



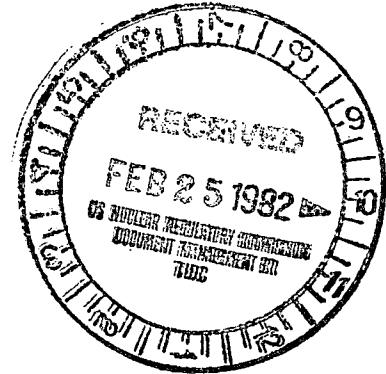
**Consumers  
Power  
Company**

**James W Cook**  
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and Construction*

General Offices: 1945 West Parnall Road, Jackson, MI 49201 • (517) 788-0453

February 19, 1982

Harold R Denton, Director  
Office of Nuclear Reactor Regulation  
Division of Licensing  
US Nuclear Regulatory Commission  
Washington, DC 20555



MIDLAND PROJECT  
MIDLAND DOCKET NOS 50-329, 50-330  
NRC REQUEST FOR ADDITIONAL INFORMATION 432.42.2  
FILE B13.3 SERIAL 15989

REFERENCES: (A) NRC (E G ADENSAM) LETTER DATED OCTOBER 27, 1981  
(B) CP CO (J W COOK) LETTER DATED DECEMBER 1, 1981  
ENCLOSURE: PALISADES EMERGENCY INFORMATION BROCHURE

Question Number 432.42.2 of Reference (A) requested that Consumers Power "provide a draft of the information that will be distributed to the public for review". The response to the question which is provided in the Midland Site Emergency Plan states that the information requested is being patterned after the Big Rock Point and Palisades public education efforts and that samples from those plants should be considered drafts for the Midland Project. Reference B provided samples of the Big Rock Point Plant information.

This letter provides six copies of the Palisades area brochure. This brochure portrays how the Consumers Power Company emergency information program is evolving and is being utilized as a guide for establishing the Midland program.

*James W. Cook*

JWC/JNL/dsb

CC RJCook, Midland Resident Inspector  
RWHernan, USNRC  
RWHuston, Washington  
JGKepler, USNRC  
JLMathis, USNRC  
DBMiller, Midland

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# **EMERGENCY PREPAREDNESS**

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## **IN VAN BUREN AND PARTS OF BERRIEN AND ALLEGAN COUNTIES**

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Information from the Office of Emergency Preparedness



**PLEASE KEEP THIS BOOKLET  
IN A CONVENIENT PLACE  
FOR QUICK REFERENCE**

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# EMERGENCY PLANNING

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Emergency planning is the result of cooperation by a number of county and state agencies. The information contained in this booklet is designed to contribute to a greater public awareness of emergency planning, which is essential for dealing effectively with any serious emergency.

H Cal Rosema Sheriff Van Buren County	Robert L Schra Sheriff Allegan County	Forrest L Jewell Sheriff Berrien County
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## FOR FURTHER INFORMATION

For further information or additional copies of this booklet, contact Emergency Preparedness Offices at the following addresses:

Van Buren County – Richard Gordenier, Coordinator for Emergency Preparedness, PO Box 156, Lawrence, MI 49064, (616) 674-8011

Berrien County – Fred R Thompson, Field Officer for Emergency Preparedness, 919 Port Street, St Joseph, MI 49085, (616) 983-7141

Allegan County – Sgt Roger Webb, Coordinator for Emergency Preparedness, 112 Walnut Street, Allegan, MI 49010, (616) 673-5441

## Emergency preparedness, just in case

Emergency preparedness is an ongoing effort in Van Buren, Berrien and Allegan Counties. Working in close cooperation with one another, a number of county and state agencies have developed plans to deal successfully with any serious emergency.

Severe winters, fires, tornadoes or other natural disasters can endanger a population. We've learned to live with the possibility that such misfortunes can occur; we're comforted in part by the knowledge that through experience, we have learned to plan for the possibility of such disasters and to cope with their effects.

Emergency planning must also take into account the possibility of man-made incidents, such as rail or highway accidents, toxic chemical spills, a national attack or the unplanned release of radiological materials from nuclear power plants.

Because of the abundance of safeguards designed into nuclear power generating facilities, the chances of a serious incident requiring an area evacuation are extremely remote. Nevertheless, prudent planning and federal law require that you, as a citizen, be informed about what to expect in the event of a radioactive materials release which exceeds safety levels.

The worst thing about a natural disaster or any serious man-made emergency is that it often catches people unprepared. We hope we will never be confronted by such problems. But, if we are, local and state authorities have trained people and sound procedures that will allow us to handle them in a safe and organized fashion.

This booklet is primarily designed to answer your questions about what precautionary measures citizens should take in the event of an emergency at the Palisades Nuclear Plant in Covert Township. Public warning for natural disasters and other man-made emergencies is also briefly discussed. Being prepared means being informed, so please read this booklet carefully and keep it in a convenient location for quick reference.

## NUCLEAR PLANT SAFETY AND EMERGENCY PLANNING

Extensive safety precautions taken at the Palisades Nuclear Plant make it extremely unlikely that radioactive materials could ever be released in hazardous quantities.

There is, nevertheless, the remote possibility that the power plant's safety systems could fail and some radioactivity could be released into the atmosphere.

Even if radioactive materials were to be released by unforeseen occurrences, safety and medical experts believe that persons living near the Plant would be exposed to minimal levels of radiation, if any. The exposure level would depend upon the direction of the wind moving across the facility. *The best course of action would likely be to stay indoors, close windows and doors and shut off outside ventilation.*

Federal regulations require that all nuclear power stations and state and local governments have detailed emergency plans to protect the public in the unlikely event of a serious nuclear accident.

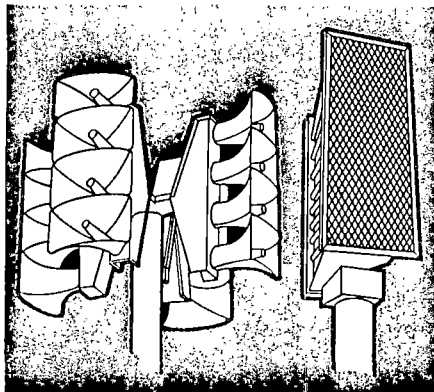
The protective actions outlined in this booklet would greatly reduce any possible exposure to radiation resulting from an accident.

## The response to an emergency

The Palisades Plant has always had its own onsite emergency plan and implementing procedures. In addition, Palisades safety experts have cooperated with federal, state and county authorities to develop coordinated emergency response plans for areas near the Plant. The plan is periodically tested in a simulated "emergency" exercise at Palisades, and in the ten-mile emergency planning zone surrounding the Plant.

### Early warning

Initial notification to area residents of a weather emergency, nuclear accident or other man-made or natural emergency requiring protective action would be made via the sounding of siren public address units. These devices are located within a ten-mile radius surrounding the Palisades Plant to meet emergency preparedness requirements of the Nuclear Regulatory Commission (NRC) and Federal Emergency Management Agency (FEMA). The sirens are controlled by one of three public safety agencies: the Covert Town-



Within 0-5 mile radius  
of the plant

Within 5-10 mile radius  
of the plant

ship Fire Department, South Haven Police Department or Van Buren County Sheriff's Department.

There are three different siren signals which may be used, each for a different type of emergency:

### PUBLIC WARNING

A steady siren sound lasting from three to five minutes, warning of a serious weather emergency, nuclear accident, chemical spill or other disaster requiring protective action.

### NATIONAL ATTACK

A wavering high- and low-frequency siren sound lasting from three to five minutes, indicating the immediate need to take cover from a nuclear attack.

### LOCAL ALERT

A rapidly alternating sharp high and low signal (like a European police car) lasting generally 90 seconds, used to summon local volunteer firemen.

If you hear any of these signals, listen to the public address system or tune to local radio or television stations listed on Page 11 to learn what, if any, precautionary measures should be taken.

The sirens are tested for approximately one minute at 12:00 noon on the first Saturday of every month to verify that the system works properly. If the siren closest to you does not work properly during the monthly test or if you observe something unusual, please contact your local law enforcement agency.

## How are incidents classified?

Any incident at the Palisades Plant would fall into one of four classifications. These are explained here in the order of their increasing seriousness.

### 1 Unusual Event

A minor event (normally not involving radioactive materials) that affects only the Plant and requires no actions by the general public. The Nuclear Regulatory Commission (NRC) and certain state and local agencies would be notified. The public address sirens would not be sounded.

**2 Alert**  
Still a minor event that could result in a small quantity of radioactive material escaping from the Plant site. Radiological Emergency Response Plans of the Plant, local, state and federal governments may be implemented as a precautionary measure in case the situation should become more serious. No actions would be required of the general public, and the sirens would not be sounded.

**3 Site Area Emergency**  
A more serious situation that could result in the release of an amount of radioactive material that would require precautionary measures for the general public in a limited area beyond the Plant site boundary. Federal, state and local officials, as well as the general public, would be notified of the occurrence and advised of what, if any, protective actions to take. All emergency response forces, including radiological specialists, would be activated and the entire Emergency Response Plan put into effect. Sirens may be activated to tell the public what actions are necessary. If they are, the best course of action would likely be to stay indoors, close windows and doors, and shut off outside ventilation.

**4 General Emergency**  
Abnormal Plant conditions that could result in the release of sufficient radioactive material to require precautionary measures for the general public out to as far as ten miles from the Plant. Additional resources would be alerted and put on standby notice for immediate activation. The warning system would be activated. The general public would be told whether sheltering or evacuation is necessary.

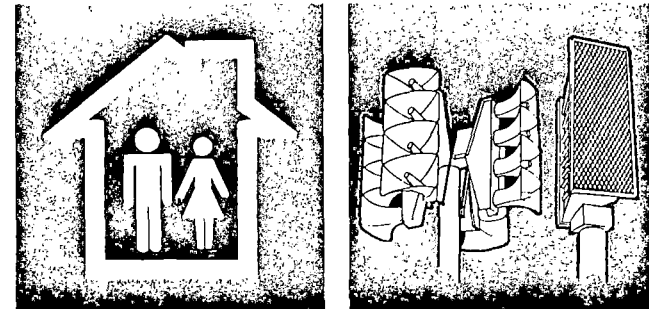
## What kind of information would I receive?

State and county public health and safety officials would determine what kind of protective action may be needed. Persons living up to *TEN* miles from Palisades could be affected by a radiological accident. In case of such occurrence, you would be advised to take "In-Place" protective measures or go to a designated Reception Center.

## What is In-Place Protection?

Stay indoors until you are instructed to do otherwise.

Listen for early warning information after the three-to-five-minute siren steady tone via the public address system and/or stay tuned to your radio or television stations for information and instructions. Page 11 provides specific information concerning area stations.



Close all windows and doors tightly.

Turn off all forced air heating and cooling systems to prevent drawing outside air into a building.

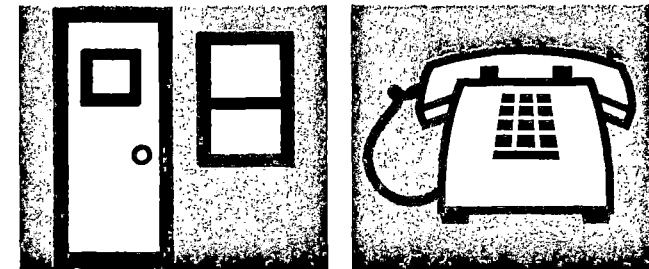
If your building has a basement, take a radio and go there.



Keep away from outside doors and windows.

Use the telephone only if absolutely necessary.

Keep calm. Panic is your greatest enemy in any emergency.



## What if I am instructed to evacuate?

If you are within *TEN* miles of Palisades, there is a remote possibility that you might be required to evacuate certain areas downwind from the Plant. The experts call this area, which could lie in the path of exposure to radioactive material from a puff or "plume," the "plume exposure pathway zone."

An Emergency Planning Zone (EPZ) within 10 miles from the Plant includes all or parts of the following municipalities: in Van Buren County—Bangor, Covert, Geneva, Hartford and South Haven Townships and the Cities of South Haven and Bangor; in Berrien County—the Cities and Townships of Coloma and Watervliet, respectively, and Hagar Township; and in Allegan County—Casco Township. If public safety officials were to call for an evacuation in your area, you would be instructed to:

Follow public notification information on radio, TV or via the public address system. Put on a dust mask or breathe through a damp handkerchief to filter out any dust in the air. Gather up a change of clothing, personal toilet articles, blankets or sleeping bags for each member of your family, special baby formulas and any special medications you or your family may need, as you would in preparation for a short trip, unless otherwise advised by local government.

Secure your property as if you were going on a short vacation. As you leave, lock all doors and tie a white handkerchief or piece of cloth on your mailbox or doorknob so that emergency response personnel will know you have evacuated. Get into your car or other vehicle, close the windows and vents and drive slowly and safely either to your Reception Center described on Page 9, or to the home of friends or relatives at least 15 miles from the Plant. If you have room in your car, take neighbors who have no means of transportation.

## What if I need transportation?

You may be able to get a ride from a neighbor. If this is not possible, stay inside your home (making sure that all doors, windows and air vents are closed) and listen to radio, television or public address.

This booklet contains a form to be filled out in advance by special needs people who would require transportation in an evacuation. Having filled out this "special needs" form in advance, you would wait during any emergency for a local emergency services person to evacuate you from your home.

## Where would I go?

Depending upon the seriousness of the incident, the duration of the resulting hazard could range from several hours to several days. The hazardous area could vary from a few feet from the Plant to a fairly large geographic area downwind from the Plant, within the ten-mile emergency planning zone. In most cases, evacuation would be ordered as a precaution well before you would be confronted with any real danger.

If an evacuation is ordered, you should follow routes (see map on Page 12) which would be identified by the public address system, the radio, television or other means. You should drive either to your Reception Center or to the homes of friends or relatives at least 15 miles from the Plant. Reception Centers include: in Van Buren County—Gobles High School, Paw Paw High School and Decatur High School; in Berrien County—Eau Claire High School and in Allegan County—Saugatuck High School. The protective actions to be taken would depend on the nature of the emergency.

## If my children are in school, what should I do?

Proceed to the location designated as the Reception Center for the school that your child attends. Be sure to use only those routes identified by the radio, television or public address system. Students from South Haven Schools would be transported by bus to the Saugatuck High School. Students from Covert and Hartford Schools would be transported to the Paw Paw High School. Students from Bangor and Wood Schools would be transported to Gobles High School. Students from Watervliet, Coloma and Riverside Schools would be transported to Eau Claire High School. Both students and parents could choose to stay at the Reception Center for the duration of the emergency.

## What about my home and possessions?

While an evacuation order is in effect, neither you nor any other unauthorized persons would be allowed back into the area until safety experts have decided that it is safe to return. Leave your pets at home with a supply of food and water. The only animals to be permitted in the public shelters would be guide dogs trained to assist handicapped persons.

## What about the elderly or disabled?

For temporary shelter, senior citizens and the physically disabled would be evacuated by special transportation to the designated county care facility. If you are hospitalized or a resident of a special care facility, special arrangements to transfer you to another facility are included in the hospital or facility's emergency plan. *If you have special needs, please clip, fill out and mail the Special Needs Form on Page 23 of this booklet.*

## If I am boating or swimming, or vacationing at one of the recreational areas within 10 miles of the Palisades Plant, how would I be notified about a general emergency?

The public warning system (siren and loudspeaker) can be heard up to one mile. The Allegan, Berrien and Van Buren County Sheriff's Departments would request the marine communications to advise boaters and fishermen of an emergency and to inform them of safe waterways and docking areas. The US Coast Guard, the Michigan Department of Natural Resources and the Sheriff's Marine Patrol would direct this operation. Boaters would also be warned by commercial radio stations. Coastal areas would be patrolled. Visitors at Van Buren State Park would be alerted by voice messages through the public notification system or through radio and television.

## What should a farmer do about his crops or livestock?

Upon receiving warning that protective measures are required, you should leave your animals with ample supplies of feed and water and confine them in/under some type of shelter, if possible, so that if evacuation instructions are ultimately given, you may leave immediately. Stored feed such as silage or hay and grain that has been protected from the elements is best. The Michigan Department of Agriculture's radiological monitoring teams would perform follow-up surveys of farm foodstuffs and agricultural products to check for any

contamination. If necessary, livestock would be relocated by the Department of Agriculture. For more information, contact your county cooperative extension service.

## How would I be informed?

You would be notified by Emergency Broadcast System (EBS) radio or television broadcasts or, if you live within ten miles of the Plant, by an emergency public notification system that uses sirens and loudspeakers. You might hear a siren giving a steady, three-to-five minute tone to alert you to turn on your radio or television and listen for loudspeaker announcements. Emergency broadcast messages carrying recommended protective actions and identifying shelter sites or evacuation routes would be repeated at frequent intervals. A regular test of the siren and public address system is always done the first Saturday of each month at 12:00 noon.

The primary stations which would provide information about an emergency include:

WCSY-FM, 98.3 on the FM dial, in South Haven, 5:00 AM to midnight

WCSY Radio, 940 on the AM dial, in South Haven, daytime only  
Other stations which would also provide emergency public information include:

WKZO Radio, 590 on the AM dial, in Kalamazoo, 24 hours

WHFB Radio, 1060 on the AM dial, Benton Harbor, daytime only

WHFB-FM, 99.9, Benton Harbor, 24 hours

WSJM Radio, 1400 on the AM dial, St. Joseph, 5:00 AM to midnight

WIRX-FM, 107, St. Joseph, 5:00 A M to 2:00 A M

WOTV-TV, Channel 8, Grand Rapids, 6:00 A M to 1:30 A M  
weekdays – 7:00 A M to 2 A M weekends

WKZO-TV, Channel 3, Kalamazoo, 6:30 A M to 2:00 A M

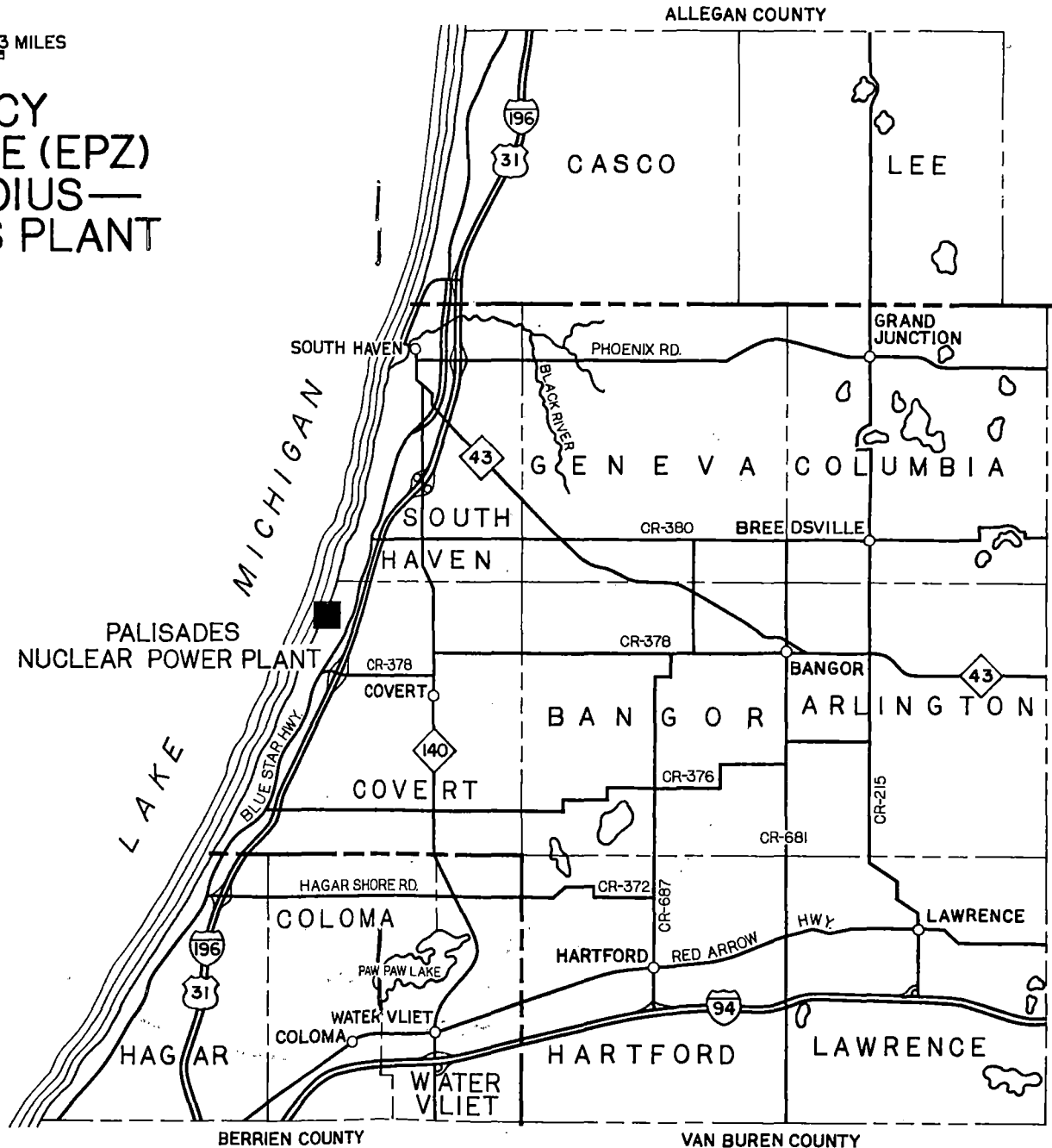
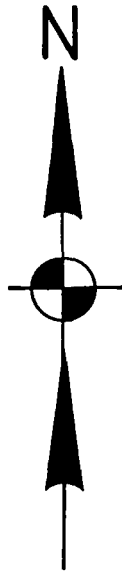
WZZM-TV, Channel 13, Grand Rapids, 6:30 A M to 1:30 A M

Specially designated telephone numbers where you may call with individual problems or questions would be broadcast over your radio or television.

**Avoid unnecessary calls to emergency numbers (police, fire, hospital, etc).** These lines must be kept clear for true emergency needs.

EMERGENCY  
PLANNING ZONE (EPZ)  
—10 MILE RADIUS—  
FOR PALISADES PLANT

SCALE 0 1 2 3 MILES





## RADIATION – A SCIENTIFIC VIEW

Radiation is a physical phenomenon which is neither new nor mysterious. All of us are exposed to radiation every moment of our lives. We receive radiation from the sky in the form of cosmic rays. Rocks and minerals give off natural radiation. Because naturally occurring radioactive materials exist in air and foods, we breathe and eat very small amounts of radioactive materials without even knowing it. X rays and other forms of penetrating radiation have brought us medical and scientific benefits.

Simply put, radiation is energy in motion. The form of radiation we are concerned with in this booklet is "ionizing radiation." This type of radiation has sufficient energy to penetrate living tissue and cause physical and chemical changes within.

### Where does ionizing radiation come from?

Most ionizing radiation comes from natural sources. Cosmic radiation from outer space showers the earth, and naturally occurring radioactive elements are everywhere. The ground we walk on, the buildings we inhabit and nearly everything we touch contains radioactive elements such as uranium, radium and thorium. Our food contains radioactive carbon and potassium; the air we breathe contains tritium, radon and other radioactive gases.

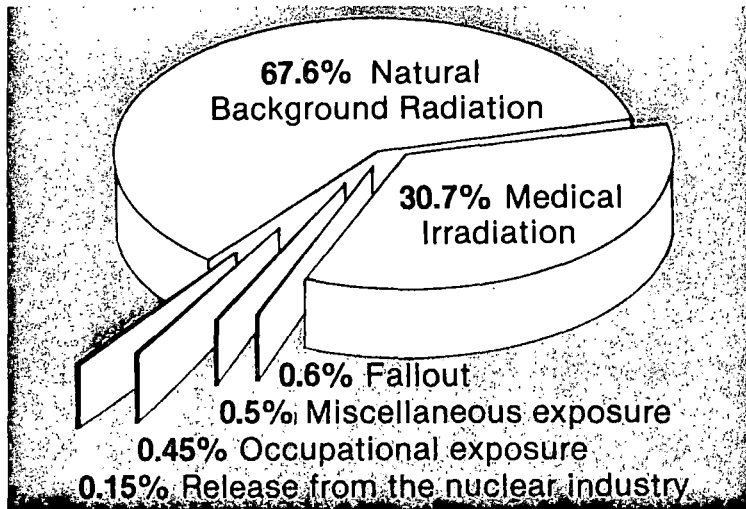


Figure 1 Sources of radiation that people receive.

Some ionizing radiation comes from man-made sources such as diagnostic X rays, television sets, nuclear weapons testing and nuclear energy facilities.

### How is ionizing radiation measured?

Radiation intensity is measured by sensitive instruments such as ionization chambers. In such instruments the radiation interacts with gas and causes a current to flow. The current is proportional to the radiation level. These instruments usually read in units called millirem per hour.

Radiation exposure to individuals is usually expressed in "rem" or "millirem" (1/1,000 of a rem) units. "Rem" is an acronym for "Roentgen Equivalent Man." In earlier times, the terms "roentgen" and "rad" were commonly used.

Radiation exposure is dependent both upon the intensity of the radiation present and time spent in the area. For example, spending 21 days in a granite building that exposes you to one millirem per day will result in an exposure of 21 millirem. You would receive the same amount of exposure in a fraction of a second by having a chest X ray.

### How much radiation exposure do people get?

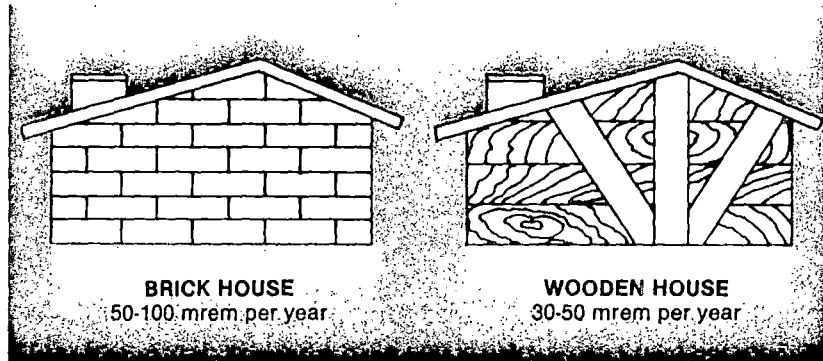
Radiation exposure can vary widely depending upon a person's location. For example, cosmic radiation is twice as high at 2,000 feet elevation than it is at sea level; ground radiation is much higher in areas containing radioactive ores such as granite; airborne radiation is greater in the vicinity of industries or mines that release radioactive materials.

Life-style, too, is important. A brick house is twice as radioactive as a wooden house; airline pilots receive more cosmic radiation, miners more terrestrial radiation; the use of radiation emitting equipment such as television and X ray equipment also increases individual exposure.

According to the BEIR-80 Report\* the average radiation exposure from natural background sources is about 100 millirem per year in the US. The average exposure from man's activities is estimated to be an

\*National Academy of Sciences, Committee on the Biological Effects of Ionizing Radiation: August 1980.

additional 100 millirem per year. This includes about four millirem per year from radioactive fallout as a result of nuclear weapons tests conducted over the last 35 years.



**Figure 2** Background (or natural) radiation to individuals: a brick house is approximately twice as radioactive as a wooden house.

## Can radioactive materials enter the body?

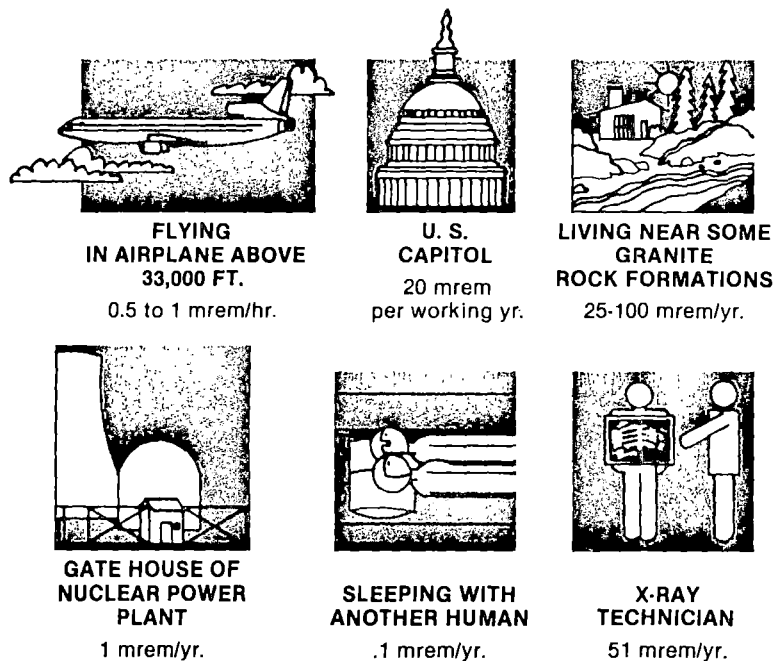
Yes. The radioactive materials we are concerned with in this booklet can be divided into two types. Some materials are not absorbed by body tissues and are quickly eliminated by the body. Other materials can combine with body tissues, but do not stay in the body for long periods of time, and can be quickly removed by various medical and dietary methods.

## How does radiation affect us?

Consider the manner in which sunlight affects us. In the northern part of the world, the winter's slanting rays seldom cause sunburn but the more direct rays of the summer sun do. Still, just a few moments in the mid-summer sun will not give you a tan or cause a sunburn. You have to stay in the sun's direct rays for some time to receive a sunburn. Furthermore, a sunburn on your face and hands may hurt but it usually will not seriously harm you. On the other hand, burning over your whole body can make you very ill.

In much the same way, the harm that can come to you from radiation will depend upon the nature and energy level of the particles and rays which strike you, the length of time you are exposed to them, how much of your body is struck by the rays, how much radioactive materials you breathe or swallow and how the material is concentrated in the body. A large dose of radiation is more damaging than a small one. Unborn and very young children are more sensitive to radiation than are older children and adults.

When emissions from radioactive substances enter the human body they can damage cells by ionizing (adding electrons to or removing electrons from) atoms. If the damage is slight, or takes place slowly, the body can usually make repairs. However, if the damage is great, adequate repairs may be impossible and the consequences severe.



**Figure 3** Approximate additional (in addition to minimum natural background exposure) background radiation. Minimum human exposure is approximately 100 millirem/year.

## How does the amount of radiation I might receive from a nuclear plant accident compare with what I might receive during nuclear medical practices?

If you lived right at the plant site boundary, the maximum amount of radiation you could receive as a result of any credible accident is comparable to the amount you could receive during some routine diagnostic nuclear medicine applications.

## Is low-level radiation harmful?

Unfortunately, there is no definitive answer to the question. Studies of low-level radiation exposures (less than 10,000 millirem per year) indicate that health effects, if they exist, are not measurable or discernible; that is, they are so low that they are masked by the health consequences of other environmental and social factors.

## Should we be concerned about low-level radiation?

Based upon the negative findings of many studies, the BEIR-80 Report states that the health effects of low-level radiation are probably lower than previously estimated. But it agrees that, to be on the safe side, adverse health effects should be assumed to be proportional to the radiation dose received until there is reliable evidence to the contrary.

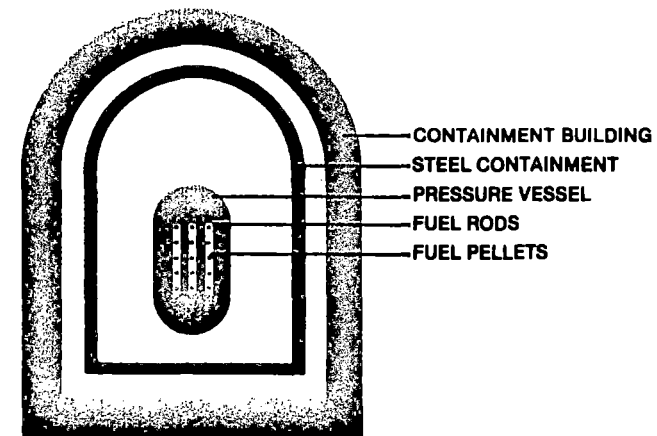
Most experts agree reasonable caution should be used. The benefits of nuclear-generated electricity, medical and dental X rays, the use of smoke alarms, TV viewing, air travel and mountain hiking are far greater than the small increased radiation risk involved.

However, certain other benefits, such as the ability to check shoes for proper fit by using a fluoroscope, are not considered to be worth the additional risk, and therefore, this practice was discontinued many years ago.

## How could large amounts of radioactivity escape from a nuclear power plant?

In a postulated accident that could have public consequences, some kind of damage would have to occur to the nuclear fuel tubes allowing the radioactive material to escape into the reactor system; damage would also have to occur to the reactor system permitting the radioactive material to escape farther into the reactor containment building. If the backup safety systems did not work properly, and should the containment building leak excessively, substantial quantities of radioactive materials could then be released into the environment.

The amount of radioactive material released would be dependent upon many factors: the concentration of radioactive material in the fuel; the amount of fuel tube damage that occurs; the nature of the reactor system failure; the effectiveness of the backup safety systems and the leakage rate of the reactor containment building. The duration of radioactive gas release is similarly dependent upon many factors and can be as little as a few minutes or as much as several days.



Multiple barriers must fail for large quantities of radioactive material to escape a nuclear plant.

Figure 4 – Barriers against release of radioactivity.

## How would weather affect the accidental release of radioactive gas?

After any radioactive release to the environment, the existing weather conditions would have a major influence on the direction and severity of hazard the release would present to the public. A stagnant or slowly moving air mass coupled with a thermal inversion would be the most severe. Under such conditions, the radioactive gases could be trapped into a plume of high concentration extending downwind of the plant and posing a radiation exposure hazard to downwind residents. The radioactive gas concentration and the degree of hazard would drop rapidly as the distance away from the plant increased.

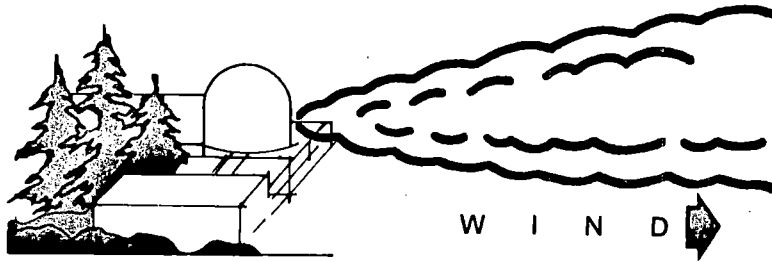


Figure 5 Nuclear plant with plume.

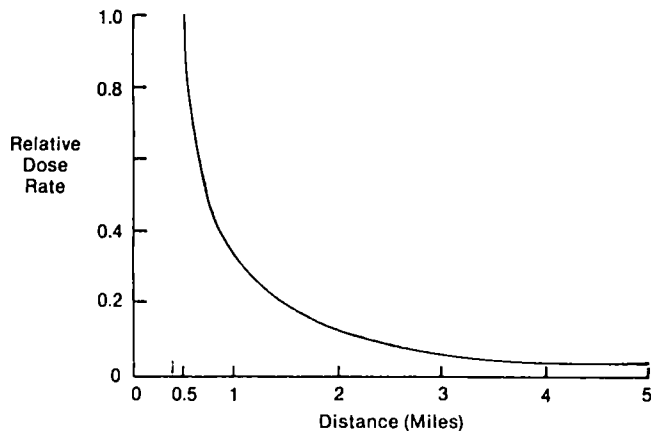


Figure 6 Dose falloff with distance (along actual plume).

Other air patterns could result in the radioactive gases being diluted and dispersed to low concentrations or carried harmlessly to high elevations. Precipitation in the form of rain or snow would tend to wash the most harmful radioactive material from the air to the ground.

## What kind of radioactive elements would be released?

Among the radioactive materials released, Xenon-133 and Iodine-131 would dominate. Xenon is a noble gas, that is, it is chemically and biologically inert. Radiation exposure ceases once the radioactive xenon gas is no longer present. Iodine-131 is a chemically active element and poses two hazards. It can settle on the skin and clothes and continue to emit radiation, damaging the adjacent tissue. Fortunately, it can be readily washed off with water. Radioactive iodine poses a greater risk if ingested either by breathing it in or consuming unwashed food contaminated with it. If ingested, it would tend to concentrate in the thyroid; if very substantial quantities were ingested, severe, but normally treatable, medical problems could result. Iodine loses its radioactivity fairly soon; it diminishes by half in eight days.

## Glossary of nuclear terms

**Background Radiation** – Radiation arising from natural radioactive materials always present in the environment, including solar and cosmic radiation and radioactive materials in the upper atmosphere, the ground, building materials and the human body. The level of normal background radiation in southwest Michigan is about 100 millirems per year.

**Containment Building** – The structure enclosing the nuclear reactor in a nuclear power plant, usually of reinforced concrete, designed to keep radioactivity from the environment in the event of a major accident. At Palisades the cylindrically shaped concrete containment building has walls 3½ feet thick, lined with a ¼-inch carbon steel plate and an 8½ to 13 foot thick concrete foundation.

**Control Room** – The center where the nuclear plant is operated, monitored and controlled. NRC-licensed operators are on duty at all times.

**Core** – Also 'reactor core'. The part of a nuclear reactor that contains the nuclear fuel.

**Curie** – A unit of radioactivity, abbreviated Ci. It is the amount of radioactivity associated with one gram of radium. A picocurie is one trillionth of a curie, a nanocurie is one billionth and a microcurie is one millionth.

**Dose** – A term which, when applied to radiation, describes the amount of radiant energy absorbed in tissue (see Millirem).

**Dosimeter** – A device for measuring radiation dose.

**Emergency Operating Center (EOC)** – A facility where state and local government representatives assemble to manage a response to a man-made or natural disaster. The facility is usually a police or sheriff's building equipped with backup power and communications systems.

**Emergency Planning Zones (EPZ)** – Two zones that encircle the Palisades Plant. The primary EPZ, with a radius of 10 miles, has been established to control airborne exposure. The secondary EPZ, with a radius of 50 miles, has been established to control ingestion of contaminated food. For these two zones, certain protective actions are prescribed for the protection of the public.

**Geiger Counter** – An instrument used to detect and measure beta and gamma radiation.

**Joint Public Information Center (JPIC)** – A facility where news media representatives receive information on the status of a nuclear plant accident from government and utility officials.

**Maximum Permissible Dose (MPD)** – The legal limit on the amount of radiation that a member of the public may be exposed to from a nuclear power plant over a given period of time. The U.S. Nuclear Regulatory Commission has established the maximum permissible dose at 500 millirem of radiation per day. For nuclear power plant workers, the maximum has been established at 5,000 millirem per year.

**Millirem** – A unit used to measure radiation doses. It is 1/1,000th of a rem (Roentgen Equivalent Man), a measure of radiation that indicates its impact on human cells.

**NRC** – Acronym for U.S. Nuclear Regulatory Commission, the federal agency that regulates the nuclear industry.

**Protective Action Guidelines** – U.S. Environmental Protection Agency (EPA) guidance to state, local and other government officials on standards to use in protecting the public from radiological hazards.

**Protective Actions** – Those emergency measures that are taken after an uncontrolled release of radioactive materials has occurred in order to minimize individual exposures to ionizing radiation.

**Radiation** – Refers to the process of emitting energy in the form of rays or particles which are thrown off by disintegrating atoms; may consist of alpha, beta or gamma.

**Radioactivity** – The property possessed by some elements that spontaneously give off energy in the form of waves or particles.

**Reactor** – A large steel vessel containing nuclear fuel.

**Reception Center** – A facility (most likely a school building) designated to provide temporary shelter prior to, during or after a man-made or natural disaster.

**Shielding** – Material, such as lead or concrete, used in a nuclear plant to prevent the escape of radiation and to protect nuclear plant workers and equipment.

## IF YOU HAVE SPECIAL NEEDS, fill out and mail to:

Richard F. Gordenier, Coordinator  
Van Buren County Emergency Preparedness  
PO Box 156 (James Street)  
Lawrence, MI 49064

I am hard of hearing Yes  No

I am visually impaired Yes  No

I am a part-time resident Yes  No

(List months of year you are here)

I am (otherwise disabled) \_\_\_\_\_

I would need transportation in the event of an emergency evacuation.

Yes  No

Other special needs (explain) \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_  
Rural Route, if applicable

City \_\_\_\_\_

Telephone \_\_\_\_\_

Any special directions to get to your house? \_\_\_\_\_

(For example: "I live on the north side of County Road 46, in the second house west of County Road 31.")

# **EMERGENCY PREPAREDNESS**

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# **IN VAN BUREN AND PARTS OF BERRIEN AND ALLEGAN COUNTIES**

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Information from the Office of Emergency Preparedness

**PLEASE KEEP THIS BOOKLET  
IN A CONVENIENT PLACE  
FOR QUICK REFERENCE**

# EMERGENCY PLANNING

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Emergency planning is the result of cooperation by a number of county and state agencies. The information contained in this booklet is designed to contribute to a greater public awareness of emergency planning, which is essential for dealing effectively with any serious emergency.

H Cal Rosema  
Sheriff  
Van Buren County

Robert L Schra  
Sheriff  
Allegan County

Forrest L Jewell  
Sheriff  
Berrien County

## FOR FURTHER INFORMATION

For further information or additional copies of this booklet, contact Emergency Preparedness Offices at the following addresses:

Van Buren County – Richard Gordenier, Coordinator for Emergency Preparedness, PO Box 156, Lawrence, MI 49064, (616) 674-8011

Berrien County – Fred R Thompson, Field Officer for Emergency Preparedness, 919 Port Street, St Joseph, MI 49085, (616) 983-7141

Allegan County – Sgt Roger Webb, Coordinator for Emergency Preparedness, 112 Walnut Street, Allegan, MI 49010, (616) 673-5441

# Emergency preparedness, just in case

Emergency preparedness is an ongoing effort in Van Buren, Berrien and Allegan Counties. Working in close cooperation with one another, a number of county and state agencies have developed plans to deal successfully with any serious emergency.

Severe winters, fires, tornadoes or other natural disasters can endanger a population. We've learned to live with the possibility that such misfortunes can occur; we're comforted in part by the knowledge that through experience, we have learned to plan for the possibility of such disasters and to cope with their effects.

Emergency planning must also take into account the possibility of man-made incidents, such as rail or highway accidents, toxic chemical spills, a national attack or the unplanned release of radiological materials from nuclear power plants.

Because of the abundance of safeguards designed into nuclear power generating facilities, the chances of a serious incident requiring an area evacuation are extremely remote. Nevertheless, prudent planning and federal law require that you, as a citizen, be informed about what to expect in the event of a radioactive materials release which exceeds safety levels.

The worst thing about a natural disaster or any serious man-made emergency is that it often catches people unprepared. We hope we will never be confronted by such problems. But, if we are, local and state authorities have trained people and sound procedures that will allow us to handle them in a safe and organized fashion.

This booklet is primarily designed to answer your questions about what precautionary measures citizens should take in the event of an emergency at the Palisades Nuclear Plant in Covert Township. Public warning for natural disasters and other man-made emergencies is also briefly discussed. Being prepared means being informed, so please read this booklet carefully and keep it in a convenient location for quick reference.

## **NUCLEAR PLANT SAFETY AND EMERGENCY PLANNING**

Extensive safety precautions taken at the Palisades Nuclear Plant make it extremely unlikely that radioactive materials could ever be released in hazardous quantities.



There is, nevertheless, the remote possibility that the power plant's safety systems could fail and some radioactivity could be released into the atmosphere.

Even if radioactive materials were to be released by unforeseen occurrences, safety and medical experts believe that persons living near the Plant would be exposed to minimal levels of radiation, if any. The exposure level would depend upon the direction of the wind moving across the facility. *The best course of action would likely be to stay indoors, close windows and doors and shut off outside ventilation.*

Federal regulations require that all nuclear power stations and state and local governments have detailed emergency plans to protect the public in the unlikely event of a serious nuclear accident.

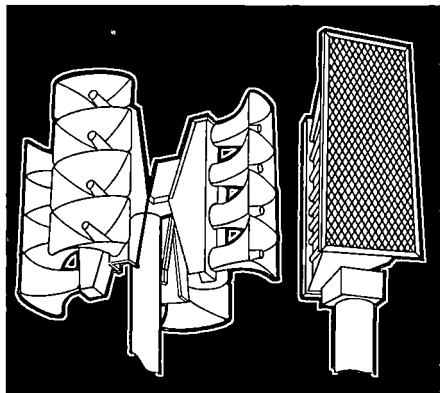
The protective actions outlined in this booklet would greatly reduce any possible exposure to radiation resulting from an accident.

## The response to an emergency

The Palisades Plant has always had its own onsite emergency plan and implementing procedures. In addition, Palisades safety experts have cooperated with federal, state and county authorities to develop coordinated emergency response plans for areas near the Plant. The plan is periodically tested in a simulated "emergency" exercise at Palisades, and in the ten-mile emergency planning zone surrounding the Plant.

### Early warning

Initial notification to area residents of a weather emergency, nuclear accident or other man-made or natural emergency requiring protective action would be made via the sounding of siren public address units. These devices are located within a ten-mile radius surrounding the Palisades Plant to meet emergency preparedness requirements of the Nuclear Regulatory Commission (NRC) and Federal Emergency Management Agency (FEMA). The sirens are controlled by one of three public safety agencies: the Covert Town-



Within 0-5 mile radius  
of the plant

Within 5-10 mile radius  
of the plant

ships and the Covert Townships. The sirens are controlled by one of three public safety agencies: the Covert Town-

ship Fire Department, South Haven Police Department or Van Buren County Sheriff's Department.

There are three different siren signals which may be used, each for a different type of emergency:

## **PUBLIC WARNING**

A steady siren sound lasting from three to five minutes, warning of a serious weather emergency, nuclear accident, chemical spill or other disaster requiring protective action.

## **NATIONAL ATTACK**

A wavering high- and low-frequency siren sound lasting from three to five minutes, indicating the immediate need to take cover from a nuclear attack.

## **LOCAL ALERT**

A rapidly alternating sharp high and low signal (like a European police car) lasting generally 90 seconds, used to summon local volunteer firemen.

If you hear any of these signals, listen to the public address system or tune to local radio or television stations listed on Page 11 to learn what, if any, precautionary measures should be taken.

The sirens are tested for approximately one minute at 12:00 noon on the first Saturday of every month to verify that the system works properly. If the siren closest to you does not work properly during the monthly test or if you observe something unusual, please contact your local law enforcement agency.

## **How are incidents classified?**

Any incident at the Palisades Plant would fall into one of four classifications. These are explained here in the order of their increasing seriousness.

### **1 Unusual Event**

A minor event (normally not involving radioactive materials) that affects only the Plant and requires no actions by the general public. The Nuclear Regulatory Commission (NRC) and certain state and local agencies would be notified. The public address sirens would not be sounded.

## **2 Alert**

Still a minor event that could result in a small quantity of radioactive material escaping from the Plant site. Radiological Emergency Response Plans of the Plant, local, state and federal governments may be implemented as a precautionary measure in case the situation should become more serious. No actions would be required of the general public, and the sirens would not be sounded.

## **3 Site Area Emergency**

A more serious situation that could result in the release of an amount of radioactive material that would require precautionary measures for the general public in a limited area beyond the Plant site boundary. Federal, state and local officials, as well as the general public, would be notified of the occurrence and advised of what, if any, protective actions to take. All emergency response forces, including radiological specialists, would be activated and the entire Emergency Response Plan put into effect. Sirens may be activated to tell the public what actions are necessary. If they are, the best course of action would likely be to stay indoors, close windows and doors, and shut off outside ventilation.

## **4 General Emergency**

Abnormal Plant conditions that could result in the release of sufficient radioactive material to require precautionary measures for the general public out to as far as ten miles from the Plant. Additional resources would be alerted and put on standby notice for immediate activation. The warning system would be activated. The general public would be told whether sheltering or evacuation is necessary.

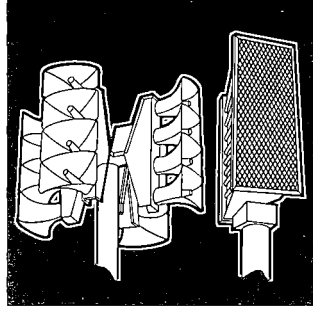
## **What kind of information would I receive?**

State and county public health and safety officials would determine what kind of protective action may be needed. Persons living up to *TEN* miles from Palisades could be affected by a radiological accident. In case of such occurrence, you would be advised to take "In-Place" protective measures or go to a designated Reception Center.

# What is In-Place Protection?

Stay indoors until you are instructed to do otherwise.

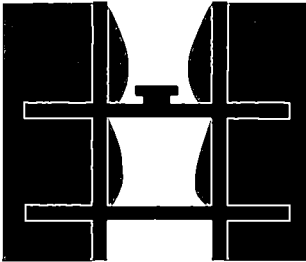
Listen for early warning information after the three-to-five-minute siren steady tone via the public address system and/or stay tuned to your radio or television stations for information and instructions. Page 11 provides specific information concerning area stations.



Close all windows and doors tightly.

Turn off all forced air heating and cooling systems to prevent drawing outside air into a building.

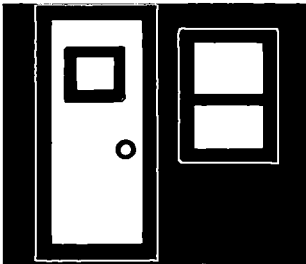
If your building has a basement, take a radio and go there.



Keep away from outside doors and windows.

Use the telephone only if absolutely necessary.

Keep calm. Panic is your greatest enemy in any emergency.



## What if I am instructed to evacuate?

If you are within *TEN* miles of Palisades, there is a remote possibility that you might be required to evacuate certain areas downwind from the Plant. The experts call this area, which could lie in the path of exposure to radioactive material from a puff or "plume," the "plume exposure pathway zone."

An Emergency Planning Zone (EPZ) within 10 miles from the Plant includes all or parts of the following municipalities: in Van Buren County—Bangor, Covert, Geneva, Hartford and South Haven Townships and the Cities of South Haven and Bangor; in Berrien County—the Cities and Townships of Coloma and Watervliet, respectively, and Hagar Township; and in Allegan County—Casco Township. If public safety officials were to call for an evacuation in your area, you would be instructed to:

Follow public notification information on radio, TV or via the public address system. Put on a dust mask or breathe through a damp handkerchief to filter out any dust in the air. Gather up a change of clothing, personal toilet articles, blankets or sleeping bags for each member of your family, special baby formulas and any special medications you or your family may need, as you would in preparation for a short trip, unless otherwise advised by local government.

Secure your property as if you were going on a short vacation. As you leave, lock all doors and tie a white handkerchief or piece of cloth on your mailbox or doorknob so that emergency response personnel will know you have evacuated. Get into your car or other vehicle, close the windows and vents and drive slowly and safely either to your Reception Center described on Page 9, or to the home of friends or relatives at least 15 miles from the Plant. If you have room in your car, take neighbors who have no means of transportation.

## What if I need transportation?

You may be able to get a ride from a neighbor. If this is not possible, stay inside your home (making sure that all doors, windows and air vents are closed) and listen to radio, television or public address.

This booklet contains a form to be filled out in advance by special needs people who would require transportation in an evacuation. Having filled out this "special needs" form in advance, you would wait during any emergency for a local emergency services person to evacuate you from your home.

## **Where would I go?**

Depending upon the seriousness of the incident, the duration of the resulting hazard could range from several hours to several days. The hazardous area could vary from a few feet from the Plant to a fairly large geographic area downwind from the Plant, within the ten-mile emergency planning zone. In most cases, evacuation would be ordered as a precaution well before you would be confronted with any real danger.

If an evacuation is ordered, you should follow routes (see map on Page 12) which would be identified by the public address system, the radio, television or other means. You should drive either to your Reception Center or to the homes of friends or relatives at least 15 miles from the Plant. Reception Centers include: in Van Buren County– Gobles High School, Paw Paw High School and Decatur High School; in Berrien County– Eau Claire High School and in Allegan County– Saugatuck High School. The protective actions to be taken would depend on the nature of the emergency.

## **If my children are in school, what should I do?**

Proceed to the location designated as the Reception Center for the school that your child attends. Be sure to use only those routes identified by the radio, television or public address system. Students from South Haven Schools would be transported by bus to the Saugatuck High School. Students from Covert and Hartford Schools would be transported to the Paw Paw High School. Students from Bangor and Wood Schools would be transported to Gobles High School. Students from Watervliet, Coloma and Riverside Schools would be transported to Eau Claire High School. Both students and parents could choose to stay at the Reception Center for the duration of the emergency.

## **What about my home and possessions?**

While an evacuation order is in effect, neither you nor any other unauthorized persons would be allowed back into the area until safety experts have decided that it is safe to return. Leave your pets at home with a supply of food and water. The only animals to be permitted in the public shelters would be guide dogs trained to assist handicapped persons.

## **What about the elderly or disabled?**

For temporary shelter, senior citizens and the physically disabled would be evacuated by special transportation to the designated county care facility. If you are hospitalized or a resident of a special care facility, special arrangements to transfer you to another facility are included in the hospital or facility's emergency plan. *If you have special needs, please clip, fill out and mail the Special Needs Form on Page 23 of this booklet.*

## **If I am boating or swimming, or vacationing at one of the recreational areas within 10 miles of the Palisades Plant, how would I be notified about a general emergency?**

The public warning system (siren and loudspeaker) can be heard up to one mile. The Allegan, Berrien and Van Buren County Sheriff's Departments would request the marine communications to advise boaters and fishermen of an emergency and to inform them of safe waterways and docking areas. The US Coast Guard, the Michigan Department of Natural Resources and the Sheriff's Marine Patrol would direct this operation. Boaters would also be warned by commercial radio stations. Coastal areas would be patrolled. Visitors at Van Buren State Park would be alerted by voice messages through the public notification system or through radio and television.

## **What should a farmer do about his crops or livestock?**

Upon receiving warning that protective measures are required, you should leave your animals with ample supplies of feed and water and confine them in/under some type of shelter, if possible, so that if evacuation instructions are ultimately given, you may leave immediately. Stored feed such as silage or hay and grain that has been protected from the elements is best. The Michigan Department of Agriculture's radiological monitoring teams would perform follow-up surveys of farm foodstuffs and agricultural products to check for any

contamination. If necessary, livestock would be relocated by the Department of Agriculture. For more information, contact your county cooperative extension service.

## How would I be informed?

You would be notified by Emergency Broadcast System (EBS) radio or television broadcasts or, if you live within ten miles of the Plant, by an emergency public notification system that uses sirens and loudspeakers. You might hear a siren giving a steady, three-to-five minute tone to alert you to turn on your radio or television and listen for loudspeaker announcements. Emergency broadcast messages carrying recommended protective actions and identifying shelter sites or evacuation routes would be repeated at frequent intervals. A regular test of the siren and public address system is always done the first Saturday of each month at 12:00 noon.

The primary stations which would provide information about an emergency include:

WCSY-FM, 98.3 on the FM dial, in South Haven, 5:00 AM to midnight

WCSY Radio, 940 on the AM dial, in South Haven, daytime only

Other stations which would also provide emergency public information include:

WKZO Radio, 590 on the AM dial, in Kalamazoo, 24 hours

WHFB Radio, 1060 on the AM dial, Benton Harbor, daytime only

WHFB-FM, 99.9, Benton Harbor, 24 hours

WSJM Radio, 1400 on the AM dial, St. Joseph, 5:00 AM to midnight

WIRX-FM, 107, St. Joseph, 5:00 A M to 2:00 A M

WOTV-TV, Channel 8, Grand Rapids, 6:00 A M to 1:30 A M  
weekdays – 7:00 A M to 2 A M weekends

WKZO-TV, Channel 3, Kalamazoo, 6:30 A M to 2:00 A M

WZZM-TV, Channel 13, Grand Rapids, 6:30 A M to 1:30 A M

Specially designated telephone numbers where you may call with individual problems or questions would be broadcast over your radio or television.

**Avoid unnecessary calls to emergency numbers (police, fire, hospital, etc).** These lines must be kept clear for true emergency needs.





## RADIATION – A SCIENTIFIC VIEW

Radiation is a physical phenomenon which is neither new nor mysterious. All of us are exposed to radiation every moment of our lives. We receive radiation from the sky in the form of cosmic rays. Rocks and minerals give off natural radiation. Because naturally occurring radioactive materials exist in air and foods, we breathe and eat very small amounts of radioactive materials without even knowing it. X rays and other forms of penetrating radiation have brought us medical and scientific benefits.

Simply put, radiation is energy in motion. The form of radiation we are concerned with in this booklet is "ionizing radiation." This type of radiation has sufficient energy to penetrate living tissue and cause physical and chemical changes within.

### Where does ionizing radiation come from?

Most ionizing radiation comes from natural sources. Cosmic radiation from outer space showers the earth, and naturally occurring radioactive elements are everywhere. The ground we walk on, the buildings we inhabit and nearly everything we touch contains radioactive elements such as uranium, radium and thorium. Our food contains radioactive carbon and potassium; the air we breathe contains tritium, radon and other radioactive gases.

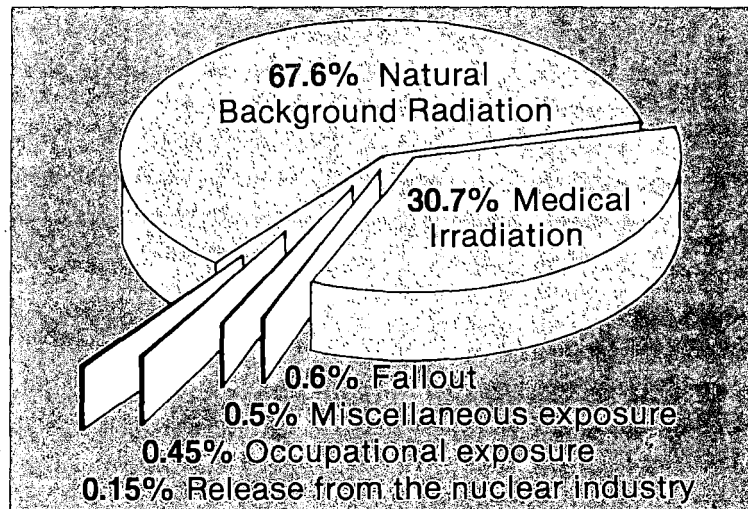


Figure 1 Sources of radiation that people receive.

Some ionizing radiation comes from man-made sources such as diagnostic X rays, television sets, nuclear weapons testing and nuclear energy facilities.

## How is ionizing radiation measured?

Radiation intensity is measured by sensitive instruments such as ionization chambers. In such instruments the radiation interacts with gas and causes a current to flow. The current is proportional to the radiation level. These instruments usually read in units called millirem per hour.

Radiation exposure to individuals is usually expressed in "rem" or "millirem" (1/1,000 of a rem) units. "Rem" is an acronym for "Roentgen Equivalent Man." In earlier times, the terms "roentgen" and "rad" were commonly used.

Radiation exposure is dependent both upon the intensity of the radiation present and time spent in the area. For example, spending 21 days in a granite building that exposes you to one millirem per day will result in an exposure of 21 millirem. You would receive the same amount of exposure in a fraction of a second by having a chest X ray.

## How much radiation exposure do people get?

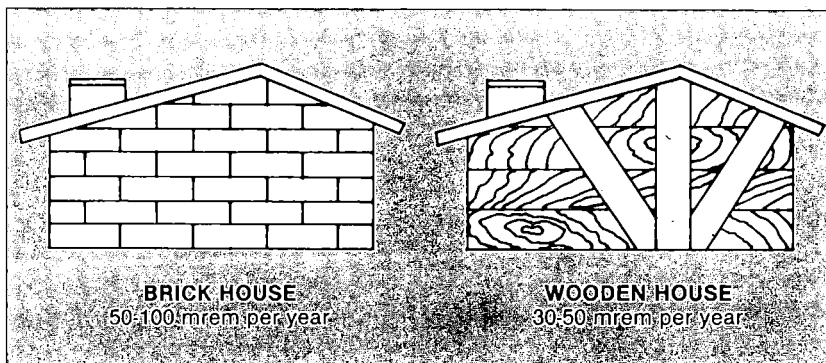
Radiation exposure can vary widely depending upon a person's location. For example, cosmic radiation is twice as high at 2,000 feet elevation than it is at sea level; ground radiation is much higher in areas containing radioactive ores such as granite; airborne radiation is greater in the vicinity of industries or mines that release radioactive materials.

Life-style, too, is important. A brick house is twice as radioactive as a wooden house; airline pilots receive more cosmic radiation, miners more terrestrial radiation; the use of radiation emitting equipment such as television and X ray equipment also increases individual exposure.

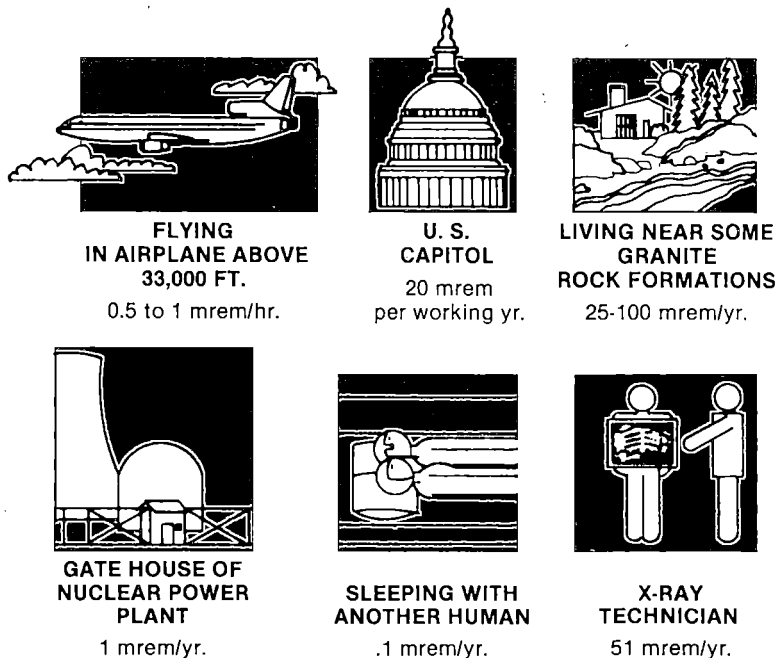
According to the BEIR-80 Report\* the average radiation exposure from natural background sources is about 100 millirem per year in the US. The average exposure from man's activities is estimated to be an

\*National Academy of Sciences, Committee on the Biological Effects of Ionizing Radiation: August 1980.

additional 100 millirem per year. This includes about four millirem per year from radioactive fallout as a result of nuclear weapons tests conducted over the last 35 years.



**Figure 2** Background (or natural) radiation to individuals: a brick house is approximately twice as radioactive as a wooden house.



**Figure 3** Approximate additional (in addition to minimum natural background exposure) background radiation. Minimum human exposure is approximately 100 millirem/year.

## Can radioactive materials enter the body?

Yes. The radioactive materials we are concerned with in this booklet can be divided into two types. Some materials are not absorbed by body tissues and are quickly eliminated by the body. Other materials can combine with body tissues, but do not stay in the body for long periods of time, and can be quickly removed by various medical and dietary methods.

## How does radiation affect us?

Consider the manner in which sunlight affects us. In the northern part of the world, the winter's slanting rays seldom cause sunburn but the more direct rays of the summer sun do. Still, just a few moments in the mid-summer sun will not give you a tan or cause a sunburn. You have to stay in the sun's direct rays for some time to receive a sunburn. Furthermore, a sunburn on your face and hands may hurt but it usually will not seriously harm you. On the other hand, burning over your whole body can make you very ill.

In much the same way, the harm that can come to you from radiation will depend upon the nature and energy level of the particles and rays which strike you, the length of time you are exposed to them, how much of your body is struck by the rays, how much radioactive materials you breathe or swallow and how the material is concentrated in the body. A large dose of radiation is more damaging than a small one. Unborn and very young children are more sensitive to radiation than are older children and adults.

When emissions from radioactive substances enter the human body they can damage cells by ionizing (adding electrons to or removing electrons from) atoms. If the damage is slight, or takes place slowly, the body can usually make repairs. However, if the damage is great, adequate repairs may be impossible and the consequences severe.

## **How does the amount of radiation I might receive from a nuclear plant accident compare with what I might receive during nuclear medical practices?**

If you lived right at the plant site boundary, the maximum amount of radiation you could receive as a result of any credible accident is comparable to the amount you could receive during some routine diagnostic nuclear medicine applications.

## **Is low-level radiation harmful?**

Unfortunately, there is no definitive answer to the question. Studies of low-level radiation exposures (less than 10,000 millirem per year) indicate that health effects, if they exist, are not measurable or discernible; that is, they are so low that they are masked by the health consequences of other environmental and social factors.

## **Should we be concerned about low-level radiation?**

Based upon the negative findings of many studies, the BEIR-80 Report states that the health effects of low-level radiation are probably lower than previously estimated. But it agrees that, to be on the safe side, adverse health effects should be assumed to be proportional to the radiation dose received until there is reliable evidence to the contrary.

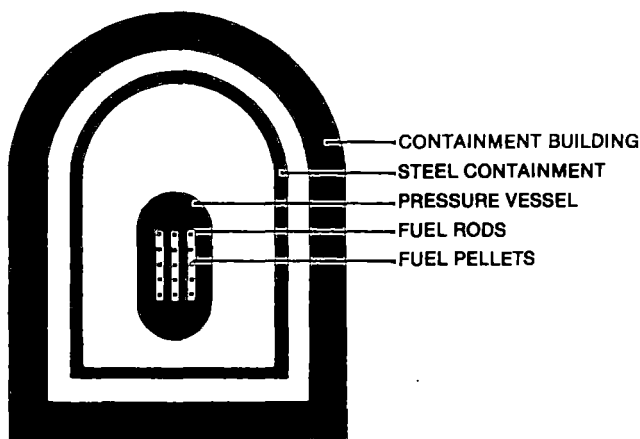
Most experts agree reasonable caution should be used. The benefits of nuclear-generated electricity, medical and dental X rays, the use of smoke alarms, TV viewing, air travel and mountain hiking are far greater than the small increased radiation risk involved.

However, certain other benefits, such as the ability to check shoes for proper fit by using a fluoroscope, are not considered to be worth the additional risk, and therefore, this practice was discontinued many years ago.

# How could large amounts of radioactivity escape from a nuclear power plant?

In a postulated accident that could have public consequences, some kind of damage would have to occur to the nuclear fuel tubes allowing the radioactive material to escape into the reactor system; damage would also have to occur to the reactor system permitting the radioactive material to escape farther into the reactor containment building. If the backup safety systems did not work properly, and should the containment building leak excessively, substantial quantities of radioactive materials could then be released into the environment.

The amount of radioactive material released would be dependent upon many factors: the concentration of radioactive material in the fuel; the amount of fuel tube damage that occurs; the nature of the reactor system failure; the effectiveness of the backup safety systems and the leakage rate of the reactor containment building. The duration of radioactive gas release is similarly dependent upon many factors and can be as little as a few minutes or as much as several days.

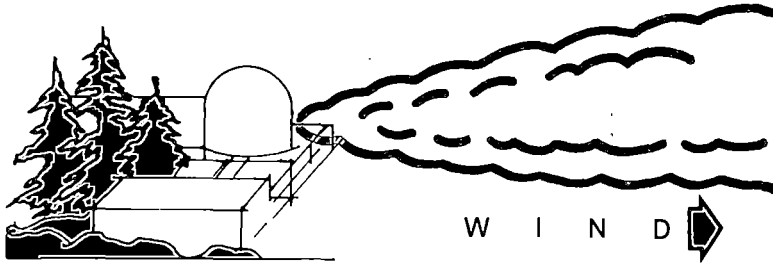


Multiple barriers must fail for large quantities of radioactive material to escape a nuclear plant.

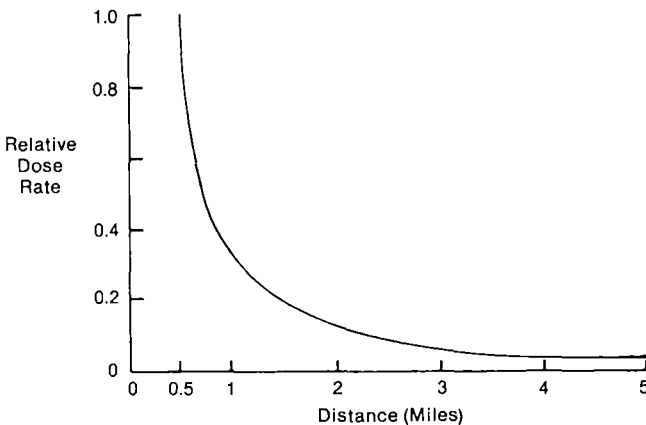
**Figure 4** – Barriers against release of radioactivity.

# How would weather affect the accidental release of radioactive gas?

After any radioactive release to the environment, the existing weather conditions would have a major influence on the direction and severity of hazard the release would present to the public. A stagnant or slowly moving air mass coupled with a thermal inversion would be the most severe. Under such conditions, the radioactive gases could be trapped into a plume of high concentration extending downwind of the plant and posing a radiation exposure hazard to downwind residents. The radioactive gas concentration and the degree of hazard would drop rapidly as the distance away from the plant increased.



**Figure 5** Nuclear plant with plume.



**Figure 6** Dose falloff with distance (along actual plume).



- Other air patterns could result in the radioactive gases being diluted and dispersed to low concentrations or carried harmlessly to high elevations. Precipitation in the form of rain or snow would tend to wash the most harmful radioactive material from the air to the ground.

## What kind of radioactive elements would be released?

Among the radioactive materials released, Xenon-133 and Iodine-131 would dominate. Xenon is a noble gas, that is, it is chemically and biologically inert. Radiation exposure ceases once the radioactive xenon gas is no longer present. Iodine-131 is a chemically active element and poses two hazards. It can settle on the skin and clothes and continue to emit radiation, damaging the adjacent tissue. Fortunately, it can be readily washed off with water. Radioactive iodine poses a greater risk if ingested either by breathing it in or consuming unwashed food contaminated with it. If ingested, it would tend to concentrate in the thyroid; if very substantial quantities were ingested, severe, but normally treatable, medical problems could result. Iodine loses its radioactivity fairly soon; it diminishes by half in eight days.

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## Glossary of nuclear terms

**Background Radiation** – Radiation arising from natural radioactive materials always present in the environment, including solar and cosmic radiation and radioactive materials in the upper atmosphere, the ground, building materials and the human body. The level of normal background radiation in southwest Michigan is about 100 millirems per year.

**Containment Building** – The structure enclosing the nuclear reactor in a nuclear power plant, usually of reinforced concrete, designed to keep radioactivity from the environment in the event of a major accident. At Palisades the cylindrically shaped concrete containment building has walls 3½ feet thick, lined with a ¼-inch carbon steel plate and an 8½ to 13 foot thick concrete foundation.

**Control Room** – The center where the nuclear plant is operated, monitored and controlled. NRC-licensed operators are on duty at all times.

**Core** – Also 'reactor core'. The part of a nuclear reactor that contains the nuclear fuel.

**Curie** – A unit of radioactivity, abbreviated Ci. It is the amount of radioactivity associated with one gram of radium. A picocurie is one trillionth of a curie, a nanocurie is one billionth and a microcurie is one millionth.

**Dose** – A term which, when applied to radiation, describes the amount of radiant energy absorbed in tissue (see Millirem).

**Dosimeter** – A device for measuring radiation dose.

**Emergency Operating Center (EOC)** – A facility where state and local government representatives assemble to manage a response to a man-made or natural disaster. The facility is usually a police or sheriff's building equipped with backup power and communications systems.

**Emergency Planning Zones (EPZ)** – Two zones that encircle the Palisades Plant. The primary EPZ, with a radius of 10 miles, has been established to control airborne exposure. The secondary EPZ, with a radius of 50 miles, has been established to control ingestion of contaminated food. For these two zones, certain protective actions are prescribed for the protection of the public.

**Geiger Counter** – An instrument used to detect and measure beta and gamma radiation.

**Joint Public Information Center (JPIC)** – A facility where news media representatives receive information on the status of a nuclear plant accident from government and utility officials.

**Maximum Permissible Dose (MPD)** – The legal limit on the amount of radiation that a member of the public may be exposed to from a nuclear power plant over a given period of time. The U.S. Nuclear Regulatory Commission has established the maximum permissible dose at 500 millirem of radiation per day. For nuclear power plant workers, the maximum has been established at 5,000 millirem per year.

**Millirem** – A unit used to measure radiation doses. It is 1/1,000th of a rem (Roentgen Equivalent Man), a measure of radiation that indicates its impact on human cells.

**NRC** – Acronym for U.S. Nuclear Regulatory Commission, the federal agency that regulates the nuclear industry.

**Protective Action Guidelines** – U.S. Environmental Protection Agency (EPA) guidance to state, local and other government officials on standards to use in protecting the public from radiological hazards.

**Protective Actions** – Those emergency measures that are taken after an uncontrolled release of radioactive materials has occurred in order to minimize individual exposures to ionizing radiation.

**Radiation** – Refers to the process of emitting energy in the form of rays or particles which are thrown off by disintegrating atoms; may consist of alpha, beta or gamma.

**Radioactivity** – The property possessed by some elements that spontaneously give off energy in the form of waves or particles.

**Reactor** – A large steel vessel containing nuclear fuel.

**Reception Center** – A facility (most likely a school building) designated to provide temporary shelter prior to, during or after a man-made or natural disaster.

**Shielding** – Material, such as lead or concrete, used in a nuclear plant to prevent the escape of radiation and to protect nuclear plant workers and equipment.

# IF YOU HAVE SPECIAL NEEDS, fill out and mail to:

Richard F. Gordenier, Coordinator  
Van Buren County Emergency Preparedness  
PO Box 156 (James Street)  
Lawrence, MI 49064

I am hard of hearing Yes  No

I am visually impaired Yes  No

I am a part-time resident Yes  No   
(List months of year you are here)

I am (otherwise disabled) \_\_\_\_\_

I would need transportation in the event of an emergency evacuation.

Yes  No

Other special needs (explain) \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

Rural Route, if applicable

City \_\_\_\_\_

Telephone \_\_\_\_\_

Any special directions to get to your house? \_\_\_\_\_

(For example: "I live on the north side of County Road 46, in the second house west of County Road 31.")

Van Buren County Emergency Preparedness  
PO Box 156 (319 James Street)  
Lawrence, MI 49064

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