



**Minnesota  
Radiological  
Emergency  
Preparedness  
(REP)**

**Emergency Worker  
Handbook**

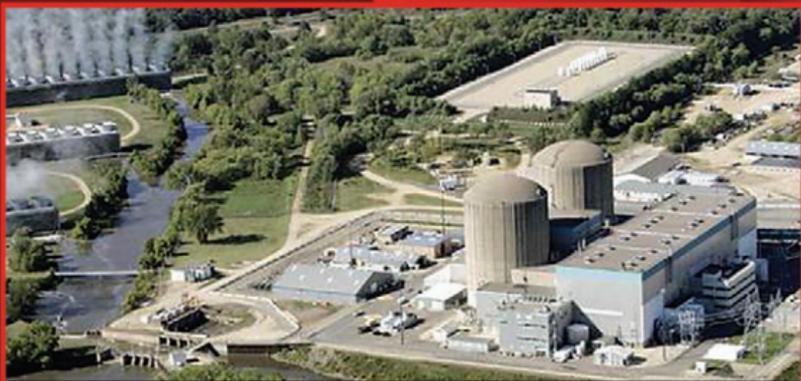


The Emergency Worker Handbook includes information about responding to a radiological emergency at one of the nuclear power plants as listed below:

Please read through this handbook. If you have any questions or concerns, please discuss them with your radiological officer or supervisor.



**Monticello Nuclear Generating Plant  
Monticello, Minnesota**



**Prairie Island Nuclear Generating Plant  
Welch, Minnesota**

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## **Radiological Emergency Preparedness Program**

Federal regulations require nuclear power plants have a federally tested and approved emergency response plan. State and county governments have the same responsibility as outlined in Minnesota State Statutes 12.3 and 12.4. The purpose of the Radiological Emergency Preparedness (REP) program is to protect public health and safety.

### **Nuclear Power Plants and Exposure**

Nuclear power plants are built to contain radioactive material but they do release some radioactivity into the environment. These releases are monitored and controlled by strict Environmental Protection Agency (EPA) guidelines. The Nuclear Regulatory Commission (NRC) is responsible for the regulatory application of these guidelines. Releases therefore, are kept well below amounts that would affect public health or the environment.

No deaths or serious injuries have been recorded during 50 years of nuclear power plant production in the United States due to exposure to radiation. This includes the country's only commercial nuclear accident at Three Mile Island.

## **Emergency Planning Zone**

The Emergency Planning Zone (EPZ) is a ten-mile area around a nuclear power plant that may be most at risk of radiation exposure in the event of a release of radioactive material.

This EPZ is divided into sub-areas. Not all residents in the EPZ may be affected during an accident so residents may be advised to take certain actions based on their sub-area.

The power plant gives immediate notification to the state and counties in the EPZ if there is any incident that could lead to protective action recommendations. The plant makes notification through the use of Emergency Classification Levels (see next section). In addition, the utility recommends protective actions to the state and affected counties.

Responders will be notified by their agencies about when and where to respond.

## **Emergency Classification Levels**

There are four emergency classification levels (ECL). Each level calls for a certain response.

### **Notification of Unusual Event (NUE)**

A low level event which poses no threat to public safety but which warrants an increased awareness on the part of plant and off-site agency personnel.

### **Alert**

Also a low level condition which poses no threat to public safety, but precautionary mobilization of certain response functions is appropriate in case conditions degrade.

### **Site Area Emergency**

At this level, conditions have degraded to a point warranting the full activation of response functions. Precautionary protective actions for high risk portions of the general public might be recommended.

### **General Emergency**

Conditions have degraded to a point threatening public safety and some form of protective actions will be initiated.

## Radiation Principles

Radiation is energy emitted from unstable atoms. Atoms are the building blocks of all matter. Unstable atoms try to become stable by giving off energy. This energy is radiation. Radiation is emitted from the air, our food and water, and from the earth itself.

In a nuclear power plant, atoms in the uranium fuel split into fragments. These fragments are not stable. Unstable atoms lose their excess energy by emitting three types of radiation: alpha and beta particles, and gamma rays.

- Alpha particles are the least penetrating and can be stopped by sheets of paper.
- Beta particles are more penetrating and can be stopped with a few layers of plastic or by the outside layers of skin.
- Gamma rays have a high penetrating power but can be slowed by dense shielding material such as lead or concrete.

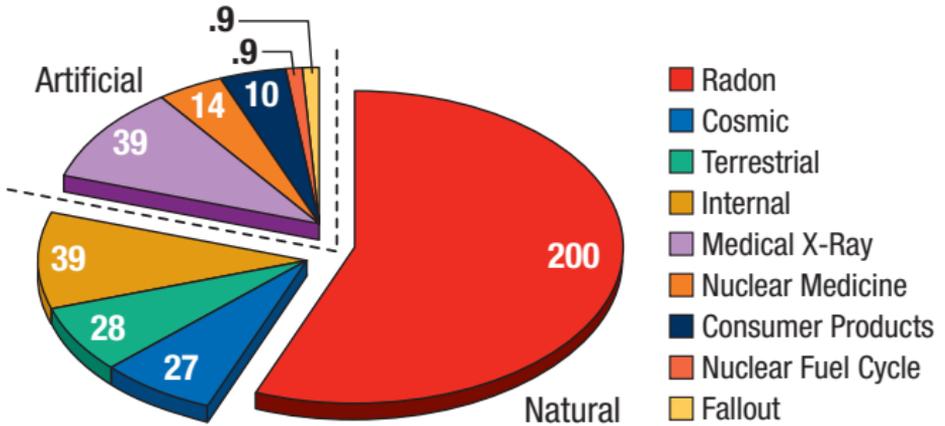
## Radiation and Us

We are exposed to radiation in our every day lives. Exposure to radiation can damage cells in the human body. It is possible for cells to repair themselves depending on the amount of radiation exposure and the physical condition of the person exposed.

We measure the biological effects of radiation on the body using the measurements of “Rem” or “milliRem” (a milliRem or mRem equals one one-thousandth of a Rem).

The chart below shows the source of radiation and exposure on an annual basis.

### Average Yearly U.S. Radiation Exposure in mRem/year



The effects of large amounts of radiation are well understood; however, effects of small amounts of radiation are not clear. Federal guidelines suggest that there is risk with any exposure to radiation, even from one of the sources listed on the chart.

The main concern is the cumulative risk of radiation exposure over a period of several years. Therefore, exposures to small amounts of radiation are considered less risky than large amounts of radiation.

Exposure exceeding 150,000 to 600,000 mRem can produce symptoms of radiation sickness. An exposure of 600,000 mRem, left untreated, could be fatal. The limits used in the REP program are designed to limit your exposure. Adhering to these limits will reduce the risk of developing any observable symptoms and reduce the risk of cancer in the future.

## Dosimetry

A dosimeter measures the amount of radiation exposure to your body. You will be issued dosimetry if you are asked to perform a specific function where you might be exposed to radiation or come in contact with radioactive material. Different types of dosimeters are used to gather radiation exposure information.

### Thermoluminescent Dosimeter (TLD)

A TLD records the amount of radiation from an individual exposure. It should be worn on the front of the body between the waist and shoulders. The TLD provides a permanent record of exposure after processing in a laboratory. The serial number will be recorded on the Emergency Worker Dosimeter Log.

While a TLD provides an accurate record of exposure, it cannot be read in the field by the responder. In order to allow workers to monitor their exposure while working, a second type of dosimeter, a Direct Reading Dosimeter (DRD), will be issued to each emergency worker or group of workers.



## Direct Reading Dosimeter (DRD)

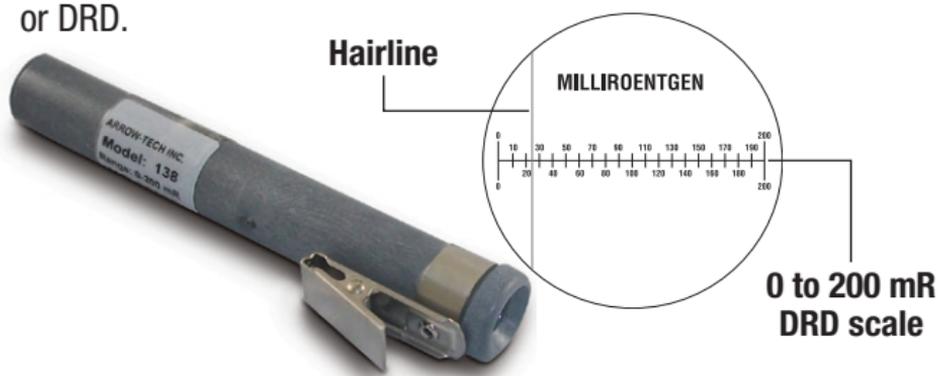
A DRD is designed to work alongside the TLD. It gauges any exposure an emergency worker receives and can be read directly in the field. Individuals can take the appropriate action based on the reading shown.

### How to Read Your DRD

Note the scale: Roentgen (R) is the range on 0 to 20R DRD  
milliRoentgen (mR) is the range on the 0 to 200 mR DRD

- Point it toward a light source.
- Note the position of the hairline (see example below) to establish a “baseline” for future readings.
- Read and record your DRD reading every hour on the “Emergency Worker Exposure Log”.

Contact your supervisor or radiological officer if you drop the dosimeter and the reading changes or if you lose your TLD or DRD.



Instructions on the use of DRDs and TLDs can be found on the “Emergency Worker Exposure Briefing” or by scanning the QR code in the back of this book. These instructions should be reviewed and followed when you are on an assignment.

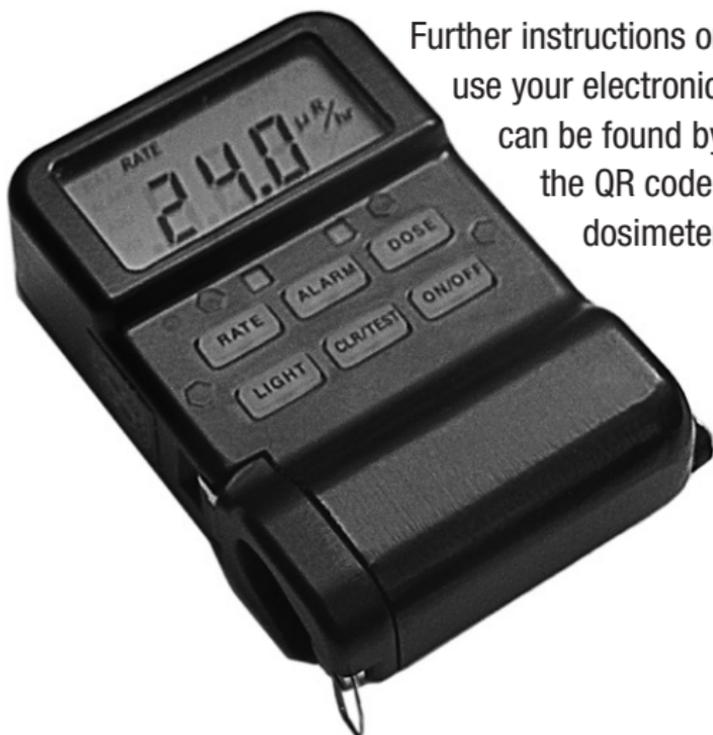
## Electronic Dosimeter

The dosimeter can be read directly in the field and has preset exposure limits and will alarm and/or vibrate when the limits are reached.

How to operate your Electronic Dosimeter

- Hold the on/off button for 3 seconds to turn on your dosimeter.
- Ensure that the dosimeter is working correctly.
- Read your dosimeter as instructed by your supervisor.

Contact your supervisor or radiological officer if your dosimeter is not working correctly.



Further instructions on how to use your electronic dosimeter can be found by scanning the QR code on the dosimeter.

## As Low As Reasonably Achievable (ALARA)

Emergency workers should reduce the risk of being exposed to radiation and keep any exposure at the lowest possible level. This concept is called As Low as Reasonably Achievable or ALARA.

Other techniques that can reduce your exposure:



### Time

reduce the time you are exposed to radiation



### Distance

increase the distance between you and the source



### Shielding

place a shield between you and the source

Specific techniques should be discussed with your supervisor or radiological officer.

# Radiation Protection

## Exposure Limits

Note: For the purpose of tracking exposure in the REP program:

1 Roentgen  $\approx$  1 Rem

1,000 mR  $\approx$  1,000 mRem

## Minnesota Emergency Worker Dose Limits

Minnesota workers performing emergency services in radiological events are assigned a base dose limit of 5 rem Total Effective Dose Equivalent (TEDE) for standard response activities, with a turn-back limit of 1R as read on their dosimeters for normal work activities.

Critical situations may justify higher emergency worker dose limits to protect the people of Minnesota. A dose limit of 10 rem is allowed for the protection of key resources and critical infrastructure, with a turn-back limit of 2R as read on self-reading dosimeters. A dose limit up to 25 rem is allowed for life saving activities and the protection of large populations, with a turn-back limit of 5R. These values are summarized in the table below:

Dose Limit	Turn-Back Limit	Response Activity
5 rem	1R	Standard Response
10 rem	2R	Protection of Critical Infrastructure/ Key Resources
25 rem	5R	Lifesaving or Protection of Large Populations

For a Hostile Action Based (HAB) incident, the dose limits follow the EPA dose limit guidance for life-saving and the protection of large populations.

There are no turn-back limits for responders working outside the EPZ or outside of an area under a protective action.

Permission to exceed the dose limits from the state is only required if you are exceeding a limit in a particular response activity identified above. Local jurisdictions determine the type of response activity and use the corresponding dose limits.

The guidance to establish these limits comes from the *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents* and uses the same limits for federal responders in a radiological emergency.

#### **Minnesota Contamination Limits are as follows**

Return Home	Less Than 300 CPM + Background
Return to Duty	Less Than 1000 CPM + Background

Items exceeding the contamination levels identified above must be decontaminated before being released or returned to service.

If you have any questions contact your supervisor.

## **Potassium Iodide (KI) for Emergency Workers**

One of the radioactive materials that may be released during a radiological incident is radioactive iodine. Iodine is used in the human body by the thyroid gland. Potassium iodide is a thyroid blocking agent and is used to “saturate” the thyroid with nonradioactive iodine. This reduces the chance that radioactive iodine will build up in your thyroid.

### **Taking Potassium Iodide (KI)**

You will be issued potassium iodide and a “Potassium Iodide (KI) Ingestion Record” if there is a possibility that you will be exposed to radioactivity in the plume.

You need to read and understand the warnings and instructions on the record before you are deployed. Make sure you know when you start and how long you should self-administer KI.

It is important to log how many times you self-administered KI. Radiation protection professionals may review this log to determine if any further monitoring of your thyroid is needed.

## **Prenatal Exposure for Female Emergency Workers**

Federal radiation exposure guidelines stress caution about exposing a fetus to any amount of radiation. The guidelines suggest no matter how small, exposure may have a harmful effect.

Equal employment opportunity regulations also mandate that a female responder has the right to fair employment. Therefore a pregnant female emergency worker is asked to consider the risks to her fetus and make a decision about limiting her radiation exposure.

## **Emergency Worker Declaration of Pregnancy Form**

An “Emergency Worker Declaration of Pregnancy Form” should be used to document the decision by the responder. Supervisors or radiological officers should have blank forms available.

Supervisors and radiological officers should be informed about the responder’s decision. The “Emergency Worker Declaration of Pregnancy” form will be used to document decisions and any associated limitations.

The form should be reviewed and signed by a supervisor or radiological officer and filed for future reference.

The emergency worker is responsible for communicating any change in status to their supervisor or radiological officer.

## Radioactive Contamination

Radioactive contamination is radioactive material in an unwanted place.

Contamination levels can not be accurately detected using a DRD or TLD.

### Contamination Monitoring

Radioactive contamination may be detected with hand held instruments or larger portal monitors. Monitoring for emergency workers is done at an Emergency Worker Decontamination Center.

The contamination limit for the REP program is 300 counts per minute above background for both people and items.

### Decontamination

There are a variety of ways to decontaminate people and items. They may include:

- **Soap and warm water** — simple washing is very effective in removing surface contamination
- **Disposal of items** — clothing or items may be discarded in an appropriate manner if they are found to be contaminated.

## **Contamination Prevention**

There are a few simple steps you can take to avoid becoming contaminated:

- Do not eat, chew, or drink while responding when radioactive material may be present unless instructed to do so.
- Use proper personal protective equipment (PPE).
- Follow procedures for your specific task.

## **Emergency Worker Decontamination Centers**

Once you reach the end of your shift or if in the unlikely event that you reach your “turn back level”, you will need to report to an Emergency Worker Decontamination Center for monitoring and/or decontamination. The goal of these centers is to monitor, and if necessary decontaminate, emergency workers and vehicles. Emergency workers will also return dosimetry and all records they used during their response. Supervisors and/or Radiological Officers may direct responders to a specific center.

## **Locations of Decontamination Centers**

### **Prairie Island Nuclear Generating Plant**

#### **Dakota County**

Hastings Public Works Department  
1225 Progress Drive  
Hastings, MN 55033

#### **Goodhue County**

Red Wing Fire Department  
420 Plum Street  
Red Wing, MN 55066

Cannon Falls Fire Department  
322 Hoffman Street  
Cannon Falls, MN 55009

### **Monticello Nuclear Generating Plant**

#### **Sherburne County**

Zimmerman Fire Department  
13028 Freemont Avenue  
Zimmerman, MN 55398

#### **Wright County**

Rockford Fire Department  
6700 Main Street  
Rockford, MN 55373

**For Additional Training Scan QR Code for  
Emergency Worker Briefing Video**



**County Radiological Officers Contact Information**

**Dakota County**

(952) 997-0061

**Sherburne County**

(763) 765-3650

**Goodhue County**

(651) 267-2773

**Wright County**

(763) 684-0973



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# Emergency Worker Exposure Briefing

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<b>Dose Limit</b>	<b>Turn-Back Limit</b>	<b>Response Activity</b>
5 rem	1R	Standard Response
10 rem	2R	Protection of Critical Infrastructure/ Key Resources
25 rem	5R	Lifesaving or Protection of Large Populations

## Minnesota REP Program Emergency Worker Exposure Briefing

To read your Direct Reading Dosimeters (DRDs) point it at a light source so that you can look through it and see the scale. The scale should be horizontal when read.

The position of the hairline establishes the “baseline” for future readings. Record this as the initial reading on the Emergency Worker Exposure Log.

Read and record your DRD reading every hour. Use the Emergency Worker Exposure Log for record keeping.

Notify your supervisor or Radiological Officer if you lose a TLD or DRD.

Report to your supervisor or Radiological Officer if:

- You record an exposure exceeding 1 R.
- The 0-200 mR DRD reaches 150 mR.
- You do not see a hairline on your DRD.

If you drop your DRD, read it and report if the hairline moved or disappeared.

Upon completion of your shift, report for monitoring and decontamination. Locations and addresses are found in the “Emergency Worker Handbook.”

If your DRD is reading any exposure to radiation and you are outside of the 10-mile EPZ, report to your supervisor or Radiological Officer.

**Notice:** This document contains information that is considered to be not public data. Distribution of this document is restricted in accordance with the Minnesota Data Practice Act.

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### Minnesota Contamination Limits are as Follows

Return Home	Less Than 300 CPM + Background
Return to Duty	Less Than 1000 CPM + Background

Items exceeding the contamination levels identified above must be decontaminated before being release or returned to service.

If you have any questions contact your supervisor.

By signing this form; I state that I have read and understand the contents of this card.

Signature \_\_\_\_\_

Date \_\_\_\_\_



For additional training  
scan this QR Code































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# Potassium Iodide (KI) Ingestion Record

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# Minnesota REP Program Potassium Iodide (KI) Ingestion Record

Name \_\_\_\_\_ Issue Date \_\_\_\_\_

Amount Issued \_\_\_\_\_ Days Supply \_\_\_\_\_

Do not take KI until advised by your supervisor or Radiological Officer. Complete this section at the time of self-administering KI.

*By signing this form, I state I have read the warning and instructions for administering KI and understand the rationale for its use as well as potential side effects that may occur from its administration. I understand that taking KI is voluntary.*

Signature	Date of Administration
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## Record Date and Time That KI is Administered Below

Date	Time Taken

Date	Time Taken

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# **Minnesota REP Program Potassium Iodide (KI) Ingestion Record**

## **Warning**

Do not take KI if you are allergic to iodine.

Side effects may include skin rashes, swelling of the salivary glands, and “Iodism” (metallic taste, burning mouth and throat, sore teeth and gums, symptoms of a head cold, and sometimes upset stomach and diarrhea).

A few people may have an allergic reaction with more serious symptoms. These could be fever and joint pains, or swelling of parts of the face or body and at times severe shortness of breath, requiring immediate medical attention.

In rare cases taking iodide may cause over activity of the thyroid gland, under activity of the thyroid gland, or enlargement of the thyroid gland (goiter).

## **Instructions**

Take only when instructed by an authorized Minnesota Department of Health official. This instruction will be passed through the respective EOC local chain of command.

Complete the KI ingestion record included in this booklet. Take two tablets (whole or crushed) daily (130mg) until you are directed to stop. Report any side effects to your supervisor or Radiological Officer.





## NOTES

## **This Handbook is Published By:**

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## **Contributing Organizations:**

Minnesota Department of Health  
Minnesota Department of Human Services  
Prairie Island Indian Community  
Xcel Energy Minnesota  
Dakota County  
Goodhue County  
Sherburne County  
Wright County  
City of Red Wing

