United States Department of Agriculture

Radiation Safety Program

Public Dose Estimate for Nuclear Gauges

Policy

Permit Holders possessing nuclear moisture/density gauges or hydroprobes must demonstrate compliance with the following two requirements (10 CFR §20.1301):

- The radiation dose received by individual members of the public must not exceed 100 mrem in one calendar year; and
- The radiation dose in unrestricted areas must not exceed 2 mrem in any one hour.

Date of Evaluation

Date:

Facility

Facility or Laboratory Name:		
Address:		
City:	State:	Zip Code:

Attach a diagram showing gauge storage location, adjacent areas and their use. Indicate on the diagram the areas where doses were estimated.

Summary of Individual Calculations

Gauge Information (Manufacturer, Model No., Serial No.)	Hourly Dose Rate (mRem / hour)		Estimated Annual Dose (mRem / year)	
	Location 1	**Location 2**	**Location 1**	**Location 2**
Totals:				

The totals for all of the gauges in one storage location must not exceed the limits of 2 mRem in one hour and 100 mRem in one year.

Individual Performing the Evaluation

Worksheet for Individual Gauges

Location or Facility Name	Date of Evaluation:

1. Gauge Information (To be completed for each gauge)

A	B	C	D	E
Manufacturer, Model No., Serial No.	Measurement Location (from Diagram)	Dose Rate at specified distance from gauge (from Manufacturer's literature or from direct measurement)		Distance to occupied area
		Dose Rate **(mR / h)**	Distance **(feet)**	Distance **(feet)**

2. Occupancy Information (To be completed for each measurement location)

Step	Location 1	Location 2	
1. Record the number of days each year that the gauge is at the storage location. (Note: The gauge log book should indicate how often the gauge is in use. Full time storage should be recorded as 365 days per year.)			**days/yr**
2. Record the number of days each year that an individual is present at the measurement location. (Note: There are typically 250 working days in a calendar year.)			**days/yr**
3. Record the average number of hours per day that an individual spends at the measurement location. (Note: Use the occupancy factors listed on the Instruction Sheet.)			**hrs/dy**

3. Hourly Dose Calculation (To be completed for each gauge)

Step	Location 1	Location 2	
1. Square the distance recorded in Item 1D.			**ft^2**
2. Square the distance recorded in Item 1E.			**ft^2**
3. Divide the value in Step 3.1 by the value in Step 3.2.			
4. Multiply the value in Item 1C by the value in Step 3.3. **This is the Estimated Hourly Dose Rate.**			**mR/hr**

4. Annual Dose Calculation (To be completed for each gauge)

Step	Location 1	Location 2	
1. Divide the value in Step 2.1 by 365 days per year. This is the fraction of the time the gauge is present in the storage location.			
2. Multiply the value in Step 2.2 by the value in Step 2.3. This is the number of hours per year that an individual is present in the area of concern.			**hrs/yr**
3. Multiply the value in Step 4.1 by the value in Step 4.2. This is the average number of hours that an individual spends in the area of concern when the gauge is present.			**hrs/yr**
2. Multiply the value in Step 4.3 by the value in Step 3.4. **This is the Estimated Annual Dose.**			**mR/yr**

Radiation Dose Rates for Various Moisture / Density Gauges
(from Manufacturer's literature)

Gauge	Maximum Surface Dose Rate (mRem / hour)	Maximum Dose Rate at 3 feet (mRem / hour)
Troxler, Model 3216		
Gauge only	25.0	0.01
Gauge in Transport Case	2.5	0.01
Troxler, Model 3241-C		
Gauge only	11.0	0.1
Gauge in Transport Case	3.9	0.1
Troxler, Model 3320 and 3330 Series		
Gauge only	0.85	0.1
Gauge in Transport Case	0.3	0.1
Troxler, Model 3401 / 3411		
Gauge only	15.0	0.4
Gauge in Transport Case	6.4	0.11
Troxler, Model 3430		
Gauge only	27.4	0.45
Gauge in Transport Case	10.7	0.3
Troxler, Model 3440		
Gauge only	20.5	0.65
Gauge in Transport Case	13.2	0.6
Troxler, Model 3450		
Gauge only	14.0	0.4
Gauge in Transport Case	7.0	0.25
Troxler, Model 4300 Series		
Gauge only	0.75	0.01
Gauge in Transport Case	0.3	0.01
Troxler, Model 4640-B		
Gauge only	19.0	0.35
Gauge in Transport Case	6.0	0.2
CPN, Model 503		
Gauge only	4.7	0.14
Gauge in Transport Case	1.9	0.13
CPN, Model 503 DR		
Gauge only	4.7	0.14
Gauge in Transport Case	1.9	0.13
CPN, Model MC-1 DR		
Gauge only	37.4	0.36
Gauge in Transport Case	10.1	0.44
CPN, Model MC-3		
Gauge only	37.4	0.36
Gauge in Transport Case	10.1	0.44

Instructions and Information

Policy

Locations possessing nuclear gauges must demonstrate compliance with the following two requirements:

- The radiation dose received by individual members of the public must not exceed 100 mrem in one calendar year; and
- The radiation dose in unrestricted areas must not exceed 2 mrem in any one hour.

This policy is required by the following Nuclear Regulatory Commission regulations:
10 CFR 20.1301: Each licensee shall conduct operations so that the total effective dose equivalent to individual members of the public from licensed operations does not exceed 0.1 rem in a year … . The dose in any unrestricted area … does not exceed 0.002 rem in any one hour.
10 CFR 20.1302: The licensee shall make … surveys of radiation levels … to demonstrate compliance with the dose limits for individual members of the public [specified] in 20.1301.

Member of the Public

A member of the public can be defined as any individual other than a Permit Holder or Associate User who will spend time in any of the unrestricted areas next to the gauge's storge location.

Diagram

The diagram required for this activity should be drawn to scale, with the location of the gauge(s) indicated. An engineering drawing is not necessary, but the drawing should be sufficiently detailed to estimate area usage and distances. The scale (e.g. 1" = 4') should be stated on the drawing. Rooms and areas adjacent to the gauge storage area should also be shown on the drawing, along with an indication of their use (office, stairs, restroom, etc.) If the storage area is located on an exterior wall, the diagram should detail the adjacent exterior conditions as well.

Selection of Measurement Areas

When selecting areas for estimation of the hourly and annual radiation dose, consider the following:

- An area can be as close to the storage area as possible, to estimate the maximum potential dose.
- An area should be where an individual normally spends time during the work day such as a desk or table, to estimate the typical or likely dose.
- The distance to the area should be from the center of the storage area to where the individual would be located.

Occupancy Factors

The National Council of Radiation Protection and Measurements (NCRP Report 49) has developed a standard for estimating the amount of time that an individual typically spends in certain areas. You can use the following table to estimate the amount of time per day that an individual spends in a designated area. This value should be recorded in Step 2.2. **Use actual occupancy data if that is available.**

Office 8 hrs/day	**Any Occupied Space** 8 hrs/day	**Parking Lot** 2 hrs/day	**Restroom** 2 hrs/day
Hallway 2 hrs/day	**Storage Areas** 0.5 hrs/day	**Sidewalk** 0.5 hrs/day	Outside Areas 0.5 hrs/day

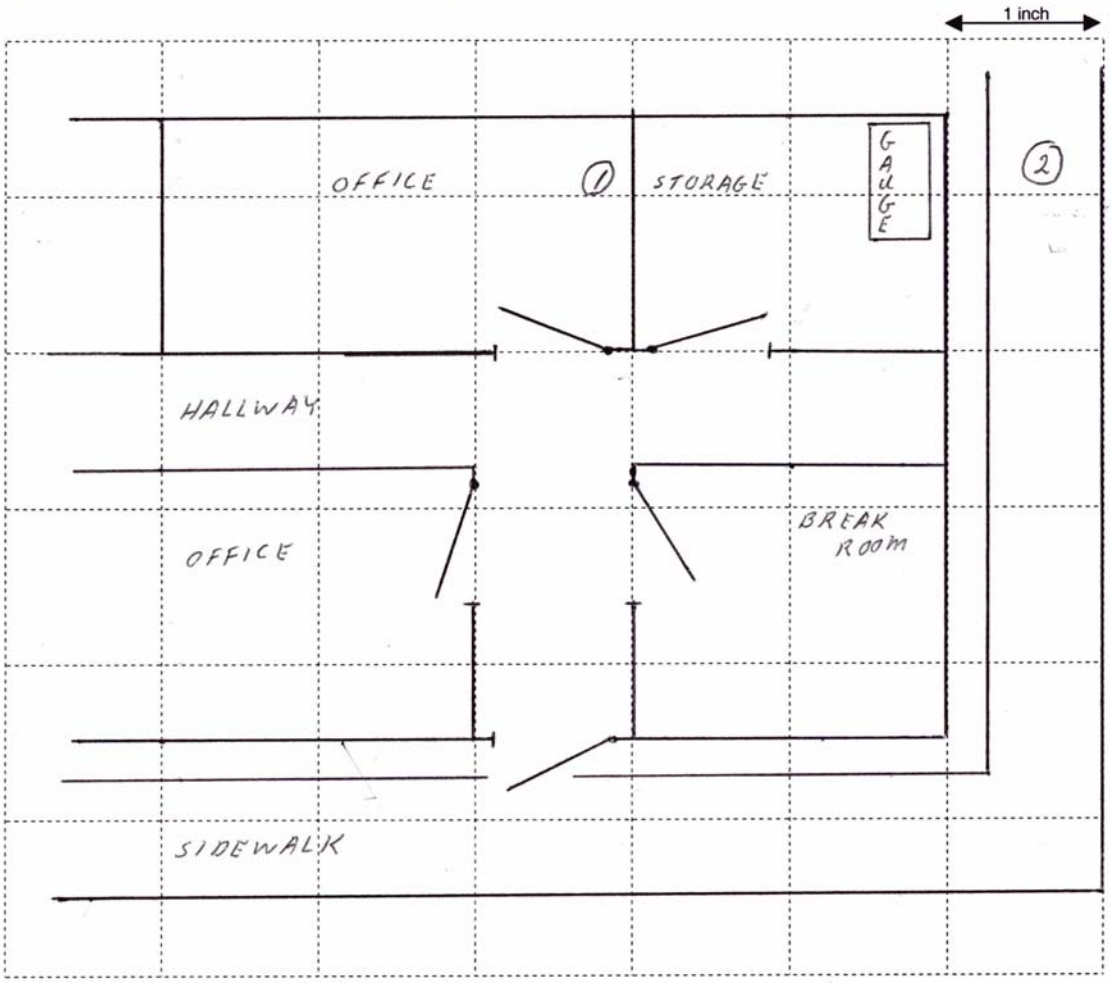
Example of an Acceptable Area Diagram

USDA United States Department of Agriculture

Survey Worksheet

Radiation Safety Staff

Facility: USDA ENGINEERING OFFICE	
Location: ANYTOWN, ANY STATE	
Purpose: LOCATION DIAGRAM	Scale: 1 inch = 4 FT



Comments:
1. OFFICE 8' FROM GAUGE STORAGE
2. OUTSIDE SIDEWALK, 3' FROM STORAGE

Inspector/Surveyor: ENGINEER BOB

Date: MAY 5, 2003