Radiation Protection Officers is responsible for ensuring that the visitor has received adequate personal protective equipment prior to entering a controlled area.

## 8. EFFECTIVE DATE

These guidelines take effect immediately upon the date of issuance and when they are published on the SHENA website at [www.shena.gov.bn](http://www.shena.gov.bn). For any further questions regarding this Guideline, the Radiation Licensees or Radiation Protection Officers and new applicants can contact the Authority at:

### **Safety Health and Environment National Authority (SHENA)**

Level 6, Knowledge Hub Building,  
Simpang 32-37, Kg Anggerek Desa,  
Bandar Seri Begawan BB3713  
Brunei Darussalam

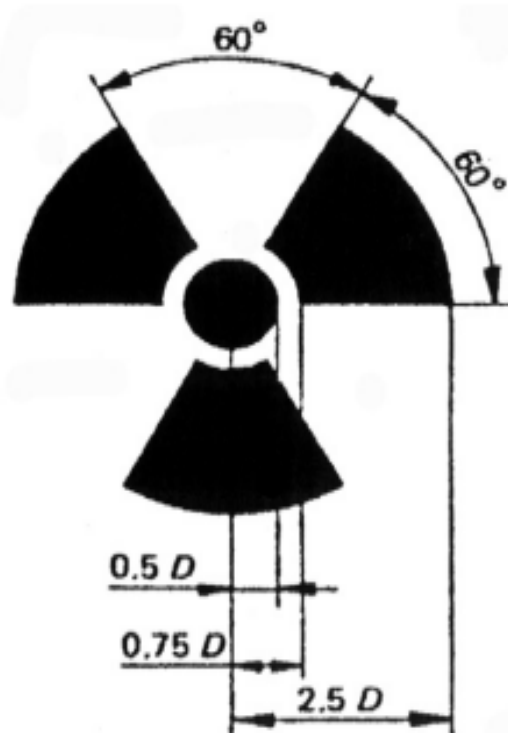
Operating hours : Mon – Fri 8:00am – 11:30am; 2:00pm – 4:00pm  
Office telephone no. : +673 238 2000  
Email address : [radapplication@shena.gov.bn](mailto:radapplication@shena.gov.bn)

## 9. REFERENCES

- i. IAEA Code of Conduct on the Safety and Security of Radioactive Sources, 2004 IAEA/CODEOC/2004.
- ii. IAEA Nuclear Safety and Security Glossary 2022 (Interim Edition).
- iii. IAEA Safety Standards. Radiation Protection and Safety of Radiation Sources: International Basic Standards. General Safety Requirements Part 3.
- iv. Occupational Radiation Protection, General Safety Guide (GSG-7).
- v. Panduan Pengelasan Kawasan Kerja Menurut Peraturan-Peraturan Perlesenan Tenaga Atom (Perlindungan Sinaran Keselamatan Asas) 2010 [P.U (A) 46].
- vi. Radiation Protection Act, Chapter 228 (RPA, 228).
- vii. SHENA Guidelines on Radiation Protection Programme (RPP) Requirements (Rev. 1).

## RADIATION SYMBOL

The radiation symbol shall consist of a three-blade design as shown below using the radiation caution colours, that is black for the three-blade design and yellow for the background.  $D$  is the diameter of the central circle. For warning signs, the minimum value of  $D$  shall be 8 millimetres.



**Figure 3:** Radiation symbol. (source: IKN-RS-SOP-09: Area Classification)